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Pastoralism as a Conservation Strategy and Contributing Towards Livelihood Security and Improvement in Eritrea

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I. INTRODUCTION

Eritrea has an area of approximately 124,000 km². Its landscape is characterised by a chain of high mountains crossing the country from south to north. The altitude ranges from 110 m below sea level in the Danakil Depression, to 3038 on the Emba Soira Mountain. There are three main agro-ecological zones in the country; these are the central highlands and the eastern and western lowlands. However, there are several micro-ecological zones between the highlands and the lowlands, which provide habitat for different plants and animals, (NEMP-E, 1995).

Eritrea falls within the Africa a belt of Sahel, which is characterised by low rainfall, climatic unpredictability and during the last two decades by drought and massive destruction of natural resources.

Eritrea has six administrative regions: Zoba Maekel, Debub, Anseba, Gash-Barka, Semienawi Keih Bahri and Debubawi Keih Bahri. The population is at present estimated to be about 3.5 million people and the main ethnic groups are Tigrinya, Tigre, Saho, Afar, Bilen, Hidareb, Kunama, Nara and Rashaida.

Pastoral and agropastoral production system is the major land use system although mixed irrigation and rain fed farming occur along the highlands. Pastoral groups in Eritrea constitute people with distinct cultural and economic characteristics, and inhabiting places with seasonal variations in the amount of rainfall. Their livelihoods are almost wholly dependent on livestock. Most livestock producers in Eritrea are subsistence farmers and their primary objectives are to produce enough food to feed their family and to maintain sufficient reserves to see them through drought years. Cash income from sales of livestock are a secondary consideration and mainly directed to household necessities such as coffee, sugar, salt, school fees and medicines. Production strategies are directed more at minimizing risk than at maximizing profit.

Livestock production is practised in a number of different farming systems. The pure pastoralists follow a nomadic life-style, relying heavily on livestock and their products, while the agro-pastoralists have a diversified economy involving crop cultivation and animal rearing. No estimate can be made at present on effective numbers within each farming system. However, pastoralism and agropastoralism are the main production systems. Qualitatively, the Afar, Rashida, Hidareb and Saho are almost purely pastoralists; the Tigrygna and Bilen are sedentary mixed farmers; the Kunama, Nara and partly Tigre and Tigrygna are agropastoralists.

The livelihood of pastoralists in many developing nations are directly linked to their animals, and thus to the environment in which they live. For this reason, any natural or human-caused crisis or disaster that affects the ability of the environment to provide resources to the people and livestock living in these regions places the people at a serious risk of losing their animals, and can impair their ability to cope with future emergencies. Generally, pastoral communities have the resources and the structural capacity to manage the effects of drought, but consecutive years of crisis can cause severe problems for

pastoralists. Yet the underlying (and usually under recognized) reality is that pastoralism is a conservation strategy to make best use of dry lands both in space (in terms of large land ranges) and time (to make best use of seasonal grazing) to help pastoralists secure their livelihoods in harsh and risk prone environments. This includes the importance of risk management and resilience enhancement. Even wildlife authorities tend to underestimate the importance of pastoralism as a conservation strategy, despite the fact that pastoralism is one of the few land use strategies that is compatible with wildlife conservation. If pastoralists livelihoods are going to be improved and the degradation of the dry lands reduced, then it is critical that pastoralism is respected and developed as a sustainable land use system. Pastoralism is based on natural resource management that respects the limitations imposed on such dry lands, the necessity for mobility, and which integrates the local knowledge and institutional systems of pastoralists.

In recent years, pastoral development in Africa has not received the emphasis and proper share of financial resources that it resumes in order to produce meaningful and tangible benefits for pastoral people. This is partly due to the lack of appropriate national policies, and discouragement of the pastoral mode of production. Pastoralism, as a potentially sustainable form of land use and conservation in harsh and arid climates, is poorly and often misunderstood at national planning and economic levels. It is poorly understood because research and studies that have been undertaken rarely find expression in a policy context and rarely influence dry land policy and planning.

Development activities in pastoral areas of Eritrea have been greatly constrained by the prolonged political struggle for independence. However, range/livestock development activities have been carried out in different areas of the country for the last ten years. These include surface water harvesting, over sowing, sporadic watering point development and an attempt to develop large grazing blocks and some herd restocking programmes.

II. LIVESTOCK PRODUCTION SYSTEM

2.1 PASTORALISM

Pastoralism is any production system that relies for substantial amount of its output on livestock. Although it is difficult to tell how much is substantial, a definite prerequisite for a system to qualify as pastoral is that it must involve some degree of mobility. Essentially, pastoralism denotes economies that derive the bulk of the food supply from livestock using a great variety of herding practice on natural pasture. Pastoralism usually consists of highly heterogeneous groups in their objectives, strategies, needs, management style and degree of mobility, hence, the basis for classification. In Eritrea we have nomadic pastoralism and transhumance with full mobility and agro-pastoralism with partial or no mobility.

2.2 NOMADIC PASTORALISM

Nomadic pastoralism essentially revolves around the husbandry of livestock and the utilisation of natural vegetation as fodder. Such an economy requires the availability of suitable domestic animals and of pastureland adequately large for sustaining the animals, because their livelihoods are totally dependent on the utilisation of marginal resources. Nomadic pastoralists are forced to constantly migrate by the need to maintain their source of subsistence, namely livestock. In its purest manifestation, nomadic pastoralism is characterised by the absence of cultivation even as a supplementary income (Khazanov, 1983). It is also defined as a system in which more than 50% of total revenue or more than 20% of food energy needs derive from livestock. Extensive long-range nomadism is a traditional practice in Eritrea, which over the last few years has diminished due to external circumstances. Typical nomads are found in the Sahel where large tracks of relatively unoccupied land allow free roaming. In Eritrea the Afar, *Rashida*, *Beni-Amer* and the *Hedareb* are typical examples of nomadic pastoralists. Nomadic pastoralists among the *Beni-Amer* migrate seasonally with their herds to the Eritrean/Sudanese and Eritrean/Ethiopian borders. The Afar also migrates to the Eritrean Ethiopian and Eritrean Djibouti borders. Among the pastoral nomads members of the household (women and children) always remained in the traditional territory whereas able bodied men migrate afar with dry herds across borders.

2.3 TRANSHUMANCE

Transhumance involves regular seasonal migrations between dry season and wet season pastures, upland and lowland pastures, upland and lowland cultivation, or pastures and salt. Probably a major difference between transhumance and nomadic pastoralism is that

in transhumance the patterns of migration are more or less predetermined under normal circumstances. Nevertheless, predetermined migration does not in any way imply rigidity in traditional resource use by transhumants. These patterns are subject to substantial deviations in times of resource scarcity such as during drought. In general, the pattern of transhumance in East Africa is usually between highlands/plateaux and lowlands/flood plains. In Eritrea the *Saho*, *Tigre*, and *Tigrinya* practise this between the Eastern coastal plains and the Eastern escarpments and the central highlands. The *Tigrinya*, *Saho* and *Tigre* are sometimes called opportunistic farmers, as often practised in the Sahel. They plant crops; usually sorghum and maize on their way east to wet season pastures and harvest them on their way back to the west during the dry season. The Beni-Amer migrate between dry season camp (*Demer Hagay*) and wet season camps (*Demer Kerem*) for search of forage and to avoid themselves and their livestock from biting flies. In between there are many different degrees of transhumance depending on the number and kind of livestock raised, type of crops planted and distance travelled. Each of these groups have distinct production systems and set of strategies that have evolved through generations and are well adapted to the vagaries of arid and semi-arid regions.

2.4 AGROPASTORALISM

Agro-pastoralism is another important type of pastoralism accounting, in many cases, for the bulk of total livestock populations. It is perhaps the most highly diverse form of pastoralism, with agriculture as the main subsistence activity, but where animal husbandry is an integral part of the household economy. The availability in agro-pastoral systems is essentially due to the recurrent drought and markets for crop and livestock, which are characterised by huge fluctuations in price and volume. These risks are reduced through the diversification of activities, mutual aid and cooperation, at least at the level of extended family. By choosing to engage in both animal husbandry and crop production, agropastoralists minimize the risk of falling below a certain threshold of disaster, and thus, maximize the probabilities of survival (Upton, 1987). The *Tigrinya*, *Kunama* and *Nara* in the Southwestern lowlands mainly practise agropastoralism.

Agropastoralists can send their livestock on transhumance in the dry season or graze them all year round close to the village, returning at night or camping on the periphery of the village

There exist apparent similarities in animal husbandry between pastoral and agropastoral societies that often tend to obscure the important differences between these two systems of production. Animal husbandry in pastoral societies is geared towards the growth of the herd over time to maintain the physical and social since subsistence of the household unit. There is no pastoral society, which, subsists exclusively on pastoral products, the specialised pastoralists have to produce animal surpluses, which can be exchanged for goods produced outside the pastoral economy. Consequently, the existence of societies producing an agricultural surplus is a necessary condition for pastoral specialization. Apart from being exclusively important as the basis for subsistence, herd in pastoral societies contribute basic forms of wealth and play a vital role in creating and

maintaining social relations and reproducing the social system as a whole. Heavy animal losses through disease or drought are compensated for by support from kinsmen and through institutionalised forms of livestock loans or gifts (Brandstrom et al, 1979).

Because of the dominant role of agriculture in agropastoral economies, practices and strategies of animal husbandry as well as the social organization set-ups differ in a number of ways from those of pastoral societies. The requirement for cultivation forces agropastoralists to subsist in less arid regions than pastoralists, which may limit their mobility in time and space. This does not preclude long distance migrations.

III. SOCIAL ORGANISATIONS AMONG PASTORAL COMMUNITIES

3.1 SOCIAL AND MANAGEMENT RULES

All pastoral societies have sets of elaborate and established social and management rules to regulate social conduct and patterns of resource use and to enforce these rules. There is a variety of formal rules and regulations enshrined in communal codes and traditions, and are known to all members. There are also informal laws to facilitate the implementation and enforcement of formal rules, and help maintain the intra-communal harmony, cohesion and coherence. Informal rules basically involve avoidance of grazing areas already in use, keeping an appropriate distance from others and avoidance of areas just recently vacated by others (Niamir, 1990). Such regulations reduce conflicts, risks of infections and pests and overgrazing, while promoting use of quality resources.

These statutes make up the backbone of and are a prerequisite to a stable and productive pastoral organization. Both types of rules and regulations are enforced by various laws, which are in themselves both formal and informal.

The capricious manner of Eritrea's creation, its long history of immigrations, invasions and partition between alien rulers, and the physical diversity of its terrain have left their stamp on the inhabitants. They are not in any accepted sense a single people but a conglomeration of different communities, which are themselves in most, cases akin by culture and blood to each other.

Giving the historical/cultural affinity of the various social groups it is easier to discuss them from a production viewpoint rather than from an ethno-linguistic prospective. The *Tigre* ethnic group who are dispersed along the northern stretch of the coastal plain and along the northern highlands and western lowlands and the *Cushaitic Hdareb* in the western lowlands have essentially practised semi-sedentary form of pastoralism. They have traditional organisations, which consist of clans, *Ghebilet*, and sub-clans, *Feriq*, lineages and extended family structures. The *Beni-Amer* who are the most important group within the *Tigre*-speaking communities traditionally belong to lower and upper classes. A small minority of the *Beni-Amer* aristocracy, the *Shumagelle* or *Natab*, for centuries ruled over the majority of the lower serf class and tribal groups such as the *Hdareb* by subjugation or conquest. The ruling *Beni-Amer* aristocracy held authority, social status and a great deal of material wealth, which was mostly livestock based. The *Nazir*, was the highest authority and was supported by the *Omda* or clan leaders. The aristocracy reaped economic benefits from its social status by owning large numbers of animals, keeping slaves, taxing the serfs and observing taboos such as aristocratic women not being allowed to milk animals or grind corn. The aristocracy did not inter-marry with the lower classes. The various colonial authorities, which ruled Eritrea for over a century,

supported the aristocratic groups enabling them to strengthen their hold on power among the communities.

During the 1940s a major rebellion by the serf classes seriously undermined the authority of the aristocracy and ultimately weakened its power. Since the beginning of the liberation struggle in 1962 the authority of the aristocracy was further undermined by the disruption of the cattle economy due to drought and war. The disruption of the pastoral economy led to the pauperisation of the aristocratic groups along with the serf classes. Both groups joined the liberation struggle and this ultimately led to radical changes, which have undermined and abolished the *Beni-Amer* aristocracy together.

The *Tigrinya* is the dominant group whose traditional territory is the central highlands of Eritrea. Due to overpopulation and over-exploitation of natural resources in the highlands some of the communities, which border the western lowlands, decided to migrate permanently in search of better agricultural and grazing opportunities to the western lowlands. According to current information such settlements began in the early 1950s and the number of highland settlers in the lowlands has increased since that time. The *Tigrinya* speaking population has now become a sizeable group within the western lowlands.

The *Tigrinyans* are settled agriculturalists and are organised in village communities, which are each composed of varying numbers of extended families. Most of these families are the original occupants and, therefore, owners of the land. They are known as *Restenya*, while the families, which immigrated later and are their tenants are the *Maekelay aliet*. Both classes of families enjoy the same rights of user of the land, but only the *restenya* have a right to a voice in the management of the village.

The highland system was administered by if in institutionally had by headed village chiefs, '*Shumamnti*', and a committee of elders, '*Shmagele*': man or *Chiqa* who by tradition is invariably appointed from a particular family *restenya*.

When the highlanders migrated to the western lowlands they maintained a cohesive social structure and organisation.

The highlanders were traditionally mixed farmers who combined livestock and crops. Having found better grazing and better land they were able to revive their traditional skills in livestock management and now are able to run and integrate a productive farming system in their new area.

In the highlands they have traditionally a different land tenure system, wherein arable land was equally distributed to all households in a village. Under this system land was distributed approximately every seven years and was strictly divided among the villagers. The other system, *Risti*, comprised of land that was privately owned but lacked the equitable distribution system of *Diesa*. The *Diesa* system allowed farmers to own their known land in more than one village and this had often resulted in long court battles over the establishment of inheritance rights.

The new settlers in the western lowlands occupied lands, which were traditionally *Terre Dominale*, which means state owned lands, and they had user rights on such land, which they occupied through peaceful expansion in what was forest, and probably dry season land for nomads.

Italians introduced uniformity by putting chiefs in charge of all sub-districts and appointing their own nominees, who were not always chosen from the traditional leading families. Similarly they appointed their own nominees to village headman ships, often ignoring the rights of the families from which the appointments were traditionally made.

The southern stretch of the coastal plain and the people who are nomadic pastoralists vast desert lying abutting it in Ethiopia and Djibouti are thinly inhabited by *Afar*. The *Afar* are organised as small clans or families, which now come under the loose control of a number of petty Sheikhs, some of whom have at various times assumed the title of Sultan (*Derder*), exercising a territorial jurisdiction from the few semi permanent centres, which have developed in this inhospitable area.

between the *Afar* and *Tigrinya*, on the eastern edge of the plateau and scattered along the escarpment and plain below, are the *Saho*. The majority are pastoral nomads or semi-nomadic pastoralists. The *Saho* are organised as clans, which have become federated into five tribes. Before Italian colonialism they had no chiefs, their affairs being managed in a haphazard fashion by councils of elders. This did not suit the Italians' need for close control and accordingly they appointed chiefs in charge of each tribe: a measure, which made for administrative efficiency if not for popularity.

Lying in the shadow of the plateau at the southern end of the northern highlands (Bgas) is inhabited by the *Bilen people*. The *Bilen* are composed of a number of small families which came under the control of two powerful clans (*Bait Tarqay* and *Bet Tauqay*). Within the two tribal organisations the member of the dominant class are known as *Simagar* and those of the subject families as *Mikuru*. The relationship between them resembles that of between *Tigrinya restenya* and *maekelay aliet*. Before the arrival of the Italians the Sims or heads of families into which the *Bait Tarqay* and *Bait Tauqay* were subdivided exercised a chiefly authority over their own families and the *Mikuru* attached to them. There were, however, no chiefs with authority over the whole of either the tribes and, as in the case of the *Saho's*, affairs were loosely managed by councils of elders until the Italians appointed overall chiefs over each of the two tribes during 1932. Many are semi-nomadic and are becoming settled agriculturalists and some are beginning to live in villages similar to those the *Tigrinya*.

The *Nara* and the *Kunama* are two *Nilotic* groups and are believed to be the original inhabitants of Eritrea and both groups practice mixed farming systems. Land inherited and grazing resources are communally shared. The *Kunama* (and this is an exception in Eritrea) are matrilineal and descent is through the female line, thus succession and inheritance is passed from the mother's brother to his sister's son. Amongst the *Nara* it is patrilineal, aselse where in Eritrea. Because of this the *Nara* have been able to retain an

earlier clan and family organization, which persists in their present village communities. In the *Kunama* villages there are no comparable family organisations. Information on the evolution and social organization of both *Nara* & *kunama* communities is scanty. Traditionally the affairs of the *Nara* and *Kunama* were managed by occasional meeting of elders and, though leaders sometimes emerged, nothing approximating to chieftainship was known until the Egyptians appointed a prominent *Nara* named *Totil* to collect taxes and execute their orders. The Italians improved the Egyptian practice by converting the position held by *Totil* into hereditary chieftainship extending to the *Kunama* as well as to the *Nara*.

The powers of the feudal aristocracy among all the groups has diminished greatly over the past forty years and decision-making in the village rotates around the council of Elders (*Mahber*) and the *Baito*, which were created and inspired by the liberation movement, the EPLF.

By the end of the liberation war in 1991 more new grass-roots based structures had emerged. On one side there is a traditional village council structure, which consists of community leaders and sheiks and on the other the peoples' assembly or *Baito* emerged as a political structure organised by the Eritrean Peoples Liberation Front (EPLF).

Baito functions among all the ethnic groups similarly as described above.

As indicated earlier the role of the *Baito* has changed in post independence Eritrea from being political-agitational to developmental. The *Baito* now serves as an important link between the communities and the local administration. They are still involved in the following activities.

- ✓ Organizing food/cash for work
- ✓ Identifying vulnerable groups for input distribution,
- ✓ Collecting land tax for the local administration,
- ✓ Protecting forested reverine areas,
- ✓ Leasing with the administration in all aspects of community development work

The role of elders can be stated as being responsible to:-

- ✓ Reconcile families, who may be in conflict,
- ✓ Mediate on inter-village conflicts,
- ✓ Settle a variety of disputes,
- ✓ Mobilize assistance for needy families (Organise loaning of grain to poor families during difficult years, Encourage the well-off members of society to assist the poor by lend lactating animals to poor female-headed households, donating seeds, loan plough animals to poor families and so on)
- ✓ Assistance with burial and bereavement,
- ✓ Help through organizing communal work for poor families,
- ✓ Act as a link between the village assembly and the community,

Mutual self-help groups of an informal structure exist in all the pastoral communities. The basic unwritten rule among the communities is that people must help each other as their forefathers did. The communities cooperate in a variety of production work, which varies according to the particular production system they have. This includes:

- ✓ Communal agricultural work (sewing, weeding, harvesting, etc.)
- ✓ Building of huts and local wealth,
- ✓ Communal herding
- ✓ Marketing,
- ✓ Women's savings groups (*Ekoub*)
- ✓ *Mahber* (Saints groups),

The communal work in Tigrinya is mewed *Wofera* or *Kewa* in *Tigre* as the most established village institution. This is a well-established institution among all the groups. *Kewa* or *Wofera* initially means “group work” and comprises a small or large number of people working together manually or using oxen to mitigate labour shortages. People believe that group work is convenient and faster. People also have the opportunity to socialise whilst they work. Aspects of non-agricultural work where collaboration is evident are building huts, constructing wells and so forth.

Among the *Beni-Amer* and *Hedareb* group work is manifested through communal herding, where small numbers of stock held by families are combined together to form a large herd *Murah*, which is then herded by one or two members of the clan, who will be remunerated in cash or in kind which is raised by the various households. Communal herding is widely practised among the semi-sedentary groups both around their homesteads and migrant herds belonging to different families.

Strong collaboration is also seen among the semi-sedentary groups during marketing. Households select the animals for sale and agree to round them up together assigning two, three or more able-bodied men to drive the animals to important markets. Among the *Hedareb* and *Beni-Amer* such persons are known as “*gallelenab*” (livestock drovers) and they are supposed to be the bridge between the local pastoralist producer and their kinsmen in the main markets.

Among the Tigrinya group there are also other forms of organisations such as the “*Mahber*” which is named after a saint obeying precisely defined regulations and having typical obligations. “*Mahber*” has a secular meaning and refers to a group of people or an association working towards a common objective. According to Eva-Maria Bruchhaus, et.al (1994) the groups are either composed of men only or men with their wives. Be it in one way or the other the leaders are always men and the women do not have a say in most of the groups.

The same author also gives an interesting description of the “*Ekoub*” which is a popular group form especially among the Tigrinya and it seems to attract particularly women. The emphasis of the “*Ekoub*” group is on savings. Some such groups function in a classical way as in many African countries.

Culturally, taking care of vulnerable and the marginalised is inbuilt in the culture. Poor families are identified and assisted through communal labour by lending lactating animals to a poor family, burying their dead, contributing to death and marriage ceremonies, and so forth. Among the *Hedareb* and *Tigre*, their Sheiks at the camp level shoulder this particular responsibility of identifying the poor within the community.

Among the more formal groups there is the National Union of Eritrean Youth and Students (NUEYS) and the National Union of Eritrean Women (NUEW).

3.2 WOMEN IN PASTORAL SOCIETIES

Although the important and arduous roles of women in mixed farming systems in Africa has received more recent attention (Lowe, 1986: pp 19-21; Gladwin and McMillan, 1989; Kumar, 1989; Webb, 1989), relatively less attention has been given to the study of gender issues in the pastoral sector (Broch-Due et al, 1981). However, Fratkin (1989) lists some references dating back to 1965 that deals with gender inequality in the rights and ownership of pastoral livestock.

Men are the heads of households and make the major decisions regarding production strategies and disposal of ruminant and equine livestock. Most of the money from the sale of these livestock apparently goes to men. Inheritance of livestock follows along male lines of descent except in the *Kunama* where descent is matrilineal.

Women, on the other hand, make the day-to-day decisions regarding milk off take, management of calves, goat kids and lambs, and derive their cash income from sales of dairy products and possibly poultry (D. L. Coppock, ILCA, personal observation).

Women's workdays are reportedly long and dominated by numerous household-support tasks and care of livestock. Verbal data also indicated significant seasonal shifts in workloads and types of activities prioritized.

Fratkin (1989) cited Dahl (1987) as noting that pastoral women are commonly responsible for running the household as well as herding and other aspects of livestock care.

IV. PASTORAL RESOURCES

4.1 ENVIRONMENT

The common belief is that traditionalism and modernism separate the pastoralists from the rest of modern society. Traditionalism is characterised by primitivism, backwardness, isolation and conservatism. Whether such descriptions are valid or not is left to individual assessment. But it is true that pastoral grazing areas are the non-equilibrium environments of arid and semi-arid Africa (Ellis et. al, 1993) characterised by erratic rainfall and distribution in time and space. The highly variable abiotic factor, which the manager unable to predict and control, has a much stronger determining influence on levels of range productivity than any biotic factor. Management of the biological system to achieve maximum output is therefore close to impossible. In addition, high level of complexity is exhibited by pastoral systems, as exemplified by the existence of multiple species in a herding system, herds structure and composition.

In drier parts of pastoral Africa we are dealing with grazing systems, which are, characterised by complexity, high variability and uncertainty. What is required of management in these situations is the capacity to respond quickly and intelligently to unforeseeable challenges and opportunities, despite the fact that it might never be cost effective to fully understand why things happen in precisely the way they do. This is management in the sense of adaptive coping, rather than optimization and control (Behnke, 1994).

Traditional pastoral knowledge is based essentially on what can be seen and remembered, and on what people perceive and consider tangible, necessary and practical to know.

Pastoral production systems demand a detailed knowledge of the environment to establish an annual cycle of efficient resource utilization. Awareness of climatic patterns and their spatial and temporal variabilities allows prediction of climatic changes indispensable for survival in harsh environments. These climatic predictions may or may not be accurate, but their internalization and institutionalization serves as the most important purpose of survival. These predictions are based on countless years of observation using various indicators. There are indicators for the onset, quantity; quality and end of rains, there are also predictors for drought, for good and bad times. Thus, categorization and perception of the environment reflect the practicality and importance of pastoralists according to environmental parameters and therefore serve as a thermometer to gauge the degree of control they have over each parameter and as a basis for future expectations and predictions.

4.2 Climatic and Agro-Ecological Zoning climatic

4.2.1 Introduction

The climatic conditions in Eritrea are diverse and closely associated with the altitudinal and latitudinal gradients. They are characterised by a rainfall regime ranging from below 150mm year in the eastern lowlands to above 1000mm in Filfil in the eastern escarpments of the central highlands, and 400mm in some parts of the western lowlands. Precipitation decreases from south to north. It is around 200mm in the northern border with Sudan and rises to over 700mm in the southern border with Ethiopia. Over the highlands and the western lowlands, rains usually fall from May/June to September, but more intensely in July and August. On the coastal zone, rain falls during the period November to March. The heaviest rainfall during the winter falls on the eastern escarpment with high concentration around Filfil and Mirara, in Semienawi Bahri, where bi-modal rain pattern is well developed. The first peak occurs in December and January and the second one in July and August. The bi-modal rainfall distribution is a characteristic of a transitional position between two climatic regimes one under sub-tropical climate, influenced from south to southwest and the other from temperate climate influenced from the east to the northeast. At Mirara the high rainfall increases the vegetation growth period, and productivity is the highest in the country.

4.2.2 Agro-ecological Zones

Although there are three major agro-ecological zones in Eritrea, i.e. the highlands, the eastern and western lowlands, many agro-climatic zones at the micro level are found, determined by the topography. Six main agro-ecological zones are often cited as relevant in the country on the basis of the prevailing climatic conditions, landforms, dominant soil types and land use (FAO, 1994).

The central highland zone is characterised by altitudes ranging from 1500m to over 2000m with annual rainfall that varies from less than 400 mm in the north to over 700 mm in the southern part, and a mostly warm to cool climate. This zone comprises at least three sub-zones according to altitude. On higher altitudes of this zone, *Juniperus procera* and *Olea Africana* dominate the natural forests. Population pressure is high in this zone as is also deforestation. Major soil types are cambisols, lithosols and fluvisols of medium and low fertility.

The western escarpment zone rises from about 600 m to 1500 m and has warm to hot, semi-arid climate. The physiography and geology of the central highlands determine its soils and relief. The woody vegetation in this zone is very mixed, including acacia species and other trees and shrubs. Population pressure is moderate.

The southwestern lowland zone has an altitude of 600 m to 750 m and has a hot semi-arid climate, and rainfall in excess of 400 mm. Soils include large areas of vertisols, and are characterised by two types of woody vegetation, large tracts of woodlands, dominated by

acacia species, and riverine forests near the Gash and the Barka Rivers. Important economic trees are found which, include e.g. *Acacia Senegal*, *Acacia seyal*, *Hyphaene thebaica* and *Boswellia papyrifera*. Population density is low, but this may change soon as the area is booming due to new economic activities and settlement.

The north western lowland zone has an altitude ranging from 400 m to 1500 m and has a hot arid climate, with about 300 mm of rainfall. In the extreme north western part, rainfall drops below 200 mm. This zone is also less inhabited, but its rocky hills are habitat to some rare wildlife species.

The unique green belt zone is located on the eastern escarpment of the central highland zone, where altitudes vary from 750 m to over 2000 m, and rainfall ranges from 700 mm to more than 1000 mm. This zone encompasses numerous micro-ecological zones, which range from sub-humid temperate to humid tropical. This zone differs from all others in that it can support perennial crops without irrigation and has significant *Juniper* and *Olea Africana* forest cover and wildlife.

The coastal plain zone is a zone of very extensive pastoralism, extending from below sea level to 600 m, with a hot desert climate and less than 200 mm of rainfall. Vegetation is generally sparse, dominated by shrubs and trees grasses as well as some acacia species. Population is sparse and some areas are not inhabited all the year round, given the harsh climate.

4.3 RANGELANDS

The status of the different rangelands can be stated as follows:

The appropriate use for the majority of rural land in Eritrea is grazing land. It has been estimated that 49% of the land is suitable for grazing, and while the 33% is barren, due to desertic environment and steep slopes.

Central Highlands: The rangelands in the highlands are infertile and steep, hence fragile under continuous uncontrolled grazing regime. Many show irreparable damage from erosion down to bed- rock due to constant grazing and removal of the woody cover. The grazing area has been shrinking over the years, because of cultivation and deforestation. Farmers use the areas that cannot be farmed (because of lack of soil or extreme slope) as rangeland. After harvest, the cropping lands are available for all stock in the community for communal grazing. Some opportunistic farmers, as often practised in the Sahelian countries, also practise transhumance.

Attempts to allow regeneration by closing rangelands and forest areas have shown promising results and are becoming models for the recovery of the rangelands. The recovery rate of some of the closed rangelands and forest areas is remarkable and this is making people think in terms of introducing the cut and carry system.

Western Lowlands: Most areas in the south-western portion of the Western lowland zone does not appear to have been damaged due to the migratory use by pastoralists. The south-western part of the western lowlands appears to be less damaged, except in those areas adjacent to population centres where bare soil with extensive gully erosion is common. This is most prominent along slopes and with dispersible soils. The intensity of use of forage in the Western Lowland Zone increases to the northeast, leaving little grass, which makes it **prone** to erosion. Land degradation under cropping follows the same pattern in this zone with least damage on the flat vertisols of the southwest. There is still grass cover with stable browse over story, but in the north-western lowlands the grass cover becomes relatively scarcer. The extensive and migratory system of animal husbandry allows the rangelands to recover, unlike in the highlands. However it is common to observe overgrazing in areas where there are watering points and under grazing in areas where there are no watering points.

The pastoralists of the Western Lowland Zone are predominantly transhumants as they retain campsite inhabited by women and children, while livestock migrate elsewhere for forage and water. There is a greater degree of agro-pastoralism in the southwest part of the Western Lowland Zone than in the northwest, reflecting the lower rainfall and consequently less reliable crop production of the later. Lack of water supply is the primary reason for the migration of pastoralists from the northern part of Western Lowland Zone with a shortage of feed also occurring in drought years. Pastoralists of the Eastern Lowland Zone have shorter distance to migrate than those in the Western Lowland Zone as the dry season camps for Eastern Lowland Zone are on the eastern escarpment.

Eastern Lowlands: In this area, rangelands are of low productivity and not in good condition in terms of ground cover vegetation as rangelands are limited within a vast desert. Generally, the rangelands are not in good.

4.4 LAND

All pastoral communities naturally have traditional and cultural attachment to land. Land is sacred and all natural and living land resources have traditional names and meanings, special uses and cultural roles. Land is a granary for all natural foods and all spirituality of human life is derived from it. Myths, legends and tales about land are narrated in a sanctified manner. Most pastoral societies believe in equal rights for all land living creatures, therefore they all have equal rights to exploit and benefit from the land, which, they believe, is large enough to accommodate all. In general, most communities believe that the ecosystem can only be destroyed when deeply rooted traditional views about land are violated or ignored, since the ecosystem is like a spider's web held together by different but complementary threads emanating from the land.

4.5 PLANTS AND WATER

Pastoral knowledge of natural resources is accurate and sometimes similar to formal science, in addition to its ecological particularism (Niamir, 1990). All natural resources occurring in pastoral areas are exploited for both productive and non-productive uses. Water, plants, soils and wildlife all serve one purpose or another. Knowledge of plants is perhaps the most refined among pastoralists. A wide range of criteria is used in plant classification and nomenclature, but in most cases they are based either on phenology and morphology or on some utilitarian criteria. Some communities recognize seasonal availability of different plants and their role in stimulating milk and meat production. This thorough knowledge of vegetation is a reflection of the high diversity of uses made of a range plants by pastoral communities. Plants provide everything ranging from food and fodder to alcoholic beverages and poison extracts. Almost all plants are used for something and most pastoral groups identify special plant species with special uses, which they highly protect. Nevertheless, despite their deep morphological and physiological knowledge of vegetation, pastoralists cannot manipulate their forage supplies to match demand by livestock because of the erratic nature of rangelands. However, they react quickly to unpredictable, dramatic but short-term fluctuations in feed supply. One effective tracking strategy is to move animals around, avoiding areas where forage is insufficient and mopping up surpluses in areas where it is abundant.

Water is perhaps the most important resource and its availability for livestock and human consumption is a perpetual preoccupation among pastoralists. Its acquisition or attempt to acquire it has often been a source of conflict between pastoral groups. In general, African pastoralists use natural ponds in the wet season; they gradually shift to shallow wells as the ponds dry up and then turn to permanent deep wells towards the end of the dry season. Water development is often the first improvement made on rangelands by pastoralists. The distribution of water points in pastoral areas and timing of their use have direct impact on range production. Vast areas of rangeland may remain relatively under-utilized if there is inadequate water. For example, the rangelands towards the border of Sudan are only utilized during the rainy season but during the dry season due to lack of watering points it is always under-utilized. The frequency and timing of use of water points are a function of the season and the need of each livestock type. Pastoral communities have adopted watering regimes that have positive impact on rangelands. In Western lowlands of Eritrea, the pastoralists water small stock and cattle once every other day in the dry season while camels drink every four to five days. Similarly in Northern Kenya, the Turkana water small stock and cattle once every other day but can be extended to every third day for small stock in the dry season while camels drink every four days (Njanja, 1993). These strategies greatly increase the radius of rangeland used and consequently reduce overgrazing around water holes.

V. LIVESTOCK TYPES AND POPULATION OF ERITREA

5.1 Livestock

Reliable statistics are lacking on current livestock populations as demonstrated by cattle vaccination figures, which are more often double the registered population. No livestock census has been carried out since 1978, and the current livestock figures are based on estimates. At present there are 1.9 million cattle, 2.1 million sheep, 4.7 million goats, 318,914 camels, 518,459 equine and 1.1 million poultry.

Cattle:

The known zebu cattle breeds or types of Eritrea are:

Begait (Barka):

Barka is dominant in the Gash-Barka Region. They rank first in population size as compared to the other types. Milk and meat are the main products of this breed. The Barka is a long legged black and white breed originating in the Barka region. It has been spread to many areas on account of its milking qualities: daily yields of 6 to 8 litres are reported as normal. They are relatively resistant to diseases and are also known for their high feed conversion rate making them good meat producers. Mature body weight ranges from 267 to 316 Kgs.

Arado:

The central highlands of the country are home for this typed breed and they are second to Begait/Barka in population. The main purpose of rearing is for meat and draft power; their milking potential is about 1 to 2 litres per day. Their mature body weight ranges from 205 to 300 Kgs.

Arebo:

The coastal plains of Northern Red Sea are home for this breed of cattle, although numerically less important than the other breeds, it reportedly has a similar milking capacity and crossing potential as the Begait/Barka. Their mature body weight does not exceed 250 Kgs.

Afar:

The coastal plains of Southern Red Sea are home for this breed of cattle. This breed has compact body size and are few in number compared to the Barka and Arado. Their milking potential is almost similar to that of Arado. Their mature body weight ranges from 220 to 250 Kgs.

Goats:

Most of the Eritrean goats are unidentified and several types and strains are seen in the country.

Rora goat:

The most notable is the Rora goat; it is similar in appearance to the Nubian with drooping ears and a milking capacity of more than one litre per day. Average live body weight ranges from 24 to 31 Kgs.

The Barka

The Barka is the preferred breed in the Gash-Barka region. Average milk production is estimated at 1 to 1.5 litres per day.

The Shukria

The Shukria are mainly found in the western lowlands. This strain reportedly produces 1.5 to 2.5 litres per day and their milking potential warrants their trial introduction to other areas.

The Hassani

The Hassani is well known for its milk production: it was introduced from the Sudan and is characterised by long hairs. Average body weight ranges from 30 to 34 Kgs.

The Maria

The Maria is found in Anseba region and has short, round ears. Average milk yield is 1 to 1.5 litres per day. Average body weight ranges from 27 to 30 Kgs.

The Lange

The Lange is a milk producer found in Gash- Barka region. It is similar in body weight as the Hassani.

The Beledi

The Beledi is a cross breed of Lange and Hassani.
There are also unidentified mountain type goats in the central highlands.

The Afar:

The Afar is mainly found in the South Eastern Coastal plains. Average live body weight ranges from 24 to 31 Kgs. Average milk production is estimated at 0.5 litres per day.

Sheep:

All breeds are hairy types. Although all the breeds are primarily for meat production, they are also often milked for subsistence consumption.

The Shimezana

The Shimezana type of the southern highland breed is fat-tailed and small. The body weight ranges from 21 to 24 Kgs.

The Rashaida

The Rashaida type of Northern Red Sea is short thin-tailed and small. The body weight ranges from 30 to 32 Kg.

The Barka

The Barka type is the most commonly known type of sheep in the Western lowlands of Eritrea. It is long thin-tailed, whose body weight ranges from 42 to 47 Kgs.

The Hamale

The Hamale is similar to the Sudan Desert sheep and is widespread in the Western Lowlands. The body weight ranges from 37 to 40 Kgs.

Donkeys:

They are of two types namely the highland donkeys and the lowland-riding donkeys commonly called the Rifa'i.

Camels:

The most common ones are the Bisharri, Arrir and Afar camels. There are also unidentified camels in the Gash-Barka and Anseba regions. The Arrir is the preferred type in the south-western lowlands due to its high yield of milk good market price and high transportation value.

It has always been a strong belief in the Western lowlands of Eritrea that the Beni-Amer and Hidareb nomads have complete control over the behaviour of their cattle and that they can order them to attack if provoked. Afar women goat herders can actually talk to their animals; a single signal would make goats do what they are asked (Yohannes, pers.com. 1994). In effect, it can be stated that pastoralists have an intimate knowledge

of their livestock. This defines, to a large extent the patterns of use of natural resources with respect to timing and length of pasture use as well as thorough knowledge of forage preference by different types of animals and how often they need water. Each animal has a name based on age, sex, physical characteristics, salient behaviour and personality and ownership brand (Ohta, 1987).

The major constraints on livestock productivity in the traditional production system can be divided in to three different categories:

First normal constraints, which include soil and topography seasonal, annual and spatial variability of quantity and quality of the available forage, are the major constraints. Low and erratic rainfall is an obvious constraint to any manipulation of the rangelands of Eritrea, both to maintain the current productivity of the resources and to improve the fodder supply. In addition, since large parts of the country are rugged and have been severely eroded, the amount of fertile soil remaining is relatively limited to some areas. Other normal constraints are endemic diseases, helminth burdens, external parasites and losses through predators and stock theft.

Normal constraints can reach disastrous proportions from time to time. Rainfall variability can turn in to drought, endemic diseases in to epidemics, and stock theft into tribal conflict, which in turn can result in catastrophic stock losses for individual stockowners even whole groups of pastoralists.

The second long-term constraint, which is disastrous, includes drought and epidemic diseases.

The third, irreversible changes include increasing population pressure and constant losses of pastoral lands due to encroachment of agriculture.

The first two have always been part of the systems and adaptive strategies have developed to compensate for their effects. The third group is of more recent origin and largely beyond the control of pastoralists.

5.2 WILDLIFE RESOURCES

In the past Eritrean forests, woodlands and pastoral savannahs hosted a wide diversity of wildlife species.

As would be expected, the deforestation and general degradation of the environment has negatively affected the survival of wildlife. Increased hunting and deforestation with the advent of Italian colonialism has triggered the decline of wildlife and affected the viability of many animals. These include big wildlife species such as elephants, greater kudu, giraffe and a number of gazelles and antelopes.

If present, the status of the terrestrial wildlife has been assessed and, surprisingly, large mammal wildlife species continue to survive, but in very small numbers, in most of the sub-regions. Some of the existing animals are hyena, jackal, baboon, fox, greater kudu, klipspringer, gazelle, ostrich and warthog. Globally endangered species that still persist in Eritrea are the wild ass and Nubian Ibex. The elephant is also a highly endangered species at the national level for they are not more than 40-50 in number.

Most of the central highlands of Eritrea are devoid of wildlife with the exception of baboons and hares, otherwise the bulk of the wildlife species inhabit the eastern coastal and the western lowlands where there is obviously heavy concentration of livestock, which increase competition, for a grazing (Hagos, 1997).

It should be noted that pastoralists have refined knowledge and very positive attitude towards wildlife. They never threaten wild animals with extinction as each species of animal or bird represents something unique and valued in an interlinking cosmology of the natural and spiritual world. Killing an animal for no apparent reason, without exaggeration, is to violate all which is sacred. They essentially turn a benign attitude towards most wildlife species and accept the right of animals other than livestock to share the rangelands and water resources. In normal times, pastoralists do not kill wildlife, except lately when circumstances have forced them to do some hunting.

In order to enhance the protection of the wildlife in Eritrea, potential protected areas have been identified and their implementation has been proposed which is awaiting legislation. Eritrea cannot afford to set aside extensive protected areas, but a few and small strict nature reserves are proposed within a wider biodiversity conservation area. The intention of such a choice is to minimise potential conflict that may arise with pastoralists in relation to the appropriation of land.

5.3 SUPPORT SERVICES FOR LIVESTOCK PRODUCTION

In its sectoral policy framework and strategy, the Government of Eritrea has placed major emphasis on the achievement of food security. This main objective is to be achieved through an enhanced productivity of crops and livestock; the creation of a modern, technologically advanced and competitive agricultural sector; and emphasis on the development of irrigated agriculture and high value commodities.

The sub-sectoral objectives regarding animal resources are formulated in order to increased supply of animal origin proteins and nutrients; promote livestock ownership and production; stimulate processing of livestock products and by products; increase supply of animal drought power. The result that should lead to achieve these sub-sectoral objectives are in the field of animal health, production, nutrition and livestock marketing and strengthening of livestock input supply and support institutions.

The sub-sectoral policy and strategy's view is to increase national livestock production through improved individual animal productivity and development of the traditional pastoral system in the lowlands through efficient sustainable rangeland use, fodder production, development of watering points and de-motivation of increase in stock number.

In the field of animal health the government has expressed its intention to improve the health status through preventive and curative medicine measures.

In the field of animal production, the emphasis is on improved animal husbandry practices. More specifically, the government in its policy recommendation underlines the importance of increased animal production through improved individual animal productivity rather than through expansion of stock numbers. Another recommendation is the improvement of the traditional pastoral system in the lowlands by efficient sustainable rangeland use and management. Furthermore, the government will actively support a commercial orientation towards animal production through the promotion of breeding systems and appropriate restocking.

The main objective regarding animal nutrition concerns increased accessibility to quality feed and improved rangelands. Anticipated outputs to arrive at such an objective are improved animal nutrition by introduction of selected improved fodder crops, allocation of grazing lands in regional and national land use plans with emphasis on fodder production and rangeland management extension strategies.

Improved livestock marketing requires an emphasis on raising quality standards, improved marketing systems for livestock and their products, as well as an improved physical infrastructure to enhance marketing.

The policy of the government of Eritrea acknowledges the importance of livestock sector in achieving national food security. There is a recognition that the existing livestock resource is yielding far less than its potential due to poor management, inadequate

nutrition, high mortality and morbidity from diseases and limited essential support services. Taking these in to consideration, in the last fifteen years after independence the government has undertaken the following development activities:

- ✓ Sporadic watering point development at strategic locations
- ✓ Surface water harvesting for minor irrigation
- ✓ Development of grazing blocks have been instituted many times
- ✓ Development of enclosure and range management projects have also included an extension component
- ✓ Development of livestock holding grounds
- ✓ Restocking projects have been designed to provide pastoralists who have lost most of their animals with the means to rejoin the pastoral economy. Most such projects give destitute households goats or sheep, and rarely cattle and camels
- ✓ Conservation of hay and crop residues as a forage reserve
- ✓ Veterinary campaigns, service centers and barefoot veterinarians represent institutional innovations to insure that producers have access to drugs and animal health care within easy reach. Field veterinary centers have been established as an organizational base for the stocking of drugs and the offering of simple treatment. Alternatively, local communities were encouraged to employ their own field assistants after a short period of externally assisted training. However organized and staffed, such units are only effective if supported by training and supervision from a higher level, which can insure access to drugs and adequate quality control for the services, offered.
- ✓ Sedentarization efforts aim at settling former nomads onto fixed parcels of land, usually around water points and where there are social services
- ✓ Small-scale irrigation has often been introduced in the hope that ex-pastoralists might be able to grow their own food and thereby reduce dependence upon their herds for subsistence

VI. IMPACT OF PASTORALISM ON NATURAL RESOURCES AND THE ENVIRONMENT

Pastoralists seem not to have a range conservation programme for the sake of conservation since they can always move to a new area, when the area under use is depleted. Conservation, as we understand it today, may not be the imminent goal of pastoralism. Nevertheless, since pastoral practices are aimed towards the protection and conservation of natural resources for future productive use, then pastoralists make one of the most important and dynamic conservationists' group that have ever existed. There are several traditional range management systems that seem to promote and sustain conservation of plant resources. These include: mobility, management of species (unique and protected habitats and range reserves) and conservation of economically important trees and shrubs.

Legesse (1994) indicated that environmental degradation in pastoral areas has been brought about by development programs rather than by pastoralism. He identified two types of degradation. The first is a natural and dynamic process caused by the use of resources by pastoralists. Thus pastoral communities build-up herd size in good years as a buffer against uncertain environmental catastrophes. Such degradation does eventually occur due to natural checks and balances of the resources. The second type of degradation is primarily a result of the various and numerous development interventions introduced in pastoral areas. The digging of boreholes provided permanent water sources, an essential factor in restricting mobility; the building of dispensaries and schools, the various forms of involuntary sedentarisation projects and the introduction of other forms of poorly planned development programs, both attracted non-pastoral communities to pastoral areas and encouraged pastoral settlements, with the resultant high concentration of humans and animals in pastoral land.

Recent studies in Eritrea have shown that the riverine areas in general are important dry season havens for livestock producers. Movement to such areas are carefully planned and coincide with the season of scarcity in the home territories of the different groups during the long dry season. It is unclear what regulations are used to manage the riverine vegetation but as a general rule all livestock owners are not supposed to cut down trees but either lop or shake trees for pods.

The riverine vegetation area in rangelands is a vital forage resource for pastoral herds, particularly during the dry season. For this reason, riverine vegetation strips are greatly valued and their protection are ensured through traditional regulatory and conservation procedures. Conservation of plant resources in unique habitats ensures adequate feed resources from trees such as *Acacia*, *Salvadora*, *Hyphaene*, *Cordia*, and others. The protection of the plant resources in the riverine sites prevents over exploitation of plant resources when their potential for regeneration is at its lowest.

According to (AMRF, 1999) in all the Beni-Amer and Hedareb village in which the survey was undertaken, respondents mentioned having had a traditional management system in the past, inherited from their fathers, which had the aim of preserving the

forests. There were village by-laws regulating forest use. The village elders known locally “*lijna*” were the institution that enforced the village by-laws. In many cases, one particular member of the *lijna* had the task of protecting the forest instead of all the elders. He was called “*Abo Gereb*” (forest father). In some cases, there could be several *Abo Gerebs* to bring the offender in front of the village for justice. Cutting live tree was forbidden; only dry wood could be collected. Under the traditional system, permission to cut live wood for housing and other purposes could only be granted by the *lijna*. However, cutting a Dom palm tree was considered in most villages as a crime which should be punished severely but there were no restrictions on the collection of Dom palm leave even for people coming from out side the community.

In many places there were a common set of rules. In the Kunama communities in Upper Gash, the medagul tree and trees useful for food were the ones most protected. An offender was believed to get sick if the best goat or sheep was not slaughtered at the site of offence as a sign of sacrifice, and was advised to be treated by traditional medicine.

In the Afar area cutting trees was considered to be like killing a human being and consequently social ostracism and punishment in terms of payments in kind were enforced.

“The Afar, Beni-Amer, Hedareb and Rashaida never hang axes on their shoulder but swords and knives on their waist”. This also indicates that these people never cut trees. This strong sense of ownership seems to have esteemed from the strong pressure exerted on the forests and the need to preserve them (AMRF, 1999).

Pastoralists particularly in the highlands have over time and space developed grazing reserves in which the utilisation of plant resources is prohibited and/or regulated for use at particular times of the year. The restriction may include grazing, wood gathering and tree cutting.

Mobility outside their home territory has been an important survival strategy for all groups involved in livestock production in Eritrea. The primary reason for such movements is the search of grass, which may be insufficient throughout the year, and the search of water, which becomes scarce during the dry season. Livestock owners also have to avoid biting flies and insects in the wetlands during the rainy season. Mobility allows a period of rest and growth during the wet season for dry season pasture. This maintains and sometimes increases vegetation biomass. The net positive effect of mobility is to cancel out the adverse impact of continuous grazing, which can, at the worst, lead to loss of plant species in the long run.

The conservation of the riverine vegetation and grazing reserves has been instrumental in preserving the vital diversity of particularly woody plants over the generations. Contrary to wide spread belief, pastoralists do not deliberately cut down trees and shrubs except for essential purposes. Woody vegetation is crucial for pastoral survival as it provides fodder, fuel wood, materials for construction of homes, fences and corals, and as a source of food, medicine and shade.

Utilization of woody vegetation is often governed by formal and informal rules that protect plants against overuse. They rarely cut valuable trees or shrubs; they instead collect dry and dead wood for fuel and cut less useful trees and shrubs for constructing fences and to reduce bush encroachment. They would rather lop or shake down leaves, seeds and pods from trees and shrubs for livestock using adapted sticks than cut down trees and branches.

Through, passive protection of seedlings or active germination and propagation by seed dispersal, pastoralists perpetuate tree and shrub regeneration. Constant mobility promotes seed dispersal by livestock and creates suitable seed beds on abandoned campsites for seed germination. Seed scarification by passage through the digestive tract of animals increases the germination rate. In addition, germinated seeds take advantage of the manure on the sites for vigorous growth.

These discussions are not intended to portray pastoral resource utilisation as a non-degradative system. It may be totally misleading to assume that livestock grazing in semi arid rangelands is unlikely to induce range degradation. In fact, modern development interventions such as water development through boreholes, small scale irrigation schemes in rangelands, increased dry land agriculture and increased human population pressure have caused localised overgrazing due to diminishing grazing land.

Most pastoralists do not deliberately improve rangelands in comparison to conventional range improvement. Nevertheless, water development, bush clearing, tree regeneration, and protection and application of bush fires are all range improvement strategies well known to pastoralists. Range productivity is sustained through livestock diversification and institutionalization of mobility strategies. Mobility represents a form of grazing rotation necessary to provide for the graze rest sequences. Bush fires are deliberately set to promote green re-growth of perennial grasses, clear dead biomass, reduce disease vectors and stop bush encroachment.

Pastoralists monitor and evaluate the quality of range resources through soil types, potential of pasture types, presence or absence of individual plant species and their palatability to different livestock, degree of greenness of forage, presence or absence of specific wildlife species and behaviour of livestock (Ba, 1982)

VII. RANGE RESOURCE MANAGEMENT AMONG PASTORAL COMMUNITIES TRADITIONAL ADAPTIVE STRATEGIES

Traditionally, risk-reducing adaptive strategies are, herd size, herd diversification and herd dispersion.

7.1 HERD SIZE

Technical people equate livestock production with beef production and want fewer livestock numbers of uniform structures. That is why the pastoralist has been constantly accused of being environmentally destructive because overstocking and, overgrazing that seem to be inherent of his life style. These allegations may have been misplaced because they ignore the essence of pastoralism.

The pastoralists derive more than 50% of their total food energy intake from livestock in the form of meat and milk. This resource extraction is largely a subsistence dairy operation because milk is the most important animal product in pastoral societies and is needed every day. Most cows conceive usually once every two to three years and provide little milk during the dry season. Females comprising more than 75% of the livestock number always dominate the herd size. This reflects the pertinence of milk as the major end product of pastoral production systems. In addition, the herd facilitates the formation and the reproduction of the domestic family unit to which it is attached, and enables the production of food and revenue for the subsistence of the family.

According to survey conducted in Kerkebet and Shieb (Tewolde 2001), the respondents in all the sampled villages emphasized the crucial role played by female dominated herd structure, especially during a recovery period. This is a widely practiced strategy, particularly for small ruminants. The herders are also reluctant to sell cows and female camels except in extremely compelling conditions, which is further strengthened by the restrictions imposed by the local administration.

Increased herd size and milk production, maintenance of an appropriate and viable herd structure and prevention of animal loss to disease have always been the core objectives of pastoralism. These are some of the reasons why large number of animals must be maintained.

As an insurance against drought, pastoralists strive to increase stock numbers, in order to provide security in case of losses, to leave a remainder of feasible size, to re-build their herd. Thus the expansion of herd sizes in “normal” times, not stricken by drought, disease or unrest, is a rational strategy and not a projection of prestige, social status and wealth. Although it is true, that parallel to increased numbers of animals, an increased social standing for the owner will develop, this has to be seen as a favourable by-product of an effort to safeguard future survival.

Freehold ranchers adjust livestock numbers to their land base when faced with large and unpredictable fluctuations in resource productivity, whereas pastoralists seek access to natural resources needed to sustain their livestock elsewhere rather than reduce herd size. This is very much in line with the certain knowledge that they must live and operate within a rigidity delimited and finite land base. Opportunistic stocking and herd mobility are a logical and tactical complement to non-exclusive tenure (Sanford, 1983; Behnke & Scoones, 1993). Further, herd size and the size of its associated family are interdependent features at any time. Seen through time, fluctuations in herd size and the process of family development are also interdependent. In other words, ecological factors require herd expansion to keep pace with family development, while social factors influence family extension to the limit of livestock surplus (Dyson-Hudson, 1966). Herd maximization is a common feature among pastoralists with optimum herd size varying between groups.

7.2 HERD DIVERSIFICATION

Herd diversification is practised as an insurance against major disease outbreaks since the different domestic species are generally not susceptible to the same pathogens. Besides the different dietary preferences of the various domestic species also allows for a better utilisation of pastures that may not be suited for one or the other domestic herbivore species. In addition, they have different water and herding requirement.

Livestock diversification offers ecological, nutritional and socio-economic benefits. Differential utilization of several livestock species that gather energy from varied forage groups increases the equity of forage exploitation. Mixtures of animal species take advantage of the availability of different plant species in terms of livestock feeding habits. Camels and goats are mainly browsers, but feed at different levels due to height differences, whereas cattle and sheep are mostly grazers. Different livestock types with slightly overlapping diets enhance more efficient use of the range. All of these varied characteristics help in the allocation of range resources in the best and most flexible way. This was supported by Mentis (1978) who argued that system of four or more interacting species are probably beyond strict optimization and the manager can apply no more than intelligent guesswork.

Herd diversification is used to meet the specific objectives of the households, especially for nomadic pastoralists in Kerkebet area (The *Beni-Amer* and *Hidareb*). Large ruminants (cattle and camels) are kept for their milk, but they also serve as a bank account in times of severe climatic stress. Sheep and goats are highly regarded as potential sources of cash income and food because of their high reproductive rates and high degree of resistance to drought conditions. This shows that herd diversification is widely practiced in the more arid regions of the country (Tewolde, 2001).

In any livestock production system, some species are preferred over others for economic and adaptability reasons. Small ruminants have some inherent attributes that makes them

suitable for arid and semi-arid type of production systems because of their small size, digestive efficiency and long distance seed dispersion (Gall, 1981)

Complementarities provided by a diversified herd sustain income requirements and the total quantity of food energy available for human consumption and reduces its seasonal variability. Camels normally provide milk throughout the year; have the highest resistance to drought and the highest market price in addition to being used as beasts of burden. Cattle provide milk which can be processed into ghee (butter) for home consumption or sale, have a good market value if sold for meat and are slaughtered, on, special social occasions. Small stock produce milk that can also be made into ghee and provide a small cash return when sold. They are slaughtered at small gatherings and to provide hospitality to guests (Al-Najim, 1991). Due to their high reproduction rate, small stocks are also important in herd rebuilding following a devastating drought. The exploitation of different species thus constitutes a rational strategy for balancing the objectives of subsistence needs, drought security and cash income.

In Eritrea, as in most developing countries, small ruminants have been raised for generations and are viewed as a symbol of wealth and prestige, and security against uncertainties and natural disaster.

Any change in species composition can therefore have a significant impact on both rangeland ecosystems and pastoral production strategies.

7.3 HERD DISPERSION

Herd dispersion is a third risk-reducing strategy, which is frequently practised in traditional systems. Stockowners separate their herds and have them herded in areas sometimes up to several hundred kilometres apart; this is primarily a measure against forage shortages and raiding. If the family is large enough, its members manage the different herding units, and family reunions and rearrangements of the different stock sections take place either during the rainy season or during certain ritual occasions.

A related form of dispersion, although of a different significance is the formation of stock alliances and stock patronage that is independent of family size and social status. Individual animals or groups of animals are given out to other stockowners, who are either needy (practical between the *Tigrinya* and *Saho pastoralist*) or in some way entitled to compensatory claims. Often the original owner never recovers the animals, but in times of hardship the son or even grandson might reclaim some or even all of the loaned stock from the recipient's heirs. This risk reducing strategy is common among all pastoralists, whose social organisation is based on clan and age set structures and should be regarded as a system of social security rather than an actual management tool.

When herders are forced to disperse livestock to several places, the labour demand for herding becomes highly disaggregated. Problems associated with labour shortages are usually solved through arrangement made between individual pastoral households. Two

or more households (usually relatives or close friends) bring their herds together under a single herder, who rotates them on a seasonal basis. Territorial alliances between the pastoral groups (*Tigre* and *Hidareb*, *Tigrinya* and *Saho*) are another form of community strategy, which helps reduce conflicts of over resource use.

Herd splitting is a common practice among pastoralists, primarily in response to immediate household food requirements, resource or labour availability. Herds are generally split based on management units, milk production units or age units. For example, the lactating animals and their young are left behind in the main camps to supply milk for the children, women and the elderly, while the rest are given to relatives and close friends to avoid the risk of total losses during situations of crisis. Those that can trek long distances, including unproductive females of large ruminants, are generally included in the satellite herd, while the core herd of young and breeding stocks is kept near the homesteads using sources of water and forage at nearby locations.

7.4 MOBILITY

The most conspicuous strategy of migratory pastoral production system was, and still is, the mobility of households and herds. The migrations, which are dictated by the availability of forage and water, can follow various patterns but are always characterised by the combination of individual stock ownership and communal land use. This combination does not usually promote sustained-yield resource exploitation whenever land becomes scarce, and in particular when dry-season grazing reserves are no longer accessible. If confined to rainy season pastures throughout the year, the mobility of pastoral households and herds will be reduced to only minor moves, for hygienic or ritual seasons, since energy expenditure for a majority move is not compensated for by a significant improvement of pastures.

There is a general lack of appreciation by modern societies for the practice of mobility by pastoralists as a strategy for exploiting patchy resources. Mobility is one of the most coherent and pervasive adaptations and deliberate strategies intended to meet livestock requirements in an ever-variable environment. Pastoral mobility can be as varied as the environment demands and is primarily a function of quantity and quality of forage, water availability as well as other factors such as salt licks, climatic factors and pests and diseases.

Mobility or transhumance between regular seasonal grazing areas is a traditional form of pasture rotation, which can be more efficient and complex than can be accomplished by conventional rotational grazing schemes, and has several simultaneous benefits. First, it provides rest and growth periods for dry season pastures during the wet season and a dry season rest to wet season pastures, which still have good ground coverage that protects the erosive first rains. Second, animal concentration around watering points is reduced in the wet season pastures, which have abundant water. Third, periods of rest break the cycles of diseases and parasites that tend to build around dry season wells (Niamir, 1990).

For the agro-pastoralist in area, Northern Red Sea coastal area of Sheab movements are upward and downward along the escarpment on a seasonal basis, while for the nomadic population in Kerkebet, movement is horizontal involving long distances.

7.5 MODERN ADAPTIVE STRATEGIES

It should be understood, that the term “modern” does not apply solely to recent or present developments, though for most African pastoralists it coincides with the respective dates of independence.

Particularly those pastoralists that become impoverished after devastating droughts may be able to re-establish themselves in the pastoral sector through various social mechanisms (stock alliances, stock patronage), will turn to irrigation agriculture, where development projects are in operation, seek wage labour (usually in low income brackets) or attempt to live on famine relief.

According to Tewolde (2001) the pastoral groups (Tigre, Hidareb and Rashida) are trying to diversify their income through various initiatives. 37 percent of the sampled households were involved in some form of extra income generating activities, including horticulture, petty trade and wage labour. Some activities are spontaneous response to drought induced food shortages (example, cattle trading), while horticulture and wage-labour are becoming increasingly important for transition from a nomadic to a diversified way of life. Age and level of awareness of herders for alternative life style also impact on involvement in non-pastoral activities. For example, young men from Kerkebet region are increasingly migrating to a place called Slaa looking for employment opportunities at the gold mining site. This is a recent trend, and the expectation is that more herders will get engaged in non-livestock income-generating activities, because the traditional pastoral system is increasingly becoming incapable of supporting the community members. These alternatives, especially the latter two, are of steadily increasing importance since the recuperative potential of the traditional livestock economies is declining for the already indicated reasons.

Out migration of labor from the pastoral sector being one means by which the pastoral human population can temporarily adapt to the fall in herd productivity caused by drought is to send some of its members elsewhere, thereby reducing the number dependent on the herd for their support. At the same time, the emigrants may start to earn an income, which can help the family left behind to buy some of its food needs. There are, however, likely to be negative effects on herd productivity from this out migration of labor, which tends to consist of young adult males, the most productive workers in the pastoral economy and crucial to the efficient management of livestock in semi-arid conditions. Researchers in both East and West Africa have noted the drop in efficiency of herd management following the outflow of labor in Mauritania and northeast Mali where the pastoral sector has lost much of its servile labor force (Bonte, 1975; Marty, 1975); in Niger where many households must send part of their workforce on migration during the

dry season when the labor demands of watering and herding stock are acute (White, 1984); and in Kenya, where the flow of migrants from the Boran economy has meant that more distant pastures can no longer be effectively used and protected, leading to bush encroachment or invasion by neighbouring pastoral groups and that areas close to Boran settlement sites are overused, leading to low herd productivity and localised pasture degradation (Dahl, 1979; Hogg, 1980).

On the other hand, many wealthy pastoralists are successfully investing in non-pastoral sectors by engaging themselves in trade and business using the structure of the remnant economy to stimulate local markets for foreign goods (petty trade). The Afar pastoralist also traditionally practice trade of salt and other commodities. Other external interests may include transport, for example in western Denkalia the camels are used as lorries to ship goods, for which payment is received, and which is used to buy food and other needed goods.

Formal education and training is also seen as another form of capital investment as it increases the chance for jobs in the higher income brackets that in turn are the only ones to allow reinvestment in the pastoral sector. Thus, the recuperative potential of the pastoral sector is augmented by non-pastoral activities, though limited to small portions of the population. Today, roughly most of the pastoralists are living below the poverty line, and, are not self reliant in terms of food production. Only a very small minority of the pastoral population are able to diversify their economic activities into non-pastoral sectors.

VIII. CONCLUSION AND RECOMMENDATIONS

The need for the development of the Eritrean pastoralists can be viewed from two perspectives: the condition of the pastoralists and the vital needs of the nation.

Based on experience all over the world, the pastoralists of Eritrea face an ecological and socio-economic crisis resulting from both desertification and encroachment upon their habitat by mechanised farming, game reserves, national forestry, and peasant farming. The pastoralists are marginalized in terms of their social and economic relations to national life.

The Eritrean pastoralists differ from each other in some of their basic socio-cultural features. The major differences centre on their resource endowment, their mode of production, and orientation to modernity, and external relationships (i.e., trade and religion). These differences require variations in development programming, which in turn requires vigorous research, resources and organisations.

The pastoralists and their habitat comprise a significant component of Eritrea's population, ethnic groups and territory. It is incumbent upon the government to make a significant effort to mobilise their energy and resources in order to alleviate the precarious conditions of such large number of its citizens, as well as to control and develop these resources.

There are three pressing questions that need answers within the context of these new approaches to pastoral development given past experience.

- a. Where do we hold pastoralism in society?
- b. Do we want to further bring about its disintegration and final disappearance through continued restriction of pastoral mobility?
- c. Can mobility be sustained given the present and persistent problems of access to land and water resources?

The design and implementation of a development program for pastoralists requires consideration of their specific environmental and socio-economic constraints and possibilities. The harsh climate, with low and unreliable rainfall and with all year round high temperatures, which severely limits the potential for rainfed agriculture.

Encroachment into pastoral areas has continued unabated. The fact that the lowlands are under-populated has led to the erroneous notion that Eritrea still has large land resources that could be used for large scale mechanised farming. As a result, crop cultivators have slowly been expanding their operations into these areas.

The establishment of all these projects was in a sense an encroachment upon pastoral rangelands, whether this was intended or not. Their negative consequences by far outweigh their direct benefits. This conclusion is not intended to suggest that the vast pastoral areas should be forever reserved for exclusive use by pastoral groups. One

cannot advocate that the big rivers be reserved for the pastoralists alone. There is a need to exploit these areas by commercial farming, but the pastoralists should be among the main beneficiaries, or be provided with a viable alternative.

Interventions by government and development agencies in natural resource conservation, while well meaning to provide essential services, may not have been sufficiently sensitive to traditional norms and the subsequent impacts. Sometimes the results have been that the communities no longer feel that they are fully responsible for their resources and well being.

In traditional livestock systems it will be more difficult to improve government rules on herd size and de-stocking that correspond to actual carrying capacities, others than the traditional rules that have kept a noticeable equilibrium between traditional livestock production systems and available natural resources maintaining environmental conditions. Community ownership of resources and development projects lead to acceptance of responsibility and encourages the community to invest in developing their own resources. However, ownership does not inherently lead to sustainable use. The effectiveness of the management system is more important than ownership per se.

Traditional resource utilisation is not automatically appropriate, since circumstances have changed (increasing population of people and livestock, access to grazing lands, need/desire for settlements, health and schools, sedentary agricultural groups, change of climate, etc.). But from a social perspective the traditional system is the only basis on which any development or intervention in the pastoral production should begin, as this is the framework for community development. If this is recognised, then community participation is a prerequisite to any interventions. The emphasis of community participation is important for the sense of ownership, acceptance, replication and potential sustainability of any form of intervention.

Pastoral societies have, over the centuries, developed sophisticated means of coping with the vagaries of disease, weather and civil strife, but these are breaking down in the face of growing human populations and the encroachment of cultivators and others on traditional grazing land. New coping mechanisms are urgently needed that reinforce the traditional systems. The first step in this direction has to be a thorough analysis of the traditional coping mechanisms. Research is urgently needed to explore alternative production practices and formulate strategies and policies to help reduce the effects of calamities on pastoral populations or to assist in re-establishing livestock production in pastoral systems after major crises.

Pastoralism is based on a livestock production system, which is ecologically adjustable to the utilisation of the meagre resources of the arid and semi-arid areas, which are not generally suitable for rain fed agriculture. Hence all necessary conditions should be adjusted to making this mode of production viable.

Therefore, if pastoralism is to continue in Eritrea the following points need to be put in place:

- ✓ Ensure the flexibility and mobility of pastoral herds, which is critical to “opportunistic range management” and the success of this system,
- ✓ Develop an extension system in the pastoral communities, a more adaptive, process oriented approach to planning is required that builds from an understanding of existing pastoral management strategies and local knowledge of environment and resources,
- ✓ Selective range management interventions to make the pastoral sector more productive, while preventing adverse ecological effects,
- ✓ In light of recurrent droughts, schemes for crisis management and rehabilitation should be devised. Preparedness for drought situations should include the storage of feed,
- ✓ Provide access to dry-season grazing and drinking water for livestock,
- ✓ Develop and provide low-cost veterinary services,
- ✓ Strengthen indigenous coping strategies - and possibly provide new options for risk management,
- ✓ Support the development and adoption of resource management practices that will protect and improve the productivity of the rangeland resources, thus increasing the resilience of the natural resource base,
- ✓ Reduce fluctuation in prices of livestock and grains during drought through expanding market,
- ✓ Improvement of livestock productivity,
- ✓ Stratification of the pastoral economy by developing alternative means of livelihood in the non- pastoral sector of the national economies,
- ✓ Alternative land use pattern has to be adopted
- ✓ Policies should be developed for the maintenance and provision of pastoral grazing land. Laws should be enacted and enforced to prevent encroachment upon the territory by mechanised agriculture without due compensation.

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