"SUBSISTENCE FARMERS' PERCEPTION OF ENVIRONMENTAL PROBLEMS AND MONETARY ESTIMATES OF AGRICULTURAL AND NON-AGRICULTURAL RESOURCES IN THE OKAKARARA AREA"

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SECTION 1

BACKGROUND TO THE RESEARCH PROBLEM

1.1 Introduction

Since the independence of Namibia, economic development has become a necessity in neglected rural areas, which were known as "Bantu Reserves" in the pre-independence era. For any economic development to be of long term benefit to the communities in those areas, a study of human-environmental interactions and the valuation of agricultura and non-agricultural resources used on subsistence level is of immense importance.

This micro-study conducted in the Okakarara area is primarily an attempt to highlight the economic and cultural aspect that may lead to environmental degradation. A household is an important unit of the community and the discussion in this study is centred around how a rural household is organised, and how such an organisation affects the use of available resources. Cattle rearing is the major economic activity in this area and this makes people dependent on the environment, which provides fodder for their livestock, construction material for their houses, medicine for themselves and their animals, as well as veldfood which adds variety and provides them with a balanced diet.

The way in which people use natural resources and their perception of the environment, determine how much they can get from the environment, at present and in future. A careful study on how subsistence farmers perceive and understan the human-environmental interaction becomes of vital importance.

Secondly, the study is also an attempt to monetarily evaluate resources used on a subsistence level that do not go through the market. These resources include agricultural resources such as milk, meat etc. and non-agricultural resources such as construction material, grass and browsing material, veldfood etc. These estimates will provide an idea of how much a rural household consumes per time period, in this case a year. It may also give farmers, planners, environmentalists and all interested parties an indication of how much it will cost the society when vital resources are considerably degraded.

1.2 Objectives

The objectives of this study are:

1. to undertake a pioneer study of the linkages between the needs satisfaction and the way rural people use the environment as their economic base;

2. to collect information on how people perceive human-environmental interactions;

3. to estimate, monetarily, agricultural and non-agricultural resources used by rural households which do not go through the market and, as such, are not priced.

1.3 Study Area

The study was conducted in the Okakarara area in the former Hereroland West[1], and included the villages of Ohakane and Okatumba to the west and Okakango to the south of Okakarara town. All three villages are approximately three kilometres from the town. Cattle rearing is the primary economic activity in the area and this makes people directly dependent on the environment. Another equally important reason for choosing this area is that the researcher could converse directly with the respondents. Ideally, similar studies will be done elsewhere in Namibia, following this pioneering work.

1.3.1 Geology and Soils

Hereroland is an area of little relief, situated on the extensive interior plateau of Namibia, at an elevation of between 1000 and 1500 metres above sea level. Large areas of the Post-Karoo surface of sandstone and calcrete are covered with unconsolidated vegetated sands and sand dunes. Towards the southern and eastern borders, weakly developed loams occur in the vicinity of ephemeral water courses.

1..3.2 Climate

Mean rainfall ranges from 400-500 mm per annum, decreasing in a westerly direction. Rainfall is very variable, with an average deviation of 25 to 35 per cent from the annual average. Rain falls on average for about 30-40 days per year, mainly during the summer months from October to March. Evaporation ranges from less than about 260 mm in the north to about 300 mm in the south of Hereroland. Average maximum temperature ranges from 31-35 degrees Celsius, increasing from west to east, whereas average daily minimum temperatures range from 3-6 degrees Celsius. North-easterly winds dominate throughout the year. The above set of parameters leads to the classification of Hereroland as a hot steppe area (BShw) according to the Koppen classification system.

1.3.3 Vegetation

The vegetation of Hereroland graduates from camelthorn savannah in the south to forest savannah and woodland towards the north. Acacia species dominate on more calcareous soils, while Terminalia sericia dominates on more sandy soils [EEAN 1991].

1.4 Methodology

This research was carried out in 1993.

Three households, one in each of the three abovementioned villages of Ohakane, Okatumba and Okakango, were picked at random. The households are represented by the letters A-C, With A representing Okatumba, while B represents Okakango and C represents Ohakane. A household in this study is defined as those people who use a common kraal i.e., keeping their livestock in a common kraal, but at such a household people may use different fireplaces (omazuko) to prepare their food.
The sample is not representative and this study should only be regarded as a micro attempt to understanding a more complex situation.

[1] Hereroland West is situated in the Otjozondjupa region, according to the 1991 delimitation.

Much of the environmental and socio-economic information was obtained from interviews with 14 respondents in the three adjacent villages. Direct observation was also used to verify information obtained from the interviews. Interviews were conducted with all members of the household on an individual basis. The same questions were posed to each member. Interviewing every member in the household made it possible to record different perceptions that depend on the age and sex of the respondent. The interviews examined farming operations, services, facilities, social organisation, health and environmental awareness.

In order to allocate monetary value to agricultural and non-agricultural resources, market prices of similar or equivalent products were used.

SECTION 2

HOUSEHOLD ORGANISATION

This section will discuss household composition, educational background of respondents, the role of the household head and household labour division.

2.1 Household Composition

The three households in the study area are extended families with an average size of 21 members. Table 1 gives the family composition of the three households studied.

Table 1 Household composition of three households studied in three adjacent villages in the Okakarara communal lands.

HH	F	M	F u16	M u16	F u12	M u12	F u6	M u6	F u2	M u2	Tot[2]	Pr
A	4	9	0	0	3	0	0	1	0	1	18	9
B	3	4	2	0	1	2	3	0	1	2	18	16
C	7	7	2	0	4	3	2	2	0	3	27	19

HH = household F = female M = male u = under (u16 = under 16 years) Pr = present members

The "present" members i.e., those individuals who stay at home full time or who are employed in Okakarara and spen their time after work at home, are the most important part of the study, because they depend directly on the resources the study area.

[2] The household size given becomes large, because of the inclusion of members who are working in towns or attend school away from home. The inclusion of the "absentees" is important as some of them own livestock and form a true part of the household.

2.2 Educational Background

The respondents had varying educational backgrounds. Table 2 shows the respondents' level of formal education.

Table 2 Respondents' Level of Formal Education.

Respondents	Sample no.(n)	% of n	Highest grade(% of n)	Present grade (% of n)	Read & Write (% of n)	Illiterate (% of n)
never at school	5	35.7	0	0	14.3	21.4
school dropouts	8	57.1	5	0	100	0
still at school	1	7.4	6	7	100	0

(Source: Omu Kakujaha-Matundu)
Note: Per centages may not add up to 100 due to rounding.

Of the 35.7 per cent who never attended school, only 14.3 per cent can read and write, while the rest i.e. 21.4 per cent are illiterate. Lack of money was cited by 71.4 per cent of the school dropouts as the reason for leaving school, while 14.3 per cent claim that they had left school due to lack of interest. The remaining 14.3 per cent had to leave school in order to take care of a sick granny.

During the study period, only one respondent was attending school, doing grade 7 and aspiring to reach university. The three households had an average of 5.6 children of school-going age, with school attendance of 100 per cent.

2.3 Role of a Household Head

A household might have one or two heads. Where two household heads are found, one accomplishes managerial tasks, while the other fulfils a more traditional (religious) role. The traditional head is accorded that position as per his/her age or birth position[3]. If such a member is present in the framework of the extended family, he is accorded the role of a traditional head of the household, even if he does not own any livestock. The managerial head is the actual head and the owner of the livestock at that particular household. The traditional head acts only in an advisory capacity. The former set-up was observed at household B, where an elderly uncle acts as a nominal head. Where a household is headed by one individual he/she fulfils both the traditional and the managerial tasks.

Because of their importance in household decision-making, particulars of the managerial heads of the three households are given in Table 3 below.

Table 3 Particulars of household heads

HH	Sex	Age	Marital Status	Ed. Level	HH Size	Livelihood-hood	Farming years	Farming time
A	F	67	Single	Illiterate	18	L/stock & pension	7	46%
B	M	46	Married	Gr 7	18	Job & L/stock	20	28%
C	M	78	Widower	Read & write	27	L/stock & pension	72	46%

(Source: Omu Kakujaha-Matundu)

[3] This could be an elderly uncle who lives with his nephews and is only a nominal head.

If other activities e.g., sleeping, eating and leisure is taken into account, a full time farmer is left with about 11 hours or 46 per cent of time farming. The head of household A, started farming with goats seven years ago, after she had lost her job as a domestic servant in Otjiwarongo and spends 46 per cent of her time farming. The head of household B started farming at the age of 26 and is currently employed by the Ministry of Agriculture, Water and Rural Development. He is at home after work and on weekends i.e., 10 hours eating, sleeping and leisure, 8 hours on the official job; leaving him with 6 hours for farming , which is about 28 per cent of his total time (including weekends). The head of Household C has spent his whole life around livestock and, since young boys start taking jobs with livestock at the tender age of six, his farming experience is given as 72 years and his farming time as 46 per cent. Their farming time could be translated into wage equivalents of similar sectors.

2.4 Household Labour Division

This section gives the household labour division as observed in the study area. The importance of this section is to give the reader an idea of the exact nature of duties of each family member as per her/his age. This may be important, when an interested development agency wants to choose a target group for environmental awareness programmes[4].

Household activities include making fire, making tea, milking, preparing *omaere* (cultured milk), cooking, driving livestock in/out, fencing, collecting firewood and water and laundry. Although most of the household work overlaps, women's work has been observed to be mainly making fire, laundry and preparing *omaere,* while men's work includes milking, driving livestock in and out, fencing, gathering wood and collecting water. Children's work is mainly driving the small stock in and out.

[4] e.g., it is better to target young children when dealing with smallstock

SECTION 3

ENVIRONMENTAL AWARENESS

Tradition and custom have played an important conservation role over the years e.g., tradition prohibited the use of edible fruit trees as firewood. Food taboos, which prohibited some clans from consuming some animal species, reduced pressure on the different species. The appropriation of the people's land and their herding into "Bantu Reserves" decreased the resources available to them; competition for resources increased and these vital conservation traditions were lost, as increasing poverty forced people to exploit the limited resources.

The over-exploitation of the limited resources led to serious environmental problems which include overgrazing, bush encroachment and local and alien plant invasion. The above environmental problems have drastically decreased the grassland productivity. Local farmers are well aware of these problems, but feel powerless in the face of all these problems and see government as the major agent in solving their problems. The overall picture is aggravated by the non-existence of agricultural extension services; consequently farmers do not have a co-ordinated view and approach towards the environmental problems they collectively face. Some of the environmental issues that need serious attention and the way in which they are perceived by the local herders are discussed below.

3.1 Lack of Organisational Structures

Colonialism undermined the African organisational structures. Appointments of new chiefs fitted the purpose of colonialists in many parts of Africa. The same happened inside the Police Zone[5]. In the case of Namibia, kings lost all their power to the German and South African administrations. The newly appointed headmen became paid servants of the colonial administration. Their duties became those of courtiers, rather than that of executive officers.

Under the colonial administration, all African land was expropriated and declared State land. Large tracts of land were allocated to white settlers, while Africans were herded into marginal areas, on the fringes of deserts, known as the "Bantu Reserves" (communal farming areas). The creation of these "reserves" basically concentrated too many people on a small piece of land, and as such "forced them off the land", in order to serve as cheap labour on European farms, in towns and in the mines [Troup 1990].

Placed in small marginal areas, with no range management system, serious degradation of the rangeland resulted. Lack of organisational structures paved the way for uncontrolled influx of people and livestock, whenever a new borehole was sunk. Unlimited numbers of people and livestock settled at the new village without taking the carrying capacity into account. As a result, new villages were overgrazed after only a few years of settlement and this also led to decreased borehole yield.

This means that lack of strong organisational structures contributed to environmental degradation in the communal areas. This also implies that, only with grassroots organisation, can further degradation be halted or reduced and the rehabilitation of the area made possible.

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[5] The German colonial authorities were unable to control the northern regions militarily or by a police force, and declared in 1907 that police protection should be confined to the areas which fell inside the influence of the railway lin or main roads (See Adams et al 1990).

3.2 Bush Encroachment

While deforestation is a serious problem in some parts of Namibia, it poses no immediate threat in the study area. Thick bushes of Acacia mellifera stretch for kilometres on end and have, according to locals, destroyed a considerable amount of grazing.

A local agricultural officer, who grew up in the area, described the landscape as flat grass plains, with only a few bushes some thirty years ago. Today, he estimates the damage caused by bush encroachment to grazing to be around 90 per cent. An intensive evaluation of the effects of bush encroachment needs to be undertaken in order to come up with comprehensive figures of the extent of the damage. In addition to the total loss in terms of palatable perennial grasses, there is also loss of secondary productivity which includes: decreased calving rates, growth, fertility, body mass etc.

Fifty per cent of the interviewees responded to the question of how bush encroachment affects rangeland productivity. 62 per cent of all male respondents saw bush encroachment as a serious problem. A. mellifera has been named in all cases as the problem bush - they reported that it prevents the growth of grass and young A. mellifera grow very thickly preventing livestock reaching the grass that grows in the patches between them.

Female respondents accounted for 37.5 per cent. Although they were aware that A. mellifera had grown thicker over the years, they did not see it as a serious problem, but rather as a useful resource, providing good browsing for goats. This difference in opinion between male and female respondents could be due to labour division; females attend more to goats that browse near the homesteads and know less about what is happening in distant cattle grazing areas.

On the question of controlling A. mellifera, 50 per cent of the respondents felt that chemical treatment sponsored by government offered the solution, while 25.5 per cent were of the opinion that government should employ people to control the bushes mechanically (chopping). This would also provide employment for the rural people.

According to residents, attempts to address this problem have been made. In 1984 a community meeting was convened in Okakarara, under the auspices of the then Herero Administration. No decision could be reached, as the older herders were against the control or eradication of the bushes. Their refusal was based on the fact that a serious shortage of grazing exists and livestock is browsing on A. mellifera leaves and pods. Thus debushing could mean the destruction of the resource on which their livestock subsists.

Since perennial grasses have perished with overgrazing, annuals such as Eragrostis porosa, which is abundant after good rains, last only until August. After August no grass is left, and cattle start relying on leaf litter (*ongundju*). Towards the end of the year when trees turn green, livestock browse on the green leaves and pods. This means that, although A. mellifera is a problem bush in general, it is also an important food source that can support livestock production in an overgrazed area.

3.3 Grass and Overgrazing

Veld conditions have deteriorated over the years due to increased pressure on grazing and the frequent droughts that occur in Namibia. The state of land is well manifested in the following annual grass species that are indicators of an over-utilised range. These grasses are: Aristida adscensionis, Aristida stipoides, Chloris virgata, Enneapogon cenchroides, Enneapogon desvauxii, Eragrostis porosa, Pogonarthria fleckii, Setaria verticillata and Triraphis purpurea

A few perennial grass species were collected in the study area during the study period and are listed in Table 4.

Table 4 Perennial grasses collected and identified in the study area

Scientific Name	Comments
Aristida congesta	First sign of regeneration
Cenchrus ciliaris	Climax grass
Cynodon dactylon	Pioneer grass
Melinus repens subsp. repens	Valuable when green
Eragrostis echinochloidea	Sub-climax grass

(Source: Omu Kakujaha-Matundu)

43.8 per cent of the total respondents commented on overgrazing, and all agree that grass does not reach the level of 20 years ago any more. 57 per cent ascribed this phenomenon to successive droughts or too little rain, which does not allow the grass to reach its previous levels, while 43 per cent noted that cattle numbers had grown over the years and created a negative pressure on the grass; they also cited bush encroachment as a factor that inhibits the growth of grass.

Younger respondents only had knowledge of annuals which are the predominant grasses still available, but older respondents could name highly palatable perennial species e.g., Stipagrostis uniplumis and Panicum maximum, both of which are not available any more. Also, the valuable browsing bush, Catophractus alexandri, had been over-browsed and only a few bushes remain.

All respondents agreed that grazing is now situated further than it was 20 years ago. Consequently, cattle walk long distances to grazing areas, which means that they are now spending more energy to reach far off grazing sites which may lower their productivity.

Farmers suggested various ways to solve the problem of overgrazing and as such rehabilitate the range. These include migratory grazing, the buying of land in the commercial area by rich communal farmers and destocking. The above suggestions would only be attained at great cost, and this may be a good indication of how costly environmental degradation could be. If the current trend of environmental degradation is not curbed, anticipated rehabilitation of the area may become more and more costly.

3.4 Invasion

Acanthospermum hispidum[6] and Sida cordifolia are alien and local invasives respectively. Local farmers reported that they had encountered A. hispidum around the mid-1960s. These invasives grow in villages and on road shoulders, where the grass cover has been completely destroyed and are a good indication of environmental degradation.

Sida cordifolia can be utilised by livestock as food when green or even when it is dry. A. hispidum causes diarrhoea in sheep and goats while green and is unpalatable when dry, because of the numerous spicules. These spicules also stick into sheep's wool and cause them great discomfort.

[6] Native of Brazil

3.5 Plastic as a Cattle Killer

Plastic bags have become a serious hazard. Shops provide plastic bags for their customers, who, with no encouragement to return the plastic bags to the shops, litter their surroundings. The three villages in this study are a few kilometres from Okakarara town and cattle easily come into contact with plastic bags, which they chew and swallow. Unfortunately, cattle are unable to digest plastic and this leads to the blockage of the alimentary tract and eventually to the animal's death. Household B had reported that they had lost eight head of cattle as a result of plastic bags. This is roughly a loss of N$[7]3 200.00.

The danger posed by plastic bags can be discussed between the shopkeepers and the local farmer's unions. A small amount (e.g. five cents) could be offered for returning a plastic bag to the outlets or make the customer pay for a plastic bag, which also encourages re-use.

3.6 Game farming and Apiculture

3.6.1 Game

The productivity of an area will be relatively high if a diverse resource mix is practised. For such a diversity to be maintained, proper management is needed. This has not been the case in the communal areas, where everything had been declared state property, except personal livestock. Land, game and other resources had been appropriated to the State, and, with no proper local structures in place for conservation and no interaction or co-operation between Nature Conservation and the local communities prior to independence, resources were prone to over-exploitation and mis--use. Nature Conservation acted as the "policeman" arresting locals for utilising game, and this led to bitter hostilities between the Nature Conservation officials and the local communities. Game was left with no local protectors or owners, and was to be protected by a few patrols by the so-called game wardens. This resulted in local over-exploitation of game by locals, who regarded game as the property of Nature Conservation.

Game has almost disappeared from the area. A respondent who came to the area two years ago could not name any game which can be found in the study area, which may be an indication of its scarcity. Older, long-time residents could name game such as eland, oryx, springbok and hartebeest that could be found in the Okakarara area, while younger respondents (thirty years and below) had not encountered any of the abovementioned game in the area. The reason for its disappearance, as pointed out by the respondents, was either over-exploitation for venison or migration to virgin lands in order to escape man and his cattle. The exact nature or reason for this disappearance could not be confirmed.

Few wild animals are still to be found in the Okakarara area. Fifty per cent of the respondents named the kudu, warthog, duiker, steenbok, bat-eared foxes, aard wolf, scrub hare, mongoose, and ground squirrel as the wildlife still found there. Tortoises, terrapins and snakes were also mentioned. Even though a few of these wildlife species are still encountered in the study area, respondents at all three households claimed that they do not utilise any of the wildlife for any purpose, because of fear of persecution by wildlife officials. Respondents could be hiding this information from a stranger for fear of persecution, although this could not be confirmed independently due to time constraints.

Turning to game farming, 50 per cent of the respondents have heard of game farming, but mentioned lack of space, capital, cash, and know-how as the main constraints in starting such a venture. The other 50 per cent had not heard of game farming at all.

The loss of revenue due to the disappearance of game from the area, could be expressed in terms of venison, trophy hunting, and loss of diversity that could have benefited the area a great deal.

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[7] denotes the Namibian dollar

3.6.2 Apiculture

18.8 per cent of the total respondents reported that they had not seen bees for a long time, but that there had always been bees around, which implies that bees have also become scarcer. This can be partly ascribed to the practice of destroying the beehive to get the honey, and the indiscriminate removal of honey combs, which destroys bee larvae.

60 per cent of the respondents had seen or heard of apiculture. From the total number of respondents, 33 per cent responded positively to apiculture, which they say requires relatively little space.

3.7 Crop Production

Dry land farming is practised on a small scale; crops are cultivated for own consumption. Common crops are melons, maize and beans. All three households have small backyard gardens in which they grow the abovementioned crops.

3.8 Diversification

For the sustainable utilisation of resources of any area, diversification remains important as it provides people with diverse ways of living. It is particularly important in the communal areas, which are degraded and nearing a point where present resources will not adequately support rural communities, because of the reliance on a single resource, namely cattle rearing. This reliance on a single activity makes the people of this area vulnerable to resource mismanagement and adverse weather conditions e.g. drought.

If some members of the community go into other ventures, such as apiculture, vegetable production, etc., rather than into traditional cattle production, the pressure on grazing may decrease and the productivity of the area may increase.

On the question of diversification, various responses were received. Women respondents claimed that they wanted to go into tailoring and knitting, but reported that lack of bridging capital and finances were the major constraints. 19 per cent of the total respondents noted that the *Ovaherero* were spiritually attached to cattle and, regardless of business ventures or employment, keeping cattle is a must. 6.25 per cent of the total respondents, who had become disillusioned with cattle because of loss of livestock to rustlers, were considering poultry as an alternative. It was observed that lack of incentive, entrepreneurial skills and spirit, seemed to steer people into the well-known cattle rearing.

SECTION 4

ESTIMATES OF AGRICULTURAL AND NON-AGRICULTURAL RESOURCES

4.0 Livestock Production and Cash Estimates

Household A had goats only, while Households B and C had cattle, sheep and goats. In addition, Household B kept donkeys and horses. Table 5 shows livestock numbers counted at the three households.

Table 5 Livestock numbers for households A, B and C, during the study period.

HOUSE-HOLD	CATTLE	GOATS	SHEEP	DONKEYS	HORSES
A	0	27	0	0	0
B	40	36	16	7	3
C	42	82	17	0	0

Herds B[8] and C had relatively high numbers of cows and heifers i.e., breeding stock compared to male or neutered animals. The same trend was observed in the goat herds of A, B and C. Average percentages of livestock of reproductive age at households A, B and C, were 57 per cent for cattle, 65 per cent for goats and 64 per cent for sheep.

Two methods can be employed to estimate livestock values:

(a) estimated mass of beast multiplied by price per kilogram multiplied by the number of livestock. This method is difficult, as prices paid at auctions per kilogram live mass fluctuate on a daily basis.

(b) an average[9] price per head multiplied by the number of livestock.

The following are the estimated average prices for a given livestock unit:

cattle = N$400
goat = N$ 90
sheep = N$120
donkey = N$110
horse = N$350

Table 6 Value Estimates as per method (b) for different household animals of the three households in the study area (in Namibian dollars).

HOUSE-HOLD	CATTLE	GOATS	SHEEP	DONKEYS	HORSES	TOTAL
A	0	2430	0	0	0	2430
B	16000	3240	1920	770	1050	23100
C	16800	7380	2040	0	0	26394

These values do not reflect the total value drawn from the environment and also values of products such as milk and it by-products and utilisation e.g., draught animals etc., which will be discussed in the sections below.

[8] i.e., herds of households B

[9] An average chosen for different types of livestock, taken from prices prevailing in the study area.

4.1 Estimates of Products Obtained from Livestock

4.1.1 Milk

The most important and immediate product is cow's milk. Cows are milked for eight months (December-July). Milk is cultured into *omaere*[10]. In good years *omaere* can be a staple diet. Another important by-product of milk is butterfat (*omaze wo'zongombe*). This fat is highly valued for its long shelf life and for its strong flavour, which makes it possible to use small quantities in food. Buttermilk obtained from the butter-making process, is usually given to dogs, but can also be retained for human consumption.

Due to the drought preceding this study, both Households B and C lost over 20 cows, and consequently they did not obtain enough milk to make butterfat. For this reason the estimated value for butterfat could not be calculated.

Table 7 shows the amount of cow's milk and its dollar value per day for an eight month period. Hypothetically, in the absence of milk producing cows, milk could be bought at an average price of N$2.73 per litre (April 1993) in the study area. This average price has been used to compute the value of milk obtained by the two households.

Table 7 Quantity of Cow's Milk (litres) and Value Estimates (N$), using market prices in the study area during April 1993

Household	no. of milking cows	milk per day (litres)	value per day (N$)	value per eight months
B	9	14.25	38.90	9336
C	3	6	16.38	3931.20

Estimates of by-products of milk, in this case *omaere* can be computed as well, using the same supermarket price method. The quantity of omaere obtained from a certain amount of fresh milk is more or less the same as the amount of fresh milk used. Estimated value added to cultured milk is about 59 per cent. Thus a litre of omaere will be in the region of N$2.73 plus N$1.61 i.e., N$4.34.

Goats are milked for about five months. Goat's milk is usually boiled and used in tea, but can also be cultured and added to porridge to enhance its flavour and increase its nutritional value. Goat's milk has a relatively higher nutritional value than cow's milk, e.g. the protein content of goat's milk is about 29 per cent higher than cow's milk [Davenda and McLeroy 1982]. In the study area, goat's milk is diluted at a ratio of 1:1 to water, but this dilution does not necessarily makes it nutritionally equal to cow's milk. Since there is no goat milk dairy in Namibia, the estimated price per litre has been taken to be equal to a one litre of cow's milk (an average of N$2.73 per litre - April 1993). Table 8 gives the quantity of goats milk and its value estimates.

Table 8 Quantity of Goat's Milk (litres) and Value Estimates (N$).
The table gives two values, one reflecting pure milk and the other that of diluted milk.

Household	no. of ewes	milk	diluted	N$ per day	N$ per five month
A	6	1.5	3	4.10	615
B	not milked[11]	0	0	0	0
C	5	1.35	2.7	3.69	553.50

The above estimates show that the three households collectively consumed cow's and goat's milk valued at N$14 435.70 per year. An important question is, what will happen if the present grazing and browse are left to deteriorate considerably? A possible scenario will be: milk may be greatly reduced and only half of the present quantities may be obtained within a ten year period. The present state of the rangeland and its effect on secondary production e.g., milk and beef production, will be discussed in the sections below.

[10] milk is cultured (in calabashes) into sour milk known as *omaere*

[11] Household B obtains enough cow's milk, thus goats are not milked

4.1.2 **Meat**

Cattle are not slaughtered for household meat consumption, the only exception being in the case of funerals or marriage feasts. Goats are important in providing household meat requirement. Meat consumption from livestock slaughtered has been estimated at N$3 330. If only half of the present livestock numbers can be maintained in the ten years to come due to environmental degradation, meat consumption may be reduced by half or more. Reduced meat consumption may lead to protein deficiencies and thus poor health.

4.2 Grazing and Browsing

It is not appropriate any more to talk exclusively about grazing in isolation from browsing, as all livestock depends to a large extent on browsing material due to reduced grass cover.

Other things remaining constant i.e. quality of grazing, rainfall etc. and if livestock relies 100 per cent on natural grazing and browse, the value of grazing and browse available to the livestock would be taken to be equal in monetary value to that of over-the-counter fodder given to pen-fed animals in order for them to survive and reproduce for the same period of time.

Research has shown that domestic animals consume about 3 per cent biomass of their body weight per day [Meissner et al 1983]. This means that a cow of 450 kilograms[12] will consume 13.5 kg of Lucerne per day. For practical reasons the bale of Lucerne will be used for valuing grazing and browsing material. An average bale of Lucerne weighs about 20 kg, which means that a LSU[13] consumes 67.5 per cent of a bale of Lucerne per day.

A bale of Lucerne was N$26.30 (March 1993 prices - Okakarara) i.e., N$17.75 per head of cattle of 450 kg per day. Using the concept of LSU equivalent tables [see Meissner et al 1983], all household animals can be converted to LSU equivalents. Table 9 gives the converted livestock numbers according to LSU equivalent tables.

Table 9 Livestock numbers (see Table 5) converted to LSU, according to LSU equivalent tables.

HOUSE-HOLD	CATTLE	GOATS	SHEEP	DONKEYS	HORSES
A	0	4.59	0	0	0
B	40.4	6.12	2.72	4.62	2.82
C	42.4	13.9	2.89	0	0

Table 10 shows different value estimates of grazing and browsing used by livestock for households A, B and C per year. The formula used is as follows:

Livestock numbers X N$17.75 X 365

Table 10 Value Estimates of Grazing and Browsing Material (N$) p.a.

HOUSE-HOLD	CATTLE	GOATS	SHEEP	DONKEYS	HORSES
A	0	29 737.46	0	0	0
B	261 741.50	39 649.95	17 622.20	29 931.83	18 270.08
C	274 699	90 054.63	18 723.59	0	0

[12] 450 kg is the mass of a head of cattle given in the Large Stock Unit (LSU) definition.

[13] Meissner et al (1983) gives the official definition of LSU as the equivalent of a head of cattle with a mass of 450 kg, which gains 500 grams per day in mass, on the grass pasture of a mean digestibility of 55 per cent.

The sum of estimated livestock consumption of grazing and browse for the three households is N$780 430.24. This amount is the cash equivalent needed to maintain 120.5 LSU with store bought fodder over a period of one year. This implies that if the deterioration in the available rangeland is such that in ten years from now they can only maintain half as many livestock units without supplementing natural grazing with store bought fodder, they stand to lose N$390 215.12. This figure will be higher when inflation is taken into account. Reduction in livestock numbers may also lead to the reduction in milk and beef production, and as such affect the livelihood of the people.

4.3 Water

Livestock are supplied with borehole water during the dry season and drink from natural ponds for up to five months, if the area has received ample rain. Water consumption estimates for different domestic animals, as given by the Department of Water Affairs 1992, is as follows:

Cattle, donkeys and horses	45 litres per day
Goats and sheep	12 litres per day

The three households use a common borehole, located between Okakango and Ohakane. The borehole is equipped with a Lister 8/1 water-cooled engine and a monopump head. The engine runs for about seven hours per day, using approximately 210 litres of diesel per month (7 litres per day).

An estimated 300 head of cattle drink at this point. A monthly wage of N$50.00 is paid to the pump operator by the village community.

To estimate the cost of providing one litre of water, the following need to be considered:
- Fuel and lubricants used
- Maintenance of engine, pipes, dams and troughs
- Number of livestock drinking at the water point
- Pump operator's wage

Due to the lack of the above information, a comprehensive valuation of borehole water could not be made. A rough estimate of how much it would cost to provide water to livestock for a time period could be obtained by using the equivalent of piped water supplied to Okakarara town and the adjacent villages by Water Affairs at the cost of 90 cents per cubic metre or N$0.09 per litre[14]. Thus 45 litres of water would cost a farmer N$4.05 per head of cattle per day or N$1 478.25 per head of cattle per year (the same applies to donkeys and horses).

A goat/sheep consume 12 litres of water per day. Using the same amount of N$0.09 per litre, a goat/sheep will drink N$1.08 per animal per day or N$394.20 per animal per year.

The amount of N$1 478.25 per head of cattle, donkey and horse per year and N$394.20 per goat/sheep per year spent on water was multiplied by the number of livestock given in Table 5 and provides the value estimates in Table 11 below.

Table 11 Value of Water Consumed by Livestock, from the three households p.a. in Namibian dollars.

HOUSEHOLD	CATTLE	GOATS	SHEEP	DONKEYS	HORSES	TOTAL
A	0	10 643.40	0	0	0	10 643.40
B	59 130.00	14 191.20	6 307.20	10 347.75	4 434.75	94 410.90
C	62 086.50	32 324.40	6 701.40	0	0	101 112.30

[14] This method will provide only a rough estimate, as the marginal cost of providing borehole water and that of providing piped water, is not the same.

HUMAN USE: Drinking water for Households A, B and C is piped by the Department of Water Affairs. Drinking water in Okakarara town costs N$0.9 per cubic meter or N$0.09 per litre for the "urban" dwellers, but is provided free of charge to the adjacent villages.

According to the Department of Water Affairs 1992, an individual needs a minimum of 20 litres of water per day. Thus, daily household water consumption can be obtained by multiplying the household members by 20 litres i.e. a household will, theoretically, pay N$0.09 X 20 = N$1.80 per individual per day, which is an amount of N$648 per individual per year.

Human and livestock water consumption can be higher than the official figures, when spillage and other forms of wastage are taken into account. This implies that value estimates for water consumed per day could be much higher than those provided in the estimates above.

4.4 Medicinal Plants and Animal Health

Although farmers in the area are replacing traditional remedies with over-the-counter remedies, medicinal plants still play an important part in animal health. Over-the-counter remedies used include: antibiotics, anthelmintics and vaccines against botulism and anthrax. Three commonly used medicinal plants, as well as the parts used, illnesses treated and their preparation is given in Table 12 below.

Table 12 Local and Scientific names, uses and preparation of the medicinal plants commonly used in animal health in the study area.

Local Name	Scientific name	Part Used	Illness	Preparation
Otjindombo	Aloe sp.	leaf	various	boiled in water
Onakauma	Zanthoxylum ovatitolatum	seed	Gastro-ailments & retained placenta	boiled in water
Omwama	Albizia anthelmintica	bark	internal parasitic worms	boiled in water

Further research is needed to determine the extent to which medicinal plants are used as well as their relative potency. Here, only a crude method has been used to evaluate medicinal plants. Estimates for the value of a particular medicinal plant are derived from over-the-counter medicines which cure the same illness. Average over-the-counter medicine prices have been used.

For example, if a dosage of a certain over-the-counter anthelmintic is N$10 per 400 kg head of cattle, then, if a plant with anthelmintic properties, such as Albizia anthelmintica is used to cure internal worms in a 400 kg head of cattle, the value of N$10 can be allocated to the same dose of medicinal plant. The usage of these plants is important, since livestock remedies are imported and are sometimes beyond the reach of an average farmer. Further research on the physical properties and the uses of these plants will save Namibia a lot in terms of foreign currency and will also provide rural employment.

4.5 Medicinal Plants and Human Health

Plants with medicinal property are widely used to treat different illnesses. One respondent claimed that she relies exclusively on these plants.

Respondents could not remember the exact number of times they had used one or another medicinal plant, which make valuations somewhat difficult. Nonetheless, any valuations in this regard will only be a reflection of the author's own methods, as methods based on scientific basis could not be obtained. A comprehensive valuation can only be made after thorough research into this area. In the absence of such research, hospital and doctors consultation fees can be used in order to obtain some rough estimates. Since hospital fees are disguised due to government subsidies, valuation in this study are based on private practice and pharmacy charges.

A case from Household C has been taken as an example. A nine- year-old observed nematodes in her stool and told he grandmother, who prescribed an Albizia anthelmintica drink. The bark of this tree was boiled in water, which she then drank three times daily before meals, for three days. The little girl was cured.

The benefit derived from this treatment can be compared to alternative ways of treating intestinal worms. For example, for a resident of Windhoek or in the absence of A. anthelmintica, two things can be done:

One is to take a drive or a taxi to a local pharmacy, which costs about N$4.00 (1993 prices). Then buy a dose of Anthelmintic, such as Vermox tablets, for N$26.64 (1993 prices), bringing the total amount to N$30.64.

Another way is to consult a doctor for advice for an average consultation fee of N$55.00. The doctor may then prescribe an Anthelmintic such as Vermox at about N$26.64 increasing the total amount to N$81.64 plus transport costs.

These crude estimates convey a simple but important message: the destruction of medicinal plants can lead to a loss of resources worth billions of dollars and the deterioration of human health. Thus the sustainable use of these resources is of immense importance.

Some of the commonly used medicinal plants are listed in Table 13 below.

Table 13 Medicinal Plants: Local and Scientific names, Uses and Preparation

Local Name	Scientific Name	Part Used	Illness	Preparation
Omumbonde	Acacia erioloba	bark	cold	boiled in milk
Otjimbuku	A. hebeclada	leaf	stomach ache	chewed
Omusaona	A. mellifera	bark	cold	boiled in water
Omungondo	A. reficiens	root	stomach and post-natal treatment	boiled in water
omwama	Albizia anthelmintica	bark	internal parasitic worms	boiled in water
Ombowa	Amaranthus thunbergia	leaf	wounds	pounded and used as plaster
Omunguindi	Boscia albitrunca	leaf	rash	boiled in water
Okatari	Cassia italica	root	stomach and menstrual pains	boiled in water
Omutjete	Dichrostachys cinerea	root	constipation	put root in milk
Okapuite	Geigeria sp.	stem	wounds	roasted and ground
Omuvapu	Grewia bicolor	root and bark	diarrhoea and wounds	put root in milk
Otjiliangatene	Harpagophytum sp.	root	bladder, kidney and back pains	boiled in water
Orukuasena	Kleinia longiflora	stem	cold	steaming
Omupanda	Lonchocarpus nelsii	leaf	cold	boiled in water
Omuseasetu	Terminalia sericea	bark	wounds	ground
Onakauma	Zanthoxylum ovatitolialatum	seed	sore throat	chewed
Omukaru	Ziziphus mucronata	leaf and root	stomach ache	leaves chewed and ro boiled

4.6 Veldfoods

Veldfoods include a variety of fruits and vegetables that grow naturally and are utilised by humans as food. Besides being nutritious, veldfoods add variety to the household diet, and as such provide families with a balanced diet. The li below includes some common fruit and vegetable plants that grow in the Okakarara area and were mentioned by respondents as the most commonly used varieties.

FRUIT

Local Name	Scientific Name
Omuhe	Grewia flavesence
Omuvapu	Grewia bicolor
Omundjembere	Grewia flava
Omunguindi	Boscia albitrunca
Omukaru	Ziziphus mucronata

VEGETABLE

Local Name	Scientific Name
Otjipiya (ozombanjui)	Tylosema esculentum
Ombowa yozondu	Amaranthus thunbergia
ombowa yozongombe	Cleome gynandra
Otjipiya (ombirihona)	Tylosema esculentum
Ovihakautu[15]	-
Ozoseu	Cyperus sp.
Omayova	Termitomyces schimperii

Two methods can be employed to allocate monetary value to veldfood. One is the supermarket price for the equivalen and the other is to construct a hypothetical market, using hypothetical sellers and buyers. Since the latter method suffe from numerous biases e.g. hypothetical bias, starting point bias etc. and also due to time constraints , the former metho has been used.

Boscia albitrunca fruit, mushrooms and spinach were observed to be the most widely eaten veldfood.

Two types of spinach, *viz.* Amaranthus thunbergia and Cleome gynandra are encountered in the study area. C. gynandra is slightly bitter and only a few leaves are cooked with A. thunbergia to serve as seasoning. Spinach cakes o *omavanda* are made from cooked spinach, which is then dried and stored over a long period of time. Using supermarket prices, a bunch of Swiss chard spinach cost on average N$4.42 per 230 gram (April 1993 prices), which i cooked as relish, can serve three people i.e. N$1.47 per head. For example, Household B, to serve a family of 16, needs an equivalent of N$23.57 of wild spinach.

If the two processes of growing wild spinach and Swiss chard, and all other costs involved until they reach the consumer could be taken to be equal, then Household B which collected and prepared wild spinach three times a week for relish, could be said to "spend" an estimated seasonal[16] amount of N$1 131.36.

Mushrooms are collected from termite mounds. Long-time respondents of the area know the termite mounds that serv as "mushroom gardens". This knowledge is important as it saves them time and energy that could have been spent on searching. Supermarket prices for a 250 gram packet is N$6.27 (April 1993). Wild mushrooms weigh on average 500 grams and can thus be priced at N$12.54 per mushroom. A household in the study area collects on average 15 mushroom per wet season, which means that one household collects naturally provided mushrooms, valued at N$188.10 per season.

The small Boscia albitrunca fruit are picked and can be eaten whole or can be pulped to make a delicious fruit juice. A respondent at Household C reported that during November 1992 she made 20 litres of fruit juice daily for about two weeks (i.e., 280 litres). Using the supermarket-price method, a litre of 100 per cent pure fruit juice is N$2.75 (April 1993), which means that Household C obtained juice valued at N$770 per season.

It can be concluded that during the study period, the three households collectively consumed, in terms of veldfoods, ar estimated value of N$2 465.66[17]. These estimates highlight the hundreds of dollars consumed by a single rural household through the consumption of veldfood provided for by nature.

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[15] Scientific name for species (bulbous) not obtained. The name ovihakautu, literaly translated means potatoes.

[16] Spinach is collected for up to four months (December-March)

[17] the figure only reflects estimates of the few veldfood types mentioned in this section i.e., spinach, only for Household B, mushroom for all three households and B. albitrunca fruit juice for household C.

4.7 Honey

Household B reported to have obtained 4 litres of honey from wild bees in 1992. Using supermarket prices, 500 ml of honey is priced at N$9.00, thus 4 litres will be N$9 X 8 = N$72. This is a clear indication that apiculture can be a viable income-generating project.

4.8 Construction Material

These are materials used in the construction of livestock pens (kraals), camps, fields and houses. An average house of 2.5 m X 2 m with a corrugated iron-sheet roof at Household B was built for N$2 400, which comprises N$1 600 for materials and N$800 for the builder.

Local builders charge N$200 to build a cow-dung house[18] of the above size (2.5 m X 2 m). Thus a corrugated iron roo cow-dung house can be valued at N$1 800. These types of houses become more expensive when renovation cost is taken into account. They are renovated twice a year, which makes them expensive in terms of labour and materials used. Seemingly, cow-dung houses are cheaper, but when the loss of soil fertility due to the collection of cow dung used in their construction is taken into account, they become environmentally costly.

4.9 Firewood

Firewood is the major energy source for cooking and heating for the majority of the rural population. Dead wood is collected using a donkey cart. A cart load of 58 logs of A. mellifera of an average length of 118 cm and circumference of 16 cm, was sold by local "woodsellers" at Household A at a price of N$11, and this can be taken to be the guiding price for wood. Household B used their own cart to collect a similar quantity of wood, which like Household A is usec for about two weeks.

This means that Households A and B used one cartload of fuel wood for a period of two weeks, or N$0.79 per day, which is N$288.35 per household per year. It should be noted that these villages share fuel wood with the growing Okakarara town and, as the commercial trade in firewood increases due to the growing demand, there may be a change from collecting dead wood to the practise of felling trees. This will not pose an immediate threat, because trees are stil abundant. But, if demand for firewood continues to grow, it may lead to serious environmental problems. As demand outstrips supply, people may resort to cutting green trees in order to dry them for fire wood. The price of N$11 per donkeycart load will gradually increase as firewood becomes scarcer and as the ease with which wood is collected disappears. Fewer families will be able to afford firewood and may resort to alternative means, such as collecting cow dung for use as a fuel source, which would reduce soil fertility considerably.

[18] a cow-dung house is a meshwork of poles and sticks, plastered with cowdung.

SECTION 5

CONCLUSIONS

This study is in no way representative of all the perceptions of the farmers in the study area. The study also uses crude methods to give monetary values to resources used by rural people, but it provides a baseline study for further research The methods used in evaluating the resources could be refined to provide closer estimates of these resources.

Respondents were well aware of the environmental changes that have taken place locally. They were also aware of the different environmental problems in their area, but they fell short of taking the responsibility for the environmental changes and the subsequent problems. Farmers considered drought as the major factor leading to land degradation. The latter observation is partly true, but a lack of organisational structures, as well as the communal grazing system wa observed to be instrumental in perpetuating the existing situation.

The study concludes that diversification of the economy of this area is the answer to the economic difficulties experienced by the residents. Government and development agencies should encourage new economic activities, such as fruit and vegetable cultivation, knitting and tailoring, game farming, apiculture and other economically viable projects.

Farmers should be educated and informed on the importance of financial institutions and other investment opportunitie available in the country. This step may make it possible for rich farmers to sell their livestock and invest their money some other ways. Selling livestock will reduce the pressure on the land and may lead to the recovery of the rangeland

SECTION 6

REFERENCES

Devendra C. and McLeroy G. (1982) Goat and Sheep Production in the Tropics. Singapore : Longman Singapore Publishers (Pty) Ltd.

Directorate of Water Affairs (1992) Revision of Bulk Water Supply Tariffs. Windhoek.

Environmental Evaluation Associates of Namibia (1991) Sustainable Livestock Production Programme in Less Developed Areas of Namibia : Environmental Assessment Study and Identification of Pilot Areas for Hereroland and Namaland. Windhoek.

Meissner H.H. et al (1981). Classification of Livestock for Realistic Prediction of Substitution Values in terms of a Biologically Defined Large Stock Unit. Pretoria.

Troup (1990) in Adam F. et al (eds.) The Land Issue in Namibia : An enquiry. NISER, University of Namibia. Windhoek.

AN APPENDIX OF HERERO NAMES

Ndjambi	Ovaherero God
Okuhuhurua	Cleansing ritual
Okurukua ena	Child naming ceremony
Okuruwo	Holy Fire
Omaere	Cultured milk
Omazuko	Fire places
Ombuena	Child birth party
Omuherero	Singular - Otjiherero speaking Namibian
Ongundju	Leaf litter
Orukopu	Marriage feast
Otjiherero	Language of Ovaherero
Ovaherero	Plural - Otjiherero speaking Namibians
Omaze wo'zongombe	Butterfat