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The Hidden Harvest: The Role of Wild Foods in Agricultural Systems

Local-Level Economic Valuation of Savanna Woodland Resources: Village Cases from Zimbabwe

Compiled by the Hot Springs Working Group

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LOCAL-LEVEL ECONOMIC VALUATION OF SAVANNA WOODLAND RESOURCES: VILLAGE CASES FROM ZIMBABWE

Report Compiled by the Hot Springs Working Group:

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Hidden Harvest Project

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The *Research Series* of IIED's Sustainable Agriculture Programme reports the findings of collaborative research carried out as part of the programme's activities. Each volume of the *Research Series* is devoted to a different research project.

This report is a case study of IIED's Hidden Harvest project, a collaborative research project coordinated by the Sustainable Agriculture Programme and the Environmental Economics Programme (formerly the London Environmental Economics Centre) at IIED. The project aims to develop approaches to local level economic assessment, using a combination of Participatory Rural Appraisal (PRA) and environmental economics. Case studies make use of various elements of these techniques to examine the importance of wild resources for rural people's livelihoods.

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NOTE ABOUT CURRENCY

All dollar values in this paper are recorded in Zimbabwe Dollars, which at the time of the survey (September 1993) were US$1.00 = Z$6.2.

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1. INTRODUCTION

The aims of the project were:

(i) To undertake a local-level resource valuation exercise, focusing on the valuation of wild food resources and tree-based resources.

(ii) To assess the applicability of a range of participatory rural appraisal (PRA) techniques for resource valuation at the local level.

The work was conducted in a workshop setting, with participants drawn from a number of research projects in southern Africa. The participants were specialists in different disciplines, including resource economics, human ecology, sociology, energy, forestry, environmental policy and range ecology. Twenty-seven persons were involved, including four selected from the two study areas, and the work was largely conducted during 14 days in the Hot Springs area of Zimbabwe.

The work was conducted within the framework of two other research programmes, the *Hidden Harvest Project* and the *Value of Trees Project*. The Hidden Harvest project combines research support and institutional collaboration to assess the role of wild foods in agricultural systems. The project, which is coordinated by the Sustainable Agriculture Programme of the International Institute for Environment and Development, is attempting to develop methods for investigating and measuring the economic value of wild foods. In addition, it aims to clarify and develop policy options for national and international planners, researchers and donor agencies regarding food security and biological diversity issues.

The Value of Trees Project is a collaborative programme of the Universities of Alberta and Zimbabwe involving sociologists, economists and ecologists. The objective is to develop, test, and assess the applicability of methodologies to value tree-based resources in smallholder production systems in Zimbabwe. An additional aim is to examine how value varies with factors such as resource scarcity, gender and tenure. Part of the programme is directed towards the valuation of the environmental service functions of tree-based systems and non-marketed products.

2. STUDY AREA

Chimanimani District is in Manicaland Province in the east of Zimbabwe and is divided into four communal areas: Chikukwa, Mutambara, Muwushu and Ngorima. The administrative centre for the district is Chimanimani Village in the east of the district, remote from most of the communal areas that it serves. The main commercial centres serving the communal land people are Nhedziwa, Hot Springs, Nyanyadzi, Biriwiri and Birchenough Bridge. There is a considerable range in relief over short distances and this makes access to some areas difficult. Two villages in Chimanimani District were selected; Chaseyama B Village (also known as Jinga) in Chakohwa Ward and Matendeudze Village in Chiramba Ward. Both wards are within Mutambara Communal Area.

2.1 Historical background to Mutambara Communal Land[1]

During the early part of this century there was widespread land alienation as white farming land was designated and the Native Reserves created. After designation not all of the indigenous people were evicted from their original land, but were kept on as tenant farmers. The Afrikaans- and Portuguese-speaking settlers of the time had a reputation for being *"lazy and unproductive"*. They relied mainly on income from their tenants, who were more productive than they were. Through the lobbies of the Methodist Missionaries who had settled at Mutambara and the chiefs, Africans were allowed to continue to live on alienated farmland, despite the provisions of the 1930 Land Apportionment Act which had made tenancy illegal.

There was widespread resistance by the Reserve inhabitants to colonial agricultural and natural resource policies. Practices such as river bank cultivation continued despite efforts to discourage them. The first irrigation schemes were established in Mutambara Communal Land in the late 1920s. Irrigation schemes were initiated to enable the Reserves, most of which were in the drier regions of the District, to support the large numbers of people who had been evicted from the more well-watered highlands to make way for the settlers.

In the 1950s, resistance to colonial polices peaked after the passing of the Native Land Husbandry Act (1951). This Act was an attempt to enforce 'centralisation' policies, which included villagisation, consolidation of arable land into blocks, delineation of grazing areas and compulsory destocking. Resistance to state policies fuelled nationalist activities against settler colonialism, as it had done in other parts of the country. An important nationalist leader of the time was the Rev Ndabaningi Sithole who was a native of the District. Nationalist sentiments and activities spread quickly as a result of the concentrated populations in irrigation schemes.

In the 1960s Chief Mutambara unsuccessfully negotiated for greater land allocation to the Tribal Trust Land (formerly Native Reserves). Although no further concessions were made by the Native Commissioner, there was unofficial spontaneous expansion of communal land into European farmland. By 1966 there were widespread reports of 'squatting' on European farmland which signified that local chiefs were not carrying out their duties of evicting people from farmland.

After Independence the Tribal Trust Lands were renamed Communal Areas, and a series of policies followed which were aimed at addressing some of the fundamental grievances of the rural people who had been the backbone of the liberation struggle, as well as to tighten the control of the central state. As a result of the Prime Minister's Directive of 1984, local government structures were set up as a

[1] Most of the information for this section is taken from Alexander (1993).

democratic alternative to the lineage leadership of the chiefs and headmen. WADCOs (Ward Development Committees) and VIDCOs (Village Development Committees) were established throughout communal lands.

2.2 Chaseyama B (Jinga) and Matendeudze villages

Location and population

There is considerable variation in relief and landform in Chimanimani district, ranging from the low altitude areas near the Save River to the high peaks of Chimanimani Mountains. The main components of the landforms are the relatively level valley of the Odzi-Save trough which rises from 478m up to a maximum of 800m. Jinga village is located in this valley. There is also an escarpment zone where the elevation rises rapidly through a rugged zone to plateau areas at around 1200m in the north and 1500m in the south. Matendeudze is located above the first escarpment.

The population density of Jinga village is 38 persons per square kilometre and there is an average of five people in each household. The male to female ratio is 87 to 100. Matendeudze has a population density of 71 persons per square kilometre, an average of 5.1 persons per household and a male to female ratio of 86 to 100. Jinga and Matendeudze are only about 20km apart, but are 40km in distance by road.

Geology and soils

The geology of Jinga is mainly granitic. The soils are largely gravelly, coarse-grained loamy sands and sandy loams. The soils are shallow to moderately shallow, with a high proportion of gravel throughout the profile. The geology of Matendeudze is mainly dolerite with some areas of granite. Most of the soils derived from dolerite have clay texture. Common soils are medium- and fine-grained sandy clays over clays, which are occasionally gravelly at depth. Stones and boulders of rounded dolerite occur throughout and have often been removed to the contour ridges and field boundaries. On the granitic rocks, shallow stony soils occur.

Climate

Jinga is in Natural Region V (see Appendix I for a description of the Natural Regions). The mean annual rainfall at the closest station, Hot Springs, is 527mm and the mean annual minimum and maximum temperatures are 15°C and 30°C, respectively. Matendeudze is in Natural Region IV (see Appendix 1). The mean annual rainfall at Mutambara Mission is 587mm.

Vegetation

Table 2.1 contrasts the environmental conditions at Jinga and Matendeudze. The vegetation of the Jinga area is mainly mopane woodland. The common species are *Colophospermum mopane, Adansonia digitata, Afzelia quanzensis, Lonchocarpus capassa, Cassia* spp. and *Commiphora* spp (Brinn, 1988). Much of the vegetation of Matendeudze has been cleared for cultivation, but *Brachystegia* spp. (mainly *Brachystegia glaucescens* and *B. boehmii*) occur on the rockier steep land (Brinn, 1988).

Table 2.1 Major environmental features of Jinga and Matendeudze villages.

	Jinga	Matendeudze
Approx. area (km^2)	17	13
Altitude range (m)	564-884	960-1228
Annual rainfall (mm)	527	587
Geology		
Lowlands	Granite	Dolerite
Highlands	Granite	Dolerite & Granite
Land units[2]		
Lowlands	Gently undulating, loamy sands and sandy loams (Unit 4)	Gently undulating, with stony clay-textured soils (Unit 3)
Highlands	Steep and rugged terrain (Unit 1)	Hilly with stony clay-textured soils (Unit 3) and steep and rugged terrain (Unit 1)
Vegetation		
Lowlands	*Colophospermum mopane, Combretum apiculatum*	(mostly cleared, probably *Brachystegia boehmii* miombo formerly)
Highlands	*Combretum apiculatum, Commiphora mossambicensis*	*Brachystegia glaucescens, Julbernardia globiflora, B. boehmii, B. spiciformis, Combretum molle*

The Jinga area, especially the lowlands, fits into the classification of arid-eutrophic savannas with the highlands in the Jinga area comprising a *Combretum-Commiphora* savanna without any of the differentiating miombo species (see Table 4.1 for species density data). The Matendeudze area, being at a higher altitude and with slightly higher rainfall, is in the miombo woodland region, ie. it falls within the mesic-dystrophic savanna (Table 2.1). However, this area is not wholly typical of the mesic-dystrophic savanna as much of the soil is derived from dolerite (and is therefore eutrophic) and the area is at the dry extreme of the miombo range. Thus, for example, *Acacia* and *Dichrostachys* species are dominant wherever disturbance has taken place.

Land use and land-cover types

The main system of land use in Jinga is rain-fed cultivation of pearl millet, sorghum and some cotton. Cattle and goats are also kept by some farmers. In Matendeudze, the main system of land use is rain-fed cultivation of maize, some sunflower, beans and groundnuts. Some farmers own a few cattle and goats and these are grazed in the natural woodland and the arable areas during the dry season.

Around 65% of Jinga is lowland, which at the time of the 1986 aerial photographs consisted of lowland mopane woodland, disturbed lowland mopane woodland and cultivated land, comprising

[2] After Brinn (1988).

roughly 13%, 16% and 35% of the entire village, respectively (Fig. 2.1). The remaining portion (35%) comprises mountain *Combretum-Commiphora* woodland. In Matendeudze, around 41% of the landscape was cultivated in 1986, 27% was dense woodland and 32% was disturbed woodland (Fig. 2.2). In the case of disturbed woodland, much of it is low scrubby vegetation, while in Jinga this same class consists of tall but scattered trees.

Figure 2.1. Land cover types - Jinga village

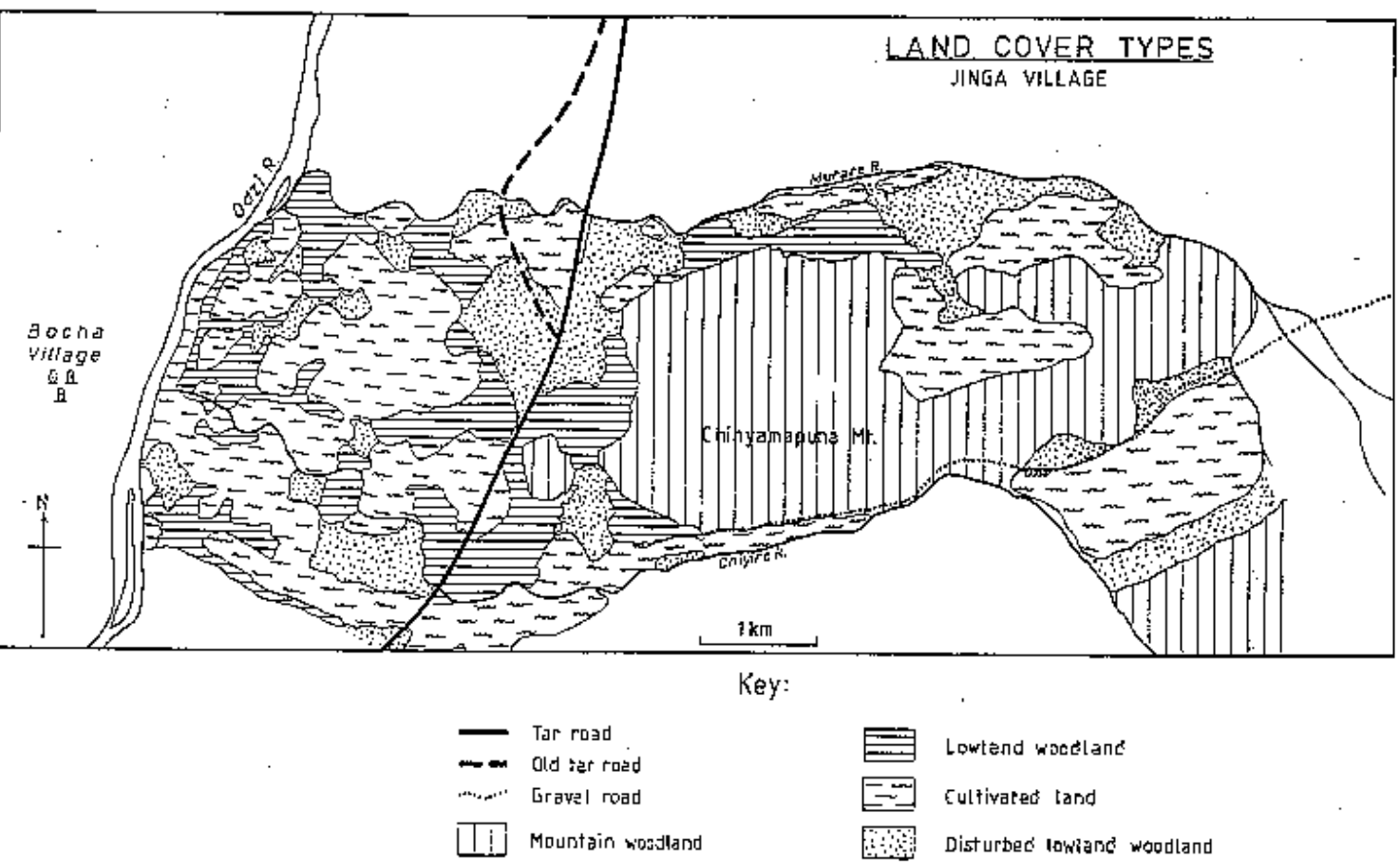
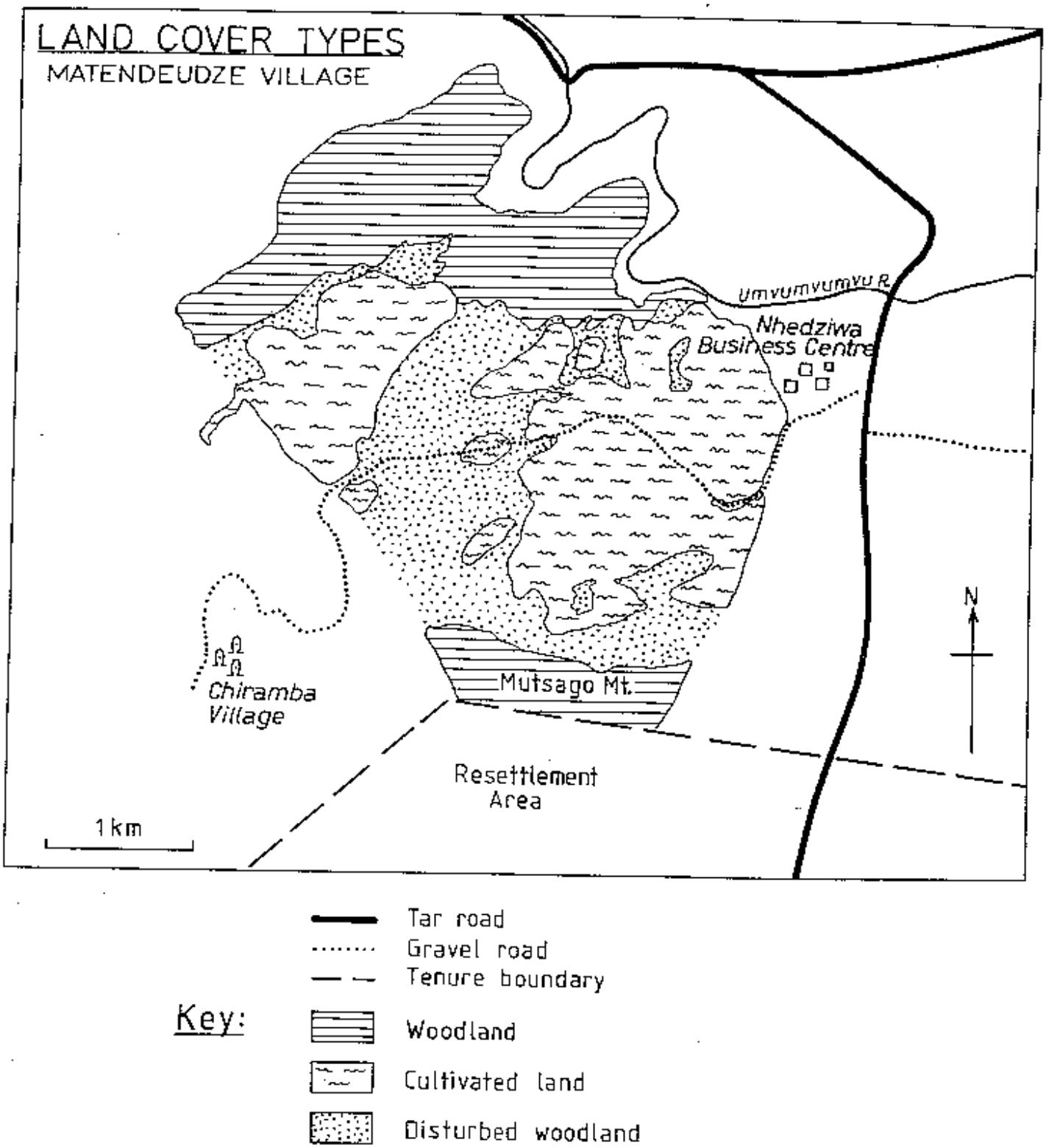


Figure 2.2. **Land cover types - Matendeudze village**



3. METHODOLOGICAL OVERVIEW

In assessing economic value of woodland resources in the two villages, this study integrates insights from economic analyses, sociological investigations and ecological assessments. A series of basic questions were posed at the start. These were:

- *What's there?* This involves an assessment of the existing resource base, with an examination of the range of land resource units and an estimation of standing woodland resource stocks and productivity (tree density, fuelwood, poles etc.).

- *What's used?* This involves an examination of the use of woodland resources. At both community and household levels the range of product flows from different resource units within (and outside) the village are assessed. Further questions relate to the seasonal patterns of use (when are products used?) and the social differentiation of use patterns (who uses what?).

- *How's it controlled?* This question involves an investigation of resource access and control issues. Tenurial arrangements for different resource types are explored along with local-level rules and regulations for resource exploitation. An historical perspective provides insights into how resource control patterns have changed over time and how this has affected the value of woodland resources.

- *What's it worth - marketed products?* A valuation of marketed products is one component of resource valuation. An economic analysis of household level returns (benefits minus costs) for a number of marketed products is carried out on the basis of household survey information. Total annual values per village of the selected marketed products can be obtained from a derived demand analysis. Market analysis provides further contextual information on the operation of local and regional markets.

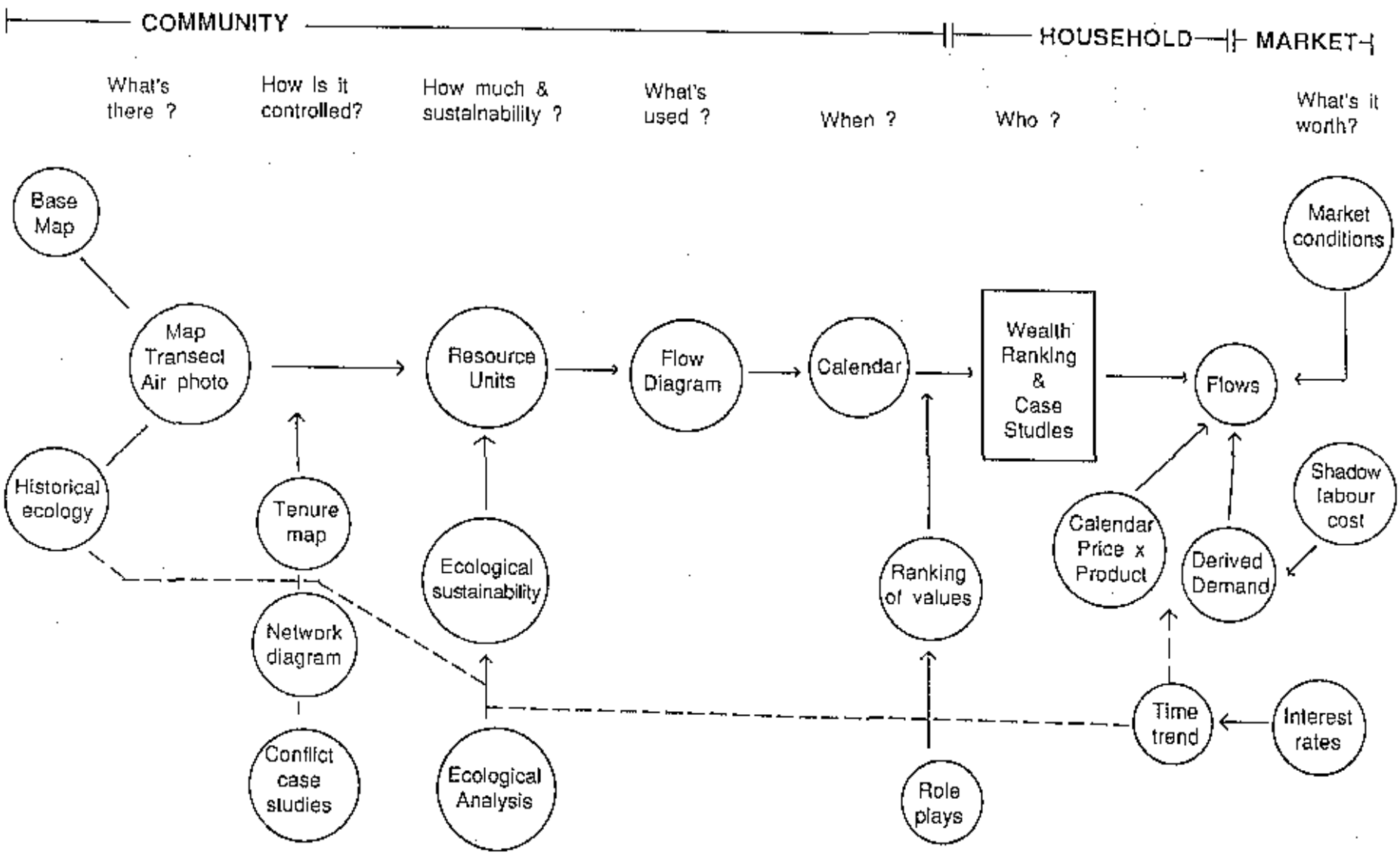
- *What's it worth - total value?* Economic value is made up of both market and non-market values. The way non-market values are perceived in relation to market values can be assessed in qualitative terms through an examination of local perceptions and the ranking of different woodland values.

- *How sustainable?* The value of woodland resources may be high simply because of high levels of unsustainable extraction. It is important to examine longer term changes in the resource base and assess the degree to which production and consumption balance over the long term.

The workshop started with a brainstorming exercise that attempted to identify the key questions for the valuation of woodland resources at a local level. This was then followed by a detailed discussion of potential methods. Arising from this workshop, a flow diagram illustrating a sequence of questions and methods was developed (see Fig. 3.1). This moved from a general descriptive analysis at the community level to a more focused, specific investigation of resource value at the household level. Cross-cutting issues such as resource tenure and ecological sustainability were identified at the same time. The framework shown in Fig. 3.1 provided the basis for planning and structuring the fieldwork sessions.

The tools of participatory rural appraisal (PRA) were used during the study, involving local people in the process of inquiry. PRA methods were combined with more conventional economic and ecological methods to provide a mix of qualitative and quantitative information at both the community

Figure 3.1. **Proposed methodological sequence for the valuation of woodland resources.**



and household level. The range of methods used in each phase of investigation are listed in Table 3.1. Further details are provided in the following chapters.

The team of researchers was divided among the two villages, with a few persons moving between teams to allow comparability. Prior to the field visit stage, more detailed, specific questions and areas of investigation were discussed within the two village research groups. Fieldwork planning involved the design of question checklists and plans for method sequences. These were continuously revised in the field and during workshop sessions following field visits. Specialist field teams from each village research group were also formed to tackle specific issues (eg. market analysis, collection of price information, ecological plots/transects etc.).

Table 3.1 Valuation questions and methods used.

Questions	Methods
What's there?	Participatory mapping; farmer transects; aerial photographic analysis; ecological plot/transect measurements with farmers; key informant interviews; historical time lines, maps or transects.
What's used?	Product flow diagrams; product calendar; household surveys; producer case studies.
How controlled?	Tenure maps; conflict case studies; key informant interviews.
What's it worth - marketed value?	Household surveys; case studies; market analysis.
What's it worth - total value?	Villagers' role plays; ranking and scoring.
How sustainable?	Farmer sustainability analysis; aerial photograph assessment; production-consumption estimates.

4. WHAT'S THERE? RESOURCE DESCRIPTION AND ASSESSMENT

4.1 Resource maps

Resource maps were drawn by villagers in both Jinga and Matendeudze to identify the major resource units in each village, according to local classifications. Discussions during and following the drawing of the maps explored product availability and use in the various areas. Additional, unexpected information was derived in each case, including useful insights into the spatial distribution of household clusters in Jinga and the dynamics of land disputes in Matendeudze.

Process notes

Jinga

The resource map was drawn by villagers on a large area of bare ground in front of Chaseyama school. A group of men drew the area north of the main road and a group of women drew the area south of the road. A separate map was developed by a group of children. Stones, leaves and ash were used to mark out the various features. The mappers used sticks to draw out boundaries and to locate different features on the ground. Villagers participated in identifying features, landmarks and locating their own homes. At the beginning of the mapping exercise a few community members dominated. But as the exercise progressed and the map took shape, more people became involved. The maps were copied onto large sheets of paper by representatives of each group. Copies were later presented to the headmistress of the school, the headman and chief.

The ground map was presented by two community representatives (one man, one woman) to the group of villagers who had gone on the transect walk (see 4.2 below). This cross-checking process allowed the mapping group to add a few more details and make corrections. The map was left on the ground and returned to the following day when further additions were made by other villagers attending the discussions at the school.

The resource map became a key reference point for later exercises, as it identified the villagers' classification of resource units (later used for flow diagramming, tenure mapping and matrix ranking) and also provided the full list of households (later used for matrix ranking and household sampling and interviewing). The households of key informants such as village leaders, crafts-persons and artisans were also identified during the mapping exercise.

Matendeudze

Following the introduction of the group and the welcome by the ward councillor, the villagers split into various groups. Three groups worked on separate maps - men, women and young boys. The mapping exercise provoked heated debates over land issues, especially among the men's group. The construction of the map focused attention on some major disputes that have affected the village over the past decade. These include the removal of village farm land for the construction of the school and the business centre at Nhedziwa after 1980 and the forced resettlement in the area of so-called squatters from Forestry Commission land in the Cashel valley. These debates diverted the men's group from a focused resource mapping exercise, but highlighted the tense, political nature of land use questions in the village.

Results

Jinga

The maps identified various landmarks (rivers, streams, roads, major buildings, mountains, sacred sites etc.), as well as the locations of all household clusters in Jinga (Fig. 4.1, Fig. 4.2). The discussion of resource units revealed a number of key areas. These were the two major hills (Chinyamatede and Chaseyama), the forest areas south of the road (Garawakafara), two important sacred sites (Dambakurimwa and Garawakafara well), the field areas and settlement sites. In addition, the villagers marked the neighbouring village of Bocha as another important resource area used by the residents of Jinga.

Matendeudze

The maps were broadly similar, although the women and children's maps provided more detail. All maps showed the basic outline of the village area with the wooded hills surrounding the fields and settlement area. The men's map identified sacred sites, such as sacred trees (*Ficus* spp. - *muonde* and *mutsamvu*[3]) and sites where rainmaking ceremonies are held. The women's map included features which indicated modernity and development, such as the two schools, the boreholes, the water tank and pipes and the cooperative bakery (Fig. 4.3). They also showed the low-lying waterlogged area where they grow bananas, guavas, mangos, sugar cane, maize etc. Sites for the collection of firewood, mushrooms and medicines were also indicated along with grazing and field areas. The children's map showed the schools, the grazing areas, the river and where they collect fruit.

The mapping exercise helped identify the village resource units. These include the range of hills surrounding the village (Gomorembudzi, Mutsago, Chitsetso, Chimbanje), the valley area (Muraba valley - chidanga) and the fields and settlement areas.

4.2 Transect walks

Process notes

The purpose of the transect walk was to find out how the different land use categories were distributed in the landscape. Historical and future land use changes were also explored. Farmers accompanied the research team, showing them a variety of land use types found in the village. The transect walks provided an opportunity for combining discussion with detailed observation of tree resources in the area.

Jinga

The transect walk began from the Odzi, a perennial river, and ended at Chaseyama school at the foot of Chinyamatede hill. A group of six farmers and seven team members went on the transect walk. Along the way the group stopped to discuss points of interest. Tenurial, ecological and historical issues and products obtained from the different land use units were discussed.

[3] See Appendix 2 for a full list of species found in the study.

Figure 4.1 **Adult's map of Jinga.**

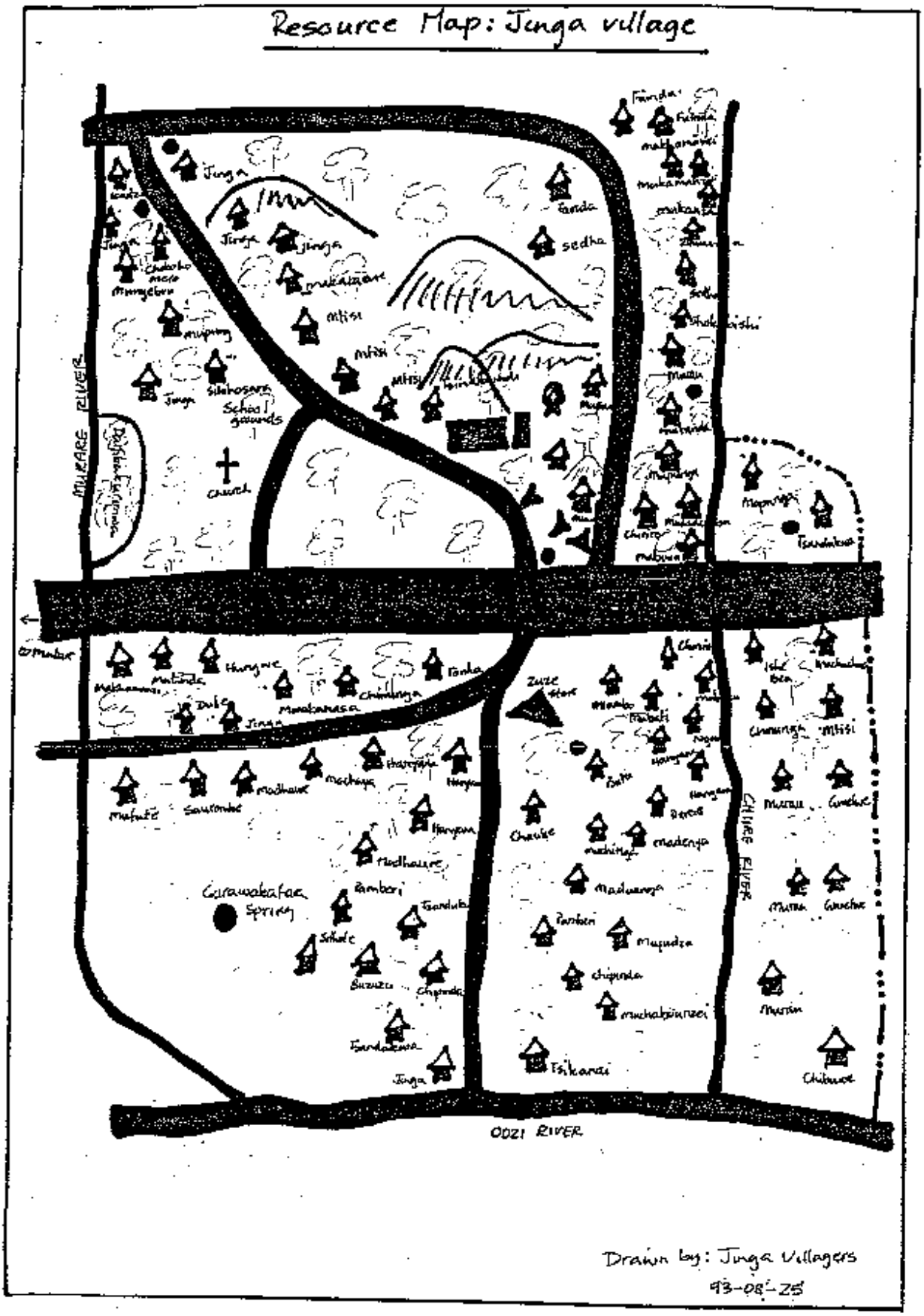


Figure 4.2 **Children's map of Jinga.**

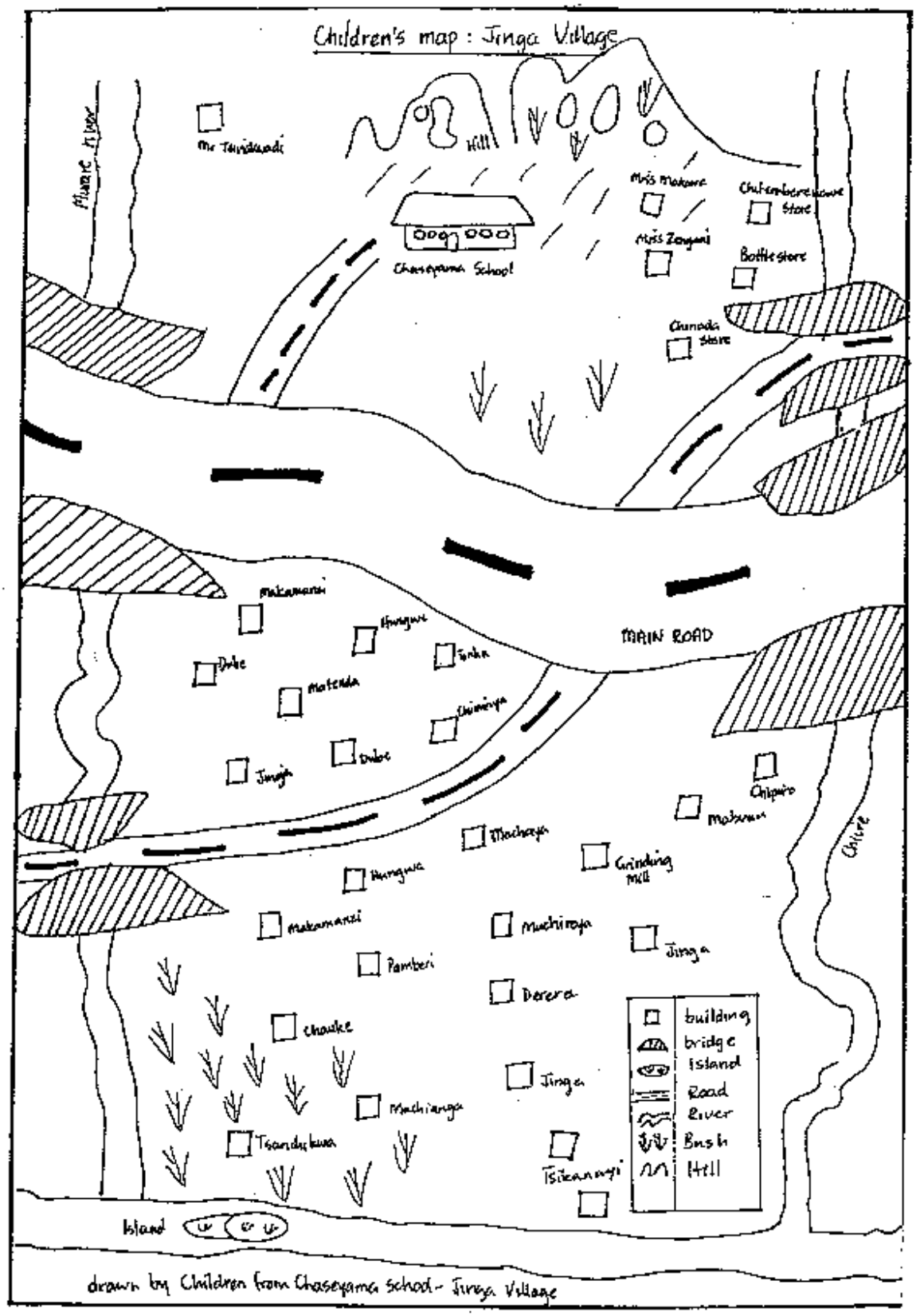
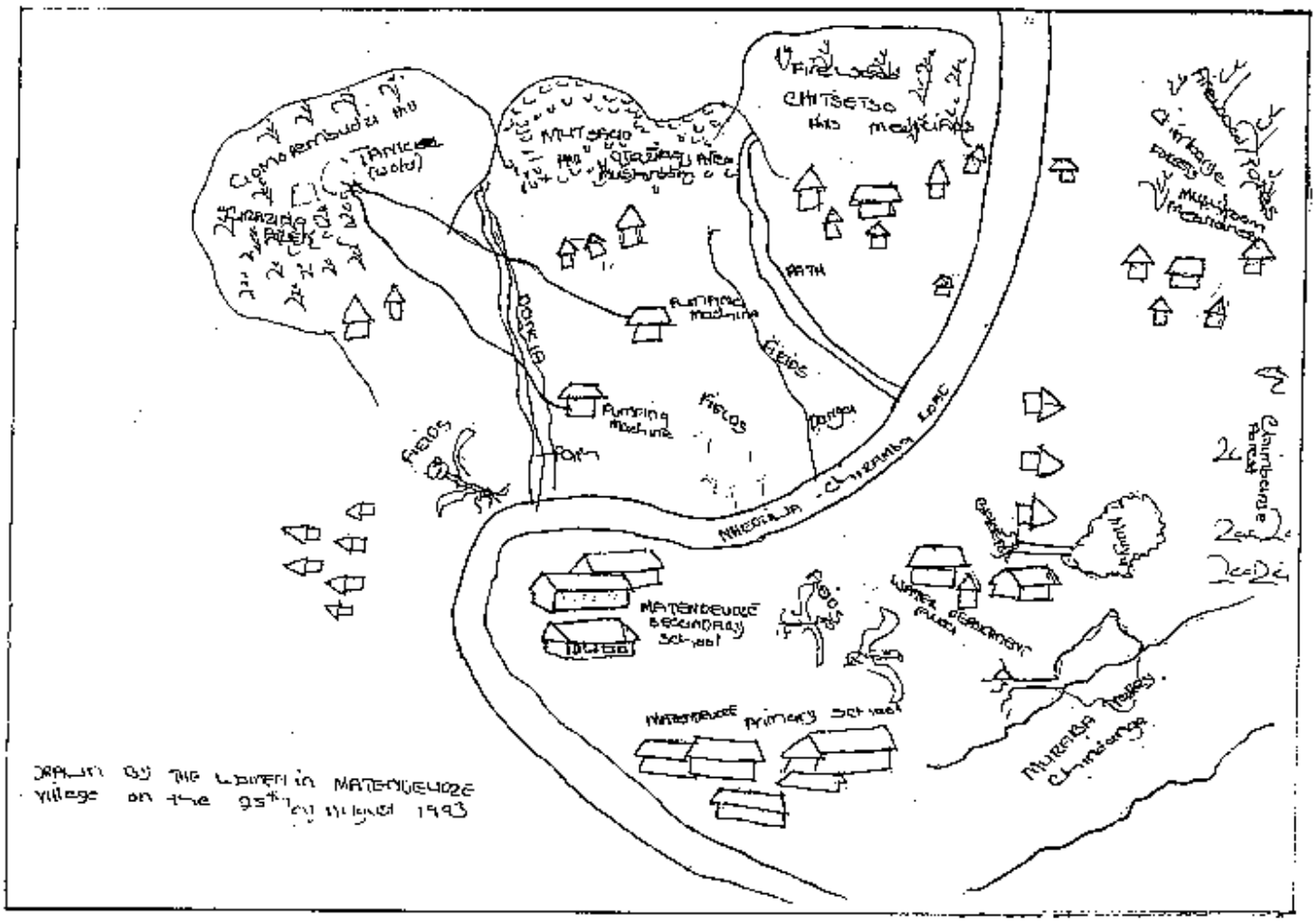


Figure 4.3 Women's map of Matendeudze.



Matendeudze

The transect walk started in the dense miombo woodland of the hills to the west of the village, passed through the fields and settlement areas to the hilly areas on the east side. Four farmers (3 men and 1 woman) accompanied the team.

Results

Jinga

The major land-use categories along the transect were vegetable gardens, fields and woodlands (Fig. 4.4). The vegetable gardens, concentrated along the banks of the Odzi, were fenced off with *Colophospermum mopane* poles. Most gardens were only started in 1992. The gardens are individually owned and are productive throughout the year. A few are washed away during the rainy season when the Odzi is in flood. In the cropping season the fields are tilled and cropped by their individual owners, but during the dry season they revert to communal tenure. Fields were cleared of trees, although fruit trees such as the baobab tree, *Adansonia digitata* (*muuyu*), *Berchemia discolor* (*munyii*), and trees with traditional or spiritual values such as *Lonchocarpus capassa* (*mupanda*) are left in the fields.

Figure 4.4 **Village transect from Jinga.**

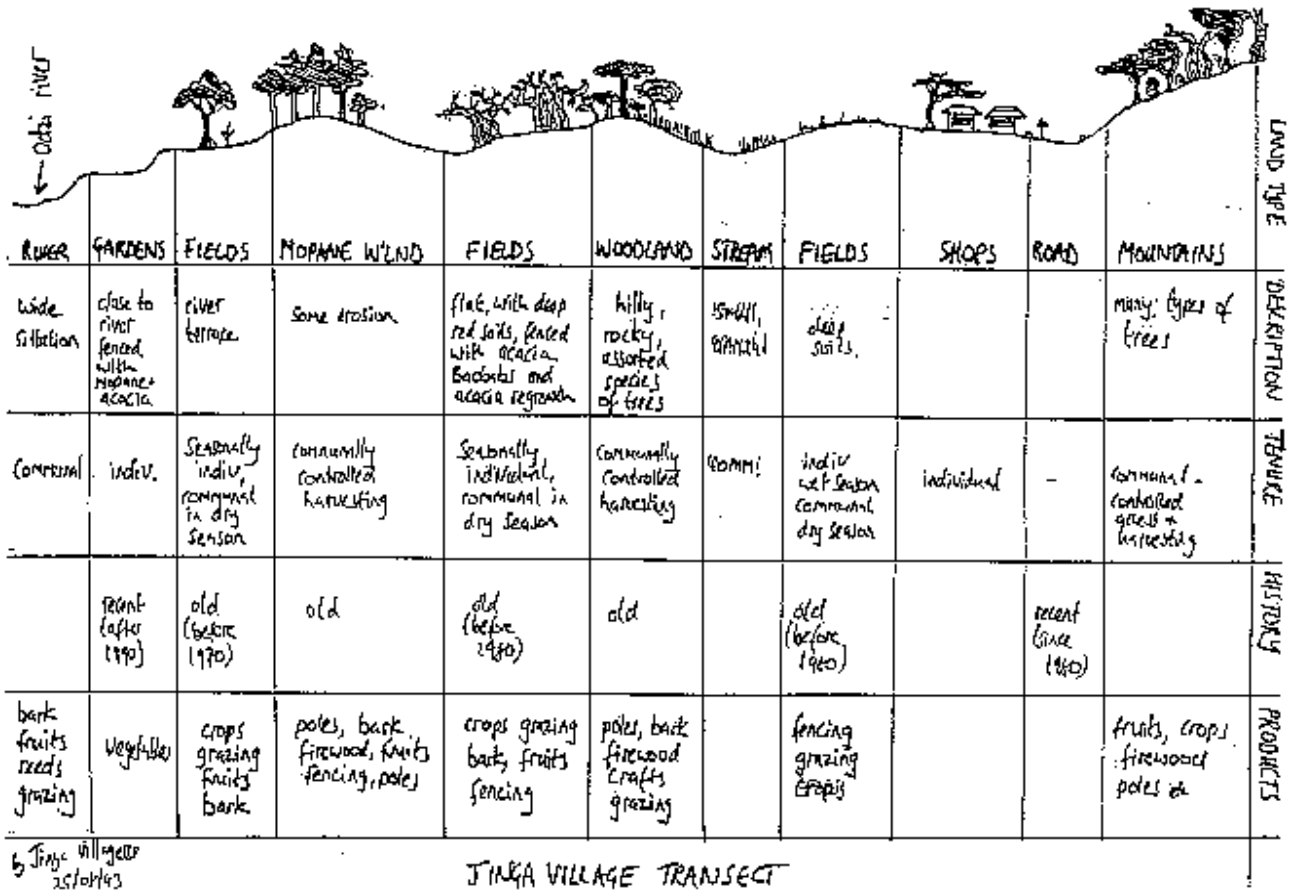
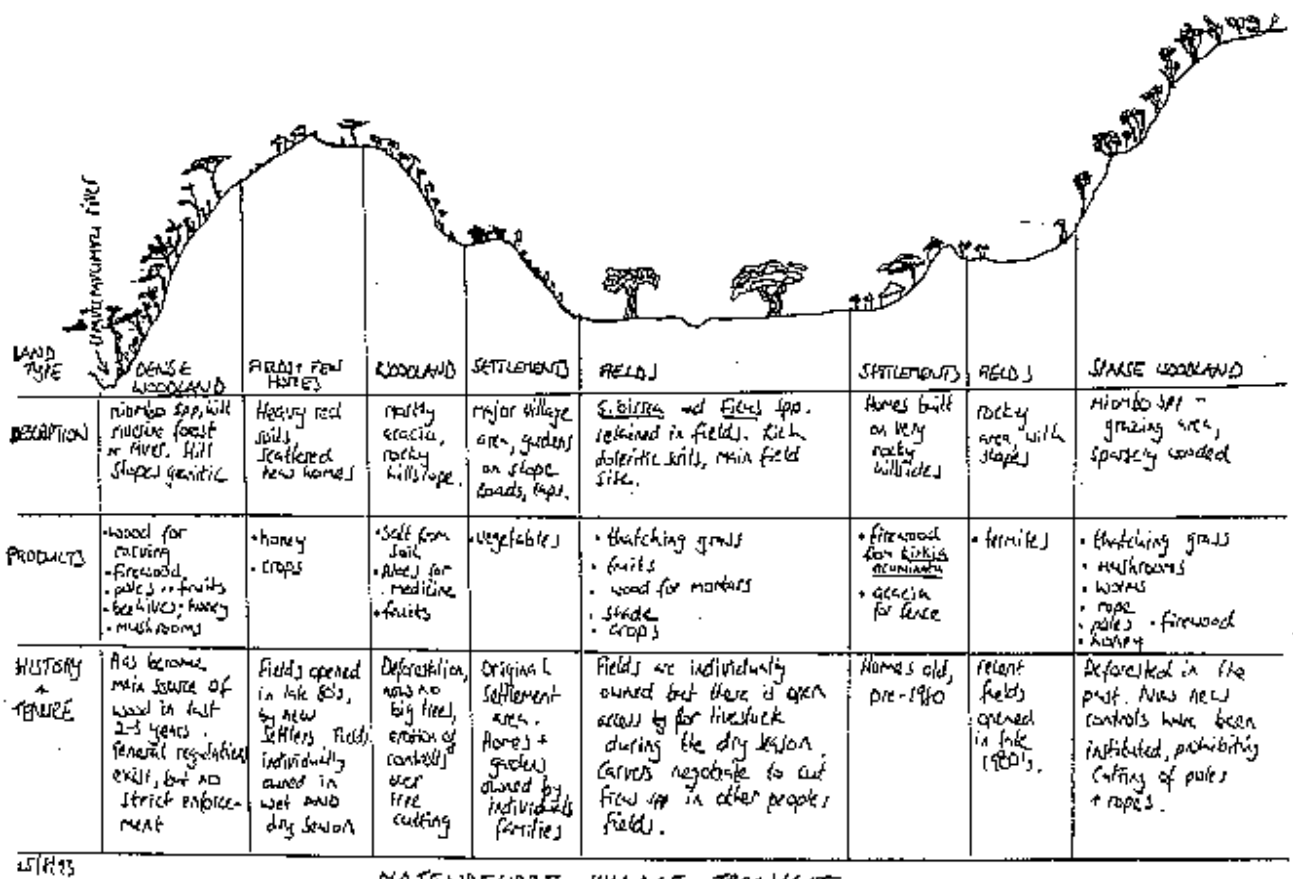


Figure 4.5 **Village transect from Matendeudze**



The predominant woodland type in the lower part of the transect near the Odzi River is *C. mopane*. Higher up the transect towards the Mutare-Masvingo road, the dominant woodland species are *Combretum apiculatum* (mugodo) and baobab. The mopane woodland is a source of construction poles, rope and firewood, while the *C. apiculatum*/baobab woodland mainly supplies firewood, fruit and bark for craft work. Honey, thatching grass, mopane worms and wood for making implement handles and other wooden items for household use are also collected from the woodlands. Cattle and goats are grazed in the woodlands throughout the year and in the field areas during the dry season.

The use of the woodland resources is open to all people in the village. Restrictions on tree cutting exist; for instance, living trees cannot be cut for firewood, but only for poles or rope. After pole extraction, the remaining wood may be used for firewood.

Matendeudze

The major land use categories identified along the transect were miombo woodland (of various densities), fields with scattered trees, scrub woodland on rocky areas and settlement areas (Fig. 4.5). A variety of products are derived from these land use types. The miombo woodlands provide the greatest variety of products including firewood, fruit, wood for craft work, poles, honey, mushrooms, grazing and thatching grass.

4.3 Ecological assessments

Process notes

Ecological assessments of some tree-based products (firewood, poles and indigenous fruits) were made in the different woodland types in Jinga and Matendeudze. In Jinga, assessments of tree density and pole and firewood availability were carried out in lowland woodland dominated by *Combretum apiculatum* and *Colophospermum mopane* and in mountain woodland dominated by *C. apiculatum* and *Commiphora mossambicensis*. In Matendeudze, similar assessments were carried out in mountain miombo woodland dominated by *Julbernardia globiflora*, *Combretum molle* and *Brachystegia glaucescens*. Assessments of fruit tree density and fruit tree production were carried out in Jinga in lowland woodland, mountain woodland and in fields/settlement areas and in Matendeudze in mountain woodland and in fields/settlement areas.

Assessments of tree density, numbers of poles and amount of available firewood were made in three 30 x 30m plots in each woodland type. Densities were assessed by counting all trees above 2.5m, while availability of firewood and poles was assessed on a tree-by-tree basis by local informants. To check whether local informants' data on firewood volume or number of poles from an individual tree corresponded with the biomass of that tree, biomass was calculated using the allometric equations of P. Frost (see Grundy et al., 1993) and regressed against the informant's data. There was a clear relationship between the regressed variables (Fig. 4.6). Assessments of fruit tree densities were made in the same plots and, in the fields/settlement areas, by using three transects of 50m width and lengths of between 0.5 to 1km. Fruit tree production estimates were assessed on a tree-by-tree basis by local informants. All assessments of production were made in locally-meaningful units (eg. headloads of firewood or 20 litre tins of specific fruits) and then converted to technically-meaningful units, using known conversion factors (Appendix 4) or estimated conversion factors.

Results

In the various woodland types in Jinga and Matendeudze, density of trees ranged from 400 to 600 trees ha^{-1}, with the possibility of extraction, if all biomass was used, of 300-400 poles ha^{-1} and 9-11 cords[4] of firewood ha^{-1} (Table 4.1).

Table 4.1 **Density of dominant trees >2.5m and mean number of poles and cords of firewood ha^{-1} in the woodlands of Jinga and Matendeudze** (data based on 30 x 30m plots in each land type).

Village	Land type	Dominant species (density of trees >2.5 m., # ha^{-1}, in brackets)	Density of trees >2.5 m (# ha^{-1}, with SD in brackets)	No. of poles (# ha^{-1}, with SD in brackets)	Firewood (cords ha^{-1})
Jinga	Lowland woodland	*Combretum apiculatum* (288); *Colophospermum mopane* (96)	477 (135)	389 (73)	9.9
	Mountain woodland	*Combretum apiculatum* (455); *Commiphora mossambicensis* (89)	644 (224)	401 (260)	10.8
Matendeudze	Mountain woodland	*Julbernardia globiflora* (122); *Combretum molle* (63); *Brachystegia glaucescens* (52)	426 (190)	294 (143)	10.4

Numbers of indigenous fruit trees in different landscape units vary considerably. However, a high density is often due to a single species, *Strychnos madagascariensis*, in lowland mopane in Jinga, and *muzodzi* (no identification possible) in mountain woodland in Matendeudze (Table 4.2). In the cultivated landscapes, the density of fruit trees averaged 14-17ha^{-1}, indicating that farmers conserve a considerable number of trees in their fields. Fruit production also varied considerably, from 90 to 5400kg ha^{-1} yr^{-1} in the different land types. Total fruit production in Jinga is estimated to be 3000t yr^{-1}, while only 850t yr^{-1} in Matendeudze.

[4] See appendix 4 for definition of a cord.

(a)

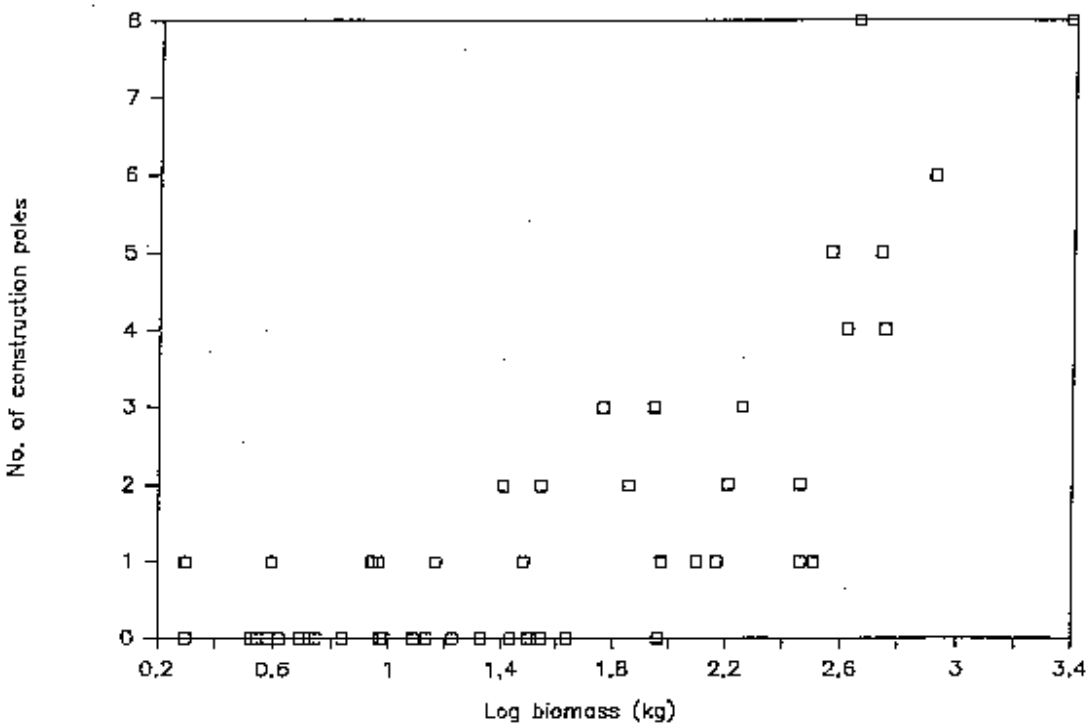


Figure 4.6 Scatter diagrams showing the relationship between biomass of individual trees and a) the numbers of poles that can be obtained from the trees and b) the numbers of headloads that can be obtained after removing poles. For a) $Y = -1.43 + 1.89\ X$, $r^2 = 0.63$, $n = 78$, while for b) $Y = -0.20 + 1.19\ X$, $r^2 = 0.53$, $n = 19$.

(b)

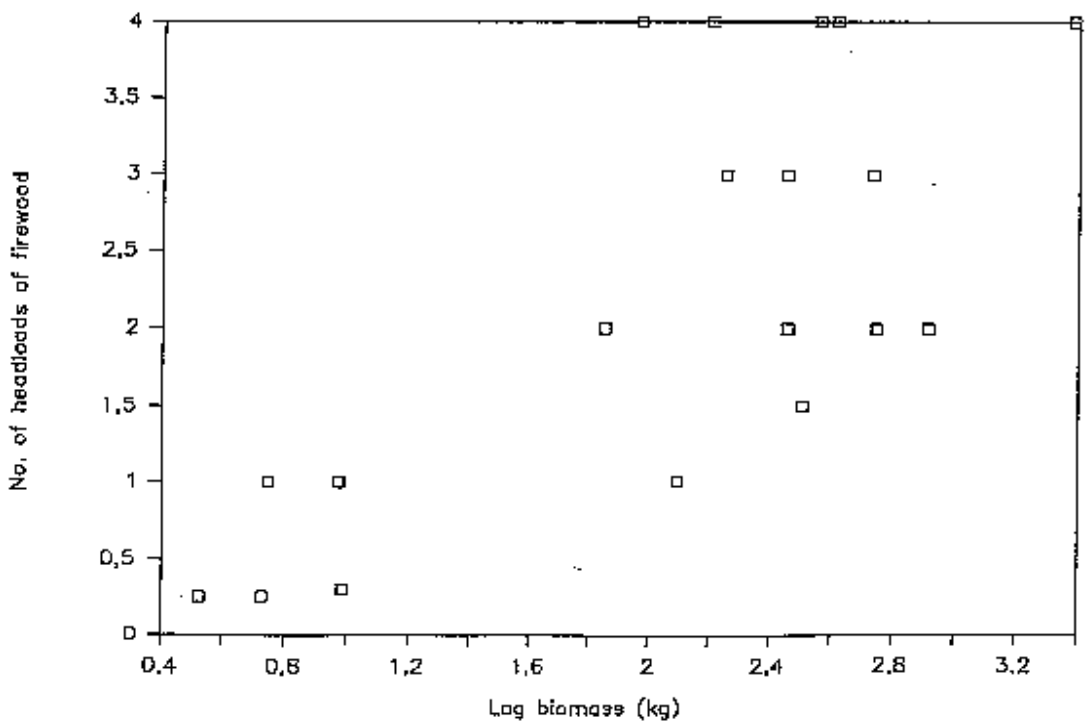


Table 4.2 **Mean numbers of fruit trees and mean fruit production in different land types in Jinga and Matendeudze.**

Species	Mean number of individual fruit trees ha^{-1}					Mean fruit production [kg ha^{-1} yr^{-1}]				
	Jinga			Matendeudze		Jinga			Matendeudze	
	Lowland woodland	Mountain woodland	Fields & settlement areas	Mountain woodland	Fields & settlement areas	Lowland woodland	Mountain woodland	Fields & settlement areas	Mountain woodland	Fields & settlement areas
Adansonia digitata	8.2	-	1.3	-	-	767	-	58	-	-
Strychnos madagascariensis	111	18	7.5	6.7	0.2	4119	33	211	139	4
Sclerocarya birrea	5	6.3	4.3	-	-	350	14	201	-	28
Diospyros mespiliformis	1.6	2.7	-	-	-	8.5	13	-	-	-
Grewia bicolor	4.4	-	-	-	-	33	-	-	-	3
Flacourtia indica	2.7	1.3	-	5.5	1	166	1	-	33	2
Zizyphus mucronata	-	6	0.3	2.2	0.7	-	21	4	44	2
Securinega virosa	-	1	-	-	0.2	-	5	-	-	1
Ximenia caffra	-	2.3	-	3.3	0.4	-	2	-	27	1
Berchemia discolor	-	-	0.3	-	-	-	-	2	-	-
'Muzodi' (Latin unknown)	-	-	-	163	0.4	-	-	-	807	5
Bridelia cathartica	-	-	-	10	1.3	-	-	-	72	6
Carissa bispinosa	-	-	-	7	0.2	-	-	-	58	1
Vangueria infausta	-	-	-	2.2	0.5	-	-	-	22	1
"Sweet dondo"	-	-	-	2.2	-	-	-	-	33	-
Artabotrys brachypetalus	-	-	-	1.1	-	-	-	-	22	-
Ekabergia benguelensis	-	-	-	1.1	0.4	-	-	-	0	5
Rhus lancea	-	-	-	2.2	0.7	-	-	-	50	3
Hexalobus monopetalus	-	-	-	1.1	-	-	-	-	11	-

Species	Mean number of individual fruit trees ha^{-1}					Mean fruit production (kg ha^{-1} yr^{-1})				
	Jinga			Matendaudze		Jinga			Matendaudze	
	Lowland woodland	Mountain woodland	Fields & settlement areas	Mountain woodland	Fields & settlement areas	Lowland woodland	Mountain woodland	Fields & settlement areas	Mountain woodland	Fields & settlement areas
Bauhinia galpinii	-	-	-	2.2	0.2	-	-	-	37	6
Bauhinia thonningii	-	-	-	6.6	4.9	-	-	-	30	66
Ficus capensis	-	-	-	1.1	0.4	-	-	-	11	16
Cassia abbreviata	-	-	-	-	2.5	-	-	-	-	15
Strychnos spinosa	-	-	-	-	0.2	-	-	-	-	4
Smilax kraussiana	-	-	-	-	0.2	-	-	-	-	1
Grewia flavescens	-	-	-	-	0.5	-	-	-	-	1
Bridelia cathartica										
Annona senegalensis	-	-		-	0.4	-	-	-	-	5
Area of each land cover type (ha)	485	565	565	525	788	485	565	565	525	788
Total for each land type (# ha^{-1} and kg ha^{-1} yr^{-1})	133	38	14	217	17	5400	89	476	1396	176
Total #'s for entire land type	64505	21470	7910	113925	13396					
Total fruit production for entire land type (tonnes)						2619	50	268	732	139

5. WHAT IS USED? WOODLAND PRODUCT FLOWS

This section assesses which woodland products are used by households in Jinga and Matendeudze. A general assessment of product flows from the various land resource units identified in the resource mapping exercise (section 4.1) is presented in section 5.1. This is followed by an examination of the seasonality of product flows (section 5.2). The consumption of woodland products is examined at a household level in section 5.3. Finally, a series of case studies of particular producers who sell woodland-derived products are presented in section 5.4.

5.1 Product flows

Process notes

Jinga

After the completion of the village resource map, villagers identified distinct resource units from the map. Each resource unit was written on large pieces of paper and laid on the ground. Villagers were then asked to identify and list on each piece of paper the different products derived from each resource unit. The species from which these products were derived were also recorded. The original diagram was produced on a large piece of card and included detailed lists of all products and species from which these products are obtained. When reducing this to A4 size these were omitted from the diagram, but included in the full product/species list for Jinga village (Appendix 3).

Matendeudze

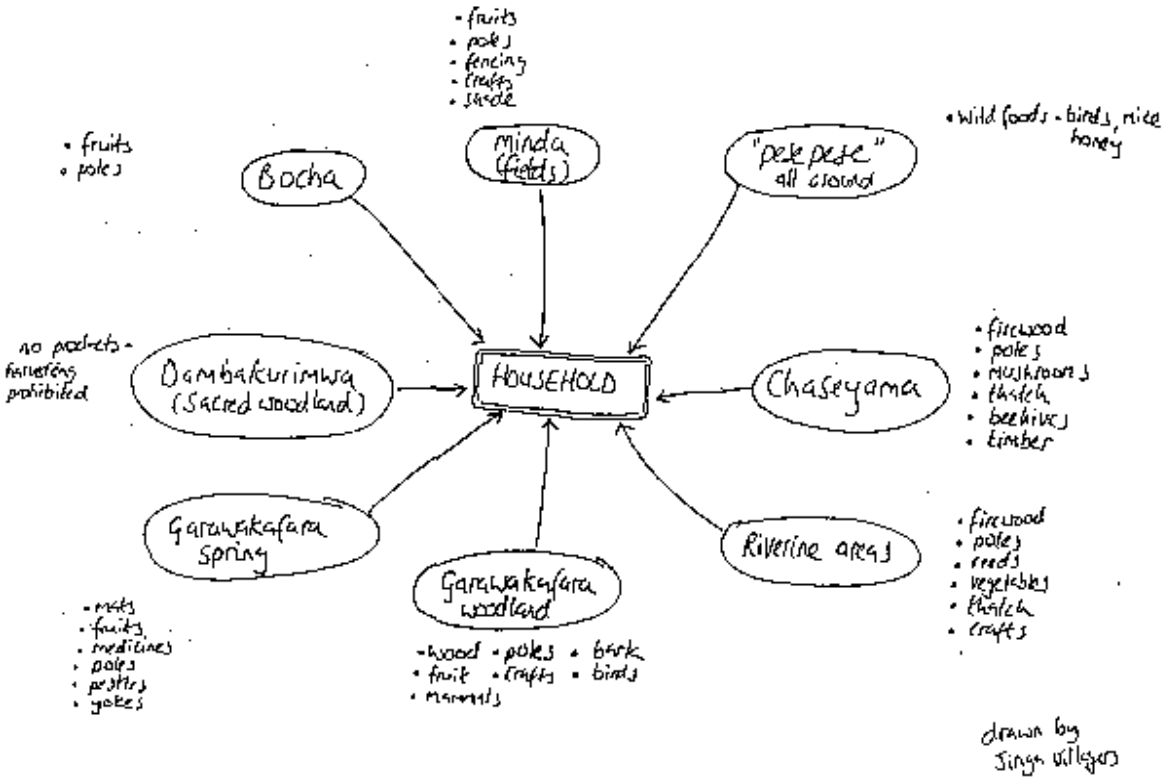
As with Jinga, the flow diagram followed on from the village resource map. A group of women who had been involved in the map sat with the facilitators, who asked them to list the products derived from each of the major resource units. The flow of each of these products was then traced to its final destination. A sketch to show the flows was drawn.

Results

Jinga

Households receive flows of a diverse range of products from a variety of ecologically contrasting sites, from riverine vegetation to mountain woodland, and from relatively undisturbed areas to highly transformed agricultural and settlement land (Fig. 5.1). The mountain woodland (eg. Chaseyama gomo) and the lowland woodland (eg. Garawakafara woodland) provide the greatest variety of products. These include fuelwood, poles, fruits, carpentry wood, animals, birds etc. Other sites are sources of specialist products. For instance, around Garawakafara well, *ilala* palms can be found for basket making and fruit collection. Cultivated areas are important collection areas for fruits as a number of different fruit tree species are retained in fields. Brushwood fencing (from *Acacia* spp.) can be found in disturbed areas near fields and homes. Other products can be found *"here and there" (pesepese)*. In particular, mice and birds are attracted to agricultural and settlement areas where they are harvested as part of pest control measures. Some products are more abundant in nearby Bocha village on the other side of the Odzi. This area is a particularly important source of baobab products as well as *C. mopane* poles. The Dambakurimwa woodland area is protected and no product can be harvested from it. However such areas have other forms of non-market value (see section 8).

Figure 5.1 Product flow diagram for Jinga.



Matendeudze

As with Jinga village, woodland resources are obtained from a wide range of sites including nearby hills, riverine vegetation, field boundaries and contours (Fig. 5.2). A large number of the products which are collected and used by Matendeudze villagers are sold at the village market. Some, such as fruits, are sold directly after collecting, whilst others, such as pots and mats are processed from the raw materials obtained from woodlands. A few specialist products such as clay- and earth-derived paints which are found only on Mutsago hill are collected by people from the neighbouring village of Maunzane. A few processed products such as honey, pestle and mortars and yokes are marketed in the city of Mutare, which is about 80 km away.

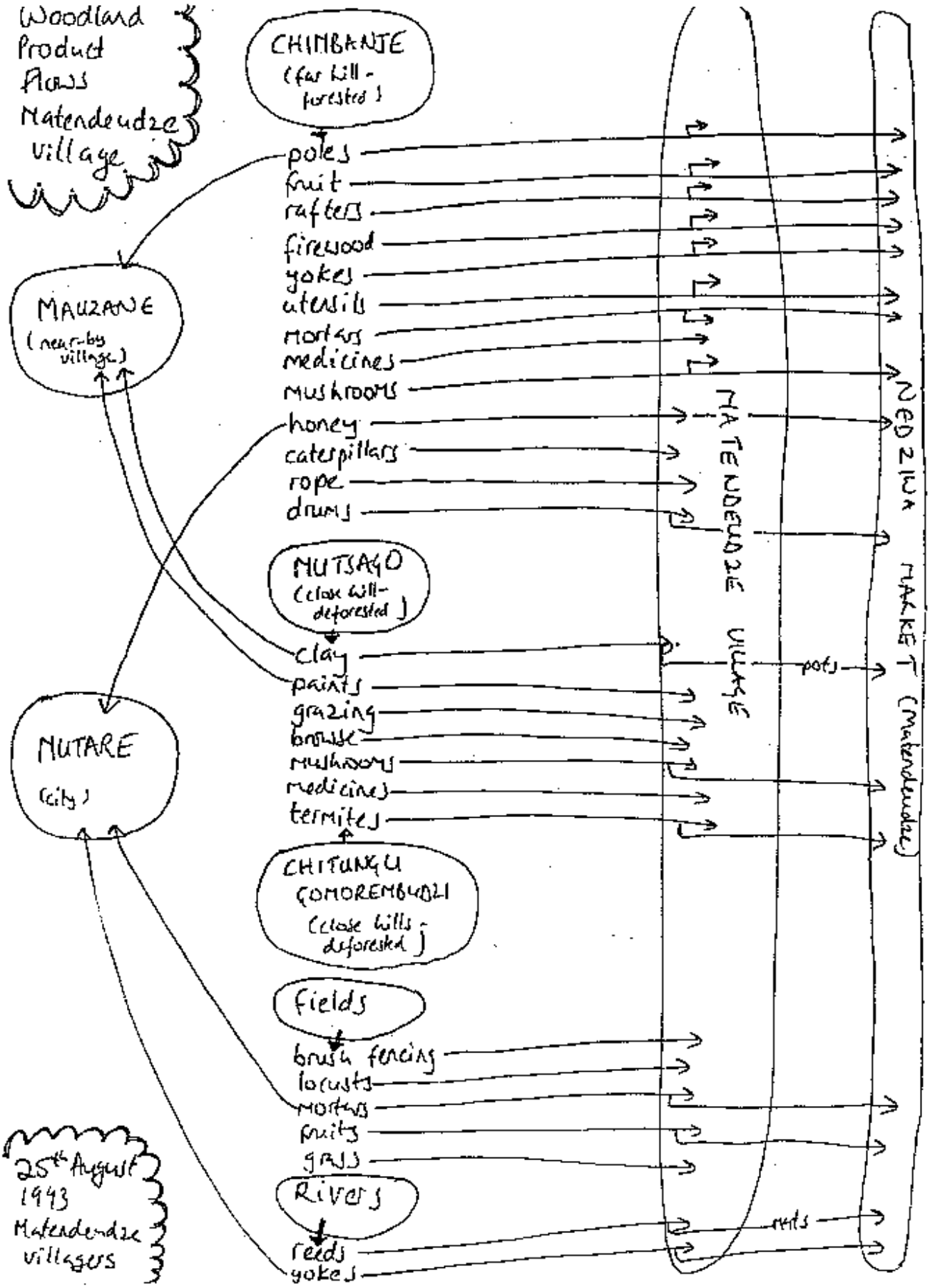
5.2 Product and activity calendars

Process notes

Jinga

The list of products used were written on pieces of paper and placed in rows on the ground. The months of the year were also written on sheets of paper and placed in the column positions on the

Figure 5.2 **Product flow diagram for Matendeudze.**



ground. Small stones were collected in a pile and placed close to the calendar. A group of women were asked to show when the product is available and the spread of quantities throughout the year. The women completed the calendar on their own. When they finished, the research team asked further questions about seasonal dynamics.

Matendeudze

Two calendar exercises were carried out; the first with a group of women and the second with a mixed group (two young men, one woman and a large group of children). The women's group drew a circular calendar illustrating how a range of farming activities and woodland product collection activities change over the seasons. The second calendar, in the matrix form of the Jinga one, focused on the seasonal availability of products. A checklist of products derived from the earlier mapping and flow diagram exercise was used to guide the interview.

Results

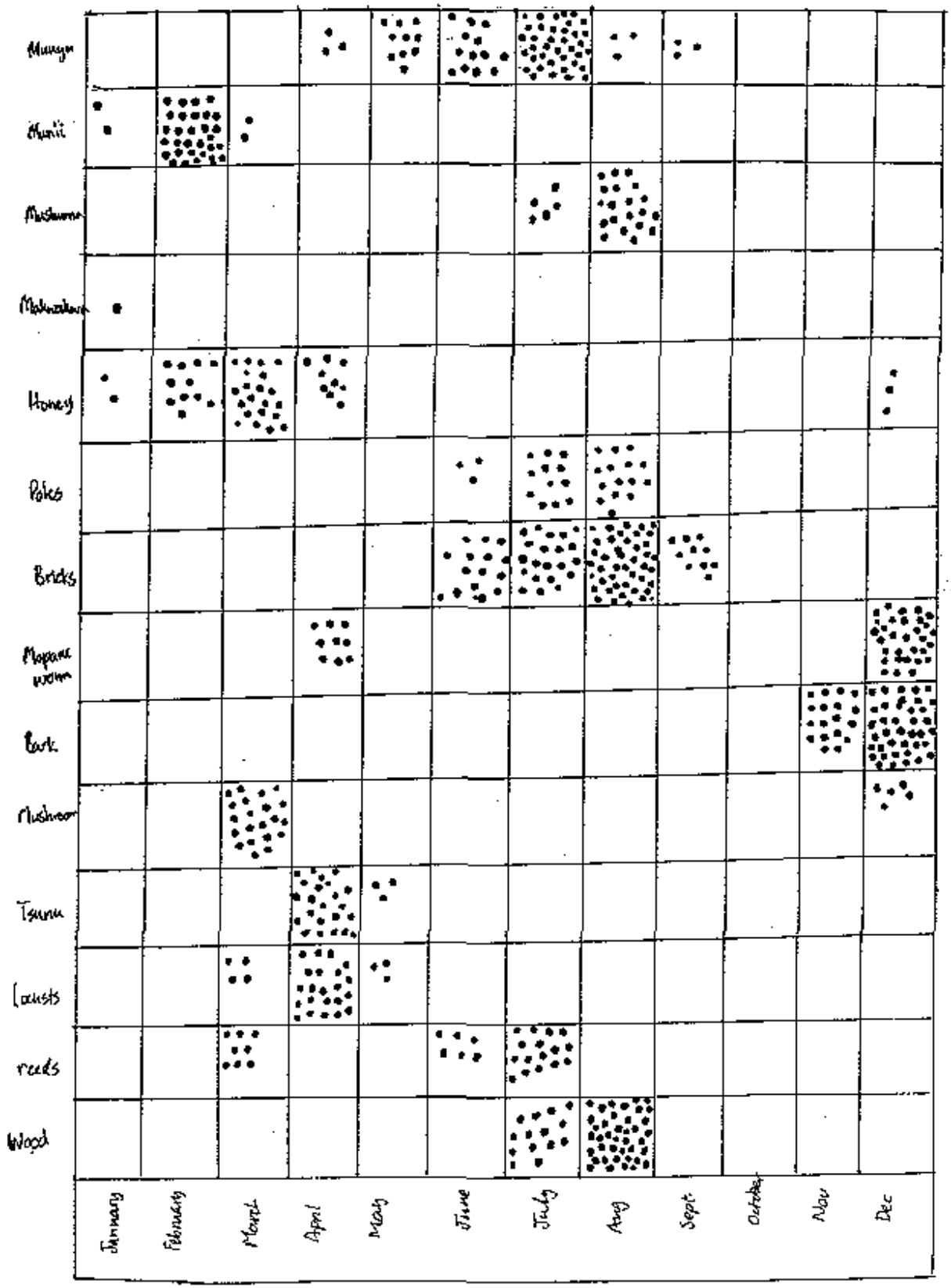
Jinga

The availability of woodland products is strongly differentiated seasonally (Fig. 5.3). Indigenous tree fruits may be found during the dry season (*Diospyros mespiliformis*, *Adansonia digitata*) or during the rains (*Berchemia discolor*, *Strychnos madagascariensis*). The appearance of other products may be linked to the rains (mushrooms, mopane worms, honey, locusts), while others may be best collected during the dry season (fuelwood for storage, poles, fuelwood for brick burning, reeds for crafts). October, at the end of the dry season and before the rains, is highlighted as a month when no woodland product is available.

Matendeudze

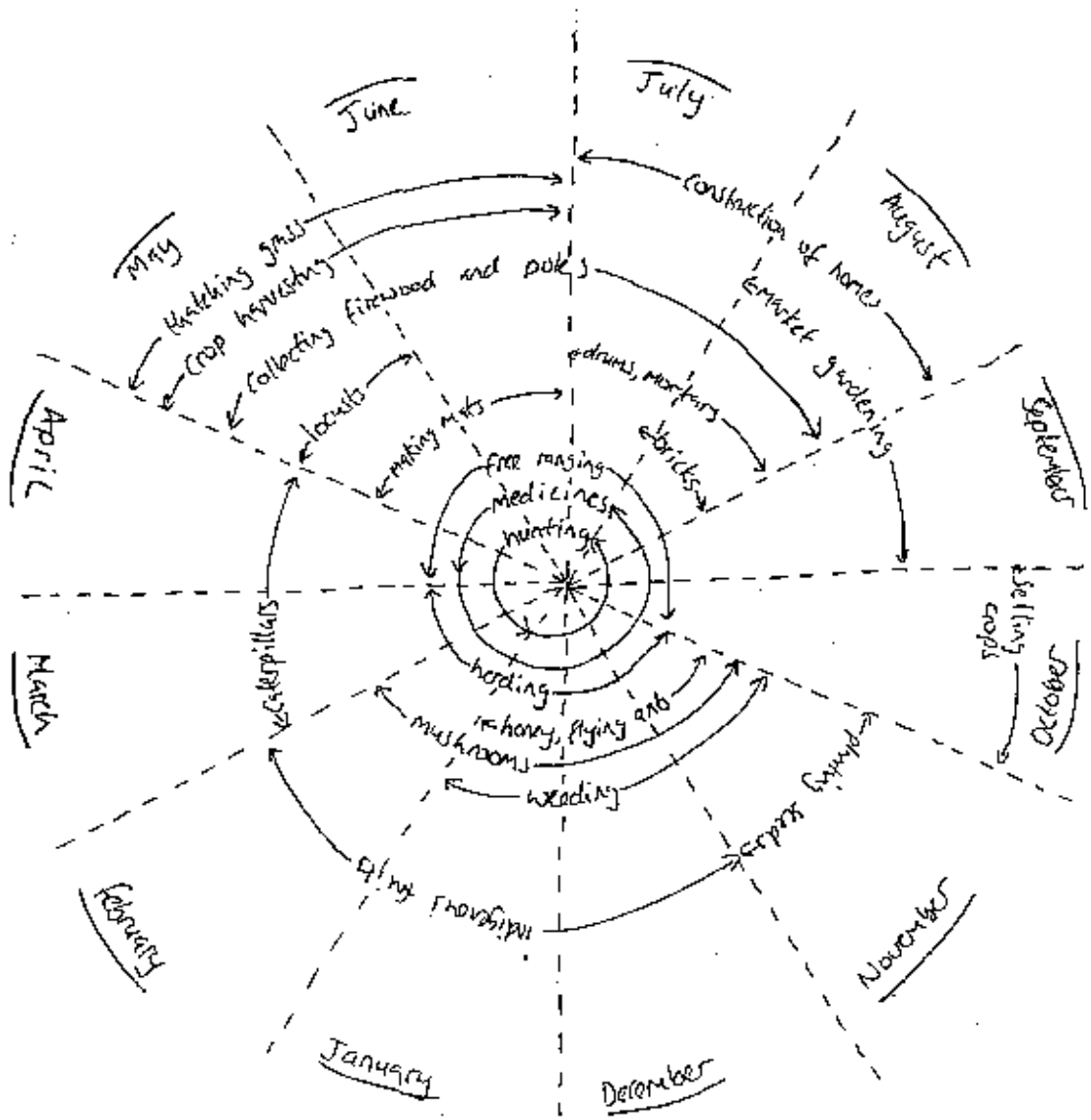
The calendars from Matendeudze illustrate how different product flows from woodland resources coincide with different activities in the annual cycle (Fig. 5.4). Certain products are collected year-round. These include medicines, hunted game and firewood, but most have a seasonal dimension to their collection and use. The dry season between May and October is a time when household labour is relatively free due to the lack of agricultural activities. This is the time for labour-consuming extraction of woodland products (collection of poles, fuelwood collection for the storage piles, thatch grass collection). It is also the time when family members are able to invest in craft and building activities. These activities are shared between men and women. Fuelwood collection, unless large amounts are being carried by scotch carts, tends to be carried out by women, while building, carpentry and wood craft activities are largely carried out by men. In the rainy season there is less labour availability but greater product diversity and abundance. This is when mushrooms, a variety of indigenous fruits, caterpillars, termites and honey are available. Opportunistic collection occurs while undertaking activities such as herding, firewood gathering or water collection. With the exception of honey collection, which is a specialist trade dominated by men, these opportunistically-collected products are largely collected by women and children.

Figure 5.3 Seasonal calendar for Jinga.



Prepared by Jinga Villagers – women
95-06-26.

Figure 5.4 **Seasonal calendar for Matendeudze.**



5.3 What's used? Household survey information

Wealth ranking

The consumption levels of a selection of woodland products were assessed as part of a focused household survey in Jinga and Matendeudze. A stratified sample of 25 households in Jinga and 36 households in Matendeudze was selected using the wealth ranking method. Households with different wealth status can be expected to have different uses and levels of use for various woodland-based products. For example, relatively rich households can be expected to be less reliant on local wood sources for house building than relatively poorer households, who are likely to construct their houses from local materials.

Process

Wealth ranking exercises were conducted in both villages while other PRA activities were going on. In Matendeudze, three wealth rankings were carried out: one with two old men; one with three women and one with a group of six young boys. In Jinga, one ranking was carried out with a group of two women. Prior to the start of the wealth ranking the name of each household in the village was written on a small card (N = 96 in Matendeudze and N = 102 in Jinga) from household lists compiled by the team members who were resident in the village. For each wealth ranking, the village household list was read out. Informants confirmed that they thought the list was accurate and complete and that they knew nearly all the people listed. Following this, the informants were asked to place the household cards into groups representing different wealth strata. At the end of the ranking, which in each case took only 10-15 minutes, the names of the households placed in each rank were read out in order to cross-check that they indeed constituted an homogenous group. The informants were then asked to describe the characteristics of each group, emphasising the ways the groups are distinguished from one another.

Results

The sample households in Jinga were selected randomly but in proportion to the total number of households found in each of the four wealth ranks. Due to problems of absent households and other difficulties, the research team was forced to choose additional households for interviewing. The final sample interviewed and the criteria differentiating the wealth groups are shown in Table 5.1.

Table 5.1 The sample selected for interview and the criteria differentiating wealth groups in Jinga.

Wealth rank	Population	Sample	Criteria
1	23	7	Reliant on steady flow of remittances from relatives with good jobs in town
2	27	5	Remittances important, but more intermittent and sent in smaller amounts than rank 1
3	42	7	Reliant on farming, brick making, local trades
4	9	5	Widows and elderly people who are reliant on the assistance of others

During the wealth ranking exercise in Matendeudze, the men came up with three groups, while the women came up with two. The children came up with seven groups. Due to the difficulty in interpreting the children's ranking, the subsequent analysis was based on only the adult's rankings. The characteristics of the different wealth groups are described in Table 5.2. Access to land and farming methods were important variables differentiating the groups.

Table 5.2 Criteria differentiating the different wealth groups in Matendeudze.

Wealth Rank	Men	Women
1	The original settlers; have fields and yards at homesteads; have gardens.	Easy access to cash through working husbands, casual labour. Includes those with and without cattle due to drought
2	Use poor farming techniques; lazy; sell vegetables at Nhedziwa; use less fertilizer than rank 1	Widows and elderly people; less sources of cash; rely on selling beer for cash
3	Do not make use of resources (eg. gardens); lazy; husbands fail to remit cash; sell firewood.	

To find out whether the ranking results from the men and women could be pooled, chi-squared tests of association were carried out on the two rankings. The results showed that the two rankings were similar ($p < 0.01$). A composite rank, using a formula which gives a weighted average of the two separate ranks, was derived as follows:

$$HR = (MR \times 2 + WR \times 3)/6$$

where HR = final household rank
MR = men's ranking
WR = women's ranking.

A final household sample of 37 was selected, with random selection of households within each household rank (rank 1: population 45; sample 19; rank 2: 32 and 11; rank 3: 19 and 7).

Household surveys: consumption patterns

Process

A full checklist of all products being used by households was compiled for each village from the flow diagrams, maps and other interviews. However, attempts in both villages to collect quantitative information on all flows coming from the woodland resources to households failed because of the difficulty in obtaining detailed and accurate information through simple recall interviews on products that were collected occasionally and opportunistically. This ambitious data collection strategy was simplified and the following day household interviews concentrated on collecting information on the annual consumption of a limited range of frequently-used products (fuelwood for various purposes, implement handles, and selected foods, namely, mushrooms and termites in Matendeudze and mopane worms and birds in Jinga). In addition, a simple capital stock assessment was carried out and inventories of wooden structures, hoes, axes, mortars, pestles and wooden furniture in the home were made, with estimates of longevity for all items also being recorded.

Results

There is enormous variability between households in consumption levels for all products examined, indicated by the large standard deviations (Tables 5.3, 5.4 and 5.5).

Table 5.3 Annual household consumption of selected woodland resources in Jinga.

Product	Mean	SD	N
Fuelwood for household cooking (kg yr^{-1})	6465	6882	23
Fuelwood for brick burning (kg yr^{-1})	1489	3387	24
Fuelwood for beer brewing (kg yr^{-1})	28	75	24
Hoe handle (Nos yr^{-1})	2.5	1.7	22
Axe handle (Nos yr^{-1})	1.1	1.1	22
Cook stick (Nos yr^{-1})	1.9	1.7	21
Mopane worms (kg yr^{-1})	0.5	1.2	23
Mice (Nos yr^{-1})	157	655	22
Doves (Nos yr^{-1})	12	39	15
Quelea (Nos yr^{-1})	649	2555	23

Table 5.4 Annual household consumption of selected woodland resources in Matendeudze.

Product	Mean	SD	N
Fuelwood for household cooking (kg yr^{-1})	3601	1924	34
Fuelwood for brick burning (kg yr^{-1})	890	2142	25
Fuelwood for beer brewing (kg yr^{-1})	66	142	27
Hoe handle (Nos yr^{-1})	2.3	1.6	38
Axe handle (Nos yr^{-1})	1.8	0.9	27
Mushrooms (kg yr^{-1})	47	112	38
Termites (kg yr^{-1})	0.72	1.45	38

Data review and cross-checking revealed a number of possible biases in the data. These included:

- *Interviewer bias*: inconsistency in asking questions about quantities between interviewers;
- *Interviewee bias*: under-estimation of quantities may have occurred in some instances due to suspicions raised regarding the motives of the research;
- *Unit bias*: conversions were carried out to change estimates from locally-meaningful units (eg. headloads of firewood or 20 litre tins of specific fruits) to technically-meaningful units,

Table 5.5 Numbers of structures, numbers of poles per structure and longevity of poles.

Structure	Nos. of structures household^{-1}				Nos. of poles structure^{-1}						Durability** (yrs)		
	Jinga		Matendeudze		Jings			Matendeudze					
	Mean	SD	Mean	SD	Mean	SD	N	Mean	SD	N	Mean	SD	N
Granaries	0.65	0.15	0.80	0.36	97	60	7	72	56	11	8.4	0.9	15
Wooden huts*	1.39	1.28	1.28	0.60	75	50	21	48	21	7	10.7	1.39	7
Brick huts	1.30	0.81	1.06	0.52	28	19	11	47	10	7	12.4	1.32	8
Cattle pens	0.44	0.38	0.38	0.34	106	36	10	42	20	5	4	1.5	6
Goat pens	0.83	0.49	0.27	0.31	126	47	16	68	19	3	3.8	0.6	6
Stover frames	0.87	0.57	0.84	0.37	48	40	13	28	4	4	2.2	0.48	11
Utensil frames	1.04	0.53			28	11	17	23	10	10			
N (number of households)	23		36										

* In Matendeudze, the so-called wooden huts are raised from the ground on stones with large wooden floors, but have brick walls ('danduru').

** All data collected in Matendeudze.

using known conversion factors (Appendix 4) or estimated conversion factors. There is the possibility that the conversion factors were not all appropriate;

- *Seasonality bias*: although interviewers attempted to assess the annual consumption rates, these were sometimes difficult to estimate because of high levels of seasonal variation. For instance, firewood collection rates in the late dry season are at a peak due to pre-cropping season storage (see Figure 5.4) and do not reflect consumption rates through the year.

Despite these problems, it was felt that the data provided a broad reflection of consumption patterns. For all products, consumption is highly variable between households. This is particularly the case for the consumption of fuelwood for brick burning or beer brewing where only a few households are involved. The same applies to the consumption of mushrooms, termites, mopane worms and mice. Household survey estimates and levels of variation between households reflect findings from elsewhere in Zimbabwe (cf. Grundy *et al.*, 1993; McGregor, 1991). Due to high levels of variability between households and the small sample size in each village, statistical assessments of differences between wealth groups proved impossible.

Most fuelwood is used for household cooking, some four to five times more than that used for brick-burning (Tables 5.3, 5.4). Fuelwood for beer-brewing is an insignificant proportion of overall consumption. More fuelwood is consumed per household in Jinga than Matendeudze, a reflection of the the more wooded nature of Jinga (see section 9). On average, between one and three of each of the following are required per year per household: cooking spoons, axe handles and hoe handles (Tables 5.3, 5.4). Households also have an average of 0.86 mortars each (SD: 0.66), which have mean longevities of 21.2 years. Consumption of *Quelea* and mushrooms is surprisingly high; the former in Jinga and the latter in Matendeudze.

There are roughly similar numbers of structures per household in the two villages, with the tendency for more structures in Jinga than Matendeudze, with the exception of granaries (Table 5.5). There are generally many more poles per structure in Jinga, with cattle pens, goat pens and granaries requiring the most poles. In terms of longevities, the poles in animal pens only last about four years, whereas those in huts and granaries last two to three times as long.

5.4 Case studies: production and marketing of woodland products

Process notes

A number of potential case studies were identified during the early phases of the fieldwork. For instance, particular artisans and crafts-persons were identified on the village household maps during the mapping exercise. Some of these individuals were included in the random selection of households for the household survey work (section 5.3), others were traced and interviewed separately. Each interview explored product collection, processing and marketing with the aim of identifying the costs and returns at each stage of the process. Assessments of market demand, market competition and pricing strategies were also attempted. In each case interviews were informal and structured around a check-list of questions developed by the research group beforehand.

Results

Jinga

- *Fuelwood.* Mr Derera is the primary actor in the fuelwood trade in Jinga village. He is the owner of a five-tonne and a seven-tonne truck. The fuelwood comes from the village woodlands or from clear felling in agricultural land. He buys firewood for $25 per 5-tonne truck. The fuelwood is sold at Chakowa, some 12km distant, at $100 per 5-tonne truck. He recalls selling a total of eight truck loads during 1992.

- *Carpentry products.* William Tsandukwa is a carpenter and makes a number of items on request, including benches, doors, chairs, mortars, yokes, *zvikei* (part of the yokes), hoe/axe handles and adzes. He cuts the wood he requires from the village woodlands. Characterisitics of production and marketing for each product are as follows:

  Benches. It takes about one day to collect, cut and deliver the raw material for a bench. A further one and a half days are required to complete the item. Each bench costs $15. During 1993 (up to September) he sold four benches.

  Axe, hoe, adze handles. The axe and hoe handles sell for $1.50 and adze handles sell for $0.75 each. During 1993 he sold five axes, five adzes and a number of hoes.

  Mortars. It takes about two days to make a mortar from collecting the wood to completion. Each one sells for $40. During 1993 he made three mortars.

  Chairs. It takes about 4.5 hours to collect the desired wood and bring it to the homestead. Another day and a half is required to make the chair. During 1993 he made nine chairs and sold each one for $40.

  Yokes. It takes 1.5 days (including wood collection) to make a yoke. Each one sells for $15. He sold one in 1993.

  Doors. It takes a week to make a door (including collection and cutting of the wood). Each door sells for $40. During 1993 he made four doors.

- *Mats.* Darius Mupunga makes mats from baobab fibre. It takes about 30 minutes to collect the fibre for a single foot mat. Around two mats can be made in a single day. He sells his mats at $4.50 each, mainly at Nyanyadzi market. During 1993 he had sold 30 mats up to September.

- *Brick making.* Mr Chauke makes bricks by the roadside. He has been contracted to make 15000 bricks. So far they have been making 13000 in four man-days. For burning 8000 bricks they require four scotch cart loads of firewood. Burnt bricks sell at $45 per thousand.

- *Pottery.* Mbuya Hanyani makes clay pots. It takes her around 5 hours to collect and deliver enough clay to make two to three pots. Pottery is normally done between July and October. She can make around five large and 10 small pots per week. She requires two headloads of firewood to fire about five pots. She sells in Jinga, as well as Chayamiti and Chakowa villages. Large pots sell for $4, while small pots sell for anything between 50c and $1.50.

- *Birds.* Peter Madhaure traps birds each year, particularly between June and September. *Quelea quelea* is the dominant species caught. Madhaure claims that on a poor day he can trap around 10-20 birds per day and on a good day he can trap up to 200 birds. He normally spends about four hours a day, nearly every day of the week during the trapping season. He sells birds both within the village and at Chakowa about 8km away. Unprocessed birds sell for 10c each, while processed ones, plucked and roasted, go for 15-20c.

- *Honey.* Beehives are owned by a number of people in the village. Most are sited close to one of the rivers because of the presence of flowering trees in the riverine vegetation. Four transects were walked between the Chivire and Murare rivers (around 1km distance). Of the 20 beehives spotted, 19 were found on the transect running close to the Odzi river. Only two of these beehives were found to be active. The drought has resulted in a decline in bee populations and honey production in Jinga. All honey currently produced is sold locally in small quantities.

- *Baobab fruit.* Knife Dube sells baobab fruits to traders who carry them to Mutare and Harare. He currently sells 100 bags of mixed size fruit for \$18 bag^{-1}. Each bag contains over 250 fruits. He buys the bags at \$5 and pays another \$1.50 for scotch cart transport to the roadside selling point. Individual fruits are purchased at anything between 5c and 20c depending on their size. Mashereni is also involved in the baobab fruit trade. He sells 40 bags, again at \$18 each. He only buys medium to large fruit at prices ranging from 10-20c. Each bag contains 150 medium-large fruit.

Matendeudze

- *Honey collection.* T. Dospani has collected honey for many years. The sale of honey is vital for his household economy. He has educated all his children on the proceeds of honey sales. Mr Dospani owns 140 beehives made from hollowed logs. Each beehive lasts around 20 years before having to be replaced. He makes the hives himself and it takes about eight hours of work from the cutting of the tree to the installation of the hive. A hive can sell for around \$20. Dospani's hives are scattered throughout the woodlands. The closest hives are only 500 m from his home and the furthest are around 6km away. Mr Dospani collects honey from active hives twice a year during the rainy season. If he spends three hours a day for a full week he can collect one drum of honey (126 hours per drum). He collects about six drums a year, although recently production levels have decreased because of drought. The honey is processed at home. It is sieved to remove impurities. He then mixes the very high quality honey with low grade honey in order to assure Grade A prices for his whole harvest. He sells all his honey to a trader who operates from Mutare. He transports the honey to the collection point on his scotch cart. Top grade honey is sold at \$550 $drum^{-1}$, while lower grade honey fetches only \$350 $drum^{-1}$. Prices are fixed by the trader, but he offers higher prices than could be gained locally. All three honey producers in Matendeudze sell through the same channel. Other than a simple sieve, drums and basic hive making tools, Dospani has no capital equipment for his business.

- *Yokes and scotch cart pull-bars.* Shupai Mujeki produces the poles for yokes and pull-bars for scotch carts. These are made from *Diospyros mespiliformis* (*mushuma*) and *Terminalia sericea* (*mususu*). The trees are found in the hills immediately behind his house, around 1-1.5 km distant. It takes around eight hours to make a yoke pole. This includes the cutting of the tree, the limited processing that is carried out in the bush (eg. bark stripping) and the manufacture of the product at home. Pull-bars tend to take longer as the bar must be fixed to the cart. All sales are local and on request. He manufactures mostly during the dry season

between July and September. At peak production times he may complete three poles a week. Yokes are sold at $7-10 and pull-bars at $7. Mujeki reckons that the prices are low compared with other markets, but he says that *"these prices are for people I live with"*. He may also combine sales with other barter and exchange deals with the buyers.

- *Fuelwood sales.* Banda Mumvuri cuts and sells firewood in Matendeudze. However, he intends to move soon to a more thickly forested area nearby, where a relative has recently acquired land. The firewood is cut in the grazing area of Matendeudze; the main species he cuts are *Brachystegia spiciformis*, *Julbernardia globiflora*, and *Brachystegia glaucescens*. He cuts in cords and stacks the wood on site. He works alone mostly, but occasionally with his daughters and wife. The major investment in the cutting operation is the construction of the roads to the cutting sites. For instance, it may take three weeks to prepare a road for only three day's cutting. One and a half days cutting can produce 2.5 cords of dry wood, equivalent to a tractor load. Clear cutting of wet wood is quicker, producing a cord a day. Mumvumi claims he concentrates his cutting on dry wood for firewood, although wet wood for brick burning is sometimes requested. Field visits suggest otherwise, with large areas having been clear-felled for wood in recent years. Since starting his operations in September 1992 he claims that he has removed seven tractor loads. He pays the tractor operator $75 a trip to carry the wood from the cutting site to Nhedziwa business centre. Sales are made by tractor load to Sunnyside Mission nearby. They have regular orders and he sells a load at $120. The rest of the wood is divided up into smaller bundles for sale to individuals at Nhedziwa (particularly store owners, teachers etc.). The extra work to chop up the bundles means a higher price. Such bundles sell for $15 (large bundles of 8' x 4' x 4') and $2.50 (small bundles of 2.25' x 1.5' x 2.25'). He is the main commercial firewood seller in the area. Apart from institutional sales (to the Mission) and some sales to Nhedziwa residents, most firewood is collected for home use and not sold.

- *Axe and hoe handles.* Mr Mutsoto is a retired Mutare storekeeper. He makes about 20-30 axe handles during the year from a variety of tree species including *J. globiflora*, *B. spiciformis* and *Combretum hereroense*. Trees are cut from Chimbanje hill. It takes about 2.5 hours to collect enough wood for six handles. He sells them locally to those who order them for $1.20 each.

- *Benches and doors.* Clifford Magwanyata saws planks for benches or doors to order. He collects wood throughout the year from Chimbanje mountain. The dry season between July and September is the peak season for his production. He will cut the trunk into planks at his homestead and make an item all in one day. During August this year he made three doors and two benches. All products are sold to local people. The demand is generally low and uneven and he cannot rely on the carpentry trade for his livelihood. Recently he has been doing contract work outside the village to supplement his income. There are only a few people who supply carpentry products made from local wood sources to the market. Most richer people prefer to buy planks of sawn pine or ready-manufactured furniture or doors. Poorer people by contrast either make the products themselves or do without.

6. HOW IS IT CONTROLLED? TENURIAL AND INSTITUTIONAL ISSUES IN RESOURCE CONTROL

6.1 Historical changes in tenure and resource management

People of Matendeudze village are originally from Bocha but are referred to as *Vagarwe* because, when they split from their main group in Marange communal lands, it is said that they crossed Odzi river by stepping on the backs of crocodiles. This is how they escaped from their adversaries from Marange. People from Jinga village are of Ndau origin, a group of people that originally came from South Africa through Mozambique. In both villages their *sadunhus* (leaders) are of chief Mutambara's lineage. Their chief has always been chief Mutambara.

In both villages there are sacred sites/shrines in which there were strict resource use regulations, but due to the erosion of the authority vested in traditional leadership, some of these sites have lost their sacredness. There were sacred springs in both villages and there are a number of hills, where members of the ruling lineage were buried. The latter have become sites for rituals and ceremonies to communicate with the spiritual world. These hills are shown on each of the tenure maps of the villages (Fig. 6.1 and 6.3). Only specific individuals such as spirit mediums, *sabhukus* (village leaders) and very old women were allowed to visit these sites to conduct religious ceremonies. The rest of the villagers had no access to these sites. As a result of the pressure on tree resources and conflicts over resource use and control, the present day controls at these sites are very different. Although the restrictions remain very strong in people's memories, they are no longer strictly adhered to. Religious ceremonies are still being held within these sites, however, and there is general agitation towards reviving the old taboos.

6.2 Resource tenure: the contemporary situation

Process notes

Jinga

The village resource map was used as a basis for developing a tenure map. The villagers talked through the resource map, recapping on the identification of the various 'resource units' in the village. These were then written on pieces of paper and organised on the ground according to their geographical location. Then villagers moved from one resource unit to the next, identifying and listing the specific tenurial conditions, restrictions and taboos associated with each of the sites. The final result was drawn on a large sheet of paper. Different social groups (men, women and village leaders) were taken through the various units separately to add to and verify the information already listed. In order to clarify mechanisms for resource control, villagers were asked to identify the various institutions which have a responsibility for resource control within the village. The villagers identified several hierarchies which they mapped out on a large sheet of paper, according to level of authority. The roles of each in resource control was added. Information about resource control obtained from the resource map and the village structure diagram was cross-checked during interviews with key informants. In Jinga, key informants were a *jinda* (one of the three councillors to the *sabhuku*) and an old woman who participates in rain-making ceremonies.

Matendeudze.

Information on resource control and access was obtained from questioning the resource map, from the village transect, as well as from interviews with key informants. Key informants were the councillor, a 'tree policeman' and a *sabhuku.* The information obtained was later used to compile a tenure map following the same process used in Jinga.

Results

Jinga

Fig. 6.1 shows the range of resource controls which apply to the various resource units in and around Jinga village. In addition to the discrete areas of woodland, each of which has varying degrees of resource control, there is the category *'pesepese'*, which was coined by the villagers to describe the trees and woodlands that are scattered in the cultivated and residential areas, and do not form a woodland as such. The concept of *pesepese* is similar to the concept of 'social forest' which has been used by some authors to describe a woodland or forest/woodland area which has been partially and selectively cleared by a farming community (Nhira and Fortman, 1993) (see section 5.2).

Whilst the types of controls and restrictions mentioned in Jinga and Matendeudze are similar, it appears that there is a greater degree of enforcement in Jinga. The lineage leaders in Jinga appear to have greater authority over resource use and control than those in Matendeudze. The chief (*ishe*) through the *sabhuku* (village leader) and three aides (*jinda*), make the rules and pass them down to the villagers (Fig. 6.2). The aides report violators through the hierarchy. These controls are said to be very effective, such that only warnings have been issued to offenders without need for fines. Most of the conservation practices that are used today have been in place as long as anyone can remember. However, there are a few additional practices governing access and use of resources which are more recent introductions. The existing practices and rules are listed below:

- Cutting of wet wood for firewood is strictly prohibited.
- Dry wood and off-cuts from poles, crafts and other implements can be used for firewood.
- Sale of firewood and poles is strictly prohibited to protect the woodlands from plundering.
- All fruit trees and certain special species (like *L. capassa)* with spiritual values are prohibited from cutting.
- Permission for brick making is granted by the *sabhuku* and people are only allowed to lop branches rather than cut standing trees.
- Dambakurimwa woodland is a sacred woodland in which tree cutting, cultivation, collecting of firewood or even livestock grazing are prohibited.
- *F. capensis*, *Afzelia quanzensis* and *mutsikiri* are protected because they raise the water table.
- The products of trees in fields belong to the owner of the field in the wet season when there are crops growing in the fields, but can be accessed by others during the dry season.

Figure 6.1 **Tenure diagram of Jinga village.**

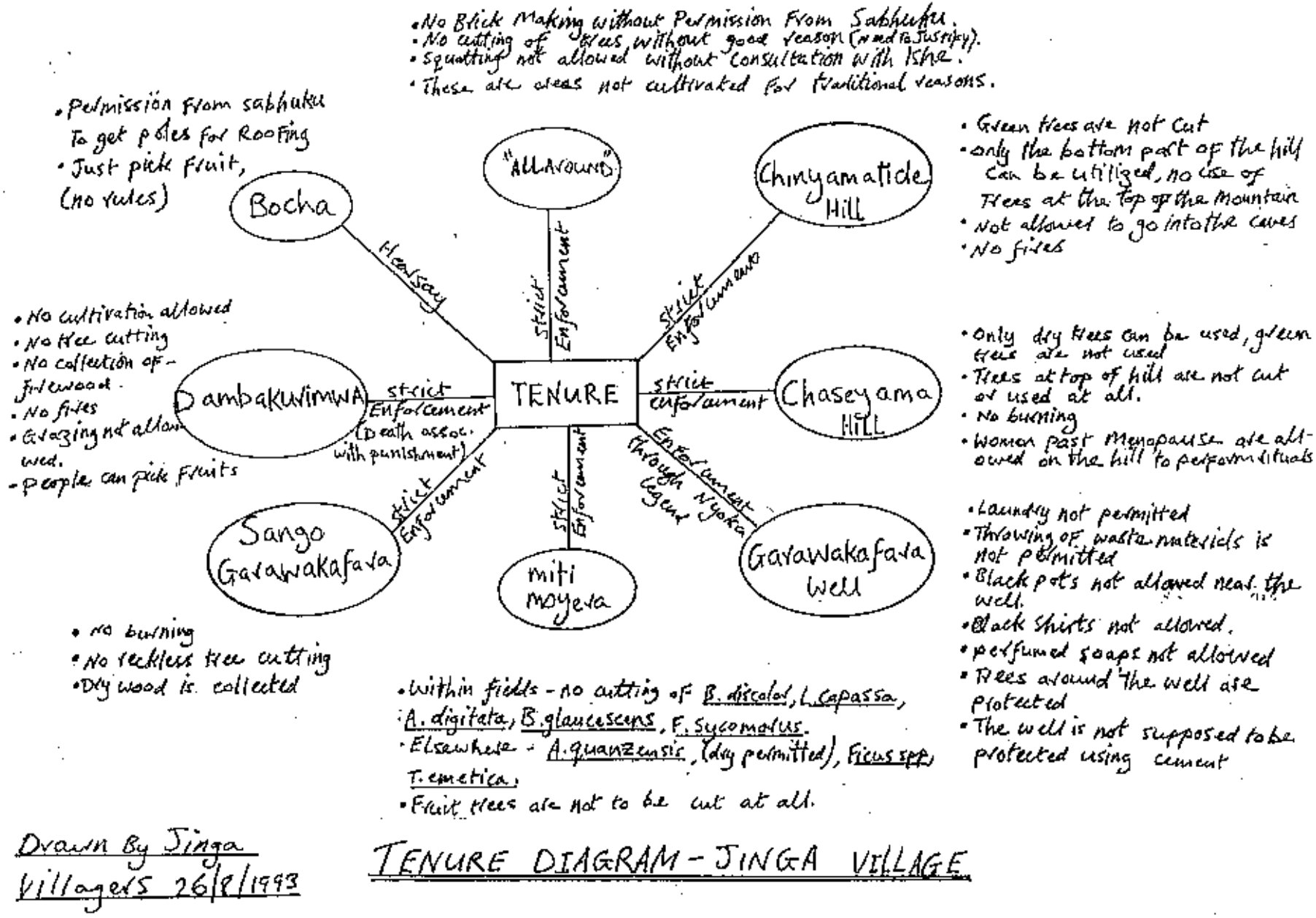
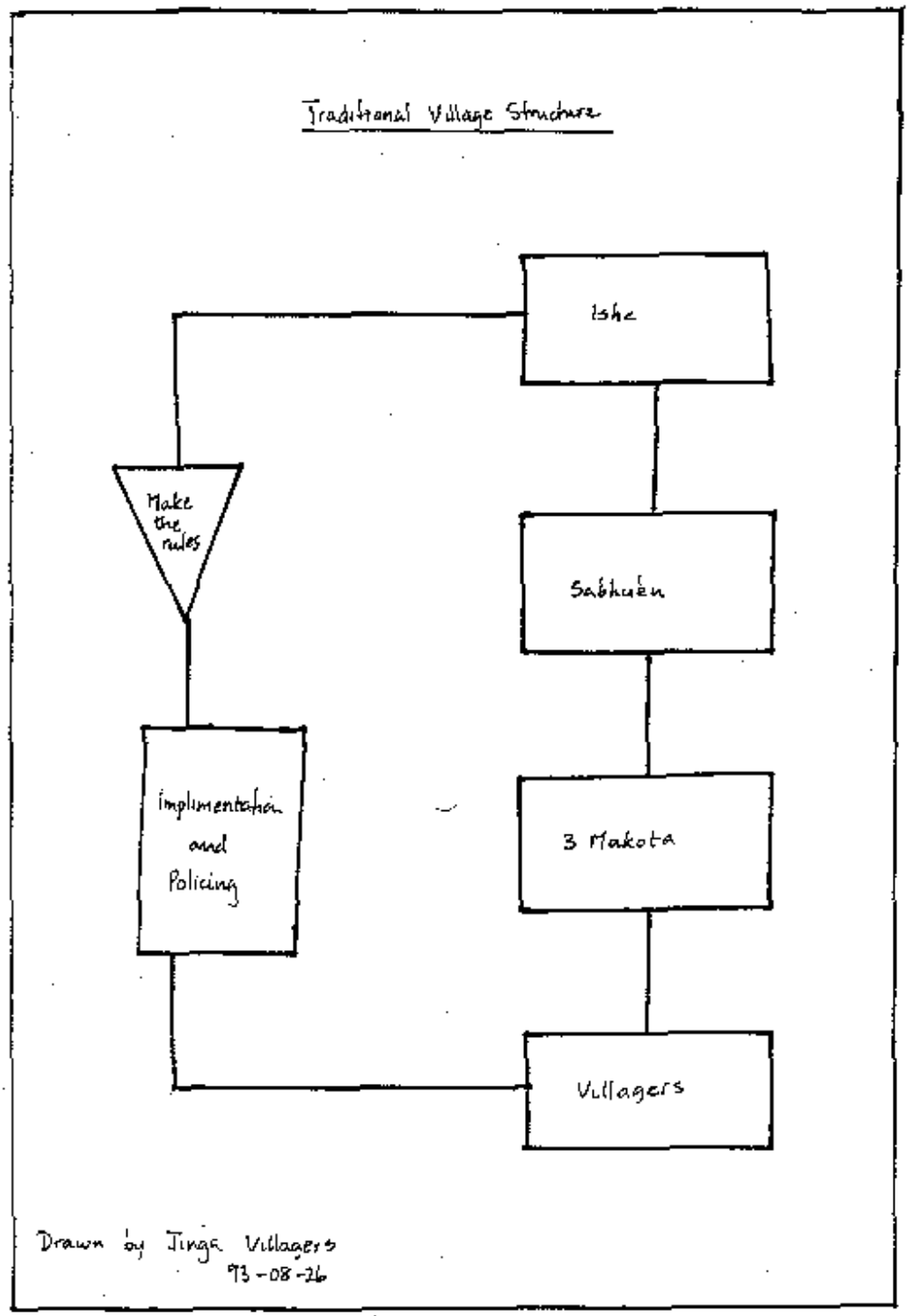


Figure 6.2 **Traditional village structures in Jinga.**



Matendeudze

The villagers were able to provide detailed information about controls over specific resources and resource sites (Fig. 6.3). It became clear from the key informant interviews and the transect walk that many of these restrictions are no longer adhered to these days. Whilst the memory of these restrictions and taboo appears to be kept alive in the culture, enforcement appears to have largely broken down. It also emerged that there is confusion surrounding land allocation and enforcement of resource use regulations. Prior to independence a new person would seek land for cultivation from the *sabhuku* and would pay either chickens or goats to show their appreciation. Land would only be allocated to people with a *"good background"* or to those whose relations were on reasonable terms with the *Vagarwe* (see section 6.1). The person would also be told specific regulations, for example:

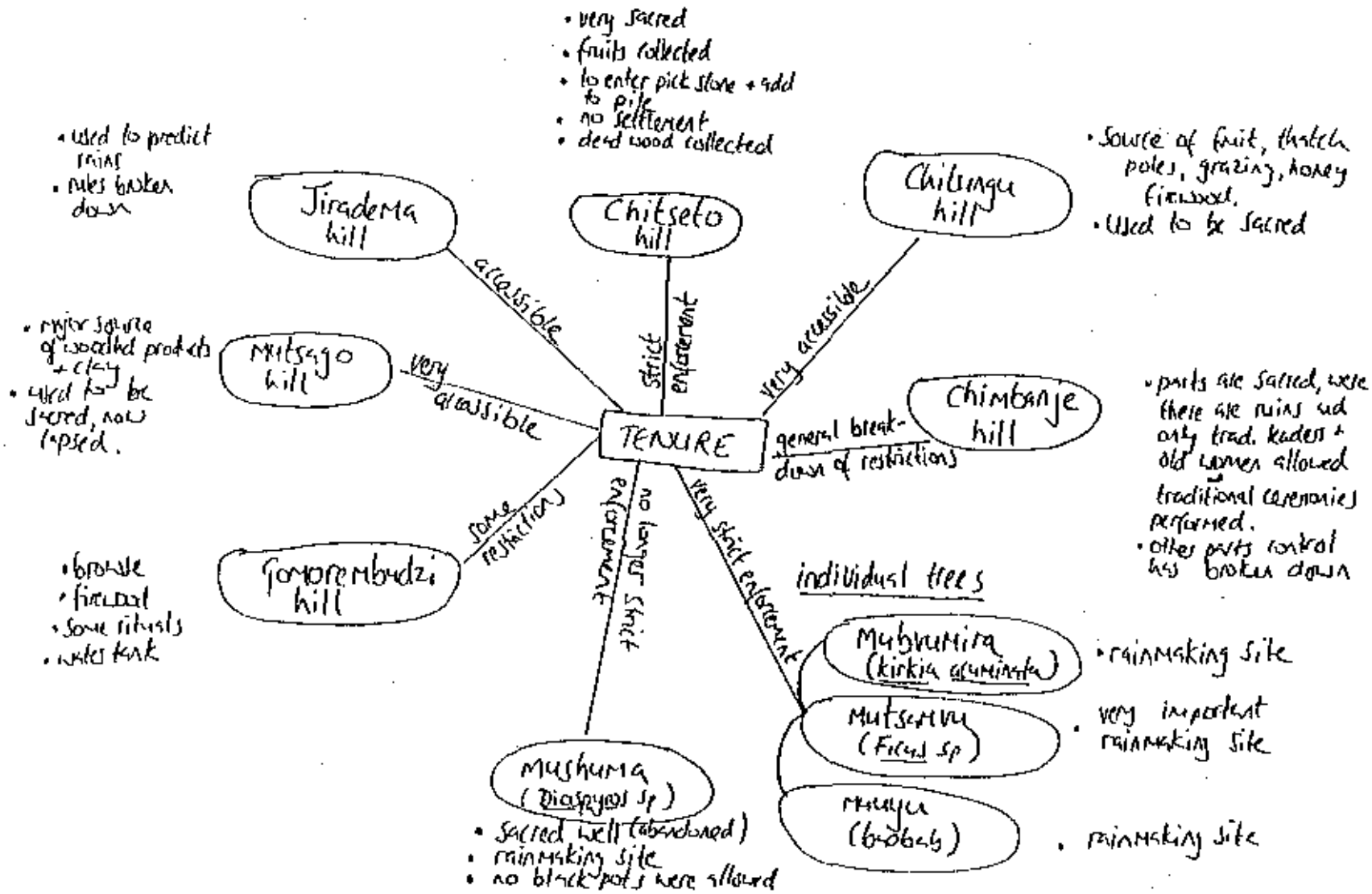
- Fruit trees should not be cut, and if they were there would be penalties in the form of chickens or goats.
- Established cultivation methods should be followed in order to combat soil erosion;
- Rest or *chisi* days should be observed, when no farming activities should be done. *Chisi* days are days when important lineage figures died.

Since independence, a person looking for land can either approach the *sabhuku* or any members of the VIDCO. In both cases there would be consultation with the other prior to allocating land. In any event, the ward councillor is also informed about such new arrivals. Current rules pertaining to resource use are:

- Not cutting wet wood for firewood.
- Making contour ridges to prevent erosion.
- Not cutting trees unless one has a specific use for them.
- Where possible, only top branches must be cut, with the rest of the tree left standing.
- Only dry wood is supposed to be collected for firewood.
- When cutting trees for a purpose, one is supposed to selectively cut from within the woodlands and not all from one place.

If anybody is found defaulting they are initially charged fines ranging from $50-$100, depending on the nature of the crime. These fines are paid at the police station at Cashel, a town nearby. If one continues to default the fine increases to $1500 and eventual imprisonment. Traditional fines which are paid in kind are also still enforced in some cases. There are parts of Chimbanje hill, for example, which are very sacred and people do not wander into them for fear of vanishing. Particular tree such as *Ochna* sp. (*muminu*) are still not used for firewood as they are believed to cause family disputes.

Figure 6.3 **Tenure map of Matendeudze.**



TENURE DIAGRAM - MATENDEUDZE VILLAGE

7. WHAT'S IT WORTH? VALUATION OF PRODUCTS

This section attempts to answer the question *"what's it worth?"* by looking at a subset of total economic value - the range of products which are regularly used by households in Jinga and Matendeudze and that have a local market value. A *derived demand* approach to valuation (described in Box 7.1) was used to assess the annual value of this range of products to the households resident in the two villages. The term *"marketed products"* is used even though it is often only a small proportion of total consumption that goes through a formal market; most products are largely of a subsistence nature. The section concludes with a general discussion of market conditions in the two villages.

7.1 Valuation of marketed products

Process

Information about quantities of marketed products obtained from the woodland per year was collected from the sample households (see section 5.3). The information was collected using household interviews following a pre-prepared question list, and findings were entered on data sheets.

Inventories were also made of the wood used for products which are not consumed on a yearly basis (ie. axe and hoe handles, poles in structures, and mortars) (see section 5.3). Those products which were consumed at very low levels were not evaluated.

Box 7.1 The derived demand approach

The derived demand approach uses prices of goods produced from natural resources to derive the value of unprocessed forest resources (see, for example, Pearse, 1990). For example, if a pole sells for $2.00 and the costs of production (harvesting and transport) are $0.50, then the value of the pole as part of a tree standing in the forest may be derived from subtracting the costs of production from the end product price, thereby yielding a value of $1.50. Provided that accurate, non-distorted, product price and cost data are available, the derived estimate will reflect the value of the natural resource in its potential to be used by village households. The derived demand approach was chosen for this study because preliminary enquiries indicated that market transactions of forest products were frequent, with the resulting process being generally well known amongst the villagers.

Interviews with villagers disclosed that labour is virtually the only cost involved for most woodland products. Occasional tools (such as axes) are used but if costed over the life of the implement, the costs involved can be assumed to be negligible (see section 5.4 for some implement prices). Labour costs were calculated for each product by multiplying the transport and collection times by the price of labour. The price of labour was estimated from a survey of local wage rates in the villages. For transportation times, the distance from the household to the resource was identified. Survey data collected from sample households disclosed a travel rate of approximately 5 km per hour. This rate was used to assign times to each trip taken. Multiplying the number of trips by the time per trip yielded total travel time. Collection times per quantity were obtained from household interviews and multiplied by quantities collected to obtain total collection time per year. The sum of transportation and collection times yielded the total time. In cases where production times were not collected, we

assume that labour input costs represent 40% of the product's market value[5]. The transportation and collection rates for the various products are shown in Table 7.1.

Table 7.1 Transportation and collection rates for marketed products

Products	Transportation	Collection
Fuelwood for cooking	5 km hour^{-1}	1 cord day^{-1}
Fuelwood for bricks burning	5 km hour^{-1}	0.29 cords day^{-1}
Fuelwood for beer brewing	5 km hour^{-1}	0.22 cords day^{-1}
Quelea		5 minutes bird^{-1}
Mushrooms		2 hours 10 kg^{-1} packet
Wild fruits	40% of product prices	
Axe and hoe handles	40% of product prices	
Poles	40% of product prices	
Mortars	40% of product prices	

To obtain the value of the woodland for each marketed product, the labour costs (collection and transport) were subtracted from market prices. The results which follow assess product values in relation to a range of labour and market prices. There are two reasons for providing a range of prices. First, there was considerable variation in the market prices given (Table 7.2). Also, local inquiries indicated that wage rates for work from farmers, traders or producers in the area (eg. cutting firewood, baking bricks, weeding fields, collecting stones for road work) varied between $5 and $25 per day. Second, descriptions of the resource base presented earlier (sections 4.2 and 5.1) show that the woodland is a major component of the local economy. Therefore, if one were to remove large areas of woodland resources, one would expect the current market prices for labour and woodland product prices to change markedly. The level of woodland prices would likely rise substantially with products having to be brought in, and the price of labour could fall, as labour previously required for obtaining woodland products would be less, thereby depressing the value of labour. Accordingly, current market prices would not be appropriate for valuing major changes to the woodland.

In several of the tables which follow, a number of values are presented for a given price of labour (Tables 7.3 to 7.7). The highest value in each column represents the minimum product price which would cause all households who are currently producing to receive benefits greater than costs. Greater values are not presented in each column as we assume that the true market price is that value which just covers the costs of the highest cost producer. Lower values within each column represent prices which would cause some of the households to not produce, because costs would be greater than benefits. Given that data was collected only from households who are producing, the values at the bottom of each column may be interpreted as values reflecting likely combinations of true market prices for labour and the products.

[5] In their calculations of the value of tropical forest, Peters et al. (1989) used a figure of 40% derived from logging and transport costs in the formal sector. Whether this figure represents the true value of production in the subsistence sector requires further investigation.

Table 7.2 Market prices for products.

Product	Jinga		Matendeudze	
	Mean $	N	Mean $	N
Benches (each)				1
Doors (each)	35	1	12.25	2
Door frames (each)			4	1
Mortars (each)	38.12	8	35.63	4
Pestle (each)	2.16	9	3.25	2
Planks (each)	1.2	1		
Yokes (each)	11.33	3	11.66	6
Hoe and axe handles (each)	1.52	16	3.31	9
Beer (cup)	0.15	2		
Honey (kg)	1	1	3.86	3
Beehives (each)			30	1
Bricks (1000 bricks)	88.57	7	71.66	3
Mopane worms (plate)	0.50	1		
Birds (each)	0.38	11		
Cooking sticks (each)	1.55	4	1.92	5
Wooden spoon (each)	4	3		
Clay pot (small) (each)	1	1	1.85	2
Fuelwood (cord)				
sold by headloads	68.96	1	116.37	6
sold by lorry load	33	1		
Fuelwood for bricks (cord)				
sold by headloads			282.50	4
Poles (each)	1.25	1	2.15	4
Dasbom* (each)			14.75	2
Skeis (each)			3.25	2
Drums (each)			22.50	2
Thatching grass (bundle)			3	3
Reed mats (each)			11.50	3
Bark blankets (each)			55	1
Wooden plates (each)			5.75	2
Wooden bowls (each)			8.50	1
Mushrooms (plate)			1.50	3
Locusts (plate)			1	1

Product	Jinga		Matendeudze	
	Mean $	N	Mean $	N
Termites (small plate)			0.43	2
Fish (each)			2	1
Mice (each)			0.25	1
Fruits				
Azanza garkeana (each)			0.10	2
D. mespiliformis (lid)			0.22	2
Adansonia digitata				
(medium each)			0.20	3
(90kg bag - 202/bag)	5	2	4	1
B. discolor (lid)	0.05	1	0.15	2
Uapaca kirkiana (kg)			0.50	1
Vitex spp				
(each)			0.01	1
(lid)			0.10	1
Vangueria infausta (each)			0.03	2
Flacourtia indica (each)			0.03	2
Carissa bispinosa (lid)			0.15	2
Ximenia caffra (each)			0.02	1

*Part of a scotch cart

Fruit production data was derived from ecological assessments of the woodland resources (see section 4.3). The net value of fruit production was calculated as follows:

Net value = [(total production - proportion not consumed) x price] - costs of collection

where:

- Proportion not consumed assumed to be 10% in the case of *Adansonia digitata*, 75% for *S. birrea*, 65% for all other species (values derived from key informants).
- Price assumed to be 5c per litre container, a conservative value.
- Costs of collection assumed to be 40% of gross value.

Results

Tables 7.3 to 7.7 present the results of the derived demand valuations for those products which were consumed on an annual basis. Many of the products listed in Table 7.1 and 7.2 were not valued as we were unable to derive estimates on numbers produced/consumed per year. For this reason, the

assessment of value presented here is only partial (see section 8 for an assessment of the relative importance of other values).

Tables 7.8 and 7.9 present the results for those products which are replaced over a number of years. In some cases, where data on a village basis were regarded as too limited, the results are presented for both villages combined. In such cases, the final quantities and values per village were divided among the villages according to the number of households in each village. The populations for Jinga and Matendeudze are, respectively, 102 and 96 households.

The wild fruit value of the different landscape units is shown in Table 7.10. Giving the most value to the woodland is *Adansonia digitata* in the lowland woodlands of Jinga. The wild fruit resource in Jinga is some two times more valuable than that of Matendeudze.

The value in each table which is marked with an asterisk represents that value which was derived from market prices which were thought to be closest to the current situation. The sum total of the asterisked values of the woodland products are contained in Table 7.11 and added to give a total value of the selected marketed products for a single year. In both villages fuelwood and wild fruits are most important in terms of total value, followed by poles. *Quelea* have a value equivalent to poles in Jinga village. Tree-based products have a higher value in Jinga than Matendeudze.

If we assume that the flow of products per year may be sustained, the value of an infinite series of annual values may be derived by dividing the total values in Table 7.11 by the opportunity cost of time, indicated by interest rate levels. Tables 7.12 and 7.13 show the total values of the selected marketed products from the Jinga and Matendeudze woodlands over a range of interest rates.

7.2 Fuelwood supply derivations

Previous studies (eg. Peters et al., 1989) have conducted derived demand valuations by subtracting some estimation of costs, averaged over all households, from product prices. In this study, we estimate costs on a household by household basis for several products. In the case of fuelwood, we have sufficient numbers of observations on fuelwood production and costs to illustrate how to derive a type of supply curve.

To derive a supply curve we assume that households are not individually able to make marginal changes in the quantities which they produce. Accordingly, price changes cause households to either continue producing their household amounts (if benefits are greater than costs), or cause them to drop out of production and buy fuelwood (if costs of production are greater than the market price). One factor which could cause such behaviour would be supply curves for individual firms which are extremely price elastic combined with demand curves which are price inelastic. Under such conditions, price or cost changes could cause firms to drop out of production, rather than adjusting their household production levels.

By assuming that producers of fuelwood drop in and out of the market, depending on prices, it is possible to derive a supply curve, based on a given level of costs, which describes the total quantities which will be supplied by households at various price levels. If the costs of production (ie. labour costs) are varied, a series of supply curves may be derived. Figures 7.1 and 7.2 show series of

Table 7.3 Fuelwood values ($ yr^{-1}) in relation to labour and fuelwood prices.

Matendeudze*	Labour prices ($ day^{-1})			
Fuelwood prices ($ cord^{-1})	5	10	15	20
10	0	0	0	0
20	1417	0	0	0
30	3816	848	0	0
40	7152	2834	689	0
50		5127	2265	822
60		7632	4251	1696
70		10847	6532	3682
80			8845	5669
90			11448	7939
100			***14542	10252
110				12564
120				15264
130				18237
Jinga**	Labour prices ($ day^{-1})			
Fuelwood prices ($ cord^{-1})	5	10	15	20
10	555	0	0	0
20	6009	1111	218	0
30	12546	5636	1667	437
40		12018	5371	2223
50		18553	11553	5307
60			18027	11272
70			***24560	17562
80				24036
90				30567

* N = 34 households, all of which consumed fuelwood, out of a population of 96.
** N = 25 households, all of which consumed fuelwood, out of a population of 102
*** Best estimates given knowledge of current fuelwood and labour prices

Table 7.4 Value of fuelwood for brick making ($ yr^{-1}) in relation to labour and fuelwood prices.

Jinga*	Labour prices ($ day^{-1})			
Fuelwood prices ($ cord^{-1})	5	10	15	20
20	142	0	0	0
30	1889	0	0	0
40		289	0	0
50		3774	0	0
60			***501	0
70				0
80				432.48
90				2211.36
Matendeudze**	**Labour Prices ($ day^{-1})**			
Fuelwood prices ($ cord^{-1})	5	10	15	20
20	0	0	0	0
30	104	0	0	0
40	520	0	0	0
50	1275	0	0	0
60		209	0	0
70		594	0	0
80		1041	0	0
90		1583	313	0
100			668	0
120			1115	90
130			1562	418
140			2009	745
150			***2859	1188
160				2083
170				2530
180				3165

* N = 25 households, 8 of which produced bricks out of a population of 102.
** N = 22 households, 5 of which produced bricks, out of a population of 96.
*** Best estimates given knowledge of current fuelwood and labour prices.

Table 7.5 Value of fuelwood for beer brewing ($ yr^{-1}) in relation to labour and fuel prices.

Matendeudze*	Labour prices ($ day^{-1})			
Fuelwood prices ($ cord^{-1})	5	10	15	20
10	0	0	0	0
20	0	0	0	0
30	0	0	0	0
40	31	0	0	0
50	84	0	0	0
60		0	0	0
70		20	0	0
80		63	0	0
90		109	0	0
100		169	9	0
120			51	0
130			94	0
140			140	0
150			**190	40
160				82
170				129
180				172
190				218
200				274
210				40
220				40

* N= 22 households, 5 of which produced bricks, out of a population of 96.
** Best estimate given knowledge of current fuelwood and labour prices.

Table 7.6 Value of *Quelea* harvested ($ yr^{-1}) in relation to labour and bird prices.

Jinga	Labour price ($ day^{-1})			
Quelea prices ($ per bird)	5	10	15	20
0.10	5214	0	0	0
0.15		4565	0	0
0.20			**3912	0
0.25				3259

* N = 25 households, 11 of which caught birds, out of a population of 102.
** Best estimate given knowledge of current quelea and labour prices.

Table 7.7 Value of mushrooms harvested($ yr^{-1}) in relation to labour and mushroom prices.

Matendeudze*		Labour Prices ($ day^{-1})		
Mushroom prices $ 10 kg beg^{-1}	5	10	15	20
1.5	143	0	0	0
3		286	0	0
4			245	0
5				**204

* N = 39 households, 12 of which collected mushrooms, out of a population of 96.
** Best estimate given knowledge of current mushroom and labour prices.

Table 7.8 Value of wood harvested ($ yr^{-1}) for axe and hoe handles*.

Numbers of handles (per household)		
	Jinga	Matendeudze
mean	2.5	3.8
N	21	29
Durability of Handles (years)		
mean	2.15	
N	38	
Number of handles used yr^{-1}		
Household^{-1}	1.16	1.77
Village^{-1}	118.32	169.92
Value		
Mean quantity	118.32	169.92
X $1.50 handle^{-1}	177.48	254.88
- 40% Labour costs	70.992	101.952
Total value ($ yr^{-1})	**106.48	**152.93

* For this product, data was collected on the number of handles owned, instead of numbers consumed per year.
** Best estimate

Table 7.9 Value of wood consumed in building structures and mortars.

	Granaries	Brick huts	Cattle pens	Goat pens	Total frames		Mortars
Mean number of building structures or morters per household*	0.74	1.16	0.41	0.52	1.02		0.86
N (number of households)	54	58	59	52	55		50
Mean poles per structure*	85	35	84.8	117	33		NA
N (number of structures)	18	18	15	19	27		
Mean durability (yrs)*	8.5	12.4	4	3.8	2.2		21.2
N (number of households)	15	8	6	6	11		32
Total poles/mortars per village required yr^{-1}						**Grand total (poles)**	Mortars
in both villages	1476	655	1707	3139	3055	10033	8
in Jinga	60	337	879	1617	1574	5168	4.1
in Matendeudze	7156	317	827	1522	1481	4864	3.9
Values of poles or mortars ($ yr^{-1})**							
in both villages						***9030	***186
in Jinga						***4652	***96
in Matendeudze						***4378	***91

* Combined for both villages.
** Numbers X \$1.50 pole^{-1} or X \$35 mortar^{-1} less 40% labour costs
*** Best estimates possible

Table 7.10 Net value of fruit production ($ yr^{-1}) for each land type in Jinga and Matendeudze*.

Species	Jinga			Matendeudze	
	Lowland mopane	Mountain woodland	Cultivated land	Mountain woodland	Cultivated land
Area (ha)	485	565	565	525	788
Adansonia digitata	23.01	0	1.74	0	0
Sclerocarya birrea	2.63	0.11	1.51	0	0.21
Strychnos madagascariensis	0.54*	0.35	2.22	1.46	0.04
'Muzodi'	0	0	0	8.47	0.05
Others	2.09	0.30	0.06	4.73	1.46
Total value ($ ha^{-1})	28.27	0.76	5.53	14.66	1.76
Total value per land type ($ yr^{-1})	13711	429	3124	7697	1387
Total value by village ($ yr^{-1})	17264			9084	

* Atypical plot with many *Strychnos* individuals excluded from the analysis

Table 7.11 Values ($ yr^{-1}) of selected marketed products in Jinga and Matendeudze.

Product	Jinga		Matendeudze	
	Value ($ yr^{-1})	%	Value ($ yr^{-1})	%
Fuelwood (cooking)	24561	48.1	14543	46.2
Fuelwood (bricks)	502	1.0	2860	9.1
Fuelwood (beer)		0.0	190	0.6
Quelea birds	3913	7.7		0.0
Mushrooms		0.0	205	0.7
Handles (axe/hoe)	106	0.2	152	0.5
Poles	4652	9.1	4379	13.9
Morters	86	0.2	82	0.3
Fruits	17264	33.8	9084	28.8
Total	51084	100	31495	100

Table 7.12 Values of sustainable production of selected marketed products under different interest rates in Jinga.

	Interest rates					
Product	2	4	6	8	10	20
Fuelwood (cooking)	1228050	614025	409350	307012	245610	122805
Fuelwood (bricks)	25100	12550	8366	6275	5020	2510
Quelea	195650	97825	65216	48912.5	39130	19565
Handles	5300	2650	1766	1325	1060	530
Poles	232600	232600	77533	58150	46520	23260
Mortars	4300	2150	1433	1075	860	430
Fruits	863200	431600	287733	215800	172640	86320
Total	**2554200**	**1393400**	**851400**	**638550**	**510840**	**255420**

Table 7.13 Values of sustainable production of selected marketed products under different interest rates in Matendeudze.

	Interest rates					
Product	2	4	6	8	10	20
Fuelwood (cooking)	727150	363575	242383	181787	145430	72715
Fuelwood (bricks)	143000	71500	47666	35750	28600	14300
Fuelwood (beer)	9500	4750	3166	2375	1900	950
Mushrooms	10250	5125	3416	2562	2050	1025
Axe/hoe handles	7650	3825	2550	1912	1530	765
Poles	218950	109475	72983	54737	43790	21895
Mortars	4100	2050	1366	1025	820	410
Fruits	454200	227100	151400	113550	90840	45420
Total	**1574800**	**787400**	**524933**	**393700**	**314960**	**157480**

supply curves for each village based on varying labour costs. To construct supply curves for the villages, the quantities derived from the household samples have been increased in proportion to the percentage of the population which the sample represents. Given that these curves represent the fuelwood supplies, per annum, for the entire village, the areas below the price levels and above the supply curves are equal to the total values presented in Tables 7.3.

7.3 Market analysis

The economic analysis presented above assumes that product markets are effective and that prices reflect an equilibrium supply-demand interaction. To test this, a limited survey was carried out to explore the nature of possible market imperfections.

Process

Discussions were held with various artisans (see section 5.4) to establish the nature of local markets for a range of products. Visits to market sites and interviews with traders were also carried out. The household survey data provided additional information on the differentiated nature of market participants as consumers and producers.

Results

There are only limited formal market opportunities available to both villages. In Matendeudze the nearby business centre of Nhedziwa provides one formal market for the sale of some woodland products. Jinga villagers have to travel further afield to Chakowa or Nyanyadzi to market products (8 and 15km away, respectively). Some informal selling was noted along the main road that bisects Jinga village. The collection points for firewood and baobab fruit sales are also along the main roads. Most marketing is carried out through informal networks. Much marketing is opportunistic in nature, relying on prior orders or requests from neighbours. Certain artisans are well-known in the area and people know where to go for particular products. Most orders and sales are therefore carried out at people's homes, rather than at a formal market site.

The volume, extent and occurrence of marketed products has been dramatically affected by the combination of the recent drought and wider changes in the national economy in both villages. Drought has had an effect on both producers and consumers. Certain woodland products have declined (mopane worms, fruits, honey, mushrooms etc), while severe financial pressures caused by the impact of drought and changes brought about by structural adjustment have seen more people trying to make a living from local natural resources. The recent increase in commercial firewood cutting in Matendeudze may be a reflection of this trend.

However, the lack of local money supply means that consumers' buying power has been severely curtailed. Lack of purchasing power is caused by drought (fewer crop sales, greater commitments to food procurement) and structural adjustment with lower levels of rural remittance flows. The result is that the demand for such woodland products as furniture or wooden implements has decreased locally.

There are effectively two parallel markets operating for woodland resource products. The first and the most important in terms of overall volume is the local informal exchange economy. Prices in these markets are often very low and transactions may combine monetary transfer, barter deals and

Figure 7.1 **Fuelwood supply curves for Jinga village under various production costs (labour).**

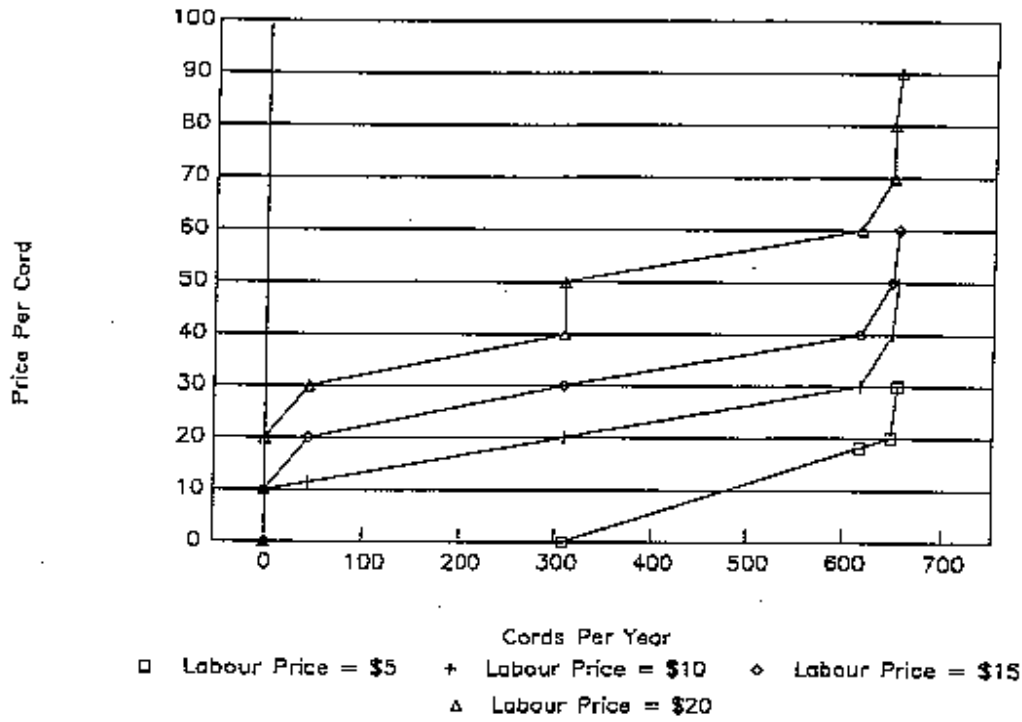
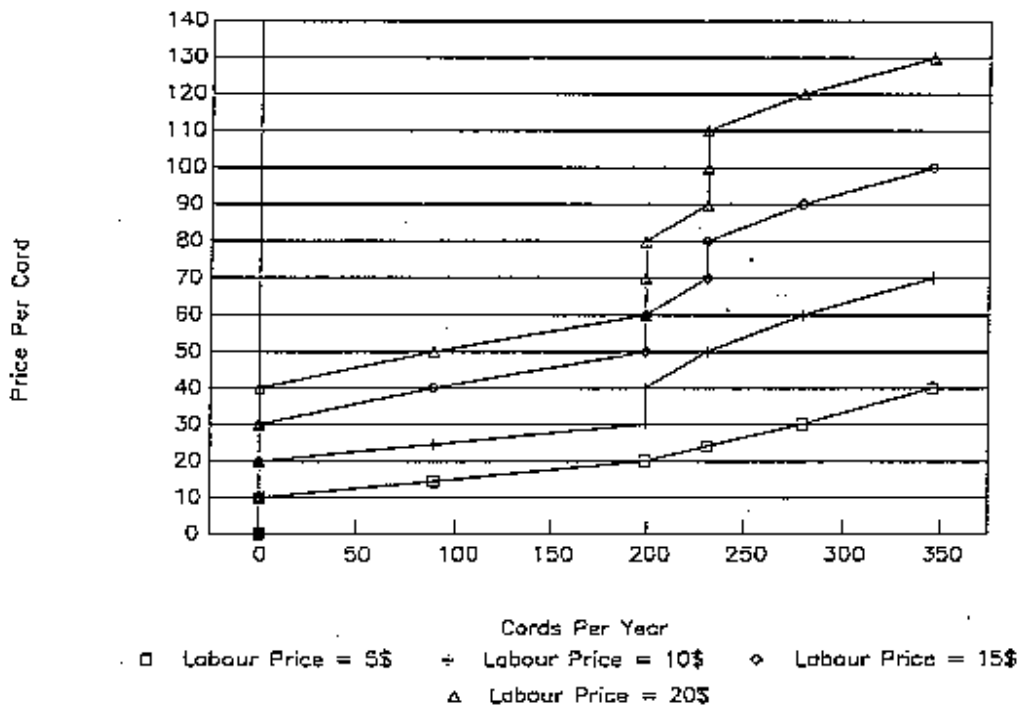


Figure 7.2 **Fuelwood supply curves for Matendeudze village under various production costs (labour).**



reciprocal exchanges of goods or services. The second set of markets are more formal and are based on monetary exchange. Here prices may be higher. For instance the sale of craft items to tourists in Nyanyadzi may realise several times the amount gained from local sales. However, only certain products are marketed in this way. These are the high volume products (eg. honey and firewood from Matendeudze and baobab fruits from Jinga; see producer case studies in section 5.4) which have fixed market channels through traders who operate outside the village (to Mutare, Harare).

Patterns of buying and selling within Jinga and Matendeudze villages vary between households. Certain individuals tend to specialise in particular areas of trade (eg. crafts, brick making, firewood selling), while others rely on purchasing products regularly. In general, poorer households tend to produce and sell woodland products, while richer households are the main consumers. However, this pattern is not universal and there is much variability within the household samples of both villages. A small minority of largely richer households are almost completely removed from the local woodland product economy, particularly in Matendeudze. They prefer to buy items from outside the area using remittance cash derived from off-farm work. However, most households in the sample group of both villages are involved to some extent in either buying or selling of woodland resource products, mostly through informal exchange at the local level.

8. LOCAL PERCEPTIONS OF VALUE: MARKET AND NON-MARKET ASPECTS

In answering the question *"what's it worth?"*, a diverse range of values, both market-based and non-market, must be considered. The previous section assessed value using a derived demand approach for a selected number of marketed products. This represents only part of the total value of the woodland resource. This section complements the market valuation analysis by extending the scope of valuation to the full range of values as defined by villagers themselves.

Prior to initiating fieldwork, the research team spent some time discussing methods for understanding non-market values of woodland resources. Some of these ideas are briefly described in Box 1. In the end, a sequence of two methods was chosen. First, role plays elicited a range of values and secondly, different ranking exercise were used to evaluate them.

Box 8.1 Brainstorming by workshop participants of possible methodologies for non-market resource valuation

- Community level/individual level time preference rates; willingness to pay for conservation now.
- Activity calendars and daily time profiles to establish people's allocation of time and use of different woodland resources/services.
- Travel times that people are willing to go if products exhausted; eg. value of shade could be calculated by distance willing to travel to find substitutes to trees at homesite.
- Community role plays of different interest groups
- Simple ranking and proportional scoring of values identified by the community
- Ranking of homestead sites to elicit criteria for assessing 'property' value
- Ranking of resource unit sites to explore contrasting values of different parts of a village resource base
- Mapping of sacred sites, meeting places, important and sacred trees
- Costs (labour, capital etc) of replacement of lost resources; eg. removal of windbreaks or shade trees.
- Local rules and regulations: fines and penalties imposed for contravention

The role plays and ranking/scoring exercises that follow illustrate how the products discussed in the market valuation (firewood, construction poles, handles and certain food products) must be assessed in the context of a wider conception of value that includes non-marketed benefits such as shade, windbreaks, aesthetics, ecological functions of soil and water cycles and spiritual aspects. This chapter concludes with an overall discussion of market and non-market woodland resource values.

8.1 Role plays in Jinga

Process

Role plays are an important PRA tool for eliciting values, beliefs and sentiments. The villagers that assembled at Chaseyama school in Jinga were divided into three groups of men, women and boys (no girls present). Before splitting, the villagers were asked to identify individuals and groups who have specific interests in woodland resources. They identified such figures as the chief, the headman, school teachers, traditional healers, herd boys, carpenters and women collectors of firewood.

Each group of villagers was asked to prepare a role play, based on the identified individuals and interest groups, to demonstrate the values of the woodland from different perspectives. Each group prepared a short play in 30-45 minutes. The plays were then performed to the whole group. Each lasted for between 5 and 10 minutes and caused much amusement. Several recorders from the research team and the community wrote down all the values of woodland mentioned by the role plays. Another group made up of members of the research team and school leavers from the community quickly drew pictures to depict each identified value on large cards. At the close of the plays the full list of values was shown to the group by displaying each of the cards in turn. A short discussion followed to confirm that this was indeed a complete list. The role plays were fun and generated much interest in the ranking activity that followed.

Results

The plots of the three plays varied considerably. Each offered a different perspective and interpretation of the value of woodland resources. The women's group emphasised the value of the woodland for medicines and fruits. The play was centred around a traditional healer who was attending to many different people from the community. The men's play showed how indiscriminate cutting of trees affects different social segments within the community. To discourage excessive tree cutting, the men's play showed the important role of local rules and regulations for woodland use. The boys' group depicted a debate between different members of the community. Each person blamed the other for the destruction of the woodland resource. For instance, the herd boy scolded the carpenter for cutting down fruit trees, while the traditional healer claimed his impact was minimal because he only removed small quantities. The school teacher lectured the others on the importance of environmental protection, while the chief stressed the significance of observing traditional practices. The diversity of perspectives presented in the role plays revealed a total of 19 different values.

8.2 Ranking and scoring of overall values in Jinga

Process

The list of values identified in the role plays was copied onto three sets of cards. The cards were distributed to the three groups (men, women, boys). The groups were asked to allocate 100 beans between the cards according to their importance. This provoked much debate about the relative importance of different values and a greater elaboration of the meanings of the different values.

Results

Table 8.1 shows the combined scoring of the three groups, together with the individual results. (Note that when working with such high numbers of small beans, it was inevitable that occasional columns failed to add up to exactly 100. Nevertheless the results still give an accurate indication of relative importance).

Table 8.1 Scoring of woodland resource values.

Values	Women	Men	Boys	Total score
Water retention	8*	12	11	31
Rainmaking ceremonies	15	8	5	28
Poles	10	8	7	25
Inheritance	7	11	6	24
Aesthetics	7	10	7	24
Preventing soil erosion	7	7	8	22
Grazing	6	5	8	19
Firewood	4	4	8	16
Fruits	3	3	7	13
Camouflage/cover	6	6	2	13
Fibre	4	3	5	12
Wind breaks	4	3	5	12
Shade	4	5	3	12
Sacred places	5	4	3	12
Crafts	3	3	5	11
Medicines	4	4	3	11
Fencing	4	1	5	10
Seasonal indicator	2	3	1	6
Whips	2	0	1	3
TOTALS	**104**	**100**	**100**	**304**

* Figures represent number of beans allocated

It can be seen that non-market values such as water retention, rainmaking, inheritance value, aesthetics and the prevention of soil erosion received a high score from all the groups. The role of woodland resources in providing water resources and rainfall was particularly highlighted. The experience of the 1991-92 drought reinforced the high rating of this value. The women's group argued that without rainfall all the other products (such as wood, fruits etc) cannot be produced, therefore the role of trees and woodland in providing for rain and soil water must necessarily be top priority.

The boys' group ranked the ecological functions of woodland areas the highest (water retention, soil

erosion protection), reflecting their exposure to environmental education at school. The women (and to some extent the men) preferred to relate environmental service values more directly to issues of spirituality and sacredness; a more traditional, 'non-scientific' interpretation of ecological function and value.

All groups gave high scores to the non-market values of aesthetics and inheritance. This was particularly so for the men who had noted the consequences of woodland destruction in other areas. As fathers of the next generation, they also recognised the importance of handing over a viable resource base to their children.

Some values had different interpretations depending on the group. For instance, cover and camouflage were mentioned as important in the context of warfare. During the liberation struggle the villagers had used the woodlands as hiding places. The boys, unable to remember the war, interpreted cover as a useful value as a hiding place from adults when they are with their girlfriends!

The research group was surprised to find such apparently essential products as firewood given low scores by all groups, including women. On further probing it became apparent that this reflected Jinga village's relative wealth in woodland resources. An abundance of firewood, fruits and other woodland products means that they are not valued as highly as other woodland products and services.

8.3 Ranking and scoring of multi-purpose trees in Jinga

Process

Groups then allocated scores to the values of multi-purpose trees common in the Jinga area. They were asked to choose the tree and then select the range of values that were relevant to that particular tree. A total of 100 beans were then distributed between the chosen values.

Results

Three trees were chosen by more than one group (Tables 8.2 to 8.4). Other trees were chosen by only one group (eg. *Sclerocarya birrea, Ficus* spp., and *F. capensis* by women, *Afzelia quanzensis* and *S. birrea* by the men and *C. molle* by the boys) (Table 8.5).

The boys chose the greatest range of values for the ranking of individual trees, while the women chose the smallest number, concentrating on the product values. The women added a number of additional values that had been ignored in the the earlier discussions (eg. for baobab: leaves as vegetables, soda, pot making implements; for *C.mopane*: worms; for *B. discolor*: dye). These were largely not picked up by the other groups.

Differences between the scores given by the men, women and boys reflect their interests and the division of labour in household tasks. For instance, the men and boys emphasised the value of fodder from both *C. mopane* and *B. discolor*, whereas the women rated the value of *C. mopane* firewood higher. The boys again emphasised the ecological functions of trees (eg. prevention of soil erosion) more than the other groups. All groups rated baobab and *Berchemia discolor* (*nyii*) fruit highly, as well as *C. mopane* poles and baobab fibre. In the ecologically-based assessment of fruit value, baobab fruits were of considerable value; here we see that fibre from these trees is nearly as important.

Table 8.2 Scoring the values of baobab (*Adansonia digitata*) trees*.

	Women	Men	Boys	Combined
Fruits	38	34	15	88
Fibre	19	17	13	49
Shade	0	17	9	26
Aesthetics	0	10	11	21
Medicine	18	0	0	18
Water retention	0	0	12	12
Preventing soil erosion	0	0	12	12
Camouflage	0	7	4	11
Vegetables	6	0	4	10
Manure	8	0	0	8
Inheritance	0	0	8	8
Sacred places	0	0	7	7
Grazing	0	7	0	7
Seasonal indicators	0	7	0	7
Bark for clay pot making	6	0	0	6
Soda	5	0	0	5
Wind breaks	0	0	5	5
Total	100	100	100	300

*In all the tables for Jinga village high numbers represent high value.

Table 8.3 Scoring the values of *musharu* (*Colophospermum mopane*).

	Women	Men	Boys	Combined
Grazing	9	23	11	43
Firewood	15	15	11	41
Poles	12	12	15	39
Crafts	6	12	11	29
Preventing soil erosion	4	0	15	19
Shade	3	8	8	19
Camouflage/cover	4	12	2	18
Fibre	6	4	8	18
Medicines	9	0	8	17
Aesthetics	7	8	0	15
Mopane worm	4	0	6	10
Windbreak	3	0	6	9
Fencing	9	0	0	9
Dye	0	8	0	8
Inheritance	0	0	8	8
Seasonal indicators	3	0	0	3
Fruits	3	0	0	3
TOTAL	97	102	109	308

Table 8.4 Scoring of *munyii* (*Berchemia discolor*) values by two groups of Jinga villagers.

	Women	Men	Combined
Fruits	21	24	45
Medicines	10	16	26
Grazing	7	16	23
Aesthetics	4	12	16
Dye	11	4	15
Shade	6	8	14
Camouflage/cover	5	8	13
Crafts	5	8	13
Prevention of soil erosion	9	0	9
Firewood	8	0	8
Sacred places	8	0	8
Windbreaks	6	0	6
Poles	0	4	4
TOTAL	100	100	200

Table 8.5 Scoring of individual trees by Jinga villagers.

Values	*Ficus capensis*	Other *Ficus* spp.	*Afzelia quanzensis*	*Sclerocarya birrea*	*Combretum molle*
	Women		Men		Boys
Fruits	20	14	0	19	0
Medicines	12	12	0	12	0
Crafts	15	0	22	8	10
Poles	0	0	0	0	16
Firewood	0	0	7	0	16
Fencing	0	0	0	0	11
Grazing	0	0	11	15	10
Windbreak	0	9	0	0	5
Shade	3	5	19	12	6
Preventing soil erosion	0	5	0	0	17
Water retention	24	15	0	0	0
Inheritance	0	0	0	0	7
Camouflage/cover	0	0	11	8	2
Aesthetics	4	5	11	0	0
Sacred places	9	5	0	0	0
Seasonal indicators	12	7	19	8	0
Rainmaking ceremony	0	23	0	0	0
Dye	0	0	0	12	0

The individual tree rankings of the baobab, *C. mopane* and *B. discolor* tended to concentrate more on direct products than on the more intangible woodland service functions elicited and ranked highly in the previous exercises. The importance of non-market values such as water retention, rainmaking ceremonies and sacredness were however mentioned when such trees as *Ficus* spp. were discussed by the women.

8.4 Valuation of village resource units in Jinga

Process

The men's, women's and boys' groups selected a range of criteria from the full list of values to distinguish between the six land resource units identified by the villagers during the mapping exercise (see section 4.1). A matrix was developed and a standard number of beans allocated to each of the value criteria. Villagers were then asked to distribute the beans across the six land resource units in proportion to their perceived importance for that criterion. Separate matrices were produced by the men, women and boys.

Results

The relative ranking of the resource units was similar for the three groups and a combined ranking is presented (Table 8.6).

Table 8.6 Matrix ranking of Jinga village resource units against woodland resource values*

Values	Chaseyama hill	Dambakurimwa	Garawakafara woodland	Garawakafara well	Chinyamatede hill	Bocha
Grazing	15	12	22	3	28	20
Fencing	21	0	21	0	23	36
Firewood	20	0	25	0	43	13
Prevention of soil erosion	20	5	20	15	15	25
Water retention	2	3	18	72	3	2
Rainmaking ceremonies	43	8	0	0	50	0
Poles	15	0	22	0	20	43
Whips	30	0	30	0	40	0
Seasonal indicators	18	20	15	20	18	8
Sacred places	17	45	3	23	12	0
Fibre	19	0	14	0	22	45
Fruits	23	7	18	8	22	22
Mopane worms	10	5	20	10	25	30
Camouflag e/cover	18	22	22	15	18	5
Dye	23	5	27	7	23	15
Inheritance	20	20	20	20	20	0
Crafts	37	0	17	0	32	15
Aesthetics	18	20	20	15	23	5
Medicines	30	20	0	0	50	0
TOTALS	398	191	332	208	487	284

*Combined ranking of men's, women's and boys' groups; the figures represent the percentage among resource units of all counters allocated by all three groups for a particular value.

The ranking shows that the hills (Chaseyama and Chinyamatede) and woodland (Garawakafara) areas provide a wide diversity of products, services and non-marketed values. Of all the resources

discussed, Chinyamatede is particularly highly valued in terms of both marketable and non-market values. Chaseyama is the next most valued resource as it has a range of harvestable products and is an important site for rain-making ceremonies. Garawakafara woodland remains important, but the depletion of its resources over time has meant that it is now less valuable than the more inaccessible hill sites. Other sites in the village have more specialist functions. The Dambakurimwa is a protected and sacred woodland area where no cutting of wood is permitted. It remains an important area for grazing and collection of some medicine and fruit. However, its major value is as a sacred site; important for rain-making ceremonies and the indication of seasonal change. Garawakafara well has a similar specialist function in villagers' perceptions. It is important in *"keeping the water"* in a dry landscape. Some products are more abundant in neighbouring Bocha village, so Jinga villagers travel there for poles, fibre, fencing and mopane worms.

The matrix exercise illustrated clearly that the values of woodland resources are spatially differentiated within the village landscape, with different sites being valued for different reasons. Sites are valued in different ways; some for direct values (products), some for indirect values (ecological services) and some for existence values (inheritance, sacredness etc.). It is this diversity that makes up the local perception of total value.

8.5 Ranking and scoring of direct and indirect values in Matendeudze

Process

Matrix ranking exercises continued from the role plays, in which villagers presented short sketches depicting use and controls of woodland resources in their area. The role plays followed the same sequence of events as at Jinga, with a play for each of four groups of women, one group of men and one group of boys. The values expressed during the role plays were then ranked using three types of matrix ranking exercise:

1) Ranking of woodland values. The woodland values expressed during the role plays were written onto strips of cards. Each of the role play groups were given a set of cards and asked to rank them according to their relative overall importance.

2) Ranking of tree products of selected multipurpose trees. Group members were asked to select a few multipurpose indigenous tree species. The values of each species were listed, written on cards and ranked. This was done for each of the selected species.

3) Ranking of different woodland areas in Matendeudze village. Six distinct woodland areas had previously been identified by the villagers during the mapping exercises. The groups were then asked to compare and contrast the areas, on the basis of their values. A matrix was drawn with woodland areas across the top and the values down the side.

Results

The results of the ranking exercises in Matendeudze are shown in Tables 8.7 to 8.10

Ranking of woodland values

The men gave the following explanation of their ranking (Table 8.7). Of primary importance are the

sacred areas within the woodlands. Respecting and preserving these sacred areas according to the wishes of the ancestral spirits is essential for good rainfall. Likewise the sites where annual rainmaking ceremonies take place are of primary importance. With good rains comes drinking water, ranked high by all groups. The wide range of woodland products derived from the woodlands are ranked lower, as they could not exist without the rains which in turn depend on the sacredness of the woodland. This broad explanation of the ranking of values is reflected in all groups.

Table 8.7 Overall ranking of woodland values by six groups of villagers from Matendeudze*

Values	Gr 1	Gr 2	Gr 3	Gr 4	Gr 5	Gr 6	Overall Rank
	Boys	Women	Women	Women	Women	Men	
Drinking water	2	1	1	1	1	2	1.3
Air quality	-	-	-	2	-	-	2.0
Water for cattle	4	1	6	-	1	-	3.0
Rain ceremonies	6	-	2	-	1	-	3.0
Thatch grass	2	5	6	-	1	-	3.5
Medicines	-	-	-	-	-	4	4.0
Grazing	4	5	4	6	1	-	4.0
Sacred sites	1	3	12	7	1	1	4.2
Poles	-	-	-	3	-	6	4.5
Firewood	10	4	3	4	7	5	5.5
Fibre	-	-	-	-	-	6	6.0
Wood products	6	9	9	8	7	3	7.0
Game	6	7	8	-	7	8	7.2
Fruit	6	9	5	10	7		7.4
Clay	-	11	-	5	-	-	8.0
Vegetables	-	-	-	-	-	8	8.0
Mushrooms	11	-	11	11	7	-	10.0
Shade	11	7	9	-	13	-	10.0
Tsvatsva**	11	-	13	-	7	-	10.3
Honey	11	12	14	9	14	8	11.3

*In all tables for Matendeudze low numbers represent high value.
**A type of grass used for sweeping

Ranking of tree products of selected multipurpose trees

This exercise was done by four groups, three comprising women and one of boys. The values of eight different species were ranked (Tables 8.8, 8.9 and 8.10). Of these, two species, *S. birrea* (*mupfura*) and *F. capensis* were ranked by three groups, whilst the remaining six were ranked by one

group only. The matrices reflect the wide range of purposes served by trees: 22 different purposes were listed for the eight selected tree species. The numbers of purposes listed for each tree species range from two to nine.

Table 8.8 Ranking of values of different trees by Matendeudze villagers

Products	*Adansonia digitata*	*J. globiflora*	*Ficus* spp.	*K. acuminata*	*Ficus. capensis*	*S. birrea*	*B. boehmii*
Fruits	1	-	2	-	3	1	-
Bark products	4	4	3	-	-	-	3
Medicine	3	-	-	-	5	6	-
Porridge	2	-	-	-	-	-	-
Relish	4	-	-	-	-	-	-
Coffee	7	-	-	-	-	-	-
Beads	8	-	-	-	-	-	-
Butter	4	-	-	-	-	-	-
Wood products	-	1	-	1	4	4	-
Poles	-	2	-	-	-	-	-
Firewood	-	3	-	-	6	-	1
Bee hive	-	4	-	-	-	-	-
Shade	-	4	4	2	8	2	-
Brush fence	-	-	-	-	-	-	-
Rain ceremony	-	-	1	-	6	-	-
Leaf litter	-	-	-	-	9	7	
Seasonal indicator	-	-	-	-	2	-	-
Raising water table	-	-	-	-	1	-	-
Beer	-	-	-	-	-	5	-
Nuts	-	-	-	-	-	3	-
Dye	-	-	-	-	-	7	-
Honey	-	-	-	-	-	-	2

Table 8.9 Ranking of *Ficus capensis* values in Matendeudze.

	Gr 3	Gr 4	Gr 5	Overall Rank
Products	Women	Women	Women	
Fruit	2	4	1	2.3
Medicine	5		2	3.5
Wood products	3	3	3	3.0
Rain ceremony			4	4.0
Shade			5	5.0
Leaf litter			6	6.0
Seasonal indicator	1	1		1.0
Firewood	4			4.0
Raising water table		1		1.0

Table 8.10 Ranking of *Sclerocarya birrea* values in Matendeudze.

	Gr 3	Gr 4	Gr 5	Overall Rank
Products	Woman	Women	Women	
Fruit	1	1	1	1.0
Medicine	4		5	4.5
Wood products	3	4	3	3.3
Shade			2	2.0
Leaf litter	5			5.0
Beer	2	3	6	3.7
Nuts		2	4	3.0
Dye		5		5.0

Ranking of different woodland areas

The results are not included as only three of the six groups did this exercise and each did it in a different way; the resulting matrices are therefore not comparable. Some general observations about each of the mountains made by each of the groups were included in the write-up on woodland resource areas (section 4.1).

8.6 What's it worth? Concluding discussion

The analysis in section 7 provided an assessment of the annual market values of a selected range of products. Section 8 has shown that this selection is but a small subset of the total range of values that villagers of Jinga and Matendeudze identified. Table 8.11 below compares the value ranking derived from the market-based assessment (Table 7.11) with the value rank derived from an assessment of

the full range of values, including non-market ones (Tables 8.1 and 8.7).

Table 8.11 Comparisons of value rankings from the market-based derived demand analysis and value ranking including non-market values.

	Jinga			Matendeudze		
Product	Market rank	Market value '000 $\$^{-1}$ yr^{-1} village	Non-market ranking	Market rank	Market value '000 $\$^{-1}$ yr^{-1} village	Non-market ranking
Firewood	1	25.0	8	1	17.5	10
Fruits	2	17.2	9	2	9.1	14
Poles	3	4.6	3	3	4.4	9
Quelea birds	4	3.9	nd	-	-	-
Mushrooms	-	-	-	4	0.2	17

With the exception of poles, the market-based analysis suggests a similar rank order of values of the selected products to that suggested by the participatory ranking exercises. Poles, however, were given a higher relative value in the non-market ranking by the villagers in both Jinga and Matendeudze than is suggested by the derived demand analysis. This may reflect perceptions of scarcity compared to other products, rather than actual consumption levels.

Some of the products that were valued in the market-based valuation were also ranked in the PRA ranking. In the PRA ranking, these products were ranked between 3rd (for poles in Jinga) and 17th (for mushrooms in Matendeudze). This suggests that there are many other products of value which were omitted in the simple market-based analysis. Thus the total economic value of the woodland is considerably higher than the totals of the selected marketed products (Table 7.11) would suggest. In both villages, a number of non-market values were rated higher than firewood by the villagers (eg. water retention, rainmaking ceremonies, inheritance, aesthetics and soil erosion protection in Jinga and drinking water, air quality, rain ceremonies and sacred sites in Matendeudze). If firewood is valued at \$25000 yr^{-1} in Jinga and \$17000 yr^{-1} in Matendeudze, this suggests that these other values are likely to carry a value higher than these figures, making the total economic value of the resource many times higher than the simple quantitative estimate given in section 7.

Since total economic value is made up of many different components, answering the question *"what's it worth?"* is not an easy undertaking. The above discussion should signal caution to any attempt at simply assigning a dollar value to a resource. Quantitative assessments will inevitably be limited by sample constraints and data availability and will thus be confined to assessing a subset of the total range of values. Such analyses must be situated within a wider understanding of total value derived from more qualitative understandings of local perceptions and relative rankings or scorings.

9. HOW SUSTAINABLE?

In this section we investigate whether the value estimated for the woodland is being obtained through sustainable production, or whether the value is partly a result of the consumption of the natural capital. We approach sustainability through three methods:

1) a PRA matrix ranking;
2) an analysis of changes on aerial photographs; and
3) an investigation of the balance between production and consumption.

9.1 Ecological sustainability

The abundance of woodland resources varies over time depending largely on climatic factors and consumption. If more resources are consumed than are produced in the woodland, they will become depleted. Without long-term ecological studies it is difficult to measure sustainability levels directly, so we asked small groups of respondents from both villages to assess this aspect of the woodland.

Process notes

To gain local insights into sustainability issues we used information from the resource flows (Fig. 5.1 and 5.2) to compile a list of the main products used. Then, using collections of stones laid out in a matrix on the ground, we asked respondents to provide relative abundance information for each product at three time periods: 1980 (independence date); 1992/1993 season (present); some time 10-15 years in the future.

In Matendeudze three groups, consisting of four men, four women and two male teenagers participated in separate analyses. In Jinga, a mixed group of men and women participated.

The methods used for ranking the abundance of products over time differed slightly between the two villages. In Matendeudze, five stones were allocated to each product to represent its abundance in the 1992/1993 season. The abundance of woodland products at the other two time periods were then scored relative to the five stone standard with a maximum of 25 stones in total allowed for each product.

No such constraint was placed on the teenagers from Matendeudze and the group from Jinga. Instead, respondents decided amongst themselves how to arrange as many stones as they felt necessary in the matrix. Although the latter method potentially allows for a two-way abundance ranking analysis (by time period as well as by product), facilitators did not raise this added dimension in the discussion for fear of diluting the main focus on sustainability. In the case of the teenagers, a shorter time frame (four years on either side of the present) was used.

The methodology was checked by including mango and gum trees as products. These were expected to increase in abundance due to planting and this was reflected in the ranking by villagers.

Reasons for changes in product abundance, as reflected in the resulting matrix, were discussed in detail. In particular, facilitators tried to separate climatic factors from anthropogenic causes of degradation.

Results

Generally, autecological responses of species and woodland products to climatic and anthropogenic disturbance were clearly differentiated. In Jinga, for example, changes in product abundances were often species-specific and reflected autecological responses to short- and long-term climatic fluctuations (Table 9.1). For instance, *Adansonia digitata* populations were scored as stable suggesting that they may not be significantly affected by the disastrous drought conditions experienced in the region in recent years. However, the reason for the decline in a shallow-rooted species used for construction-wood, *Combretum apiculatum*, was given as drought.

Mushrooms, honey production and mopane worms apparently increased significantly after the high rainfall episodes experienced in the years leading up to and including 1980 (Table 9.1). However, Jinga villagers commented that the increase in human populations, caused either by immigration and/or regional population growth, also contributed to the decline since 1980 of a number of important products such as *C. mopane* and an undisclosed assortment of medicinal plants. Of all the products in Jinga, only *A. digitata* and *Acacia* spp. were perceived as not decreasing.

Table 9.1 Ecological sustainability analysis of a few key woodland products, done by a group of Jinga villagers.

Products/species	Local name	No. of stones		
		1980	1993	+2006
Fruits				
Berchemia discolor	munyii	7	6	4
Adansonia digitata	muuyu	12	12	12
Diospyros mespiliformis	mushuma	8	6	4
Strychnos madagascariensis	mukwakwa	7	6	3
Mushrooms	hwowa	7	0	0
Honey	huchi	8	1	1
Mopane worm	mashonja	2	0	0
Medicine	mishonga	9	6	5
Firewood & construction				
Colophospermum mopane	musharu	8	5	3
Combretum apiculatum	mugodo	7	4	3
Brush fencing				
Acacia spp.	muvhunga	10	10	10
Craft grasses	uswe	8	3	1
Reeds	tsanga	8	4	3

At Matendeudze, the three groups provided very different, and at times contradictory, responses (Tables 9.2, 9.3 & 9.4). For example, the women's and teenager groups suggested that brush fencing

material from *Acacia* spp. was decreasing due to use, while the men's group concluded that it was increasing due to the spread of its seed by animals and anthropogenic disturbance factors.

Generally, the men were very pessimistic and blamed everything on recent changes in traditional value systems in the region. However, there was some suspicion among the facilitators that this group may have had a different agenda attached to the exercise and did not reflect objectively on what was asked of them. It was felt that the women and two teenagers consulted provided greater objectivity, and in discussion assessed all possible contributory factors to resource change. In general, all three groups from Matendeudze felt that their woodland resources were not being used in a sustainable way. However, the women and teenager groups attributed changes to population pressure and urbanisation, while men blamed resource change on the abandonment of certain rituals. Droughts played an important role in the two older Matendeudze group assessments but not for the teenagers.

The Matendeudze women's group acknowledged that individual trees were disappearing from the landscape. However, they also commented that children no longer knew how to exploit many woodland products and the decline in product use therefore reflected this cultural shift.

Table 9.2 Ecological sustainability analysis of a few key woodland products: men's group, Matendeudze.

Products/species	Local name	No. of stones		
		1980	1993	+2006
Fruits				
Ficus sycomorus	muonde	12	5	0
Diospyros mespiliformis	mushuma	20	5	0
Bridelia cathartica	mupambara	20	5	0
Medicine	-	20	5	0
Firewood & construction				
Brachystegia boehmii	mupfuti	20	5	0
B. glaucescens	muunze	20	5	0
Julbernadia globiflora	munondo	8	5	0
Brush fencing				
Acacia tortilis	muunga	1	5	8
Thatch grasses	uswa	20	5	0
Reeds	tsanga	20	5	0

Table 9.3 Sustainability analysis: women's group, Matendeudze

Products/species	Local name	No. of stones		
		1980	1993	+2006
Fruits				
Azanza garckeana	mutowa	11	5	1
Flacourtia indica	mududwa	11	5	5
Diospyros mespiliformis	mushuma	11	5	2
Mushrooms	chowa	11	5	5
Honey	huchi	11	5	3
Termites	ishwa & majuru	5	5	5
Medicine				
Ficus sycomorus	*F. capensis*	6	5	1
Firewood & Construction				
Brachystegia boehmii	mupfuti	11	5	2
Adansonia digitata	muuyu	5	5	5
B. spiciformis	musasa	10	5	1
Julbernadia globiflora	munondo	10	5	1
Brush fencing				
Acacia tortilis	muunga	11	5	2
Thatch grasses	uswa	6	5	4
Reeds	tsanga	5	5	1

Table 9.4 Sustainability analysis: done by two teenage boys from Matendeudze.

Products/species	Local name	No. of stones		
		1980	1993	+2006
Fruits				
Diospyros mespiliformis	mushuma	8	8	9
Strychnos madagascariensis	mukwakwa	7	8	11
Mangifera indica	mango	6	9	10
Honey	huchi	11	10	4
Mopane worm	mashonja	11	8	6
Firewood & construction				
Brachystegia boehmii	mupfuti	9	9	7
Dalbergia melanoxylon	murwiti	10	9	6
Julbernadia globiflora	munondo	14	7	1
Eucalyptus spp.	gum	5	7	14
Brush fencing				
Acacia tortilis	muunga	13	7	5
Termites	tsanga	10	9	6

Of all the species assessed at Matendeudze, only *Acacia* spp. (for the men) showed an increase over time, and only a few products remained stable. These included termites and *Adansonia* (for the women) and wild fruits (for the teenagers).

Generally, according to the inhabitants of both villages, the ecological sustainability of key woodland products is not encouraging. They perceived that the majority of products have declined in the last ten years and will continue to decline into the next century. Respondents also had little confidence that their future requirements would be met. They felt, however, that the woodland products might again increase and their demands would be met if high rainfall years occurred in the future.

9.2 Changes in vegetation cover

Process

Aerial photographs from 1972 and 1986[6] were used to investigate the variation of woodland cover over the period. Transparencies with grid dots (0.5 cm square grids) were used to determine the vegetation in one of two land uses: woodland or cultivation/settlement.

Results

Table 9.5 shows the results of the aerial photographic analysis. In Jinga the woodland area has decreased by 12% over the period. Clearance for agricultural land plus settlement of new people in the area after the war contributed to this change. A similar pattern of decline in the area of woodland is seen in Matendeudze. Shifts in settlement patterns have resulted in some new areas of land being cleared for agriculture while other areas that were previously cultivated have reverted to woodland. However, the net change in the area is towards decreased woodland cover and increased cultivated land. In Matendeudze, this pattern has increased since 1986, as more settlers have arrived in the area after being expelled from Forestry Commission land (see section 4.1).

Table 9.5 **Percentage of total land under different land uses in 1972 and 1986 in Jinga and Matendeudze (Note: S1, S2 are two sample sites west and east of the main road respectively).**

Village	Area	Woodland		Cultivated land		Sample size (grid points)	
		1972	1986	1972	1986	1972	1986
Jinga	S1	63	43	37	57	123	145
	S2	75	70	25	30	257	345
	Mean	69	57	31	43		
Matendeudze		50	40	50	60	321	585

[6] Jinga: Melsetter, 1972, 1:29000, Photo No 508 and Chimanimani, 1986, 1:27000, Photo No 1091 ASA. Matendeudze: Melsetter, 1972, 1:32000, Photo No 385 and Chimanimani, 1986, 1:24000, Photo No 1030 ASA.

9.3 Production-consumption analysis

Process

Estimates of the standing stock of certain products (firewood and poles) were derived from plots and transects (see section 4.3). The total annual production of poles and firewood (estimated from the literature and converted to a product production rate with a simple regression relationship, see Figure 4.6) was then compared with the estimates of annual consumption derived from the household surveys (see section 5.3).

Results

Total annual consumption of poles and fuelwood currently exceeds annual production in the woodlands of both villages (Tables 9.6 and 9.7). This is particularly so for firewood which is being extracted at around six times its replacement rate in both villages. The rate of consumption of both fuelwood and poles is higher in Jinga village, reflecting the higher availability of extractable wood and lower resource prices. In Matendeudze, increasing resource scarcity appears to be linked to lower consumption rates (especially of fuelwood) and higher prices (see Table 7.2).

Table 9.6 **Standing crop of construction poles, annual pole production and numbers of poles used by villagers from Jinga and Matendeudze.**

Village	Woodland area (ha)	Total number of poles in woodland	Annual pole production in woodland *	Mean no of poles used household^{-1} yr^{-1} **	Total poles used village^{-1} yr^{-1}
Jinga	1050	414750	4450	50.6	5169
Matendeudze	525	154350	2205	50.6	4865

* Assuming an annual production of 1.1 tonnes ha^{-1} yr^{-1} (Hofstad, 1993) in the woodland and the conversion of biomass to number of poles derived from the equation in Fig. 4.6.

** Data from the two villages combined.

Table 9.7 **Standing crop of firewood, annual production and firewood consumption in Jinga and Matendeudze villages (one headload of firewood = 30 kg; one cord of firewood = 1000 kg).**

Village	Woodland area (ha)	Total no of cords of firewood in woodland *	Annual firewood production (cords^{-1} yr^{-1}) **	Mean number of cords of firewood used household^{-1} yr^{-1}	Total no of cords of firewood used village^{-1} yr^{-1}
Jinga	1050	10870	108	6.4	654
Matendeudze	525	5460	54	3.6	346

* Excluding poles that would have been extracted and used for construction purposes.

** Assuming an annual production of 1.1 tonnes ha^{-1} yr^{-1} (Hofstad, 1993) in the woodland and the conversion of biomass to number of headloads of firewood derived from the equation in Fig. 4.6.

With consumption levels exceeding replacement rates, the current level of extraction inevitably results in a reduction in capital stock over the longer term. The increasingly denuded hill-sides of Matendeudze reflect this. However wood resources may also be derived from other sources, such as neighbouring villages (eg. Bocha near Jinga, or nearby resettlement areas or farms near Matendeudze). Woody biomass harvesting may also be a by-product of land clearance for agriculture. Pole and fuelwood derived from such sources thus reduce the impact on the remaining local woodland. On the other hand the commercial extraction of wood, as shown in Matendeudze (eg. see section 5.4), has not been incorporated into the overall consumption rate, which is based on household domestic consumption.

Future options in Jinga village appear brighter than in Matendeudze. The considerable amount of high quality standing crop in the existing woodland is likely to last for a long period, even with the high consumption levels observed today. In Matendeudze the situation is different. The quality and quantity of the existing resource base is lower than at Jinga and with current levels of estimated consumption (compounded by commercial wood extraction) shifts in resource utilisation patterns will inevitably be necessary.

Elements of such resource conserving strategies are already in evidence in Matendeudze. These include:

- Occasional use of dung or crop residues as a substitute for firewood;
- Substitution of building poles for stones, bricks or purchased timber;
- Recycling of old wood from buildings, frames and fences to be used as firewood;
- Increasing collection of firewood in the form of twigs and small branches, including the cutting of field coppices
- Reduction in the practice of wood piling for cropping season fuel;
- Fuel conservation measures when cooking (eg. draught reduction in kitchens);
- Higher prices for fuelwood (especially for brick making);

We can expect such practices to expand and spread as the resource becomes increasingly scarce. As in other areas of Zimbabwe (cf. Campbell *et al.*, 1993; McGregor, 1991), a significant shift from high consumption levels with large biomass wastage (during both cutting and burning) to lower consumption with greater resource conservation is likely to be necessary in Matendeudze within the next decade or so. The time span for such a shift in consumption patterns is likely to be much longer in Jinga and the high consumption-high wastage pattern currently observed is likely to remain for some time to come.

10. CONCLUSION

10.1 PRA techniques for valuation

At the close of the workshop, discussions were held on whether PRA techniques had proved useful in the valuation exercise. The consensus was that:

- PRA exercises helped break the ice and established a relaxed and informal atmosphere during the fieldwork (section 4). This helped in the difficult process of gaining local confidences in such a short period.

- PRA provided useful information that set the stage for the work, identifying general parameters, providing a descriptive framework and allowing the group to pose more precise questions (sections 4, 5 and 6).

- Clear understanding of the purpose of any investigation is needed before rushing to the field. The methods that worked best were designed to answer specific questions and their execution (including sequencing with other methods) was well planned.

- There are clear opportunities for effective linkage between PRA and economics techniques if work is phased efficiently. This would involve the use of PRA methodologies to define the key issues from a local perspective. More conventional quantitative data collection techniques can be used to examine these issues, with data amenable to formal economic analysis. Such activities would be phased with sufficient time in between to allow for information evaluation and planning. Such time was not available during the tight workshop programme.

- Opportunities for collecting economic data using PRA methods were missed during the workshop. For instance, inventory data from households could have been collected as part of the social mapping exercise. Also more details of flow quantities could have been derived from the flow diagramming exercises at community and household levels. Similarly, ranking exercises might have been used to assess shadow labour rates with the community. Instead of more innovative approaches, familiar, conventional survey approaches were resorted to. This reflected the lack of time during the workshop to consider every method being employed.

- PRA ranking exercises, combined with role plays, provided an interesting way of exploring non-market values (section 8). The links with contingent valuation procedures used in economic analysis were not pursued, but PRA ranking and scoring approaches may offer ways of improving on the conventional willingness to use questionnaires to get a greater insight into local perceptions of value.

- PRA approaches using local informants proved valuable for obtaining ecological information about the area rapidly (sections 4.3 and 9.1)

The contrasting paradigmatic origins of economics and PRA pose a challenge to the effective marriage of the two approaches. This relates to a whole range of issues, including:

- the nature of data (quantitative *versus* qualitative);

- the assessment of results (statistical analysis *versus* other measures of trustworthiness);

- the role of the researcher (field enumerators and distant analyst *versus* interdisciplinary field-based teams and analysis with villagers);

- the ideological position ('objective' research and advice *versus* participation and empowerment for development).

Such dilemmas were not really addressed during the workshop, but remained a query in participants' minds.

10.2 Values of marketable products

Part of the work aimed to place a monetary value on tree-based resources (section 7). This was achieved through a derived demand approach to valuation, which was essentially based on household interviews rather than on PRA techniques. Within the context of a workshop environment the household survey proved problematic initially. A poorly-framed question list had to be dramatically revised. Limited time precluded fuller pre-testing of the questions. A small sample size meant that statistical analysis of highly variable data was problematic.

Nonetheless, the results obtained indicate broad patterns which are likely to reflect the true situation in the two villages. The ecological differences in the villages (section 2.3), with Jinga in the arid-eutrophic savannas and Matendeudze in the mesic-dystrophic savannas, are reflected in some of the differences between the values in the two villages. Much more of the natural woodland had been cleared in Matendeudze, this partly reflecting the higher agricultural potential of this village and the greater clearance for cultivation. This in turn reduced consumption levels of wood, giving rise to lower values for fuelwood for household cooking and poles in Matendeudze, because of lower extraction rates. The opposite was the case for fuelwood for brick-burning, largely a result of the very much higher prices for this fuelwood in Matendeudze compared to Jinga. Ecological differences also dictate the differences in value of wild foods. In Jinga, wild fruits are much more abundant than in Matendeudze, while mushrooms are more abundant in the miombo woodlands of Matendeudze. The *Quelea* resource is only found in Jinga. On the other hand, it is not only ecological differences between the villages that are important. The greater clearance of woodland in Matendeudze must also be partly attributed to the activities of fuelwood traders, and ultimately to the breakdown of traditional rules, the influx of new settlers displaced from State Forest and the micro-political conflicts within the community (sections 4.1, 6.2).

The total values obtained for the woodland products, roughly US$85[7] household^{-1} in Jinga and US$50 household^{-1} in Matendeudze, are somewhat lower than that obtained by Campbell et al. (1991), US$300 household^{-1} for a generalised woodland in Zimbabwe. However, taking into account that this latter value is a gross value not reflecting costs of extraction (roughly 40% of total value), and that the gross value of Campbell et al. (1991) included the value of trees for crop production and livestock production (roughly 30% of total value), then the various estimates are very similar, with the comparable figure for Campbell *et al.* (1991) being US$130 household^{-1}. The value of woodland products can be seen to be sizeable in terms of annual cash income, which is well under US$250 household^{-1}.

On an area basis, the tree-based products investigated in the cultivated lands (fruit trees only) are valued at US$0.30 ha^{-1} in Matendeudze and US$0.90 ha^{-1} in Jinga, the three-fold difference being due to the much larger numbers of trees left standing in Jinga in cultivated and settlement areas. The

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[7] Converted to US currency, to allow for comparisons between years.

comparable figures for the woodlands are US$9.00 ha^{-1} in Matendeudze and US$7.00 ha^{-1} in Jinga. The difference is possibly not significant, but if indeed it is significant it relates to the large area of unused mountain woodland in Jinga. The comparable figures estimated by Campbell *et al.* (1991), adjusted to net value for the same range of products, are US$2.00 ha^{-1} and US$27 ha^{-1} for cultivated areas and woodland, respectively. The differences are most likely due to methodological differences.

Apart from this formal valuation exercise, informal discussion with traders in tree-based products (section 5.4) indicated that trees support the enterprises of a number of households. Tree-based products form the basis of a widespread informal sector. However, market analysis has also indicated that some of the assumptions used in the derived demand approach may not be strictly valid. One of these assumptions is that prices reflect an equilibrium supply-demand situation.

10.3 Valuation based on PRA methods

For the products common to the PRA ranking/scoring exercises and the derived demand analysis, a similar rank order of values is suggested, with the exception of poles (section 8). The products selected for the latter analysis were ranked between 3 (for poles in Jinga) and 17 (for mushrooms in Matendeudze) in the overall ranking of value carried out by villagers. This suggests that the overall value of the woodland is considerably higher than the total calculated simply by adding the selected marketed products, as presented above. In both villages a number of non-market values were rated higher than firewood by the villagers (eg. water retention, rainmaking ceremonies, inheritance, sacred sites, aesthetics, soil erosion protection, drinking water provision, air quality maintenance). If firewood is valued at $17000-25000 yr^{-1} for each village, this suggests that the total economic value of the resource is many times higher than the simple quantitative estimates given.

Since total economic value is made up of many different components, answering the question *"what's it worth?"* is not an easy undertaking and should not be answered by means of a simple economic valuation only. The apparently definitive dollar value given to the resource by the economic valuation needs to be treated with caution. Such analyses must be situated within a wider understanding of total value derived from more qualitative understandings of local perceptions and relative rankings. In this regard, the PRA exercises all contributed to understanding value in the wider context. The resource mapping and transect exercises showed the role trees play in the landscape, while the seasonal calendars showed how tree-related activities fit into broader farming activities. Tenure exercises showed how trees are treated within the set of local institutions. The ranking exercises were the most illustrative and demonstrated the wide range of non-market values that trees have.

10.4 Sustainability of resource use

The analysis of sustainability indicated that according to the inhabitants of both villages, the ecological sustainability of key woodland products is not encouraging. Consumption of certain products far exceeds production, woodland continues to be either disturbed or converted to cultivated land, and a decline in the natural capital is expected. The dynamic nature of the system highlighted that exercises in valuation should not be based on single analyses. Furthermore, the economic valuations derived should recognise that the current value may not be maintained; or that the value will change as a likely consequence of decreasing levels of extraction but increasing prices.

Future options in Jinga appear brighter than in Matendeudze because of the considerable amount of high quality standing crop in the existing woodland in Jinga. In Matendeudze the situation is made worse by the extraction of wood by commercial woodcutters. The fragility of traditional tenure

control can be seen in this area, where everyone knows the rules but these rules are broken to the detriment of the village. The interviewed woodcutter claimed that he only cut dry wood (section 5.4) but field visits indicated extensive clear-felling. Communities should have more say in such commercialisation and should reap more of the benefits of such resource use.

10.5 Are valuation exercises worthwhile?

Most participants agreed that valuation exercises are worthwhile, particularly if the outputs are directed towards a known audience. The form of the output should be adjusted accordingly. For instance, if a valuation exercise is being used by the Ministry of Finance to make planning decisions, then attempts at dollar valuation may be required. In other cases, for instance in NGO project development with communities, this may not be so necessary and a more qualitative analysis may be more appropriate.

Applications of valuation exercises that were suggested include:

- Natural resources policy settings, when it is important to get across the diverse nature of market and non-market values of woodland resources, to avoid the trap of under-valuing woodland resources in resource policy and ignoring local perceptions of value;
- With/without project scenarios (eg. when the woodland is going to be removed as part of some major land clearance project);
- Planning resource sharing or community management schemes, to assess the potential value of the resource prior to setting up institutional arrangements for resource management and use.

References

Alexander, J. 1993. *Traditions, Modernization and Control. Local and National Disputes Over Authority and Agrarian Policy in Chimanimani and Insuza Districts of Zimbabwe.* Doctoral thesis, University of Oxford, Oxford, UK.

Brinn, PJ. 1988. Communal Land physical resource inventory, Chimanimani District. *Chemistry and Soil Research Institute Soils Report* No A557. Ministry of Agriculture, Harare, Zimbabwe.

Campbell, BM. Grundy, I. and Matose, F. 1993. Tree and woodland resources - the technical practices of small-scale farmers. In: Bradley, P. and McNamara, K. (eds.) *Living With Trees.* World Bank, Washington.

Campbell, BM., Vermeulen, S. and Lynam, T. 1991. *Value of Trees in the Small-Scale Farming Sector in Zimbabwe.* IDRC, Ottawa.

Grundy, I., Campbell, B., Balebehoro, S., Cunliffe, R., Tafangenyasha, C., Fergusson, R. and Parry, D. 1993. Availability and use of trees in Mutanda resettlement area, Zimbabwe. *Forestry Ecology and Management* 56: 243-266.

Hofstad, 0. 1993. Woodland management practices in Zimbabwe. In: Pearce, GD. and Gumbo, DJ. (eds.) *The Ecology and Management of Indigenous Forests in Southern Africa.* Forestry Commission, Zimbabwe.

McGregor, J. 1991. *Woodland Resources: Ecology, Policy and Ideology. An historical case study of woodland use in Shurugwi communal area, Zimbabwe.* Doctoral thesis, Loughborough University of Technology, Loughborough. Cited in Bradley, P. and McNamara, K. (eds.) *Living With Trees.* World Bank, Washington.

Nhira, C. and Fortman, L. 1993. Local woodland management: realities at the grass roots. In: Bradley, P. and McNamara, K. (eds.) *Living With Trees.* World Bank, Washington.

Pearse, PH. 1990. *Introduction to Forestry Economics.* University of British Columbia Press, Vancouver.

Peters, CM., Gentry, AH. and Mendelsohn, RO. 1989. Valuation of an Amazonian rainforest. *Nature* 339:655-656.

APPENDIX 1. NATURAL REGIONS AND RELATED FARMING SYSTEMS

Natural Region I: The specialised and diversified farming region

The rainfall in this region is high (above 1000mm per annum in areas below 1700m altitude, and above 900mm per annum in areas above 1700m altitude) normally with some precipitation in all months of the year. Temperatures are normally comparatively low and the rainfall is consequently highly effective enabling forestry, fruit and livestock production to be practised in frost-free areas. Plantation crops such as tea, coffee and macadamia nuts can be grown.

Natural region II: The intensive farming region

Here the rainfall is confined to summer and is moderately high (750-1000mm). Two subregions have been defined: sub-region IIa has at least 18 rainy pentads[8] per season and normally has reliable rainfall, rarely experiencing severe dry spells in summer. This region is suitable for intensive systems of farming based on crops and/or livestock production. Sub-region IIb has an average of 16 to 18 rainy pentads per season and is subject to rather severe dry spells during the rainy season or to the occurrence of relatively short rainy seasons which affect crop yields in some years but not sufficiently frequently to change the overall utilisation for intensive systems of farming.

Natural region III: The semi-intensive farming region

The rainfall in this region is moderate in total amount (650-800mm), but because much of it comes in infrequent heavy falls, and temperatures in this region are generally high, its effectiveness is reduced. This region has an average of 14 to 16 pentads per season. The region is also subject to fairly severe mid-season dry spells, and is therefore marginal for maize, tobacco and cotton production or for enterprises based on crop production alone. The farming systems in conformity with the conditions of the area should be based on both livestock (assisted by production of fodder crops) and cash crops under good management of soils with high available moisture potential.

Natural region IV: The semi-extensive farming region

This region has fairly low rainfall (450-650mm) and is subject to successive seasonal droughts and severe dry spells during the rainy season. The rainfall is too low and unreliable for cash cropping except in certain very favourable localities, where drought-tolerant crops can afford a sideline. The farming system in accordance with natural factors should be based on livestock production, but it can be intensified to some extent by the growing of drought-resistant fodder crops.

Natural region V: The extensive farming region

The rainfall in this region is too low and erratic for the reliable production of even drought-resistant fodder and grain crops, and farming has to be based on the utilisation of grazing lands alone. Extensive cattle production ie. ranching and/or game ranching are the only sound farming systems in the region. Included in this region are areas below 900 m in altitude where the mean annual rainfall is below 650mm in the Zambezi Valley and below 600 mm in the Save and Limpopo Valleys.

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[8] A rainy pentad is defined as the centre of three 5-day periods (pentads) which together receive more than 40 mm of rain and two of which receive at least 6 mm of rain.

APPENDIX 2. SPECIES OBSERVED DURING THE STUDY

Species	Local Name
Acacia tortilis	muunga
Acacia nilotica	muguvhunga
Adansonia digitata	muuyu
Afzelia quanzensis	mukamba
Annona senegalensis	muroro
Antidesma venosum	murungamunyu
Artabotrys brachypetalus	mudavashoko
Azanza garckeana	matowe
Bauhinia galpinii	chigwendere
Bauhinia thoningii	musekesa
Berchemia discolor	munyii
Brachystegia boehmii	mupfuti
Brachystegia spiciformis	musasa
Brachystegia glaucescens	muunze
Bridelia cathartica	mupambare
Carissa bispinosa	munzambara
Cassia abreviata	muremberembe
Colophospermum mopane	mupane/musharu
Combretum hereroense	murowamhuru
Combretum molle	mugodo
Combretum apiculatum	mutsingidzi
Commiphora mossambicensis	munyera
Dalbergia melanoxylon	murwiti
Dichrostachys cinerea	mupanagara
Diospyros mespiliformis	mushuma
Diospyros quiloensis	mukukuti
Ekebergia benguelensis	mudyamhofu
Ficus spp	mutsamvu
Ficus sycomorus/ F.capensis	muonde
Flacortia indica	mududwe
Garcinia huillensis	mutunduru
Grewia bicolor	mutongoro
Grewia flavescens	mubhubhunu
Grewia inaequilatera	mutezwa
Hexalobus monopetalus	mukorongwa
Hexalobus monopetalus	mukwingwiziri
Hyphaene benguellensis	murara
Julbernadia globiflora	munondo
Kigelia africana	mumvee
Kirkia acuminata	mubvumira
Lonchocarpus capassa	mupanda
Ochna pulchra	muminu
Parinari curatellifolia	muchakata
Rhus lancea	chisawu
Sclerocarya birrea	mupfura
Securinega virosa	musososoti
Strychnos madagascariensis	mukwakwa
Strychnos spinosa	mutamba
Strychnos cocculoides	mutamba
Syzygium guineense	mukute
Terminalia sericea	mususu
Trichilia dregeana	mutsikiri
Trichilia emetica	mutsikiri
Uapaca kirkiana	muzhanje
Vangueria infausta	munzviru
Vitex payos	mutsubvu
Ximenia caffra	munhengeni
Zizyphus mucronata	muchecheni

APPENDIX 3. INVENTORY OF WOODLAND PRODUCTS FOR JINGA AND MATENDEUDZE

Jinga		Matendeudzo	
Species	Local name	Species	Local name
Fruit			
Adansonia digitata	mbuyu	*Adansonia digitata*	mauyu
Azanza garckeana	mitowe	*Annona senegalensis*	mororo
Berchemia discolor	nyii	*Antidesma venosum*	murungamunyu
Diospyros mespiliformis	shuma	*Azanza garckeana*	matowe
Ficus sycomorus	mionde	*Bauhinia thoningii*	masekesa
Ficus spp	tsambvu	*Berchemia discolor*	nyii
Flacourtia indica	nunguru	*Bridelia cathartica*	mupambare
Grewia bicolor		*Carissa bispinosa*	nzambara
Sclerocarya birrea	mipfura	*Diospyros mespiliformis*	shuma
Strychnos madagascariensis	hwakwa	*Ekebergia benguelensis*	matoma
Vitex payos	hubvu	*Ficus sycomorus*	muonde
Ximenia caffra	nhengeni	*Ficus capensis*	maonde
Zizyphus mucronata	chechem	*Ficus spp*	tsamvu
Securinega virosa	masosoti	*Flacourtia indica*	mandudwe
		Garcinia huillensis	maturndurur
		Grewia bicolor	mutongoro
		Hexalobus monopetalus	makwingwiziri
		Parinari curetelifolia	shakata
		Rhus lancea	matepe
		Sclerocarya birrea	mapfura
		Securinega virosa	masosoti
		Strychnos madagascariensis	hwakwa
		Strychnos spinosa	matamba
		Syzygium guineense	hute
		Uapaca kirkiana	mazhanje
		Vangueria infausta	nzviru
		Vitex payos	hubvu
		Ximenia caffra	nhengeni
		Zizyphus mucronata	chechem
Mushrooms (chowa)			
			dendejawa
		Boletus edulis	dindidzi
			jokova
			mbuyanwanga

Jinga		Matendeudze	
			munhumowahwar e
		Termitomyces sp.	nhedzi
		Lacterius sp.	nyakacheche
			sheta
Medicine (mishonga/mushonga)			
		Ficus sycomorus	muonde
Vegetables			
		Sidi alba	derere
			muchandirasha
			nhanza
Firewood & Construction			
		Brachystegia boehmii	mupfuti
Colophospermum mopane	musharu	*B. glaucescens*	muunze
Combretum apiculatum	mugodo	*Julbernadia globiflora*	mutondo
Diospyros quiloensis	mukukuti	*Dalbergia melanoxylon*	murwiti
Kirkia acuminata	mubvumira	*Terminalia sericea*	mususu
Acacia spp	muguvhunga		munondorito
C. apiculatum	mutsingidzi		
Farm tools			
Combretum spp.	murovamhungu	*Julbernadia globiflora*	mutondo
		Brachystegia spiciformis	musasa
		Combretum hereroense	murowamhuru
Pestles, mortars, drums			
Ficus capensis	muonde		
Acacia spp.	muguvhunga		
Crafts (mats, hats, bags)			
Adansonia digitata	muuyu	*Adansonia digitata*	muuyu
		Sclercarya birrea	muphura
Beehives			
Afzelia quanzensis	mukamba		
Dalbergia melanoxylon	muhwiti		
Trichilia emetica	mutsikiri		
Kigelia africana	mumvee		
Kirkia acuminata	mubvumira		
Brush fencing			
Acacia spp.	muwunga	*Acacia tortilis*	muunge
Ropes			
Grewia inaequilatera	mutezwa		
Adansonia digitata	muuyu	*Adansonia digitata*	muuyu

Jinga		Matondeudze	
Colophospermum mopane	musharu		
	mugunjaro		
Birds (shiri/shire)			
	ngozha		
guinea fowl	hanga	guinea fowl	hanga
weaver	gwetura		
dove	njiva		
franklin	chikware	franklin	hware
quelea	chikumguru		
Mammals			
mice	mbeva	mice	mbewa
bushbuck	dzoma		
kudu	nhoro	kudu	nhoro
hare	tsuro	hare	tsuro
		duiker	mhembwe
		mole	shindi
		rock rabbit	mbira
Reptiles			
Tortoise	kamba	tortoise	kamba
Snakes	nyoka		
leguaan	gwema		

Other products used:

Jinga: Honey (huchi); mopane worm (*mashonja*); craft grasses (*uswa*); thatch (*mwenje*); reeds (*tsanga*).

Matendeudze: Honey (*huchi*); mopane worm (*mashonja*); thatch grasses (*uswa*); salt; reeds (*tsanga*); clay; termites (*ishwa, majuru*)

APPENDIX 4. CONVERSION FACTORS OF QUANTITY UNITS USED IN THE CALCULATIONS

Firewood:	1 headload	=	29 kg
	1 cord (1 m x 1 m x 3 m stacked wood)	=	1000 kg
	1 scotchcart	=	1000 kg
	1 tractor load	=	2500 kg
	7 tonne truck	=	3300 kg
Poles:	*Full pole*		- roofing
			- kraal
			- granary
			- fencing
	Half pole		- *dara*
			- *mbariro*
	Handles		- hoes
			- axes
Mushrooms:	1 dish	=	5 plates
	5 litre tin	=	3 plates
	10 kg sack	=	12 plates
	1 bucket	=	12 plates
Fruits:	5 litre tin	=	1 basket
Honey:	1 drum	=	200 kg
	1 ml	=	1 gram
Termites:	500 g	=	1 plate
	20 vaseline lids	=	1 plate

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