Household Livelihoods in Semi-Arid Regions

Options and Constraints




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Executive summary

Questions. Our over-arching question is: What can the development community do, or facilitate, to significantly improve livelihoods in semi-arid systems? To answer this we ask: What are the relative contributions of different sources of livelihood and how does this vary amongst households? To what extent are people constrained by their assets, including labour availability? How are livelihood portfolios changing? What are the options to alleviate poverty?

Cases studies. We base our analysis on two case-study sites in the communal lands of southern Zimbabwe – Romwe and Mutangi in Chivi. These are fairly typical, from a biophysical perspective, of a vast domain of granite/gneissic landscapes in semi-arid areas of numerous developing countries on three continents. Long-term mean annual rainfall is around 550-600 mm and population densities 55-90 people/km^2. The study areas are relatively well positioned to markets — within 100 km of the provincial capital and close to smaller rural markets. The woodlands and rangelands are part of the commons, while dryland fields (maize predominant) and gardens are quasi-private. The latter are irrigated from groundwater or surface water. Considerable responsibility for administration and resource governance now resides with the district council, but *de facto* rules and regulations operative at the village level are centred on traditional authorities. Our quantitative household survey largely pre-dates the meltdown in the national economy that became increasingly grave after 2000. From the specific characteristic of Romwe and Mutangi related to site and history, we have derived general principles relevant to policy in semi-arid regions.

Methods and approach. Our main tool was a detailed livelihood questionnaire (with 24 visits per year to the sampled households). This survey yielded unique empirical results — very few of the resource-use patterns recorded would be captured in standard household budget surveys. The survey data were supplemented by participatory rural appraisal, participatory observation (researchers and research assistants living in the community for nearly three years), action research (some together with CARE), biophysical resource surveys, a geographical information system and systems modelling. For the survey data, we identified four equal-sized wealth quartiles based on household assets, using assets identified by participatory wealth ranking. The systems model was produced as a means to integrate different components of the project and as a means to integrate the different capital assets and multiple livelihood strategies. To structure our research, we used the sustainable livelihoods approach. While having many positive features, it is not without certain problems.

Capital assets. Human, financial, physical and natural assets are severely constrained for most households. An analysis of rules, leadership and committee operations indicates a system dominated by informal arrangements and the ineffectiveness of a number of institutions.

Human capital. After sleep and domestic activities, most time is spent on dryland cropping, though on a per acre basis, gardening (mostly by women) is two times more labour intensive than dryland cropping. Labour is generally fully utilised, without major under-utilisation even in the dry season. Households make significant investments in education, in terms of school fees, uniforms, school supplies and forgone labour. We focussed some attention on the development of leadership in the action research, with good pay-off for one of the community gardens (Chidiso), which was revitalised and expanded.

Financial capital. Households spend an average of Z$11,000 per year, with 80% of this used for domestic needs.[i] Some households in Romwe were fortunate enough to have received loans of between Z$500 and Z$3000 from a micro-credit scheme, representing a major injection of cash. In a number of cases this resulted in some significant improvements in livelihoods beyond the immediate cash injection, but the sustainability of the scheme is open to question.

Physical and natural capital. The distribution of arable land appears to be the outcome of a strong historical influence, with more recent arrivals having fewer assets. The local traditional leaders allocate land, this being one way to gain recognition in the local social arena. Over time, arable plots have been continually subdivided into small units as plot owners pass on land to their grown-up sons. Given the lack of room for cropland expansion, intensification is likely to increase as a response to land scarcity. However, HIV/AIDS is threatening to change these scenarios. Government resettlement initiatives have not reduced population pressures. Access to labour and labour-saving equipment allow households to have larger field areas. One of the primary constraints to economic and social development in these areas is the difficulty encountered in developing reliable water supplies.

Social capital. There are numerous local norms about how behaviour within the society, including those covering resources such as woodlands and water. Reciprocity is still strong, though declining for some aspects. Rules wax and wane depending on the status of the resource and the needs of the extractor. Committee functioning was shown to be far from satisfactory, and the elite (largely traditional leaders and their relatives) dominate resource management and use. The complexity of local organisations and power struggles is likely to defy attempts by development projects to facilitate change. Development agencies and scholars often equate the lack of strict enforcement of rules as evidence of institutional failure. Institutional flexibility may lower transaction costs and cater for the shocks and stresses that impinge on livelihoods.

Production and income

Production activities. Most households rely on income (cash and subsistence) from a number of sources, including dryland crop production, gardening, livestock production, woodland activities, wages or home industries and remittances/gifts. For dryland crops, gross income is highest for, in order, maize, cotton, groundnuts and roundnuts. Major garden crops are tomatoes and leafy vegetables (mostly rape). Draft, transport and milk are the largest gross income sources from livestock. Woodland income largely comes from fuelwood, structural items and wild foods. Remittances are mostly from urban areas in Zimbabwe but also from South Africa and commercial farms/estates. Local wages are for a wide range of jobs and there is also a diversity of home industries. All activities are deeply embedded in local social processes (e.g., for gardens this involves negotiating water use and, in the community gardens, many decisions related to crop production).

Net incomes — subsistence and cash. On average, dryland crops contribute 22% of total net income (cash and subsistence), gardens 8%, livestock 21%, woodlands 15%, wages and home industries 12% and remittances and gifts 21%. About 45% of total net income is cash

income. Very little of the total net income for dryland crops, livestock and woodlands is cash (only 21%, 8% and 10% respectively), but for garden crops half is cash (54%). It is clear that income from wages/home industries and remittances/gifts is particularly important for cash income generation (73% of total cash income), with only 10% of cash derived from dryland crops. It is during the dry season from June to November that households are especially constrained by cash.

Differentiation and the determinants of income

The assets – a gloomy prognosis. The capital endowments and production activities of households interact to determine the well-being outcomes of households. A major determinant of dryland crop production income is cattle numbers, as these provide inputs into cropping (manure and draft), but access to non-farm cash income also improves crop income, as it is a major source of cash to purchase inputs. For garden production, the important variable is access to land for irrigation, while remittance income is probably the main variable determining improved livestock income, as remittances are used to purchase cattle. Lack of access to cash income drives some households into sales of woodland products and larger wage/home industry incomes are associated with higher educational status. Given low capital endowments, there are limitations on what a household can produce. We found many limitations in the ability to expand natural capital. Labour is fully utilised and undertaking secondary education is in decline. The state is continuing to withdraw from its service role (education, extension, health, veterinary). Injections of cash from the agricultural output of the previous cropping season are limited to a small sub-population of the communities that have specific characteristics (e.g., access to cash for inputs, access to fields with particular soil characteristics).

Axes of differentiation. Inevitably, there are different types of households, with different livelihood strategies and different patterns of resource use. The major axes of differentiation are those related to gender, wealth and site. We can identify 10 household types (based on income levels and different activities). Differences between these are largely the result of the levels of income that various activities bring, rather than qualitatively different activities. Thus, differentiation is not as marked as in many other rural locations around the globe. It is apparent that our asset-based wealth class is the most important differentiating variable (as compared to others such as sex of the head of household, ethnic group, etc.). One factor driving differentiation is whether a household has access to remittance income, which can be reinvested in farming activities (especially livestock and cash crops) and education, two variables which can further change household status.

Wealth differentiation. Marked wealth differentiation occurs, with local people recognising the different wealth groupings largely on the basis of various capital assets. There is marked inequity in access to assets (e.g., 20% of households own 61% of the overall cattle herd). We see wealthier households committing more funds to building human capital and to purchasing physical assets. Not only do wealthier households have more labour units, they also devote more time to productive activities and academic pursuits, as well as hiring more labour. The relative proportion of net income from different sources indicates clearly how the asset-based wealth quartiles rely on a different spectrum of activities. Income from dryland and subsistence crops never exceeds 25% of total income, with the higher proportions in the wealthier households. About 30-35% of income is cash from wages/home industries and remittances in all wealth quartiles, with remittances proportionally more important in wealthier households and wages/home industries in poorer quartiles. Poorer households receive only 7% of total income from livestock, but this is 25% in wealthier households. Woodlands show the opposite pattern with 28% in poorer households and 9% in the wealthier groups. The lowest quartile is particularly dependent on wages as a source of cash. The top quartile is the only one in which households derive more than one-third of their gross cash income from crops, but their main source of cash income is remittances.

Site differences – patterns of intensification. We can identify greater intensification (measured as inputs per unit area) and monetisation in Romwe, with more purchased and in-kind inputs, closer livestock-crop integration and greater cash outputs. This may be due to the closer proximity of Romwe to a market (Ngundu Halt), but it may also be due to the better cropping potential and/or higher population densities in Romwe (with resulting greater land scarcity). On the other hand, the cash market for woodland products is better developed in Mutangi, where woodland resources are less plentiful. The patterns of increased intensification do not lead to any degree of poverty alleviation in Romwe; in fact, Mutangi, on average, may be in a slightly better position as a result of its lower cash input costs.

Gender. Males spend 18% less time on productive work than females. Women have less time for leisure and almost none of their time is devoted to academic activities. On the agricultural side, men focus on livestock and dryland cropping, while women focus on gardening and dryland cropping. We see the ruling elite, dominated by men, having a strong control over the activities of the community. However, in a number of cases there are some powerful women also wielding considerable power. There has been an upsurge of trading activity, much of it conducted by women.

Drivers of change. Elements of change can be identified in numerous aspects of capital assets and livelihood strategies. We suggest that there are some key drivers of change, namely: (a) rainfall, (b) macro-economic changes, (c) changing institutional arrangements and social processes, and (d) demographic processes and HIV/AIDS.

Rainfall. Rainfall is a primary driver of change, altering crop production from year to year and causing massive longer-term fluctuations in livestock numbers. Households are unable to raise sufficient grain for their subsistence needs in one out of three years. In particularly bad droughts, or as a result of a sequence of bad years, water reserves are reduced and garden production is also affected, with preference for water use given to watering livestock (not without contest and conflict). Droughts are great reducers of inequality, with the largest absolute losses in income in post-drought periods incurred by the farmers with many cattle. However, these farmers also have a great deal of resilience, and are usually in a better position to build up the herd again.

Macro-economic changes. Smallholder farmers are linked to the national economy through remittances derived from other sectors of the economy, prices of agricultural inputs and products, and services provided by government. Between 1993/94 and 1996/97, when structural adjustment was being implemented, remittance income increased in neighbouring Shindi Ward, but now the national economy is undoubtedly shrinking and remittance income is, by numerous local accounts, in decline. Terms of trade have also changed over the last few years, with a resulting drastic decline in groundnut and roundnut cultivation and increased maize and cotton production (though the recent downturn in the national economy has seen cotton production reduced). There has also been a shift from food crops to cash crops, at least in the top wealth quartile. Liberalisation of the exchange rate saw an influx of tourists into Zimbabwe in the 1990s, fuelling the woodcraft market. Liberalisation also led to some other positive changes for rural people, e.g., a flourishing informal trade. One negative impact of structural adjustment, as implemented in Zimbabwe, has been the rolling back of government services in rural areas, including the previously free health and education services, agricultural extension and veterinary services. Cash is at a premium – we calculate that cash income stands at less than US$0.20 per person per day. The need to raise cash and the reduced rates of out-migration by young males to formal jobs is having repercussions throughout the livelihood system. Many of the changes we see can be linked to these processes – increased monetisation, changing gender relations, changing social norms, diversification into non-farm activities and greater differentiation.

Changing institutional arrangements and social processes. At the country/regional level, the enforcement of some national environmental laws has been all but halted, resulting in an upsurge of gardening and the widespread sale of forest products. Traditional leaders remain central to daily village life and they are behind many important decisions that influence the livelihoods of villagers, but their powers are being challenged and traditional rules are not as strictly adhered to. These leaders will often turn a blind eye to some activities that transgress the local rule system citing the dire economic situation that their subjects face. Younger men, now more in evidence in the community as a result of declining external opportunities, are also forces for change – challenging the authority of the older men and the elites. Reciprocity is still important but cash is governing more transactions amongst households. At the household level, women are moving into new activities, such as trading, which involves them moving temporarily away. Changing mores are also noted – petty theft, which was once seldom heard of, is now more frequent.

Demographic processes and HIV/AIDS. With the slowly rising populations, the lack of jobs in the formal sector for young men, and the limited land redistribution in Zimbabwe not providing opportunities for people such as those in Chivi, endowments of natural capital – land, livestock, common land for grazing and woodland products – continue to decline. These are factors set to drive intensification. However, most of the quantitative data that we have compiled on temporal change illustrate trends that are much more rapid than the demographic changes that are taking place. Thus most of the changes we discern cannot be primarily attributed to population increases. In the study areas there has been an unprecedented rise in deaths linked to the HIV/AIDS pandemic. This has had negative impacts on remittances (and all the ensuing effects on education and crop and livestock production) and labour availability, has increased the cash diverted to medical and death expenses, and has even increased the slaughter of cattle. Unexpected impacts are a reduced willingness/ability to attend development-oriented meetings because of other demands on time (e.g., attending funerals, work to maintain household income).

Resourceful farmers in a changing world

Resourcefulness. The study suggests that households have a rich and varied livelihood portfolio, with displays of infinite resourcefulness to make ends meet. Patterns of livelihood change over time, with their concomitant changes in institutions, illustrating the responsiveness of farmers and the community to external signals, and their resourcefulness despite the low levels of capital assets. Who would have predicted in the 1980s that within the next decade there would be a minor gold rush, an unprecedented upsurge in woodcarving, a flourish of trading activity and a new migration to South Africa? Many past interpretations of communal areas in Zimbabwe, as elsewhere in Africa, have followed neo-Malthusian reasoning, but we find little evidence for a downward spiral of communities triggered by rapid population growth. The neo-Boserupian perspective, on the other hand, is clearly enviro-optimistic and also tends to be livelihood optimistic. We do not see the poverty status of rural households changing fundamentally in semi-arid regions, as part of the neo-Boserupian processes, if indeed such processes are occurring.

A conceptual model of change. Any simple model of change, e.g., that of Boserup, may give us some useful insights but is severely limited when confronted with the complexity of rural production systems, with their multiple pathways of change and multiple causalities. Following Mortimore and Benjaminsen, we suggest that a more appropriate model of such systems is that they are non-equilibrial and opportunistic; they are systems in constant transition. Elements of the system can display long-term changes in slow variables (e.g., population growth, reduction of 'sacredness' of landscape features), rapid directional (at least for a certain period of time) changes in

fast variables (e.g., rapid expansion of production of a specific crop such as cotton in response to specific market signals), fluctuations in responses to some determinants (e.g., rainfall) and reversals of states (e.g., loss of a breadwinner from HIV/AIDS causing a household to move from the wealthiest quartile to a very poor quartile). Different households, depending on their capital assets, will be moving in different directions. Rural economies and societies appear as a shifting kaleidoscope of activities, household types, conflicts, alliances and manoeuvres, in which it is difficult to discern the direction a particular household type will next take, who is in control, the next strategy and the impact on the asset base.

Poverty — can we make a difference?

Poverty status. Seventy per cent of the households fall below the food poverty line,[ii] while 90% fall below the consumption poverty line,[iii] indicating the pervasive poverty that exists. *De facto* female-headed households (households where the male is working away from the homestead) are shown to be better off than *de jure* female-headed households (widows or unmarried/divorced women) or male-headed households. This reinforces the importance of remittances to uplift a household, as *de facto* female-headed households have high remittances. Development agencies generally try to focus on the poorest of the poor – in the case of Chivi, and many similar semi-arid systems, the bulk of the population could be considered prime targets for interventions. Even the wealthiest quartile has a mean income of less that US$1 per day per person. Households with large remittance and cash crop incomes can escape poverty. Cattle numbers, size of dryland fields and educational levels are also correlated with poverty status. Thus access to assets is important in determining poverty levels. This is probably a self-reinforcing cycle with access to assets allowing households to improve income, and hence to reinvest in further assets. Case-study interviews indicate a general consensus that the richer are getting richer, while the poor are getting poorer; thus differentiation is thought to be increasing.

The causes of poverty, and the need for integrated approaches: Rural poverty in semi-arid regions is a result of a combination of interacting social, economic and environmental factors and processes operating at a range of scales. Some of these are: (i) adverse biophysical conditions, resulting in, among other things, low agricultural potential and disastrous crashes in livestock numbers; (ii) insufficient high-quality land, which is a result of colonial land-allocation patterns; (iii) labour scarcities, even more so in the face of the HIV/AIDS pandemic; (iv) economic remoteness, with presumably higher transaction and input costs, and few investments because returns to investments are low compared to other places; (v) lack of credit markets as a result of little or no collateral; (vi) few employment opportunities and low levels of education and skill; (vii) low incomes and hence an inability to purchase some basic needs (e.g., medicines, secondary school education); (viii) poor macro-economic conditions; (ix) the HIV/AIDS pandemic, resulting in the loss of breadwinners, labour scarcities and increased costs; (x) low levels of empowerment; and (xi) declining woodland resources leading to the need for greater investments (e.g., labour) to acquire basic products. The multi-faceted nature of poverty indicates that there is no silver bullet to rural development, and that an integrated, multi-sectoral approach to development is critical, with different but complementary activities across a wide range of sectors.

Environment-poverty nexus. Considering that livestock income is largely based on rough grazing, the common pool resources of the woodlands and grazing areas provide 30-40% of net income for all wealth quartiles, with this income being predominantly grazing for the top wealth quartiles and forest products for the lowest quartile. In these landscapes water can also be classed as a predominantly common pool resource – it is essential for garden production, which contributes nearly 10% of total income in all quartiles. Thus common pool resources form the basis for between one-third and one-half of all income.

Given their contribution to household livelihoods, it is surprising the extent to which some analysts disregard these resources, the focus often being on dryland crop production. There is some evidence that woodlands are degrading and, from a technical perspective, a higher degree of management of the herd size would probably lead to greater financial return from grazing lands, but the transaction costs of achieving management of a common pool resources are presumably very high. In general, we recognise that there are very low incentives to manage natural resources in the commons, and there are almost no technical or institutional interventions that could be used to change this situation. Removing ineffective national- and district-level regulations related to woodlands and grazing areas, and empowering local leaders, will be a step in the right direction. Given that households are mostly well below the poverty line, and that forest products (here we exclude grazing) are more important to the poorest groups, we consider forest resources to be a safety net, preventing households from even slipping further into poverty. For a few individuals (e.g., the master carvers) woodlands may be more than a safety net.

Interventions. Our main conclusions, through statistical analysis of the livelihood data, systems modelling and action research were that: (i) an integrated approach, covering several production activities, is required to make any sizeable impact on income; (ii) building the capacity of organisations can be as important, if not more so, than any focus on a particular production system; (iii) market development is critical to improved cash income; and (iv) macro-economic impacts on local livelihoods outweigh the effects that can be achieved through local development initiatives. Of paramount importance is the development of an enabling policy environment in which indigenous capital can be effectively mobilised and the merits of technological options can be explored by the farmers themselves. Support through the provision of market information and the development of marketing organisations will allow households to respond positively to markets, and thus to drive development themselves. A variety of possible intervention points are identified.

But, can rural development really make a difference? The donor community has set an ambitious target for poverty alleviation in developing countries — the reduction of people living in extreme poverty by half between 1990 and 2015. We can identify rural development options to improve livelihoods but the impact, in terms of lifting people beyond an income of US$1 per day, will be limited. Our overall conclusion is that there are very few options for significantly improving livelihoods in semi-arid regions and that the poverty alleviation targets set by the international community are overly ambitious. Our analyses suggest that rainfall variation and the state of the macro-economy are likely to have a greater impact on livelihood status than any intervention at the local level. We suggest that for real poverty alleviation we have to look forward to the day without communal lands! The pre-condition for this (or even only a portion of this dream), however, is very high growth rates in the manufacturing and service industries driven by high investment levels to create the necessary additional employment. This, of course, presumes a conducive political climate, macro-economic stability and good luck: good rains, buoyant commodity prices, lowering trade barriers, and so on. Rural development is only one small part of alleviating poverty.

[i] US$1 = Z$38-40 at the time of the study.
[ii] The food poverty line represents the income required to meet basic nutritional needs.
[iii] The consumption poverty line allows for basic food consumption and some spending for housing, clothing, education, health and transport.

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Abstract

The overall aim of this study was to explore what the development community can do, or facilitate, to significantly improve livelihoods in semi-arid systems. We based our analysis on two case-study sites in the communal lands of southern Zimbabwe, areas fairly typical of a vast domain of granite/gneissic landscapes in semi-arid areas of numerous developing countries on three continents. Our main tool was a detailed livelihood questionnaire, supplemented by participatory appraisal and observation, action research, biophysical analysis and systems modelling. Human, financial, physical and natural assets are severely constrained for most households. An analysis of rules, leadership and committee operations indicates a system dominated by informal arrangements, and the ineffectiveness of a number of institutions. Most households rely on cash and subsistence income from a number of sources — dryland crop production, gardening, livestock production, woodland activities, wage or home industries and remittances/gifts. Marked wealth differentiation occurs, with local people recognising the different wealth groupings largely on the basis of various capital assets. One factor driving differentiation is whether a household has access to remittance income. The wealthiest quartile is the only one in which households derive more than a third of their gross cash income from crops, but their main cash income is remittances. Elements of change can be identified in numerous aspects of the capital assets and the livelihood strategies. We suggest that there are some key drivers of change, namely: (a) rainfall, (b) macro-economic changes, (c) changing institutional arrangements and social processes, and (d) demographic processes and HIV/AIDS. The study suggests that households have a rich and varied livelihood portfolio, with displays

of infinite resourcefulness to make ends meet. We found little evidence of a downward spiral triggered by rapid population growth, but we do not see the poverty status of rural households improving in semi-arid regions, as part of intensification processes. Most households fall below various internationally recognised poverty lines. Rural poverty is the result of a suite of interacting social, economic and environmental factors and processes operating at a range of scales. The multi-faceted nature of poverty indicates that there is no silver bullet to rural development, and that an integrated, multi-sectoral approach to development is critical, with different, but complementary, activities pursued at different levels. We recognise that there are very low incentives to actively manage natural resources in the commons, and there are almost no technical or institutional interventions that could be used to change this situation. Removing ineffective national- and district-level regulations related to woodlands and grazing areas, and empowering local leaders, will be a step in the right direction. In pursuing poverty reduction, of paramount importance is the development of an enabling policy environment to allow farmers to experiment and capture opportunities. Our overall conclusion is that there are very few options for significantly improving livelihoods in semi-arid regions and that the poverty alleviation targets set by the international community are overly ambitious. Our analyses suggest that rainfall variation and the state of the macro-economy are likely to have a greater impact on livelihood status than local rural development interventions.

1. Introduction

This book is about the challenges and constraints rural households face in living in semi-arid areas, and the role of development in alleviating poverty. Foremost among the challenges are the often-marginal environmental conditions for many forms of agriculture, created by low and erratic rainfall, frequent droughts and generally poor soils (Scoones *et al*. 1996; Mortimore 1998; Frost and Mandondo 1999). Surface and groundwater supplies are often poorly developed, unreliable or contaminated by livestock. Access to good-quality agricultural land is often limited, sometimes by high population densities (e.g., Malawi) or by the alienation of better farming land for large-scale commercial concerns (e.g., Zimbabwe). Chronic food shortages are widespread. For instance, almost 54% of the population in the districts of Chiredzi, Beitbridge and Chivi in southern Zimbabwe requested food aid each year during the period 1982-1993 (Frost and Mandondo 1999).

The risk and uncertainty associated with semi-arid regions, in particular the recurrence of drought and the frequency of crop failure, means that farmers adopt risk-averse strategies (Scoones *et al*. 1996; Mortimore 1998; Frost and Mandondo 1999). Such strategies, placed in the context of high livestock and human populations, may encourage heavy dependence on the environment. Rural communities depend on a wide range of natural products to supplement their livelihoods, most of them derived from the commons (Bradley and Dewees 1993; Braedt and Standa-Gunda 2000). Weakness of local institutions and high transaction costs, however, make it difficult to manage common pool resources as new pressures emerge (Campbell *et al*. 2001b). Environmental problems include deforestation, overgrazing of rangelands and increased soil erosion, though there is much debate as to the severity, causes and impacts on livelihoods (Whitlow 1980; Whitlow and Campbell 1989; Bradley and Dewees 1993; Timberlake *et al*. 1993; Scoones *et al*. 1996; Campbell *et al*. 1997a; Mortimore 1998).

Whereas agricultural production is constrained primarily by the low potential of much of the land, it is also affected adversely by a range of socio-economic factors (Frost and Mandondo 1999). It is almost impossible for farmers to secure the credit and loans needed to purchase agricultural inputs. Markets are under-developed and often difficult to access consistently because of long distances, cost of transport and sometimes poorly developed and maintained infrastructure. Access to appropriate extension advice is minimal. Institutional arrangements governing resource use may not function efficiently, to the detriment of local livelihoods and the environment.

Many people, mostly men, are attracted by paid employment outside the rural areas, leaving women with the burden of production. Labour scarcities are being further compounded by the rising number of deaths as a result of HIV/AIDS (World Bank 1996). The contribution to household economies of income derived from employment, returned through remittances, may be declining, because of stagnating and declining economies in the region (Addison 1996; World Bank 1996; Arrighi 2002). Livelihoods are also vulnerable to economic policy shifts, particularly economic reform programmes whose

pressures reinforce dependence by the poor on the environment, often causing further rapid deterioration in its quality (Chipika and Kowero 2000).

In our study we investigate livelihood activities, in the context of natural resources and their use, and explore how development initiatives might influence the relative poverty or affluence of the people. We focus on two nearby sites in southern Zimbabwe. While the sites have many peculiarities dictated by space, time and history, the central themes are of wide interest to researchers and practitioners in semi-arid regions. These themes cover the causes and consequences of poverty, the drivers of livelihood changes, the importance of external factors in controlling local livelihood outcomes and the role of rural development practitioners in promoting change. All too often rural studies are too narrow, ignoring the wider dynamics of society, politics and the economy, and failing to take history into account. Our focus on the details of survey data from the two sites could lead to this same myopia, at least in print in such a book, with us getting lost in the means, standard errors and significance tests. Here we do describe much of the survey data collected, as the book is the descriptive account of the bulk of our data — in subsequent publications, led by Chris Zindi and Sibongile Moyo, we will be taking components of the data and providing more in-depth and more sophisticated analyses (largely using mathematical programming and econometric models based on utility maximisation). While we do provide some qualitative data in this book, the project has produced a series of publications that focus on qualitative insights regarding livelihoods and social processes (Mandondo *et al*. 2002; Nemarundwe 2002a,b,c; Nemarundwe and Kozanayi 2002; Sithole *et al*. 2002).

Our over-arching question is: What can the development community do, or facilitate, to significantly improve livelihoods in semi-arid systems? The donor community has set an ambitious target for poverty alleviation in developing countries – the reduction of people living in extreme poverty by half between 1990 and 2015 (World Bank 2001). Can rural development practitioners make a major contribution to this goal? Despite decades of investment in rural development initiatives, poverty is widespread in sub-Saharan Africa, with no signs of significant reduction (Berry 1993). Scoones (1994), writing on pastoral development in Africa, notes that all is not well in the drylands of Africa, citing recurrent drought, civil war and economic decline as characterising too many of the drylands. An appalling record of previous governments in supporting pastoral development has convinced donors and governments that further investment will be of little value. However, he suggests that there is growing consensus of a new approach. Chambers (1994) abounds with optimism, citing the elements of a professionalism that will rise to the challenges and opportunities emerging from farmers' realities. Elements of this professionalism include taking risks, embracing errors and learning; developing, adopting and spreading new methods and approaches; forming new alliances and associations; articulating a vision of an agriculture based on participation and equity; and working to make that vision a reality, with poor farmers gaining more say and playing more of a role in rural development. While we agree that there are new approaches and insights that can drive our rural development initiatives, this book examines whether there is any room for optimism in relation to our goal of significantly changing poverty levels through rural development.

The specific objectives and key questions of our study are:

- *To identify the different groups of resource users and quantify their dependence on each class of resource relative to the other components of their livelihoods.* What are the relative contributions of different sources of livelihood? In particular, to what extent does agriculture play a role in subsistence and cash income generation, as compared to forest products and non-farm income? What role do common property resources play in the livelihood portfolios of people in semi-arid regions? Inevitably, there are different types of households, with different patterns of resource use (Scoones 1995; Cavendish 1999a, 2002a,b). What is the pattern of differentiation among households? What is driving differentiation? To what extent are people constrained by labour availability?

Labour is generally in short supply in smallholder semi-arid systems (Berry 1993; Mortimore 1998). We also ask how HIV/AIDS may be influencing labour availability (and livelihoods more generally). We consider the social processes that mediate supply of labour.

- *To analyse how livelihood portfolios are changing*. Available evidence suggests continuing livelihood diversification, increased monetisation and constantly shifting livelihoods (Bryceson 1996, 2000, 2002; Scoones *et al*. 1996; Ellis 1998, 1999, 2000; Mortimore 1998; Ashley and Maxwell 2001; Orr and Mwale 2001). We examine whether this is the case, exploring whether there is any evidence of poverty reduction, and look at the drivers of change. Change and adaptation are central themes in the study of semi-arid livelihoods (Scoones 1994; Scoones *et al*. 1996; Mortimore 1998), with common drivers being variable rainfall, changing market conditions and the complex of factors driving intensification and monetisation of production (Boserup 1965; Mortimore 1998; Bryceson 2000). The use of water for economically productive purposes is part of a well-established progression of gradual intensification of farming systems (Boserup 1965).
- *To identify options that are likely to significantly improve the livelihoods of people*. From the perspective of external agents, is the integrated management of livelihood assets a means to eliminating rural poverty? DFID NRRD (1998) suggests that the sustainable livelihoods approach (Carney 1998) needs to be tested and transformed into practice. DFID NRRD (1998) go on to suggest that one approach to development is to improve the understanding of the asset base of a particular rural system and then develop a suite of options for interventions. We embraced the sustainable livelihoods perspective to derive our conceptual model of the system and to frame the way we undertook our work. We reflect on the value of the approach as a means towards poverty alleviation. We are particularly concerned that rural development initiatives, centred on natural resource use, may not lead to significant poverty reduction (Wunder 2001). The value of natural resources as a component of livelihoods is undeniable (e.g., Cavendish 2002b), but this does not imply that natural resources will provide the means to poverty alleviation. The constraining biophysical conditions in semi-arid regions, particularly low and unreliable rainfall, may severely limit the ability of households to mobilise resources and improve incomes. In addition, the lack of reliable markets may limit the ability of households to intensify production and benefit from cash crops. It is these themes that we address in this book.

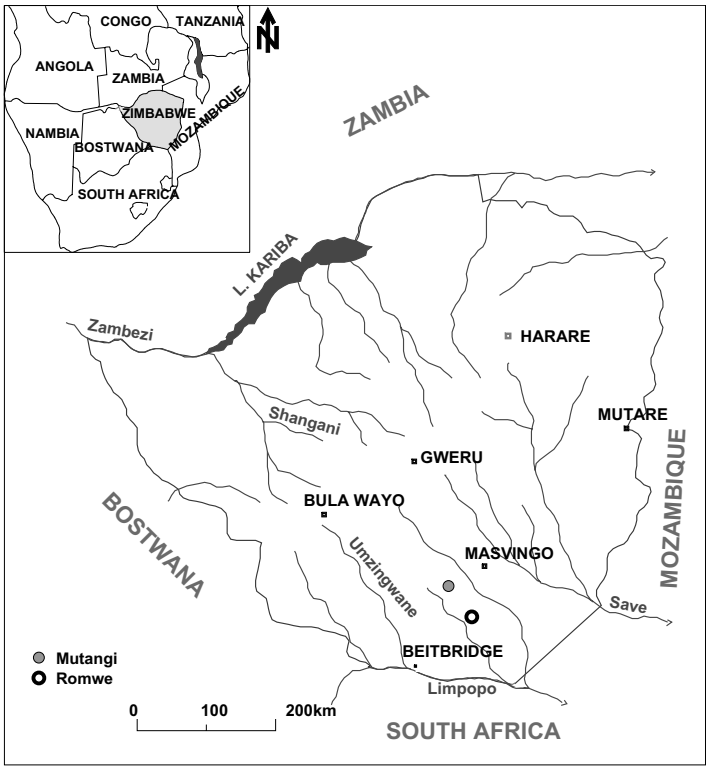
In Chapter 2 we give a background to the study sites in southern Zimbabwe. This is followed by a description of the methods (Chapter 3). In Chapter 4 we derive a household wealth index and briefly describe its variation between the study areas. The index is based on indicators of wealth (e.g., cattle numbers). In the fifth chapter we analyse the resources that can be utilised for productive activities: human, financial, physical and natural capital. In Chapter 6 we investigate gross income in the various sectors of household activity: crop production, livestock production, woodland production, wages/home industries and remittances/gifts. Chapter 7 explores differentiation amongst households. Chapter 8 describes how net income varies amongst households. It also explores the poverty status of households. Chapter 9 summarises the temporal dynamics in household livelihoods. Chapter 10 explores the likely impacts of different development options on cash income using a systems modelling approach. Chapter 11 concludes with our responses to the questions about whether the sustainable livelihoods approach is valuable as a means to poverty reduction, and whether the development community can substantially improve livelihoods in semi-arid regions.

2. The Study Sites

2.1 Location

The work was conducted at two sites in Chivi District of Masvingo Province in southeastern Zimbabwe. The study areas were the villages of Romwe (20° 45'S, 30° 46'E) and Mutangi (20° 15'S, 30° 30'E) surrounding two physical micro-catchments. They are 70 km apart as the crow flies (Figure 1). In Romwe the physical catchment was centred on the Chidiso collector well,[4] used for small-scale irrigation of the Chidiso garden. In Mutangi the physical catchment was that of the Mutangi Dam, also used for small-scale irrigation (Figure 2). Our survey covered households from villages in the so-called social catchment, covering the villages using the physical catchment for woodland and/or water resources. There is much resource sharing across village boundaries in Chivi (Nemarundwe 2002c; Nemarundwe and Kozanayi 2002), so we used the concept of social catchment to encompass the broader community of resource user in the physical catchments. While the physical catchments of Romwe and Mutangi are only 4.5 km^2 and 5.9 km^2, respectively, the social catchments cover 31.6 km^2 and 50.8 km^2.

Figure 1. Location of the two study areas in southern Zimbabwe



2.2 History and population

Zimbabwe was one of the last African countries to gain its independence (in 1980) and was also one of the most intensively colonised. Until 1980 development opportunities were heavily biased in favour of the white settlers, and even after 1980 the small white population controlled many aspects of the national economy. In the early part of the 20th century, land was divided along racial grounds with the settlers being allocated the best land (currently termed 'commercial farming' areas), forcing the bulk of the increasingly marginalised and impoverished black community into heavily populated communal areas. The inequitable distribution of land was a major factor fuelling Zimbabwe's war of independence and continues to be an important component in Zimbabwean politics. The pattern of land distribution remains to this day, though the recent (post 2000) fast-track resettlement programme and the general anarchy prevailing in the commercial farming areas has seen some breakdown of the pattern. Chivi communal land (which forms the bulk of Chivi District) is thus a product of colonial history.

Figure 2. Mutangi Dam, used for small-scale irrigation, fishing and livestock watering. In such semi-arid regions it is a key part of the livelihood strategies (photo: Bruce Campbell)

Of particular relevance to Chivi was the forced relocation of a large swathe of Zimbabwe's black population in the 1950s when land policies were enforced. At this time, land grants were being made to white soldiers who had served in WWII, and the original inhabitants of the land were forced to move to areas like Chivi. There was some limited redistribution in the 1980s but this did little to relieve population densities. Even in the post-2000 period there has been negligible impact of resettlement on population densities in Chivi (Sithole *et al*. 2002).

Chivi communal area covers 3534 km^2. Its administrative centre is Chivi Business Centre, an old settlement established in the early part of the 20th century. Chivi was settled in the mid-19th century (Box 1). At the start of that century the estimated population of Chivi District was only around 15,000 (Scoones *et al*. 1996). By 1930 the population had grown to an estimated 28,500, partly due to population movements into the reserves. The southern parts of Chivi, such as Romwe, were only settled during the 1950s, with the arrival of people displaced from farms designated for European occupation further north. Census figures in 1962, 1969 and 1982 showed district populations of 57 220, 80 580 and 103 656. The 1992 census shows a total

Box 1. Some historical gossip - the settling of Chivi — by Alois Mandondo and Witness Kozanayi

According to Beach (1994) the Chivi people arrived around the mid-19thcentury. The ruling Mhari lineage is thought to have come from the Mutoko area, in northern Zimbabwe, with splinters of them settling around the Mashava hills and Nyaningwe mountains. It is reputed that the Chivi chieftaincy originated around a character called Tavengerweyi, who married among the tribes already residing there, and had 14 sons. Some among the 14 sons rose against their ruling uncles overthrowing them, and driving them across the Runde River into what is now called Mazvihwa communal lands. When the fleeing uncles arrived at Runde River, the eldest refused to cross the flooded river. One of the sons pushed the resisting uncle into the flooded river to try and drown him. The uncle managed to swim across the river and, when on the opposite bank, shouted at the son '*Chivi charo*' ('sinful one'). The son retorted '*Wazvihwa*''('serves you right'). Henceforth the area on the eastern side of the Runde river was called Chivi and the western side was called Mazvihwa.'The Chivi are to this day still considered the 'uncles' to the Mazvihwa.

The Mutangi people came to settle in Chivi in the early 20th century long after the Mhari people. The Mutangi people originated from Manicaland in eastern Zimbabwe. They came to Chivi in search of cropping land and grazing area for their livestock. When they arrived in Chivi they settled near a mountain called Rushinga. After talking to the Mhari people, they were allocated a new area at the foot of Mushungwi mountain. Here they had enough grazing but inadequate cropland. Again they shifted, to Baradzanwa, where there was sufficient cropland and grazing area. Unfortunately, the stay of the Mutangi people at Baradzanwa was short lived. There was an outbreak of a disease and the Mutangi people suspected that they were being punished by local spirits for having settled in the area without the blessing of the spirits. They then migrated to the site where Mutangi Dam now stands. When the dam was built in the 1940s, the Mutangi people were again relocated to their current sites. The leader of the Mutangi people was buried behind the dam wall and the dam was named after him.

population for Chivi District of 157,428, with a growth rate of 1.98% and a population density of 44.5 people/km^2. Our calculated population densities for the social catchments in 2000 were 86.1 people/km^2 for Romwe and 58.2 people/km^2 for Mutangi.

Both Romwe and Mutangi are predominantly Shona but some of the residents of the Romwe social catchment (10%) are Ndebele who moved from Kwekwe and Shurugwi areas in Midlands Province mainly as a result of displacement during colonial occupation in the early 1950s. Even the Shona in Romwe came at about that time, also as a result of displacement. This is different from Mutangi, which was settled much earlier (Box 1).

2.3 Markets, infrastructure and services

The closest large town to Romwe and Mutangi is Masvingo, the capital of Masvingo Province, with a population of 55,000 at the time of the 1992 census. It is the major market town in the region. The turn-off to Romwe is 86 km south of Masvingo, on the main road to South Africa, and then there is 5 km on gravel to the catchment. Other markets for Romwe farmers are Museva and Ngundu Halt, also on the South Africa road. Museva is a small bus stop 5 km by foot from Romwe, while Ngundu is a bustling truck stop and local growth point 7 km by foot from Romwe or 12 km by cart or 14 km by road. Mutangi is 6 km along a gravel road from the main sealed road running through Chivi Business Centre. It is 80 km from Masvingo and 19 km from Chivi Business Centre. The study areas are relatively well positioned for market access, by Chivi standards, as Ngundu Halt and Chivi Business Centre are the two largest trading sites in the communal area. Vegetables and other garden produce are largely traded informally at Ngundu, Chivi Business Centre and the other smaller centres. Truck drivers stopping at Ngundu often purchase products to take to South Africa (e.g., sweet reeds, roundnuts, groundnuts and even maize), though the purchased amounts are small (e.g., a maximum of a few sacks). Women and children generally walk to the points of sale, carrying what they will try to sell on that day. There will be occasional trips, generally by bus, as far as Masvingo, for sale of a few boxes of tomatoes or other such crops. These trips will be timed to coincide with trips needed to purchase commodity items and farm inputs. For the major cash crops, namely maize and cotton, there are nearby depots, or traders come to the roads close to the study areas. Farmers speak of low prices or high costs of transport.

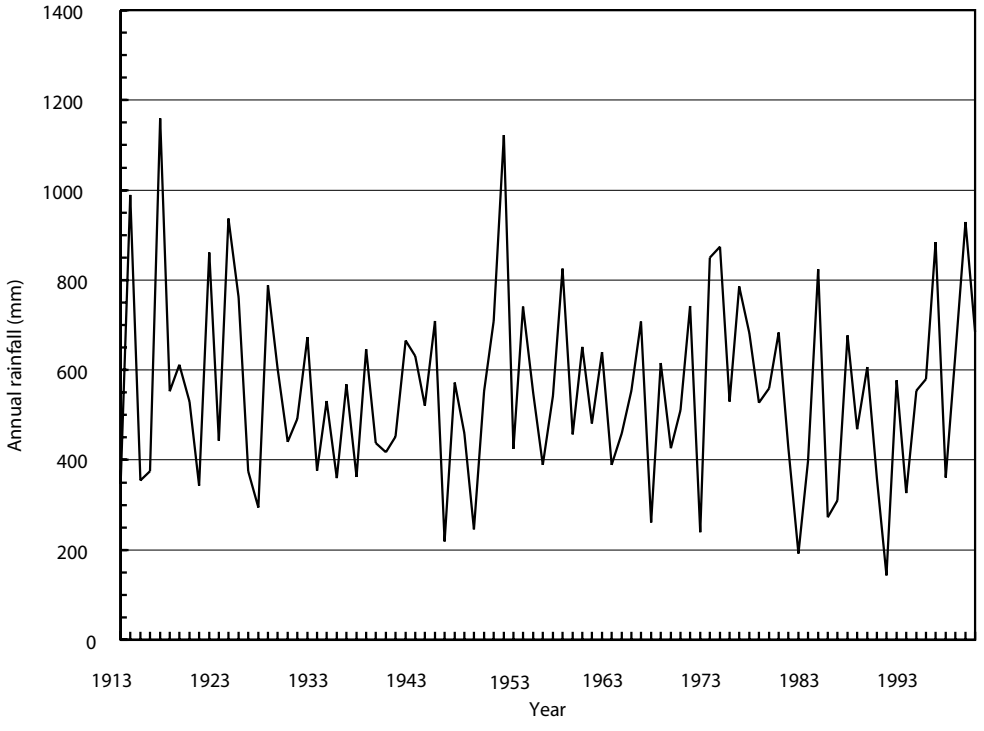
The agricultural sector, particularly for commercial farmers, is relatively well developed in Zimbabwe, with an agro-industry that supplies the full spectrum of inputs, well-developed credit markets and suitably organised markets. The situation is not so favourable for communal farmers. Widespread formal credit became available to smallholders in the 1980s, but this system soon collapsed in the face of numerous failures to service the debts. The extension system was widely expanded in the 1980s, but by the 1990s government operating budgets had been so curtailed that extensionists were all but absent from the field. Similar cutbacks have occurred with the veterinary service. In many years Chivi farmers received free inputs (seed and fertiliser) as part of drought relief efforts, but by the late 1990s such schemes were no longer possible for a government increasingly facing economic problems. Soon after independence, agriculture was stimulated by the expansion of centralised marketing systems, which meant that remote rural producers received subsidised transport of their crops, but by the mid-1990s marketing had been liberalised and subsidies withdrawn. Withdrawal of subsidies also has occurred in non-agricultural sectors, and now payments are required for senior schools and health clinics. Withdrawal of subsidies for agro-industry has seen a rise in fertiliser prices.

2.4 Climate, agricultural potential, land use and risk

Long-term mean annual rainfall at Chivi Business Centre is 545 mm (1913-2001). The rainfall average in Romwe is estimated to be 620 mm, while that in Mutangi is 550 mm — Romwe thus has higher potential for dryland production. On average, 89% of the

annual rainfall at Chivi Business Centre is received during the summer rainy season from November to March. However, rainfall amount, intensity and distribution are highly variable, and inter-annual variation is large (Figure 3). The long-term mean has a standard deviation of 207 mm or coefficient of variation of 38%. Droughts are recurrent in the region, and the most recent in 1991/92 was the worst on record, when only 83 mm of rain fell in the Romwe catchment. Throughout the country there was almost total crop failure, and livestock populations plummeted. Researchers can identify wet and dry rainfall cycles (Moriarty and Lovell 1998), with, for example, the 1970s and late 1990s having above-average rainfall, while the 1980s precipitation was below average. The questionnaire survey captured dryland crop production for the 1998/99 season, a period with 15% above-average rainfall at Chivi Business Centre — a high rainfall year during a wet period. Masvingo is the closest site for which long-duration temperature and evaporation records exist. Monthly average daily maximum temperatures vary between 22°C in June and 29°C in October. Average minimum temperatures range between 5°C in July and 17°C in January.

Figure 3. Annual rainfall at Chivi Business Centre



Communal lands make up 49% of Zimbabwe. Approximately 75% of these lie within natural regions IV and V which are characterised as being unsuitable for intensive farming due to low and variable rainfall, and poor soils. Most of Chivi, including Mutangi, falls within natural region IV, but a central area of hills is more typical of natural region III (characterised as being wetter and more suitable for farming), and it is in this area that Romwe is situated.

In the Romwe area the valley floors, at about 700 metres above sea level (m.a.s.l.), are encircled by relatively steep rocky hills, with summits of about 1000 m.a.s.l. Mutangi is less hilly, with altitudes between 850 m.a.s.l and 950 m.a.s.l. Both areas are underlined by Precambrian gneiss with occasional dolerite intrusions. The former gives rise to nutrient-poor soils, while the latter produces more fertile soils. In Mutangi there are sodic soils in the low-lying areas near the drainage lines, making up 36% of the physical catchment (Gotosa *et al. 1*999). These soils are not cultivated and are easily eroded.

Land use is typical for communal areas in this region, with rainfed cultivation and rough grazing dominating the landscape. In Romwe the rainfed cultivation is on the valley floors with grazing in the densely wooded miombo woodland in the hills (Figure 4). In Mutangi the landscape is gently undulating; the few hills have some grazing and degraded woodland, but more important for grazing are the areas covered by degraded mopane woodland on sodic soils along the water courses (Figure 5). Households also have small garden plots either close to their homestead and fed by wells or near key water points.

Figure 4. The view south-east from the top of the Romwe inselberg (photo: Patrick Moriarty)

Figure 5. Gently rolling landscape in Mutangi showing areas cleared of woodland for dryland crops and strips of *Colophospermum mopane* in the low-lying areas along streams (photo: Martin Hodnett)

Risk and uncertainty are endemic to such dryland farming systems (Scoones *et al*. 1996). Rainfall is the key resource in semi-arid rainfed agriculture. Thus when the rains arrive, how much rain falls, how it is distributed within the season and when the season ends are critical to the production achieved. The nature of a season is unpredictable, but more often than not rainfall is insufficient or poorly timed. Studies at Romwe have found that too much rain can do as much damage as too little, and when the rain arrives can be as important as how much falls (Moriarty and Lovell 1998). Crop failure in the Romwe catchment, on the gneissic soils, is as likely to follow from waterlogging due to too much rain as from drought. Rainfall is not the only component of risk and uncertainty; others include fluctuations in input and commodity prices, pest and disease outbreaks (for humans, livestock or crops), and the condition of the country's macro-economy (which determines, among other things, levels of remittances and availability of non-farm employment). In an area where off-farm work and remittances are often critical, a sudden decrease in employment can have as devastating an effect on livelihoods as a drought or flood.

Our data are generally presented for four quarters of the year, corresponding to the enumerating schedule. During quarter 1 (March to May 1999) at the start of the dry season, rainfed crops were being harvested and, where possible, marketed. During quarter 2 (June to August 1999) people turned to irrigated production in small garden plots and other non-farm activities (brick moulding, building, thatching and various woodland-related activities). In the third quarter (September to November 1999) dryland fields were being prepared for planting and the irrigated gardens were maintained. The fourth quarter (December 1999- to February 2000) was the height of the growing season for the rainfed crops.

2.5 Institutional framework

During the colonial period, legislative controls on woodland use were established, starting with the Native Reserve Forest Produce Act in 1928, and subsequently the Natural Resources Act (1942) and the Forest Act (1948). These Acts increased State control over natural resources (largely woodland resources), especially in the communal lands. Traditional leaders, together with government extension agents, were responsible for enforcing rules governing woodland use in the communal lands. The traditional authority was also responsible for tax collection and overseeing other administrative responsibilities. The traditional structure consists of a hierarchy of chiefs, headmen and, at the local level, *sabhukus* (kraalheads).

At independence one of the first major policy initiatives was to change the governance structure for communal areas, with consequent changes to natural resource institutions (Mandondo 2001). Through the District Councils Act (1980), the Communal Areas Act (1982) and the 1984 Prime Minister's Directive on Decentralization, the power to allocate land was removed from traditional chiefs and headmen and given to the District Councils. In addition, local organisations known as the Village Development Committees (VIDCOs) and Ward Development Committees (WADCOs) were established. These formed a parallel institution to the traditional authority already in place at village level. WADCOs and VIDCOs are elected bodies and have the responsibility to spearhead development in areas under their jurisdiction as well as monitor natural resource use and land allocation. These new administrative structures further stripped traditional authorities of their powers. In 1998 the government revised the position of the WADCOs and VIDCOs, having seen that they were ineffectual. This has restored some of the authority of the chiefs through the enactment of the Chiefs and Traditional Leaders Act (1998). However, the legislation now supports two power structures, the traditional structures and the VIDCO/WADCOs, without clarifying the various roles and responsibility. It should be noted that even when such powers as land allocation were withdrawn, the traditional authority continued to exert an influence, albeit with less absolute powers than before.

Decentralisation is now high on the agenda of the State, inspired in part by the appeal of an international''back to the people' option that is a potentially more ethical and effective alternative to centrally directed management of natural resources (Mandondo 2001). Of late a new rural development thrust, coming with structural adjustment programmes, has also encouraged cash-strapped governments in many African countries to decentralise by passing on some roles to lower levels of government. In spite of the envisioned merits of decentralised natural resource management, experience in Zimbabwe generally suggests that the State is reluctant to relinquish power and control. The State view of appropriate management of resources still appears to extend to local communities through a centrally directed structure and process. Effective control is still largely vested in the State or bureaucracies under its direction like the Rural District Councils. State regulation is, however, severely undermined by its inherent incapacity to assert effective control.

The communal lands are officially State land but managed by a combination of modern and customary law. Considerable responsibility now resides at the district level, where the Rural District Council is able to mobilise limited funds for development activities and provides the legal framework for resource management (through by-laws) (Mandondo 2001). People in the study area complain that they have minimal interaction with the district officials, and it is blatantly obvious that the by-laws have almost no function in the village settings. The *de facto* rules and regulations operating at the village level are centred on the traditional authorities (Mandondo *et al*. 2002; Nemarundwe 2002c).

2.6 The national economy

Like other post-independence African countries, Zimbabwe has been implementing various macro-economic policies in an attempt to improve the welfare of its people. Two diametrically opposite policy regimes were implemented in the first two decades of independence. In the 1980s fiscally driven redistribution, import substitution and government controls were adopted, while in the 1990s emphasis was on getting prices right, through structural adjustment programmes. Neither yielded the desired outcomes. The period immediately after independence in 1980 saw major improvements of social services, such as health, education and infrastructure. Agriculture also performed very well in the first half of the 1980s (Rukuni and Eicher 1994). However, in the second half of the decade, the economy declined, forcing the government to adopt (in 1991) an Economic Structural Adjustment Programme (ESAP), designed with assistance from the World Bank and the International Monetary Fund (Addison 1996; World Bank 1996).

While the reform programme may have had a series of positive impacts on the large-scale commercial farming and manufacturing sectors (Addison 1996; World Bank 1996), a central question is whether the programme, as implemented in Zimbabwe, has had positive or negative impacts on the rural smallholder sector. The first half of the 1990s was marked by decreasing subsidies for farming inputs and social services, increasing unemployment, declining real wage levels and, presumably, decreasing remittances (World Bank 1996; Oni 1997). Most African countries introduced liberalisation measures, in response to both internal and external crises resulting from increases in the price of petroleum, adverse commodity terms of trade, wars and political upheavals, droughts, wrong domestic policies of overvalued exchange rates, subsidised imports and distorted factor market prices, overextended and inefficient public sectors, and poor bureaucracies (Wangwe and Musonda 1998). The ESAPs were intended, but largely failed, to integrate the African economies into the global economy, since adjustment measures such as trade liberalisation help open up economies and at the same time expose domestic industries to external competition. Debate about the social and distributional impact of reforms has accompanied economic reform programmes from their inception. For example Ahmed and Lipton (1997), in reviewing the literature on the impact of structural adjustment on sustainability of rural

livelihoods, conclude that there is no systematic improvement or decline in rural livelihoods as a result of adjustment measures.

In the late 1990s and into the 21st century the economy declined even further, when drastic moves were taken by government to win the votes of the populace in the face of declining popular support and the threat of election defeat. In addition, the large expenses committed to the civil war in Congo stretched the national coffers. This period saw massive inflation (57% in 1999, 60% in 2000, rising to over 100% by 2001), collapse of many industries, including the tourist industry, rapid rise in unemployment, subsequent massive movement of young able-bodied men to South Africa (especially from late 2001) and breakdown in law and order. Our quantitative survey data comes from March 1999-February 2000, so we largely missed the major meltdown in the economy, but the qualitative data continued to the end of 2001.

The average annual growth in real GDP between 1979/80 and 1998/99 was just under 2.2%. Growth rates of more than 7% per annum were achieved only in 1979/80 (10.7%), 1980/81 (9.7%), 1984/85 (7.6%), 1987/88 (7.3%), 1993/94 (7.8%) and 1995/96 (8.5%). In most cases, these apparently impressive growth rates merely reflected low GDP in the preceding year due to factors such as drought. At the time of our quantitative survey the GDP growth was 0.1% in 1999, 4.9% in 2000, and a further such decline was expected in 2001.

2.7 Why Chivi and why two case-study sites?

The research on livelihoods was conducted within the framework of a much larger research project on micro-catchments and common property resources. The Institute of Environmental Studies (University of Zimbabwe) led the work, in close collaboration with the Department of Research and Specialist Services (Zimbabwe Ministry of Agriculture), Centre for Ecology and Hydrology (UK) and the Center for International Forestry Research. CARE led development work in both catchments, as part of a much larger development project throughout Masvingo Province, in which small dams were rehabilitated, irrigation was introduced or improved, and organisations were facilitated to provide local management.

In many parts of the world there are vast shields of igneous and metamorphic rocks. The most common of these 'hard rocks' are granites and gneisses. Large parts of this geological type lie in least-developed, semi-arid regions. This is especially true in parts of Brazil, peninsular India, Sri Lanka, Korea, China, the Red Sea region, West Africa and much of central, eastern and southern Africa (Lovell *et al*. 2002). Chivi is relatively typical, from a biophysical perspective, of this vast domain (Lovell *et al*. 2002). Within Zimbabwe, Chivi is similar to large portions of the communal areas running from the north-west, down the central and eastern areas to the south of the country.

Rather covering many locations in Zimbabwe (and beyond) we decided to focus our work, providing the opportunity for in-depth understanding through frequent returns to the same households and living at the study sites. We selected two sites to provide some degree of contrast, while choosing nearby sites for logistical reasons. Romwe was selected as it had a history of relevant research, while Mutangi was a contrasting site with greater levels of land degradation, lower rainfall and, possibly, a poorer community. We hypothesised that in Mutangi, with its harsher conditions than Romwe, there would be less intensification of land use and there would be greater poverty; thus allowing us some insights into household variability in relation to site differences.

While being empirically based we have attempted to focus on processes of relevance to semi-arid regions elsewhere in Zimbabwe and beyond. From the specific characteristics of Romwe and Mutangi, relating to site and history, we have attempted to derive principles relevant to policy in semi-arid regions generally. Instead of engaging in the development rhetoric based on generalisations, we enter the debate from an attempt to understand the intricacies of everyday life.

3. Methods

3.1 Livelihood questionnaire data collection

In order to collect data to support the livelihood analysis, a household questionnaire was designed and administered. The survey paid particular attention to the need to ask questions that did not require long-term, detailed memory, and were therefore answerable with a high degree of accuracy. Therefore, highly disaggregated data were collected, and then aggregated by the analysts. The uniqueness of the survey has to be noted. The survey followed the methods of Cavendish (1999a; 2002a), with some modifications that we believe are improvements. Cavendish (1999a) notes that such survey instruments lead to unique empirical results; very few of the resource-use patterns recorded would be captured in standard household budget surveys (e.g., collection of wild fruits, collection of poles). Standard surveys consistently underestimate woodland-based income; hence overestimating agriculturally based income. Cavendish (1999a) paid particular attention to design recall periods to capture the use of products that is seasonal, casual and small. For some variables we recorded both three-monthly and weekly recall data. The three-monthly recall results proved to return much lower estimates than those based on one-week recall. As many of our results are based on the shorter recall periods, we believe we have achieved greater accuracy. Particular differences to the methods of Cavendish (2002a) were the attention to labour (he collected no labour data) and our collection of data on goods and services derived from livestock (he only collected numbers of animals and cash sales). The price of detail in a questionnaire, with up to 24 visits per year to sampled households, is respondent fatigue and very time-consuming data capture and analysis. The household survey was designed to be completed in less than one hour at a household during the first round of each quarter. The subsequent six rounds in a quarter were quicker (often less than half an hour). Nonetheless, halfway through the survey it was judged that households needed to be compensated for participation in the survey, and households subsequently received a small gift of appreciation per quarter (a packet of *kapenta* dried fish valued at Z$65). Despite more or less fulltime attention to data entry, cleaning and analysis, some of the more complicated modelling is only now being undertaken, more than two years after the final data were collected (Moyo, forthcoming; Zindi, forthcoming). One limitation of this work is that we pay scant attention to intra-household decisions and allocation patterns.

3.1.1 The field survey and the recall periods

The survey was conducted as a quarterly household income and expenditure survey, over 15 months from late 1998 to early 2000 (Table 1). The focus of the survey was on tracking how households use their available resources in the pursuit of livelihoods, and the returns that they receive from these activities. Because of the seasonal variability facing these villages, data were collected quarterly. The first visit (round) in each

quarter was structured around major activities for which households could reasonably be expected to remember over three-month periods. The subsequent five visits (rounds 2-6) in a quarter collected information from short recall questions — for example, obtaining estimates of labour inputs for the previous 24 hours, thereby providing five days of labour data per household per quarter.

The nomenclature used in Table 1 for quarters and rounds is somewhat confusing when it comes to reconstructing a year of data. 'Quarter 1, Round 1' and 'Quarter 1, Rounds 2-6' represent the field schedule for enumerators. In 'Quarter 1' the three-

Table 1. Household survey structure

Survey segments	Date conducted	Dates covered	Type of Data Collected
Quarter 1			
Round 1	March 1999	Starting conditions; monthly activities from Dec. 98 to Feb. 99; weekly activities for a week in March 99	• Background information on the household (shelter, land size, demography); • Three monthly recall on large items, including remittances, salaries, wages, dryland crop production, major input costs, livestock dynamics, wood use patterns. • Weekly recall on other items (smaller items that are not easily remembered over a month), including garden production, livestock production (milk, draft etc.). • Water use (not quarter specific)
Rounds 2-6	March to April 1999	March to April 99	• Weekly recall questions covering woodland harvesting, purchases of inputs, income sources for a male, female and child in the household • Daily recall for labour (i.e. what was done the previous day), for a male, female and child in the household
Quarter 2			
Round 1	June 1999	Monthly activities from March to May 99; weekly activities for a week in June 99	• Same items as for Quarter 1, Round 1, but excluding the background info that was relatively constant • Quarterly water use patterns
Rounds 2-6	June to July 1999	June to July 99	• Same items as for Quarter 1, Rounds 2-6
Quarter 3			
Round 1	Sept. 99	Monthly activities from June to Aug. 99; weekly activities for a week in Sept. 99	• Same items as for Quarter 2, Round 1
Rounds 2-6	Sept. to Oct. 99	Sept. to Oct. 99	• Same items as for Quarter 1, Rounds 2-6
Quarter 4			
Round 1	Dec. 99	Monthly activities from Sept. to Nov. 99; weekly activities for a week in Dec.	• Same items as for Quarter 2, Round 1
Rounds 2-6	Dec. 99 to Feb. 2000	Dec. 99 to Feb. 2000	• Same items as for Quarter 1, Rounds 2-6
Quarter 5			
Round 1	April – May 2000 for Mutangi, and April to July 2000 for Romwe	Monthly activities from Dec 99 to Feb 2000; weekly recall for the time when the survey was done.	• Covered the same items as for Quarter 2, Round 1. • Additional background information for households (e.g. village name, organisations involved in, access to collective gardens)

month recall covers the period December to February, but the weekly and daily recall questions (Rounds 2-6) cover weeks and days during the time of the surveys (i.e., in March and April; see Table 2). In reconstructing a year of income and expenditure, the weekly and daily recall questions from Quarter 1 rounds are to be matched with the three-month recall questions for Quarter 2 Round 1. Thus the first quarter for which we have a full set of data on all questions is March to May 1999. This necessary overlap created the need to conduct a '5th Quarter, Round 1'. The above overlaps meant that some data were not used when constructing annual budgets. However, the data were not completely discarded in that they were used for specific purposes and/or for checking consistency of results.

Table 2. Reconstruction of quarterly data

Survey instruments (see Table 1)	Date collected in the field	Three monthly recall variables used for:	Weekly and daily recall used for:
Q1R1	March 1999	—	Mar-May (Quarter 1)
Q1R2-6	Mar-May	—	Mar-May (Quarter 1)
Q2R1	Jun	Mar-May (Quarter 1)	June-Aug (Quarter 2)
Q2R2-6	Jun-Aug	—	June-Aug (Quarter 2)
Q3R1	Sept	June-Aug (Quarter 2)	Sept-Nov (Quarter 3)
Q3R2-6	Sept-Nov	—	Sept-Nov (Quarter 3)
Q4R1	Dec	Sept-Nov (Quarter 3)	Dec-Feb (Quarter 4)
Q4R2-6	Dec-Feb	—	Dec-Feb (Quarter 4)
Q5R1	Apr-May 2000	Dec-Feb (Quarter 4)	—

Table 3. Original sample of households in Romwe and Mutangi villages

Village name	Number of households sampled	Village name	Number of households sampled
Romwe		Mutangi	
Chikanda	22	Chimuti/Zivengwa	7
Dhobhani	10	Ngindi/Mubviigwi	4
Sihambe	11	Venganai/Murazvo	2
Matenhese	8	Hlanga	16
Tamwa	17	Masimba	4
Ndabaningi	22	Chidanhika/Vurayayi	5
Munikwa	6	Mafuka	3
Puche	17	Matangani	4
Joni	8	Madamba/Tapera	2
Magomo	4	Tambu	9
		Gwarisa	9
		Tichagwa	6
		Hwari	11
		Mudzingwa	11
		Manikayi	4
		Chimwa/Njini Zivanai	11
		Mutangi	12
		Pedzisai	0
	Total	245	

Weekly recall is important for collecting accurate data but one needs a large number of such recall events in any single year. We had 20 rounds of weekly recall data for the year of the study for most variables, but we did have a problem with livestock (for draft, transport and milk) and gardening. The weekly data for these activities was collected in Round 1 with the other agricultural data, and so was only done four times per year. This was particularly a problem for draft, which is used at a very specific period of the year and then only for a short time. As the weekly data for the December to February quarter covered the period of high use in December, we assumed our weekly recall was an appropriate figure for that month but for the other two months in the quarter we assumed they were the same as the average for the next quarter.

3.1.2 The sample

The Romwe area contained 417 households in 10 villages, with three of the villages falling, at least partially, in the physical catchment of the Chidiso collector well (Tamwa, Dobhani and Sihambe). The Mutangi area contained 453 households in 18 villages, with at least five villages being partially or completely in the physical catchment of the Mutangi Dam. A complete household list was compiled for the villages and a stratified random sample was taken with households selected from each of the villages in proportion to the total household number in a village (Table 3). In Mutangi one of the 18 villages in the area (Pedzisai) was not in the original village and household listing for the catchment, resulting in Pedzisai households not being sampled. The distribution of households within the villages is shown in Figure 23 and Figure 28.

The target sample size was 125 households each from Romwe and Mutangi. Contact was made with 245 households in total in the first round of the questionnaire. Because of enumerator problems in the third quarter in Mutangi, a number of cases had to be deleted from the final data compilation. Thus the final data matrix has 124 households in Romwe and 75 in Mutangi (total 199). For a number of analyses it was possible to use the full data set when annual statistics did not need to be compiled from third-quarter data.

3.1.3 Enumerators and supervisors

Ten enumerators were selected from applicant pools of young adults in each area. The enumerators were trained over a week-long intensive session that included numerous pre-tests of the questionnaire. The enumerators were trained to administer the interviews in English and in Shona, the local language. Each enumerator was assigned approximately 25 households that were contacted repeatedly as described above. Supervision took place at a number of levels. The research assistants based at the study sites made random checks and weekly follow up on enumerators. Post-fieldwork coding was conducted in Harare, during which errors and contradictory answers were identified. Questionnaires with problems were returned to the field supervisors and enumerators for clarification (and in many cases enumerators had to return to the interviewed household).

3.1.4 Units of goods and services used

To obtain physical measures of production, locally meaningful units were used (e.g., contours to define area, wheelbarrows and carts for amounts of manure). Measurement units that are commonly used by communal households are sometimes not 'standard' units. However, to ensure a common standard by the participants, these locally understood units were used, most of which are based on volume. To assist conversion a separate survey was conducted in which local units were measured in terms of standard units (e.g., kilograms, acres; see Appendix 1).

3.1.5 Surveyed prices

Prices were collected in the household surveys in cases where goods and services were bought and/or sold. Where possible, we have used 5% trimmed means for prices. A trimmed mean is the arithmetic mean calculated after the highest 5% and lowest 5% of cases have been eliminated. Eliminating the extreme cases from the computation of the mean results in a better estimate of central tendency, especially when the data are non-normal (SPSS Version 10). The non-trimmed mean sale price is used in cases with few observations for prices, such that the 5% trimmed mean cannot be computed. In all cases the standard deviations reported are for non-trimmed means. Prices are vary widely across and within years for some goods and services (e.g., Scoones *et al*. 1996), making calculations sensitive to the price variable. For maize, we used two prices: one for dryland maize and the other for garden maize, as each is generally produced at different times of the year, with widely different products and prices (green maize sold from gardens at roadside markets, while dryland maize is sold as less valuable dry maize). Our approach of using a single price across all households probably means that we have reduced the difference between the poor and the rich. Our key informant interviews indicate that the rich hold products (e.g., grain and livestock) until prices are better, both because they have better access to market information (e.g., relatives working in urban areas) and because they have the resources not to make frequent crisis sales. Turner and Williams (2002) document similar phenomena in West African livestock markets in semi-arid regions.

All prices were captured in Zimbabwe dollars, for which the exchange rate conversion was Z$38-40 to US$1 during the time of the survey (Appendix 2). Values reported are all in 1999 Zimbabwean dollars.

3.2 Livelihood questionnaire data analysis

3.2.1 The sectors for analysis

In analysing household livelihoods, we identify seven classes of activities that are subsequently referred to as sectors (Table 4). For some analyses, we subdivide the Domestic sector into sub-sectors of Leisure and sleep, Academic and Basic (i.e., any other domestic activity).

Table 4. Sectors and activities for analysis of household livelihoods

Sector	Activities/products
Dryland crops	Maize, sorghum, millet, groundnuts, etc. (rainfed)
Gardening	Tomatoes, green beans, okra, etc. (irrigated)
Livestock production	Cattle, donkeys, goats, pigs, poultry etc.
Woodland use	Wood and non-wood products including construction wood, fuelwood, thatch, small animals, fruits, mushrooms, etc.
Domestic	Maintenance of basic household health and nutrition including: preparing and eating meals, housekeeping and construction, attending gatherings, travelling, leisure and sleeping, and education
Wage labour and home industry	Wages from local employment (e.g. domestic and agricultural work) and cash- generating home industries such as carving, brick moulding, fixing bicycle/implements, making household utensils from scrap metal, etc.
Remittances and gifts	Cash sent by family members not living with the household, and gifts

Cash expenses and income were tracked for all sectors with a number of questions, some of which overlapped to allow crosschecking. For dryland crops, there was a record of sales of production by crop, using quarterly recall. For the smaller and more continuous production of garden crops, weekly recall data was collected by crop. Quarterly recall was used for large woodland items for construction, but weekly recall also captured this in addition to firewood and the various non-timber forest products. Expenses for large domestic purchases (e.g., school fees) were based on quarterly recall, as were data for remittances and wages. In addition to the above records, data were collected, using weekly recall, for all cash received and expended by source. This was subsequently classified into sectors.

In a number of cases, it was not possible to separate dryland crops from gardening in terms of cash expenses (e.g., fertiliser was purchased and subsequently allocated to different crops but it was not possible for some respondents to accurately apportion the inputs amongst crops for each type of agriculture), time allocated (e.g., marketing of products from both types of agriculture at the same time), or income (i.e., income from both types of agriculture was reported together). Accordingly, we have allocated all 'Agriculture General' into dryland crops and gardening according to the proportions (Table 5) based on the data that did apportion amounts between dryland crops and gardening. We feel that this procedure is justified as the cases of 'Agriculture General' were less frequent than the cases when agriculture was specifically allocated.

Table 5. Proportions used to allocate 'Agriculture General' between dryland crop production and gardening

		Dryland crops as a proportion of dryland crops plus gardening (averaged over all households)
Expenses (quarterly recall data, for items requiring large cash expense)		0.92
Expenses (weekly data)	Child	0.05*
	Female adult	0.75
	Male adult	0.76
Time		Done on a household by household basis using the proportion of time allocated specifically to dryland and gardening
Income (weekly data)	Child	0.45
	Female adult	0.58
	Male adult	0.75

* This would mean that 5% of the child expense figure is allocated to dryland crops with the remaining 95% allocated to gardening

3.2.2 'Income' terminology and the calculation of net income

We use the term income to cover cash income and subsistence (or in-kind) income. We recognise gross and net income. Gross income is the full amount of income without any subtraction of expenses. Net income is exclusive of all cash and in-kind inputs, excluding labour, following the approach of Cavendish (2002a). The exclusion of labour from the measure is the usual approach in rural household studies (Ellis 2000). Gross income was calculated on a sector basis from the stated production figures (e.g., milk consumed and milk sold, manure used and sold, poles used and sold, etc.) and the stated prices. Net income was less expenses recorded in the weekly recall data. A proportion of the expenses was allocated to cash income and the remaining amount to subsistence income, in proportion to the ratio of gross cash income to gross subsistence income for the sector in question. We use the word 'total' to indicate the sum of cash and subsistence income. The concept of net income, as employed here, is a standard measure of welfare, used in most rural income and expenditure surveys. While

consumption is often preferred to income as a welfare measure in household studies (Deaton 1980), in this and other rural studies in Africa the distinction between net income and consumption is not great. This is because some quantitatively economic activities represent both consumption and income (e.g., the consumption of own-produced goods and own-collected woodland products) (Cavendish 1999a). The total gross income is normally compiled from the many components of income within a sector (e.g., livestock income is the sum of income from manure, draft power, milk, transport, etc.). We present gross income data instead of net income (the standard measure) because it would have been extraordinarily difficult to find the expenses for each sub-component (e.g., for livestock, the veterinary costs and all the other costs would have to be apportioned by the components).

3.2.3 Statistical analysis

For the simple case of comparing variation in continuous variables across single factors, one-way ANOVA was used to determine whether differences existed among the means. If a significant difference was found at the 5% level, pair-wise multiple comparison tests were conducted. Multiple comparison tests describe confidence levels for an entire system of intervals, simultaneously, for a given variable. For example, in Table 8, for the variable adult males, there is a system of four confidence intervals, one for each wealth quartile. Several types of multiple comparison tests are available, the appropriate use of which depends on whether variances of the populations are equal. Levene's homogeneity-of-variance test was implemented to test for equality. The Scheffe pairwise test is applied to cases depicting homogeneous variance and the Dunnett C test is applied to cases depicting non-homogeneous variance. For those readers wanting to see standard deviations for all the means that are presented in tables and figures in this document, we have compiled these on the project CD-Rom (Sampurna *et al*. 2002) available from the authors.

Where we analyse differences amongst quarters, we have a repeated measures design, as the dependent variable is measured on the same case. In much of our analysis, 'quarters' is only one of three independent variables, the others being 'wealth quartile' and''site'. Differences due to these variables and interactions among variables were investigated with a single analysis of variance, using the general linear model procedure for repeated measures (the repeated measure being the quarter). In these cases the significance levels for a single analysis are presented across several tables for the different means being compared. For instance, for the single analysis of cash expenses incurred for dryland crops, the statistical results are presented in the first line of Table 19 (effect of quarters), Table 20 (effect of wealth quartile) and Table 21 (effect of site).

We used the gross cash and subsistence income data for the different sectors to classify the households into different types (Section 7). This involved using a multivariate cluster analysis technique, with the similarity between each and every household calculated on the basis of squared Euclidean distance and the households clustered into groups using average linkage clustering. In this way we were able to recognise 10 different types of households, each type with their characteristic set of income sources. The similarities among the different types were explored using principal component analysis with the data in the analysis being the mean gross income levels for each of the sectors.

We have also examined the variation in total net income and net income for different sectors in relation to a variety of socio-economic variables (e.g., age of head of household) by using analysis of covariance, which allows the use of categorical and continuous independent variables (Section 8.3). Where we want to determine what variables relate to the presence or absence of a condition (e.g., being above or below the food poverty line) we have used stepwise binary logistical regression.

All analyses were conducted with SPSS Version 9 or 10. The raw data, various intermediate data files and the command files (all in SPSS format) are stored on the

project CD (Sampurna *et al*. 2002). Two files on the CD describe the survey, one giving further details of procedures in data collection and another providing a guide to the SPSS command files.

3.3 Participatory rural appraisal (PRA), participatory observation and action research

Various participatory tools and techniques were used during the study period. The first major PRA exercises were conducted in late 1998, but throughout the life of the project numerous meetings were held, many of them using PRA tools. A number of key informant interviews were conducted to capture the diversity of and changes in livelihood strategies. Some of these are presented in the boxes of this book as cases studies of households (for others see Nemarundwe 2002b; Sayer and Campbell 2002; Sithole *et al*. 2002). Names of individuals have been altered to maintain confidentiality. In three villages in Romwe, short key informant interviews were conducted with all households to explore the patterns of human mortality in the last few years. From early 1999 to late 2001 one research assistant was based in each of the two villages, so participant observation was extensive and written up in various field and monthly reports. During this period the researchers were accepted as part of the community, especially in Romwe, and participated in all aspects of community life. In addition, a researcher working on the livelihood data was based in Romwe catchment for one year (1999/2000), at the time of the livelihood survey. The participatory tools, the participatory observation and some components of the action research are described in detail in Nemarundwe *et al*. (1998), Nemarundwe (2002a,b,c) and Nemarundwe and Kozanayi (2002).

Action research mainly covered irrigation development, garden expansion, soil and water conservation, micro-credit, tree planting and capacity building of local organisations. Previous research in the area as well as extensive consultation with the community ruled out some lines of action research (e.g., anything relating to livestock or fuelwood; Campbell *et al*. 1997b, 2000a). The action research allowed fieldworkers to be part of real-world allocation decisions. In this action research we were greatly facilitated by CARE, who was implementing a large development project in the area, based on small-dam rehabilitation, while focussing on the sustainable livelihood approach.

3.4 Biophysical resource surveys and the geographical information system

A number of biophysical surveys were conducted, allowing the following data layers in the GIS: land cover, vegetation types, cropping patterns (in a subset of the area), geology, soils, household locations and water sources, as well as the usual physiographic features. We were able to overlay income and other household characteristics on the biophysical data.

3.5 Systems modelling

While it is ideal to collect longitudinal data from households, this is often not possible in the time frame of a single project. We therefore used a systems model to investigate likely impacts of development options on livelihoods (Chapter 10). A systems model was also produced as a means to integrate different components of the project and to integrate the different capital assets and multiple livelihood strategies).

The model development and the actual model are described in detail in Cain *et al*. (2001). Here we give a brief overview. The model was based on a Bayesian Network (BN), which consists of three elements:

- A set of nodes representing management system variables, each with a finite set of mutually exclusive states.
- A set of links representing causal relationships amongst these nodes.
- A set of probabilities, one for each node, specifying the belief that a node will be in a particular state given the states of those nodes that affect it directly (its parents). These are called conditional probability tables and can be used to express how the relationships amongst the nodes operate.

A fully functioning BN is a compact representation of the joint probability distribution over all the variables in the network. Therefore, the impact of entering findings about one of the variables can be observed as it affects the marginal probabilities of the other variables in the network. The software used in this study is called Netica and is produced by the Norsys Software Corporation (www.norsys.com). Three workshops were held over a period of two years (two of these also had agenda items other than modelling). At the first, representatives of all stakeholders in the project were asked to list all the things that affected rural livelihoods in the two catchments and to describe the relationships between them. However, as the resulting collection of variables and relationships would have resulted in an extraordinarily complex model, it was used as the starting point from which key variables could be selected, at the second workshop. Subsequently, a prototype model was developed by Jeremy Cain using Bayesian Networks and distributed to the research team for comment and use. The first model was used to explore the impacts of micro-credit interventions (see descriptions of some aspects in Campbell *et al*. 2001a and Sayer and Campbell 2002). On the basis of feedback, a relatively advanced BN diagram was developed and brought to the third four-day workshop, attended by seven researchers in different fields (Jeremy Cain: modeller; Peter Frost: ecologist; Manyewu Mutamba: micro-economist; Alois Mandondo: sociologist; Francis Mugabe: agricultural scientist; Chris Lovell: hydrologist; Bruce Campbell: natural resource scientist) as well as the two research assistants living in the study sites (Witness Kozanayi and Osiman Mabhachi). The team members were then encouraged to change and extend the BN until it met their needs. This model was built to explore our understanding of the best ways too improve the cash income of poor people, as this was considered to be the key to other livelihoods improvements. We also examined 'vulnerability', which is an amalgam of levels of cash income and the resilience of that income. The focus on cash income was partly practical (to simplify) and partly the recognition that cash income is a crucial component of broader livelihood needs (Sections 6.5.1 and 6.5.4).

Once a final model structure had been agreed, the project team specified the functionality of the model by completing the conditional probability tables. This was done primarily using the results of the livelihood questionnaire survey, but other field results were used for specific parts of the model. Where the surveys were unable to provide the necessary information, the expert judgement of the team was used, so some relationships were specified on the basis of limited data. With the model complete, the project team carried out a preliminary exploration of the model operation by changing the value of certain variables in the network and examining how other variables responded to this. Where unexpected results were found, the reasons were identified and either accepted as genuine or corrected as errors. A sensitivity analysis was then performed on the model to identify the variables in the system that control peoples' livelihoods most strongly. The results of the sensitivity analysis were presented to the team. Once again, where surprising results were found, the research team used the BN to explore how these results had arisen. In this way, both the model outputs (in the form of the sensitivity analysis) and the model operation were used to improve the research team's understanding of livelihoods in Romwe and how resource management strategies might enhance them.

Model building was thus an iterative process; it provided insights that changed the way the project was being implemented and, with a deepening understanding gained from various aspects of fieldwork and data analysis, the model was improved.

4. The wealth index and its variation

In conducting the analyses in this paper, we were interested in how income sources differ amongst households. While we return to the topic of differentiation in detail in Chapters 7 and 8 , here we need to introduce one of the major differentiating factors: asset status, as this will be used in the descriptive results presented in the subsequent sections. Wealth ranking, a PRA technique, was undertaken for three villages centred on the Romwe physical catchment to explore local perceptions of household stratification. The key informants regarded 'wealth' as the main differentiating factor. In the wealth ranking, 10% of the households were classified as rich, 19% as average, 36% as poor and 35% in the poorest category. Variables identified by the key informants as important in distinguishing households were: type of shelter; livestock numbers; ownership of farm implements; yields achieved from dryland production; amount of remittances received; degree of food security; ability to offer food to guests; nutritional status of the family; level of education of children; and the kinds of schools children attend.

Cavendish (1999a,b, 2002a,b), in his excellent household studies from nearby Shindi Ward in Chivi, used wealth quintiles to explore patterns of income distribution. We undertook a preliminary questionnaire analysis and identified wealth status as the most important factor to be considered in describing household livelihoods (more important than variables such as the age and sex of the household head, site, household size, etc.).

It was thus necessary to develop some means of differentiating wealth levels among households, and to do this we developed a wealth index based on household assets. We could not use wealth ranking from PRA, as the household survey covered an area that encompassed more households than could be included in a wealth ranking exercise. The wealth index we developed uses variables that were identified as important criteria in differentiating households in the PRA wealth ranking.

4.1 Creating the wealth index and wealth quartiles

The wealth index was created using Principal Components Analysis (PCA). This technique involves combining several original variables into a few derived variables. In this case, there is a single derived variable, which is interpreted as a wealth index. Original variables investigated include: area of dryland fields; area of irrigated land; type of shelter; remittances in the period December 1998 to February 1999; number of cattle; number of goats; number of donkey; number of various types of productive equipment (e.g., machete, wheelbarrow, plough, etc.); and number of various types of household equipment and furniture (e.g., mortar and pestle, sewing machine, etc.).

Several analyses were conducted in creating the wealth index. In the initial analysis, the first principal component (the derived variable) accounted for 21% of the variation in the original variables and had high loadings for many of the variables.[5] In particular, number of beds, chairs and cattle had loadings ≥0.70. Because the number of beds and chairs were probably more related to household size than wealth, in the second analysis these kinds of variables (e.g., beds, cooking pots, chairs, tables) were removed. In this second analysis variables with loadings of ≥0.45 were identified, and these variables were used in the third analysis.[6]

In the third analysis the five variables with the highest loadings were number of cattle (the coefficient for this variable in the principal component was 0.19), ownership of scotchcarts (0.19), ownership of wheelbarrows (0.17) and type of shelter (0.16). Scoones (1995) also identified these variables as wealth-related. Other variables included in the analysis but with lesser loadings were ownership of televisions (0.15), ownership of sewing machines (0.14), number of goats (0.12), ownership of solar panels (0.12), number of donkeys (0.11), ownership of radios (0.11), ownership of drums (0.11), ownership of ploughs (0.11) and ownership of spades (0.07). To calculate the wealth index these coefficients are multiplied by the standardised values of the respective variables. The wealth index accounts for 31% of the variation in the original variables used in the analysis. It was used to divide the sample of 199 cases into wealth quartiles with 49 to 50 households in each.

While it may have made sense to have classes that were not equal in size, it is more appropriate from a statistical perspective to have equal-sized classes, and we cannot assume that the four unequal-sized classes recognised in the PRA wealth ranking in three villages apply to all the other villages. We did explore different ways of constructing the wealth classes, including the use of classes defined by 'natural' breaks in the wealth index, but settled on the current system after much preliminary data analysis.

4.2 Wealth quartile characteristics

The distribution of households among wealth quartiles is almost identical in Romwe and Mutangi (Table 6). There was no significant statistical difference in the wealth index between Romwe and Mutangi (one-way ANOVA, F = 0.14, df = 1 & 197, p > 0.1). However, this finding should not be interpreted to imply that the composition of wealth is the same in both sites. There are more cattle and larger areas of dryland fields and gardens in Mutangi than in Romwe (Table 7). However, field sizes are not necessarily wealth related; they are probably larger in Mutangi because of the predominant nutrient-poor soils, resulting in more extensive production systems, with a higher proportion of fallow land. In addition, Mutangi has less hilly terrain than Romwe and more cultivatable area.

Table 6. Distribution of Romwe and Mutangi households by wealth quartiles (% of households)

Areas	Lowest 25%	25-50%	50-75%	Top 25%		Sample size
Romwe	25	23	26	26	100%	124
Mutangi	24	28	24	24	100%	75
Overall	25	25	25	25	100%	199

Table 7. Differences in wealth indicators between Romwe and Mutangi

Variables		Romwe	Mutangi	Significance (One-way ANOVA, F test for continuous variables; X^2 test for categorical data)
Dryland field areas (acres)		5.1	7.0	***
Garden areas (acres) (*% ownership of gardens*)		0.37 (*77%*)	0.52 (*85%*)	*** (NS)
Cattle numbers (*% owning*)		2.8 (*52%*)	3.9 (*65%*)	* (NS)
Ownership (% of households in the study area owning)	Scotchcarts	42	31	NS
	Wheelbarrows	75	88	*
	TVs	10	6	NS
Shelter type (% with metal or asbestos roofing)		38	33	NS

NS = level of significance is < 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%

5. Human, financial, physical and natural capital — the assets available to households

Households use a variety of resources as inputs into their production processes as they attempt to meet and extend their livelihood needs. These can be classified as human, financial, physical, natural and social capital, as has been popularised in the sustainable livelihoods approach (Carney 1998). We have used the five capital assets as a means to structure this chapter, as it ensures that all the components of the livelihood assets are addressed. Similarly, in our modelling endeavours we have used the capital assets framework as an organising principle. By breaking down the assets into different components one risks having a disaggregated rather than an integrated perspective. Thus in the last Section (5.6) of the chapter we return to an integrated perspective of households and their assets. In that section we point to the emerging temporal trends, the manner in which household assets are inter-substituted and the major axes of differentiation that are apparent. Some limitations of the capital asset framework also emerge (Section 5.1.6).

As households make choices about how to use their resources to further their livelihoods, the allocation of human capital, chiefly labour, is arguably the most important resource decision (Mortimore 1998). We give this decision considerable attention. Decisions regarding investments in financial capital tend to play a lesser role, as the scarcity of cash prevents frequent and large investments. Furthermore, limited availability and transferability of natural capital prevents frequent and major decisions regarding land allocations. In this Chapter we describe the capital assets, and in Chapter 6 we describe how the assets translate into production.

5.1 Human capital

In semi-arid systems labour can often be regarded as the chief resource available to households (Mortimore 1998). We begin below by investigating household size, composition and health. Next, we discuss how investments in human capital are made through education. We then investigate how households allocate their time between alternative activities. The next section looks at the seasonality of the opportunity cost of labour, in order to explore whether there are particular labour bottlenecks. We then investigate the extent to which households may go beyond the labour resources available within their households, by hiring outside labour. The final section summarises and indicates the need to broaden the concept of human capital to human capability.

5.1.1 Household size, composition and health

Households comprise an average of 6.51 members. Wealthier households tend to have more adult males and females, while there are no differences for children and minors amongst wealth quartiles (Table 8). In other words, households with more adults appear

to be able to create more wealth, while children do not appear to contribute to household wealth. As household resources are invested in children, returns to households appear to be received when they mature and can contribute more towards household production as adults. Consistently for all wealth classes there are more adult females than males, a reflection of the greater degree to which males move from the household on a relatively permanent basis to take up employment in urban areas, on mines and on large-scale commercial farms. Our case studies show that women are increasingly moving into long-distance trading of a wide variety of farm and non-farm products (e.g., garden produce, second-hand clothes, non-timber forest products). This requires that they move temporarily to other areas, but they seldom move away permanently.

Table 8. Household composition by wealth quartile

Variable	Lowest 25%	25-50%	50-75%	Top 25%	One-way ANOVA, F test
Number of adult males[1]	1.2[a]	1.5[ab]	1.3[ab]	1.7[b]	*
Number of adult females[1]	1.5[a]	1.8[a]	1.8[ab]	2.4[b]	***
Number of children[2]	1.7	1.9	1.9	1.8	NS
Number of minors[3]	1.5	1.3	1.5	1.2	NS
Total number of household members	5.9	6.5	6.6	7.1	NS
Sample size	49	50	50	50	

Dunnett C test: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; NS = level of significance is < 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%; [1] Males or females 16 years; [2] Children who are 10 – 16 years; [3] Children under 10 years.

We did not conduct any health surveys, but during the period of participatory fieldwork, an increase in funerals became apparent. It is not possible to attribute the deaths with absolute certainty to the HIV/AIDS pandemic, as it is unacceptable to openly discuss the cause of death. However, it is clear that the majority of the deaths are associated with HIV/AIDS-related diseases. In the three villages centred on the Romwe physical catchment, we surveyed all households for mortality in the previous 4 1/2 years (1997 to mid-2001). Twenty-four per cent of households lost a member, with an average of 20 deaths per 1000 persons per year, twice the national average at the time of the last census (1992). The current rate in Romwe is probably much higher, as many of the deaths were recorded in the last two years. Some families have lost between three and seven members. The demographic impact is reduced family sizes and a higher dependency ratio (other impacts are discussed in Section 9.2.4).

5.1.2 Education

Households may undertake significant investments in terms of school fees, uniforms, school supplies, and forgone labour, in order to educate family members. While there is no difference among wealth quartiles at levels of primary education, secondary education is associated more with higher wealth households, while no education is more associated with the lowest quartiles (Table 9). The number of family members with post-secondary school education is extremely low. Zimbabwe had an extremely strong drive to provide education for all after independence, as reflected in the number of people with primary school education. The current trends are worrying as increasingly children are being withdrawn from school, especially secondary school, due to the introduction of school fees and the fact that households have less disposable income. Shocks such as the death of breadwinners may also result in withdrawal from school (e.g., Box 13). Lack of employment opportunities in the country has also discouraged children from completing the basic four years of secondary education. It is now common to hear young children querying why they should keep on going to school given that their older brothers and sisters, who completed secondary and even tertiary education, are unemployed. Rather than 'waste' time and school many decide to join the exodus to South Africa seeking jobs.

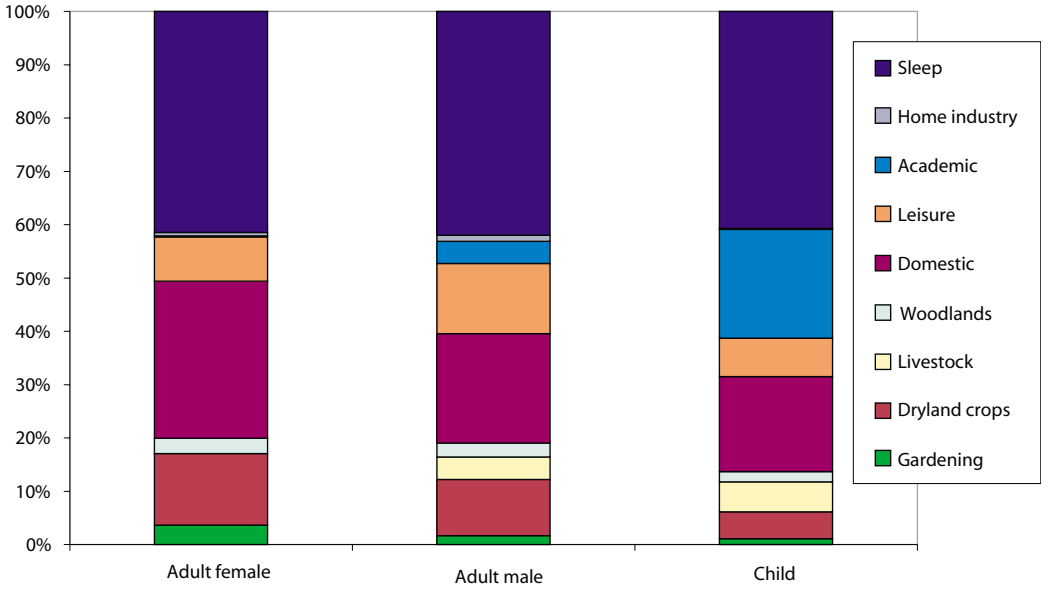
Table 9. Education level by wealth quartiles

Variable	Lowest 25%	25-50%	50-75%	Top 25%	Mean (all households)	One-way ANOVA, F test
Number of household members with no education	1.5[a]	1.5[a]	1.3[ab]	1.0[b]	1.3	*
Number of household members with primary school education	3.5	3.4	3.2	3.5	3.4	NS
Number of household members with secondary school education	1.0[a]	1.6[b]	2.1[bc]	2.6[c]	1.8	***
Number of household members with post-secondary school education	0	0.02	0	0.04	0.02	NS
Sample size	49	50	50	50		

5.1.3 Household use of time

Household labour resources, described above, may be used in numerous activities to contribute to household livelihoods. As these activities are known to vary seasonally, and by age and gender, data on time spent in various activities were collected to analyse potential differences. In, this study, we are dealing with time units and not energy units — the pattern for energy allocation could be quite different as various activities have very different energy requirements. After sleep and domestic activities, dryland crop fields receive the most attention in terms of time (Figure 6). Domestic activities include gatherings for meetings, funerals, etc — this is important in building social capital. Males contribute 18% less time to agricultural and domestic activities than do females, spending more time on leisure and academic pursuits. Numerous

Figure 6. Average time allocation (hours per day) for females, males and children in 1999-2000



Means for the various activities were different amongst the three categories (females, males, children) in all cases, except for sleeping and woodland between males and females, leisure and sleep between females and children, and livestock activities between males and children (Dunnett C test). Standard deviations for all the means that are presented in tables and figures in this document have been compiled on the project CD-Rom (Sampurna *et al*. 2002).

men spend this extra leisure time at the nearby beer halls or business centres, many times to near midnight. It is not befitting respectable women to remain out so late. Females contribute much more to dryland and garden production than males, while males spend more time on livestock production. Leisure activities average two days per week, more for males, and less for females. The main leisure days are usually one day over the weekend (to coincide with the day of prayer, depending on the religion) and one day during the week (*chisi* — the traditional rest day). Academic activities are important for children, and secondarily for adult males, with adult females having no time for such activities. Children still contribute a significant amount of time to family labour in spite of the upsurge in school attendance since independence. For example, while females contribute about 50% of a 24-hour day to agricultural and domestic work, children contribute about 30%.

The absolute amount of time given to garden production is not very high, but when the time input to drylands and gardens is calculated on a per area basis, garden production is much more labour intensive (two times more than drylands), with most of this labour contributed by female members. Households in the top wealth quartile appear to allocate much more labour to gardens than households in poorer quartiles, but there is wide variability and the differences are not significant (Table 10). The pattern of labour by wealth class for dryland fields is not as clear, as wealthier households have more labour-saving devices (Table 22) and they hire more labour (Table 17). More time is spent in the fields in Romwe than in Mutangi, and this is significant for dryland crops (Table 11). Traditionally, gardens are the domain of women with the food produced going to domestic consumption. In Mutoko, in north-central Zimbabwe, a project improved garden production and marketing to the point where gardens become lucrative money earners. Men became more involved, with women being allocated some garden land to raise food for the household (Sithole 1999). We interpret the dominance of women in gardening in Chivi (Nemarundwe 2002b) as a sign that garden production in Chivi is not sufficiently lucrative to attract men. It is also noted by local people that men shy away from labour-intensive activities such as gardens, but may be tempted to devote more time to garden production if labour-saving techniques were available.

The biggest seasonal differences in time allocation for all family members appear for dryland crop activities, and for adult males and children in livestock and academic activities (Figure 7, 8 and 9). The usual interpretation is that time is more abundant in the dry season (May to October) — indeed this may be the case for males, as leisure time increases by one to two hours per day, but they also increase domestic and wage-related activities. However, in general, we see that time is at a premium; there are seasonal shifts in time allocation by males and females to different activities, but

Table 10. Differences in labour per acre among wealth quartiles (average hours per acre per household per year)

Variable	Lowest 25%	25-50%	50-75%	Top 25%	One-way ANOVA, F test
Dryland crops	1545	1217	1181	1347	NS
Gardening	2110	2823	2893	3272	NS

NS = level of significance is < 5%

Table 11. Differences in labour per acre among sites (average hours per acre per household per year)

Variable	Romwe	Mutangi	Two-way ANOVA, F test	Site by wealth interaction, F test
Dryland crops	1525	982	***	NS
Gardening	2960	2464	NS	NS

NS = level of significance is < 5%

Figure 7. Average time allocation (hours per day) by females in the four quarters of 1999-2000. All activities, except academic and livestock, are significantly different amongst quarters (ANOVA). Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level (Dunnett C test).

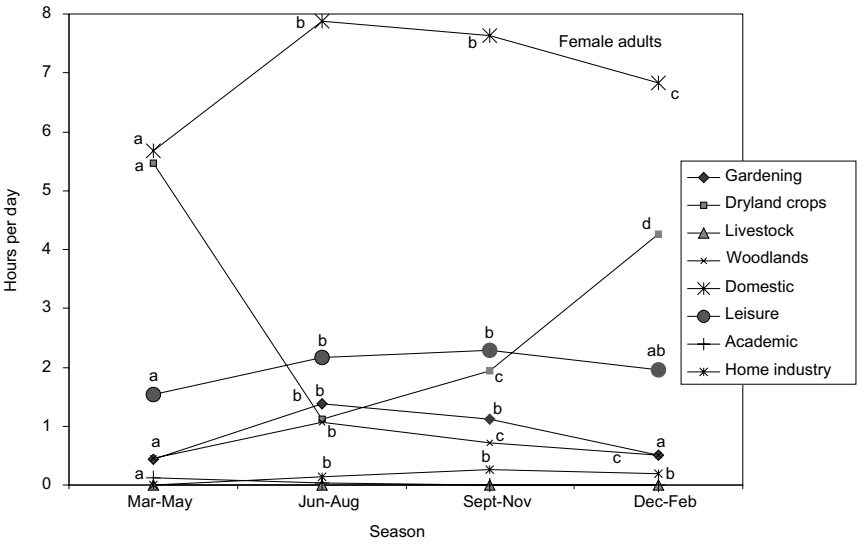


Figure 8. Average time allocation (hours per day) by males in the four quarters of 1999-2000. All activities are significantly different amongst quarters (ANOVA). Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level (Dunnett C test).

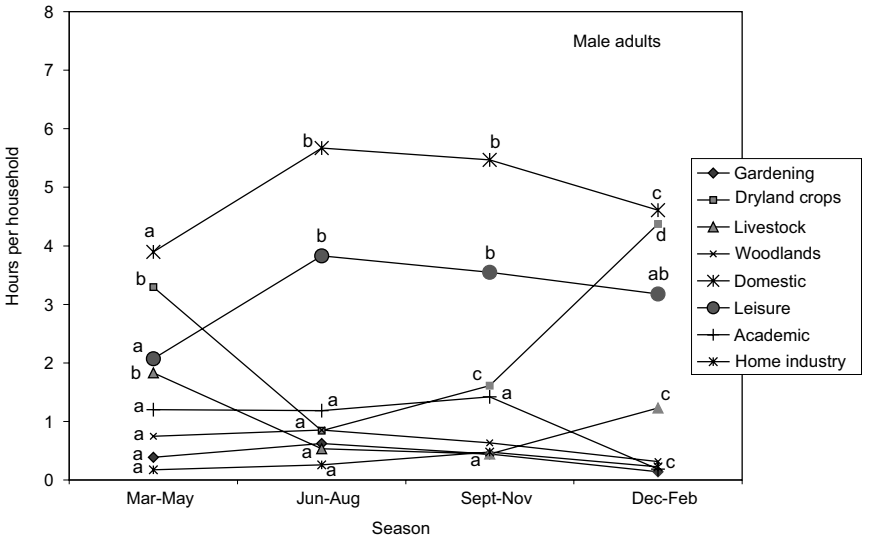
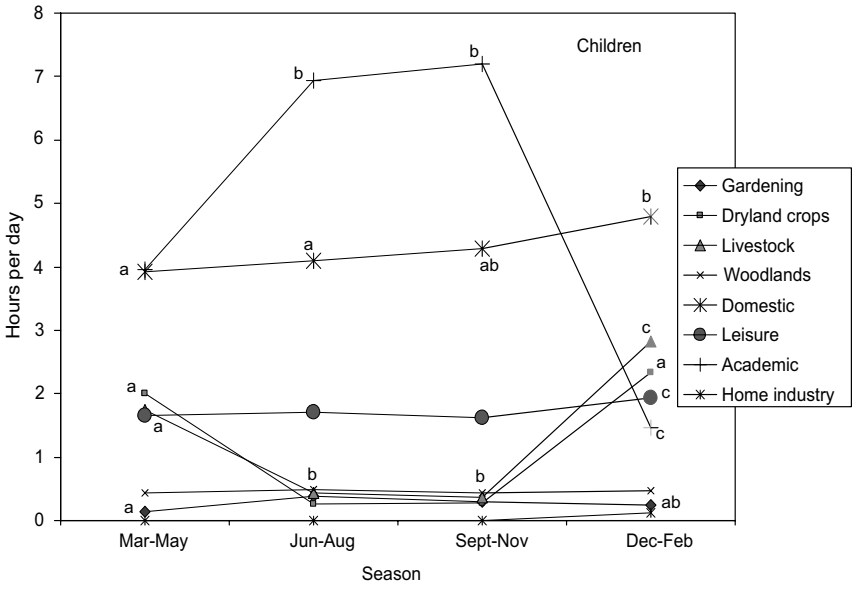


Figure 9. Average time allocation (hours per day) by children in the four quarters of 1999-2000. All activities, except leisure, home industry and woodlands, are significantly different amongst quarters (ANOVA). Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level (Dunnett C test).



large amounts of free time do not exist (we address this in greater detail in Section 5.1.4). Children are withdrawn from school in the wet season (and this is the time of the long holiday) to supplement family labour, especially for dryland fields and livestock herding. There are few fences to exclude animals from the dryland cropping areas, and during the wet season animals are more closely herded so that they do not enter the fields where the crops are growing.

Further analysis was conducted to see whether activities differed among wealth quartiles (Table 12). Time allocated to livestock, gardens and academic work is shown to increase with wealth. In contrast, activities where time increased for poorer households included collection of woodland products.

Table 12. Differences in time use (average hours per day) among wealth quartiles for males, females and children (daily recall data)

Activity	Lowest 25%	25-50%	50-75%	Top 25%	One-way ANOVA, F test
Males					
Garden	0.40^{ab}	0.27^{a}	0.44^{b}	0.50^{b}	**
Dryland crops	2.61	2.50	2.51	2.50	NS
Livestock	0.80^{a}	0.73^{a}	1.10^{b}	1.46^{c}	***
Woodland	0.81^{a}	0.69^{a}	0.65^{a}	0.41^{b}	***
Domestic	4.74	4.94	5.12	4.78	NS
Academic	0.71^{a}	0.69^{a}	0.87^{a}	1.74^{b}	***
Home industries and wages	0.23	0.26	0.37	0.26	NS
Leisure plus sleeping	13.71^{a}	13.90^{a}	12.91^{b}	12.35^{c}	***
Females					
Garden	0.70^{a}	0.84^{ab}	0.96^{b}	0.93^{b}	*
Dryland crops	3.07	3.31	3.20	3.25	NS
Livestock	0.05	0.06	0.06	0.10	NS
Woodland	0.89^{a}	0.69^{b}	0.66^{b}	0.49^{c}	***
Domestic	6.95	6.77	7.09	7.18	NS
Academic	0.01^{a}	0.06^{ab}	0.04^{ab}	0.01^{b}	*
Home industries and wages	0.18	0.10	0.20	0.14	NS
Leisure plus sleeping	12.15^{ab}	12.16^{a}	11.78^{b}	11.80^{ab}	**
Children					
Garden	0.34	0.23	0.24	0.25	NS
Dryland crops	1.33	1.20	1.22	1.07	NS
Livestock	1.22^{ab}	1.09^{a}	1.51^{b}	1.51^{b}	**
Woodland	0.57^{a}	0.43^{ab}	0.39^{b}	0.46^{ab}	**
Domestic	4.34	4.05	4.27	4.41	NS
Academic	4.54	5.18	4.90	5.09	NS
Home industries and wages	0.04	0.05	0.10	0.03	NS
Leisure plus sleeping	11.62^{ab}	11.77^{a}	11.40^{bc}	11.17^{c}	***
Sample size	697	869	840	791	

All Dunnett C tests: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; NS = level of significance is < 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%

5.1.4 Inquiries into seasonality in the opportunity costs of labour

A key question regarding labour and household livelihoods concerns whether there are large seasonal variations in the demands for labour. If labour is severely constrained on a seasonal basis, then new activities or projects that require labour during periods of high demand will be less likely to succeed. In contrast, if projects are introduced

that require labour during seasons of low demand, then they will have a higher probability of success. This assumes that the demand for labour displays significant seasonal fluctuations. An alternative scenario is that households have a suite of labour-using activities that allows them to smooth their labour demands throughout the year. For example, during periods of low labour demand for dryland crops, more time may be spent on gardens, academic endeavours and woodland collection.

The degree of seasonal variation in labour demand was investigated using three approaches: (a) analysis of leisure/sleep time, (b) analysis of wages, and (c) analysis of substitutability of activities.

(a) Analysis of leisure/sleep time

The literature on agricultural household models presents two major approaches to considering leisure in agricultural households. The first set of studies explicitly considers leisure. Such studies include Lau *et al*. (1978), Strauss (1982, 1984), Coyle (1994) and Young and Hamdok (1994). One justification for including leisure is that, in communities where significant off-farm and non-farm income earning opportunities exist, the opportunity cost of leisure is high. As a result, leisure should be included to capture the opportunity cost of alternative time use. This scenario holds in communities where, during the dry season, household members seek non-farm seasonal employment if they have the opportunity.

A second school of thought suggests that leisure need not be incorporated into the analysis of household production. Lobdell and Rempel (1995) argue that leisure can be excluded from household analysis, for two reasons. First, in peasant households the typical tradeoff is between different types of work activities or between more or less work effort, rather than between work and leisure *per se*. The other reason is that in a society where significant amounts of time and effort are invested in the maintenance of social relationships, the distinction between work and leisure becomes problematic. Assuming that leisure can be excluded from the analysis, the amount of family labour devoted to farm and non-farm work can be taken as a close proxy to the total stock of time available to the household.

The first school of thought is consistent with the hypothesis that there is seasonal variation in the demand for labour. It is assumed that during the dry season there is more time available so that household members seek non-farm employment. The second school of thought is consistent with the hypothesis that there is little variation in the demand for labour — that leisure time remains roughly constant, and that relevant tradeoffs are between types of work.

If the hypothesis of seasonal variation labour demand were correct, one would expect to see large and significant differences in the amount of sleep or leisure time that households spend between quarters. If the hypothesis of constant labour demand were correct, small and/or no significant deviations in leisure/sleep time between quarters would be expected.

During the June to November period, when dryland crop and livestock activities are less pressing, adults spend the greatest amount of time on sleeping and leisure (Table 13). In contrast, children spend the most time on sleeping and leisure during the December to May quarters, when less time is allocated to academic activities. Although tests show that all means are not the same, differences in time spent on leisure and sleep between quarters are not large. In particular, for women and children the largest difference between quarters for mean time spent on sleeping and leisure is only 0.7 hours. For adult males, the largest difference is slightly greater at 1.6 hours.[7] Therefore, there do not seem to be important tradeoffs being made between work and sleep plus leisure. Instead, the important tradeoffs seem to be between different types of work. We analyse this further in the following section.

Table 13. Differences in mean leisure plus sleep time (hours per day) by quarter (daily recall data)

Activity	Mar-May	June-Aug	Sept-Nov	Dec-Feb	Repeated measures ANOVA, Greenhouse Geiser F test
Adult female	11.7	12.3	12.2	11.6	***
Adult male	12.4	14.0	13.5	12.9	**
Children	11.8	11.1	11.1	11.8	**
Female sample size	981	944	959	948	
Male sample size	940	886	868	849	
Child sample size	836	815	797	749	

** = level of significance is 1%; *** = level of significance is 0.1%

(b) Analysis of wages

Another way of investigating whether there are slack labour periods is to look at mean wages by quarters. If labour markets were functioning in the area, we would expect that decreased demand for labour during the heavier leisure and sleep quarters for adults (June to November) would lead to reduced wage rates.

In nominal terms, tests show that the mean values between all quarters are not the same at the 1% level, with the highest wages occurring in the September to February period (Table 14).[8] However, it is also apparent that wages generally increase over time. This is most likely due to inflation, which is estimated to have been approximately 60% per annum over the course of the year during which these households were surveyed. Accordingly the tests were also conducted on deflated, real values.[9] Results show that with deflated values, there is only evidence that the mean values are not the same between quarters at the 5% level. Furthermore, only one quarter, September to November, tends to stand out with a high value. However, this period also coincides with the higher sleep and leisure quarters. Increased labour demands for dryland crops and grazing do not lead to higher demand for labour. The wage rate recorded in June to August, was half the minimum wage at that time (Z$130 per day) and was at the lower end of the range of wages paid to unskilled workers in various industries, which ranged from Z$60 to Z$180 in August 1999 (*Financial Gazette*, 13 August 1999).

Table 14. Differences in mean wage rates among quarters

Activity	Mar-May	June-Aug	Sept-Nov	Dec-Feb	Overall	Repeated measures ANOVA, Greenhouse Geiser F test
Nominal daily wage rate (Z$/day)	58	68	106	105	80	**
Real daily wage rate (Feb 1999 Z$/day)	48	49	62	45	51	*
N	110	94	76	67	347	

* = level of significance is 5%; ** = level of significance is 1%

(c) Substitutability of activities

The final approach used to investigate the question of seasonality was an inquiry into the substitutability of activities among household members. In situations where there were no slack periods of labour, one would expect that increased time allocation for one activity would displace time previously devoted to another activity. Therefore, one would expect to see negative partial correlations among activities, signifying that more of one activity is undertaken at the expense of another. In contrast, positive correlations between activities would imply that more of an activity could be undertaken while simultaneously increasing time allocated to another undertaking.

For all males, females and children, negative correlations are much more frequent than positive correlations (Table 15).[10] For example, in the case of males in the March

to May quarter, all activities have negative and highly significant partial correlations associated with dryland crop activities, implying that more time on dryland crops takes time away from all other activities (see Appendix 3). For the few cases where there are positive partial correlations, they are mostly recorded between sleep (not shown in Table 15) and another activity, implying that more sleep may be required after some tasks.

Table 15. Number of paired activities with partial correlations that were negative, positive or not significant at the 5% level (excluding those with leisure and sleeping)

	Mar-May	June-Aug	Sept-Nov	Dec-Feb
Males				
Negative	16	13	15	10
Positive	0	0	0	0
Not Significant	5	8	6	11
Females				
Negative	7	8	8	7
Positive	0	0	0	0
Not Significant	14	13	13	14
Children[a]				
Negative	8	8	7	14
Positive	0	1	0	3
Not Significant	7	12	14	4

[a] Some values for children were not computable because of insufficient numbers of observations.

Combining these results with the leisure plus sleeping analysis and wage tests, it can be concluded that there is little evidence to support the contention that the opportunity cost of labour varies seasonally. Instead, household members seem to be fully employed throughout the year. Therefore, any new activity that requires labour would have to compete with other productive uses of time throughout the year.

5.1.5 Hiring labour from outside the household

What are the conditions of access to non-family labour? In the past some of the labour demands were met by group labour, but the importance of this source of labour has strongly diminished (as is the case elsewhere in semi-arid regions, e.g., Mortimore 1998). Few households hire labour with the result that average amounts spent on hired labour per household are very low (Table 16). There are exceptions — for example, the wealthy retired schoolteacher in Romwe, with access to large fields, hired a local church group, which was on a fund-raising drive.

There was only sufficient data to conduct statistical tests for dryland cropping, livestock and total labour hired. In the case of dryland cropping and total labour there was significant seasonal variation, with most labour hired in the harvest season. For all variables wealthy households hire more labour (Table 17). Thus we find that the poor sell their labour to the rich. Much more livestock-related labour is hired in Mutangi where cattle numbers are higher ($F=10.2$, $df = 1$ & 192, $p < 0.01$). Hiring labour for dryland fields is the same in Mutangi and Romwe.

5.1.6 Human capability not human capital?

For most of Africa's poor, the prime asset they control is their own labour. The productivity of this labour depends on skills and knowledge acquired, health status and degree of experience. From our labour analysis, we see that households have

Table 16. Differences in expenditures on wages by quarters (weekly recall data)

Activity	Mar-May (Z$ per quarter)	June-Aug (Z$ per quarter)	Sept-Nov (Z$ per quarter)	Dec-Feb (Z$ per quarter)	Overall (Z$ per year)	Repeated measure ANOVA, Greenhouse Geiser F test
Dryland crops	74	16	0	14	104	***
Gardening	0	0	0	0	1	-
Livestock	20	21	26	6	73	NS
Woodland use	7	1	0	0	8	-
Domestic	4	0	0	0	4	-
Total	105	38	26	19	190	***

NS = level of significance is > 5%; *** = level of significance is 0.1%

Table 17. Differences in expenditures on wages among wealth quartiles (average Z$ per household per year)(weekly recall data)

Variable	Lowest 25%	25%-50%	50%-75%	Top 25%	Repeated measures ANOVA, F test
Dryland crops	5[a]	64[a]	52[a]	293[b]	***
Livestock	0[a]	0[a]	2[a]	287[a]	***
Total (over all sectors)	5[a]	75[a]	54[a]	618[b]	***

All Dunnett C tests: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; *** = level of significance is 0.1%.

little room to manoeuvre. Labour is generally fully utilised, with little under-utilisation of labour even in the dry season. Given the HIV/AIDS pandemic, the exodus of able bodied men from the area to South Africa and the rise in movement out of the area for trading by women (Section 6.4.2), the labour situation is not likely to improve. Labour largely remains family labour. There are mechanisms of mobilising labour through customary social institutions and relationships. For example, there are still some group work parties, where individuals will get together to tackle some specific jobs (e.g., digging a well) in return for some reward, usually beer in the case of male groups. The prevalence of reciprocity as a social norm also results in the boost of labour in times of particular need. However, case-study interviews indicate these mechanisms for mobilising labour are on the decline (see also Berry 1993; Tomich *et al*. 1995). Reciprocity is still part and parcel of social norms but is not as strong as it was 10 or 20 years ago. Hired labour appears to be increasing in prevalence, but is still a minor component of total labour. We conclude that labour is constrained and these constraints are likely to increase (Mortimore 1998). In terms of technical interventions, a focus on labour-saving devices and technologies could have a positive impact. The livelihood system we describe is dominated by labour as an input, and as there are scarcities, there are tradeoffs and bottlenecks in supply. The cheap price of labour is just a reflection of low productivity systems that require lots of labour to have any productive impact. This is symptomatic of the problems of improving livelihoods in this system.

For Sen (1997) 'human capital' is too economistic; too much about the productivity of labour. Following Sen (1997) and Bebbington (1999), we need to talk also of human capability. To be able to read and write, to negotiate and to facilitate change is perhaps more important than having a specified number of labour units. Given capability, humans can become the architects of change. Analysis of labour units is necessary but not sufficient when planning for and promoting change. In the current project we focussed some attention on the development of capability in the action research component (Mandondo'*et al*. 2002). Inspired by the writings of Freire (1997) and Hagmann (1999), and seeing problems with leadership of committees, we organised 'Training for Transformation' workshops (Hope and Timmel 1984) with community committees and

leaders, and farmer exchange visits to build experience of what can be achieved in these semi-arid zones. Most of these techniques were used in a complementary fashion, i.e., exchange visits and leadership training helped build the confidence and self-esteem that proved essential in dialogues with district-level officials during discussions about changing the rule system in the area. Nowhere did the results pay off better than with respect to the revitalisation and expansion of Chidiso garden in Romwe. The garden scheme started in the early 1990s but was almost collapsing in the period 1999-2000. People variously attribute the slump at that time to leadership problems in the scheme, including lack of accountability, poor organisation, bad handling of meetings and failure by leaders to attend crucial meetings. After several exchange visits and the involvement of the leaders in a leadership training course, the committee was revamped and the roles of the various leaders more clearly specified — leading to the rejuvenation of the garden scheme. After the Training for Transformation course there were numerous calls for change in the garden committee. Negotiations amongst the community and between the community and the external parties over the expansion in the garden were prolonged. However, once some training had been completed and incumbent leaders saw they could better respond to community calls for change, there was rapid agreement on the way forward, a new life to the garden was seen (with improved production) and the garden was doubled in size (Section 11.3f).

5.2 Financial capital

'Capital' is the stock of accumulated goods devoted to the production of other goods *(Webster's Dictionary)*. In smallholder systems in semi-arid areas, financial capital in the form of cash is severely constrained; cash received is soon allocated and spent (Mortimore 1998), and the Chivi sites are no exception. An important component of financial capital is livestock, which acts as a store of wealth and buffer against bad times (Ellis 2000). We examine livestock holdings under natural capital (Section 5.4.2), though it could have been discussed here. We explore financial capital by exploring the cash expenditure flows through the system, rather than stock numbers (Section 5.2.1). We present results on how households allocate their cash to different household sectors. In Chapter 6 we consider where this cash comes from as a return from various activities. We also explore the micro-credit scheme in Romwe, as this is a source of much-needed finance (Section 5.2.2).

5.2.1 Cash expenses

Purchases for domestic purposes make up approximately 80% of all household expenses, but this figure includes a minimal amount of expenditure on home industry (Table 18). Dryland crops are a distant second at approximately 12%. Woodland cash expenses are minimal. Across all sectors, cash expenses average about Z$11,000 per household per year. Table 18 also shows that cash expenses for major items, collected using quarterly recall, make up only about one-third of the all cash expenses, collected using weekly recall. It appears that weekly recall is important for documenting the many small expenses that make up the majority of household expenses. However, for dryland crops and livestock production, which are largely made up of large purchases, quarterly recall and weekly recall produce results that are more consistent. For our calculation of net income, where we need to know the expenses by sector, we are fortunate enough to be in position to use weekly recall data.

From weekly recall data, cash expenses for dryland crops come in the early dry season and early growing season (August to November), the time when fields are being prepared (Table 19). Domestic expenses peak at the end of the year, probably reflecting availability of cash as a result of remittance inflows of cash that time (Table 41), coinciding with bonus time in formal employment and Christmas (also when most remitters return to their rural homes for holiday). Major purchases, as shown by quarterly recall data, follow similar patterns.

Table 18. Household cash expenses by sector (average Z$ per household per year)

	Expenses (weekly recall data)	Expenses for specific large items (quarterly recall data)
Dryland crops	1312 (12%)	927 (25%) (inc. draft, fertiliser, seeds, pesticides)
Gardening	302 (3%)	77 (2%) (inc. fertiliser, seeds, pesticides)
Livestock production	420 (4%)	577 (15%) (cattle purchases)
Woodland	147 (1%)	
Domestic & home industry	8883 (80%)	2193 (58%) (inc. school fees, clothes, kitchen utensils, building materials)
Overall	11064 (100% - total)	3779 (100% - above items)

Table 19. Differences in expenses among quarters (average Z$ per household)

Activity	Mar-May (Z$ per quarter)	Jun-Aug (Z$ per quarter)	Sep-Nov (Z$ per quarter)	Dec-Feb (Z$ per quarter)	Overall (Z$ per quarter)	Repeated measures ANOVA, Greenhouse Geiser F test	Significant interactions with quarter, F test
Weekly recall data (all expenses							
Dryland agric	181	175	447	509	1312	***	Site (**)
Gardening	18	122	93	69	302	NS	None
Livestock	77	107	131	105	420	NS	None
Woodland	31	81	34	1	145	NS	None
Domestic	1525	2042	2152	3163	8883	***	Site (*)
Total	1831	2527	2857	3849	11064	***	Site (*)
Quarterly recall data (major expenses)							
Dryland agric	37	141	566	184	927	***	Site (***) Wealth (*)
Gardening	4	10	47	15	77	***	Site (**) Wealth (**)
Livestock	82	156	151	187	577	NS	None
Domestic	550	535	438	671	2193	NS	None
Total	677	842	1200	1057	3776	**	None

NS = level of significance is > 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%

In most cases where there were significant differences amongst quarters, there were also significant interactions between quarter and site or wealth (Table 19). The most notable interaction is that between quarter and site for dryland crops, indicating that the differences between quarters are particularly notable for one site. This is shown in Figure 10 where Romwe has very high inter-quarter variability in cash expenses on dryland crops. Greater inputs were made in the case of Romwe.

Expenses differ between wealth quartiles (Table 20). Based on weekly recall, for all sectors except gardening and woodland use (the two lowest expense sectors), greater amounts are expended by wealthier families. Results are similar for major expenses, except that there is significantly more spent by households in the top quartile on gardens. The domestic expenditure for large items (e.g., school fees) is some five times greater for wealthy than poor households.

Figure 10. Interactions between quarter and site for cash expenses for dryland crops (weekly recall data). Error bars show mean and one standard error

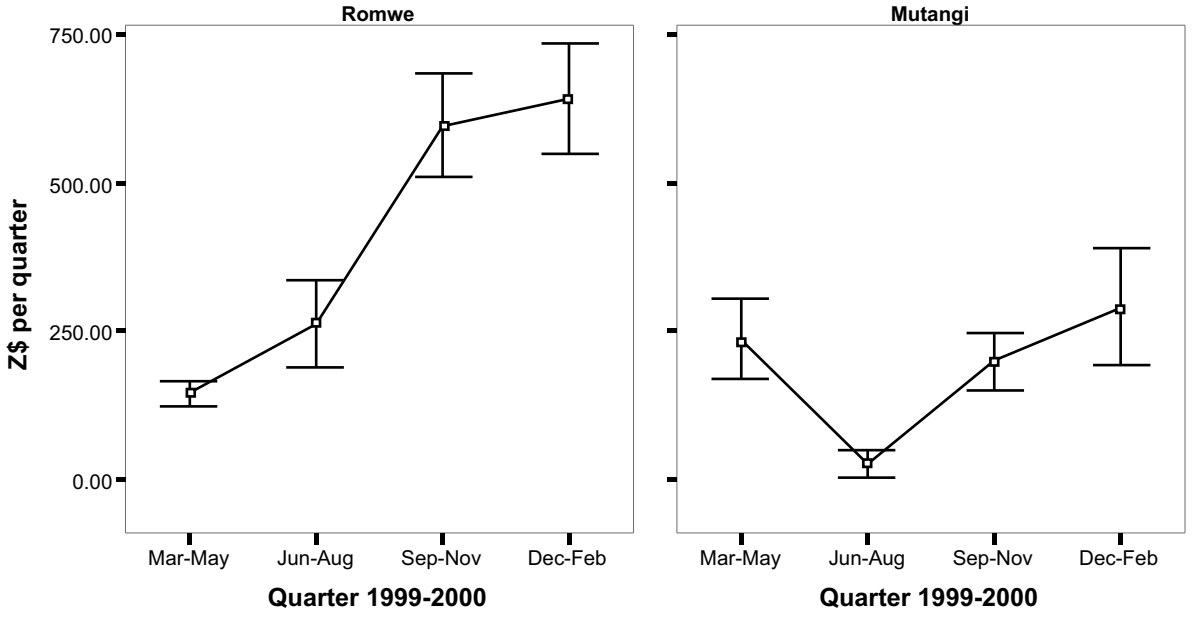


Table 20. Differences in expenses among wealth quartiles (average Z$ per household per year)

Variable	Lowest 25%	25-50%	50-75%	Top 25%	Repeated measures ANOVA, F test
Weekly recall data (all expenses)					
Dryland crops	654[a]	938[ab]	1450[bc]	2192[c]	***
Gardening	144	201	276	584	NS
Livestock	247[a]	216[a]	306[ab]	907[b]	***
Woodland use	10	398	63	113	NS
Domestic	5145[a]	6392[ab]	8174[b]	15747[c]	***
Total	6200[a]	8145[a]	10269[a]	19543[b]	***
Quarterly recall data (major expenses)					
Dryland crops	487[a]	802[a]	821[a]	1589[b]	***
Gardening	41[a]	60[a]	70[a]	137[b]	***
Livestock	761	611	397	553	NS
Domestic	838[a]	1481[ab]	2075[b]	4352[c]	***
Total	2127[a]	2954[a]	3363[a]	6631[b]	***

All Dunnett C tests: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; NS = level of significance is > 5%; *** = level of significance is 0.1%

There are differences in expenses between Romwe and Mutangi for all sectors except woodlands, with expenses being greater in Romwe (Table 21). Higher agricultural land productivity, as noted earlier (Chapter 2), and Romwe's location near a thriving informal market for vegetables (Ngundu Halt), seems to be attracting larger investments. A small portion of the heightened expenditure may be due to the micro-credit scheme in Romwe (Section 5.2.2). Interactions between site and wealth generally yield no significant results.

Table 21. Differences in expenses among sites (average Z$ per household per year)

Variable	Romwe	Mutangi	Repeated measures ANOVA, F test	Site by wealth interaction, F test
Weekly recall data (all expenses)				
Dryland crops	1648	757	**	NS
Gardening	431	90	*	NS
Livestock	540	222	*	NS
Woodland use	182	89	NS	NS
Domestic	10277	6579	**	NS
Overall	13078	7737	***	NS
Quarterly recall data (major expenses)				
Dryland crops	1040	740	*	NS
Gardening	85	63	NS	NS
Livestock	585	563	NS	NS
Domestic	2018	2482	NS	*
Overall	3728	3848	NS	NS

NS = level of significance is > 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%

5.2.2 Micro-credit in Romwe

There is much informal borrowing of money as part of the social fabric of these rural communities, though the amounts are not large. In addition there is widespread formation of savings clubs to which one gives a small amount of money each month, all the money going to a particular person whose chance it is to receive the money (with no obligation to give it back, but an obligation to keep making monthly payments). Thus one is ensured of a windfall every so often to buy larger items rather than putting aside small amounts of money each month. Access to formal credit is more or less absent. In Romwe in late 1998, 54 individuals received loans totalling Z$45,000, while in late 1999, 63 individuals received Z$55,000. This disbursement occurred in three villages in the Romwe area as part of a donor-assisted, but community-run, micro-credit scheme. Thirty-seven per cent of households in the three villages received loans in 1998, and 47% in 1999 (some households received loans via two different household members). The disbursed funds reached some of the respondents in the survey, and amounted to, on average over all households in the Romwe sample, Z$100 in 1998 and Z$160 in 1999. Households that borrowed from the scheme received between Z$500 and Z$3000. This reflects a substantial amount of money if it is considered that annual expenses in the Romwe area are only in the order of Z$13000 per household. Loans were relatively equitably distributed amongst wealth quartiles.

In a number of cases the loans were put to good use and resulted in relatively sustainable improvements in livelihoods. However, we also received reports of numerous instances of wasteful use of the funds (e.g., supporting the drinking and womanising habits of young men at Ngundu Halt!), and there was widespread defaulting on the loan repayments. In the second report from the micro-credit committee (late 1999), it noted that as a result of the loans, two farmers who purchased inputs for cotton production used the proceeds of cotton sales to buy cows; one farmer used money generated by the loan to pay someone to dig him a well; 10 to 12 women used the proceeds from the cotton harvest to buy kitchen units and utensils; two cotton growers used the proceeds to build themselves new, more modern houses. The diversity of use of the micro-credit funds is illustrated in the case studies (Box 2, 3, 4, 9 and 13).

Box 2. Ms Gradicy — Rearing chickens after accessing financial capital

Ms Gradicy, a single mother, completed her 'O' level certificate[11] a couple of years ago. Since then she has not been able to enrol at a college for professional training, nor has she been able to secure formal employment. She is involved in broiler production.

She received a loan of Z$1000.00 in 1998 from the local credit scheme and managed to start a poultry project. At first she was in a partnership with another woman from the catchment, a widow. After selling their first batch of chickens, Ms Gradicy found that the partnership resulted in very small profits, and she then went alone.

At any one time she keeps 100 birds. She sells the chickens locally at Z$200.00 each.[12] She rears the chicks for at least seven weeks so that they reach a sellable weight. The viability of her business is now under threat due to the high cost of feed. In the past she mixed her own feed using maize and pig concentrate. Maize is locally available and was affordable. Pig concentrate is usually cheaper than chick concentrate. At present maize and pig concentrate is very expensive and her buyers are unable to pay the higher prices that she needs to charge. She has temporarily halted business, but is hoping to re-start as soon as the conditions improve.

She used the proceeds from her chicken venture to look after the family — her mother, an uncle and her sister's three children. Her mother is not married and no member of the family is formally employed.

For the 1999 disbursement, reported in the third report from the committee (late 2000), most farmers were said to have used the funds for inputs into dryland cropping (seed and fertiliser). The 1999/2000 season was disastrous due to waterlogging, so many investments in dryland cropping probably did not pay off (Section 6.1.4). Many recipients (18 of the 63) invested in cotton production (Box 3). Fifteen had received Z$1000 while the remaining three received Z$500. The majority bought cotton seed, fertiliser and chemicals, but Z$500 was insufficient to buy most of the basic inputs needed to produce cotton, with consequent low productivity. In addition, the poor 1999/2000 season resulted in low yields. Some farmers harvested as little as 30-40 kg of cotton, some harvested more than 500 kg.

Box 3. A successful cotton grower: The case of Mr Rusipe

Mr Rusipe has been borrowing money from the micro-credit scheme and investing in cotton production.[13] In 1998 Mr Rusipe received a loan of Z$500. He bought pesticides for cotton production. He purchased cotton seed and fertilisers with money remitted by his sons who work in towns. He harvested six bales of cotton and realised Z$11,000 from the sale of the cotton. He used the money to buy an ox (Z$9500) and to hire a tractor from the district development fund to plough his five acres (Z$2000). In 1999 he received Z$1000 from the micro-credit scheme. Again he bought cotton chemicals and seed. He harvested four and half bales of cotton and received Z$15000 from their sale. He is planning to deposit most of the money in a savings account at the bank, for his 'pension'. With the rest of the money he also started a poultry (broiler) production project. He has 25 broilers, which he sells locally at Z$150 each. He is planning to hire someone to dig some infiltration pits in his field to improve the water-holding capacity of the soil, an example of an investment in the physical assets of the household.

Some farmers, especially women recipients, invested in gardening, buying seeds and pesticides, and made good profits (Box 4). Other women used funds to start trading activities. For example, one women received Z$500 and used it to purchase fish from Kyle Lake near Masvingo to sell locally. After two successful trips one of her close relatives fell ill and she used her profits to pay hospital bills for the sick relative.

The micro-credit scheme provided an opportunity for jointly addressing local-level equity issues together with enhancing community capacity for collective action. The first phase of the scheme faced several constraints including lack of regular and scheduled meetings of the micro-credit committee, lack of elections, poor accounting systems and financial records, domination by members of elite lineages, inequities in the distribution of the loans in which political and economic elites gained at the expense

Box 4. Mrs Chivaura, a productive vegetable producer

Mrs Chivaura is one of the farmers who invested her loan in vegetable production and made a profit. She received Z$1000 from the micro-credit scheme.[14] She used Z$500 for bus fare to get to her original home to attend a funeral. With the remaining money she hired someone to fence her private garden. In the garden she grew onions and leaf vegetables, using manure to improve soil fertility. From the sale of vegetables (largely onions) she received Z$2300, in addition to getting some output for home consumption. Mrs Chivaura bought some kitchen utensils with the profits and onion seed. Unfortunately, cattle trampled the seedlings before she could transplant them. She is hoping to carry on with onion production, as it has proved to be a lucrative enterprise and is not as labour intensive as other crop enterprises.

of the less privileged, and low repayment profiles. Researchers sourced more credit funds and facilitated the formation of a new and more representative loan committee. In spite of this, some members from the old committee, particularly those from influential lineages, still found their way onto the committees, and the disbursement of funds still remained largely inequitable, with influential village heads generally receiving much more than ordinary people, particularly young families. But in general more people from less privileged groups were able to access the loans than before. Inequitable outcomes are partly attributable to the fact that the facilitators adopted open-ended approaches without necessarily directing the process. Such unexpected outcomes appear to suggest that in some cases, particularly where elite interest has deeply entrenched itself, open-ended facilitation can be a slow and painful process in which only marginal gains can be expected. In spite of the small margins realised in terms of impact, researchers on the project were still facilitating a culture of transparency and accountability in the handling of the funds up until the end of the project. This was done mainly through meetings, which allowed ordinary members to interact with committee members.

While we documented successes in terms of the funds being put to good use and improving livelihoods, the overall scheme was not successful due to the large number of defaults on repayments. Hope seems to spring eternal, as those receiving loans largely invested the money in dryland crop production. With the disastrous season of 1999/2000 very few loans could be repaid (Section 6.1.4). There would appear to be little hope for sustainability of such a scheme over the longer time period without constant cash injections from external sources.

While ideas of using the credit for group activities were enthusiastically discussed in 1999, the loan recipients showed their preferences by allocating the bulk of the money to their individual dryland cropping endeavours. In the third year, partly as a response to widespread crop failure and loan defaults, the committee and the members decided to allocate one-third of the funds to a group scheme — the purchase of fencing material to expand the community garden (in which members farm individual plots). This represented a more focussed use of money, which would otherwise have been spread thinly across households, and probably demonstrates some increased capacity of the community to work collectively.

5.3 Physical capital

In this section we look at physical assets of the communities. Some of the variation in physical assets among households has been dealt with in Chapter 4 on the wealth quartile derivation, as the wealth quartiles are mostly based on physical and natural capital. Physical assets of a household include huts/houses and implements (Table 22). As the wealth index is defined by many of these variables, their significant difference among wealth classes comes as no surprise (however as the wealth index is a linear combination of many variables it does not mean that all variables in the index will necessarily be significantly different). Higher percentages of households own huts/houses with tin or asbestos roofs, scotchcarts, ploughs, wheelbarrows, manual saws,

radios and music instruments in the wealthier quartiles. The ownership of hoes, fishing rods and kerosene lamps is not associated with wealth quartiles. Some ownership data has to be read together with cattle ownership. For example, although 80% of households have ploughs, only 66% of the households have two or more cattle or donkeys and the current situation is the best it has been since animals were decimated in the drought of the early 1990s. The case studies show that cash windfalls are often used to improve physical assets. Households with members in the formal workforce are also often able to invest in physical assets. In one case wages covered the purchase of a diesel water pump, which greatly increased irrigated production, only to falter when the pump ceased to work (Sayer and Campbell 2002). Ownership is only one measurement of access, as the high degree of reciprocity allows non-owners to access some of the key physical capital resources. For example, a plough may be borrowed from a neighbour or a kinsman. However, this may not substitute perfectly for ownership, as the access may come at an inconvenient or inappropriate time, or with various implicit strings attached. Increasingly, there are many transactions that are now governed by cash exchanges.

Table 22. Differences among wealth quartiles in percentage of households with various assets

Variable	Lowest 25%	25-50%	50-75%	Top 25%	X^2 test
Roofing type of main hut/house as as bestos or metal (as opposed to thatch)	2	24	33	87	***
Owning a scotchcart	0	12	51	90	***
Owning a plough	43	82	96	98	***
Owning a wheelbarrow	2	30	85	94	***
Owning a hoe	100	100	100	100	NS
Owning a manual saw	14	22	27	40	*
Owning a radio	27	30	43	80	***
Owning a musical drum	8	12	35	53	***
Owning a fishing rod	18	16	8	9	NS
Owning a kerosene lamp	53	54	49	55	NS

NS = level of significance is > 5%; * = level of significance is 5%; *** = level of significance is 0.1%. As the wealth classes are defined by some of these variables, it is not surprising that they differ significantly amongst wealth classes.

At the scales of the community and district the important elements of physical capital are the infrastructural facilities that improve the working of markets, speed the flow of information and increase the mobility of people, resources and outputs. Relative to many other rural settings in Africa, the study sites are fortunate in being close to sealed roads with relatively frequent bus connections, close to sizeable rural business centres and within 100 km of a small town (Section 2.3). In both study areas there are dip tanks for livestock, primary schools, clinics and small-scale irrigation systems.

5.4 Natural Capital

Incomes in rural Africa are closely tied to natural resources, land for crop and livestock production, woodland for a wide variety of goods and services, and water for household consumption and small-scale irrigation. Human activity can reduce or increase the quantity and quality of a resource.

5.4.1 Land for crop production

Land is part of the natural stock of capital that can be used in conjunction with other inputs to support livelihoods. Households generally have three types of cropping land, two types for dryland production and a smaller area for irrigated garden production of

largely vegetables. These are quasi-private but through a variety of arrangements other households are permitted access to certain resources (e.g., crop residues in the dry season). The dryland croplands comprise a field close to the homestead and a field (usually larger) much further from the homestead. The former is usually more intensively managed (Scoones *et al*. 1996; Campbell *et al*. 1998). Gardening varies from very small plots around the homesteads, to large gardens near perennial sources of water (e.g., some shallow wells/springs in Romwe) to large community gardens. As an illustration of the diversity of the situation we describe Romwe. In Chikanda village the majority of the gardens are along the Musapwe, a seasonal river that flows through the village. In Ndabaningi some of the gardens are along a seasonal stream that flows from the Barura Dam. In Sihambe and Dobhani villages most gardens are around privately owned wells.

Traditional authorities allocate land. In principle, the traditional leaders are supposed to allocate the land in consultation with the Village Development Committee (VIDCO) or Ward councillors and an agricultural extension officer. In practice, however, the traditional leaders clandestinely allocate land without consulting the other parties. This allocation of land is one of the ways traditional leaders gain recognition from the people they lead and gain an edge over their 'adversaries' in the local social arena (VIDCO and WADCO leaders and councillors). Previously allocated land is inherited within the family. Alternatively, a farmer may sell his piece of land to another farmer when he is emigrating. In the past such land would revert to the traditional leaders who would take it is as part of the 'common pool' land for re-distribution to new landless families. There is much informal borrowing of patches of land and even some leasing of land. Thus farmers who are able to crop larger areas by having access to the required inputs (especially labour) can increase their acreage, within limits. We recorded 6.5% of the households in Romwe leasing out land and 0% in Mutangi, the leasing price averaging Z$285/acre. A retired schoolteacher in Romwe is a good example of a farmer who has managed to lease land from his neighbours (Box 10).

The importance of labour and labour-saving devices is shown in the analysis of covariance of area of dryland fields as related to ownership of a plough, site, number of household members, age of household head and remittance income. Age of the household head reflects household maturity, and is used in the analysis because households tend to accumulate assets (including land holdings) as they mature. Remittance income is entered as a proxy for wealth, as we later show that remittances tend to drive local production.[15] The first three-mentioned variables are significantly related to cropping area, in the order site ($F = 16.3$, $df = 1$ & 192, $p < 0.001$), number of household members ($F = 9.3$, $df = 1$ & 192, $p < 0.01$) and ownership of ploughs ($F = 4.4$, $df = 1$ & 192, $p < 0.05$). As indicated earlier field sizes are larger in Mutangi than Romwe (Table 7). The more household members there are, the greater the area of dryland fields. The trend is much clearer in Romwe where land shortage appears to be more extreme, but on average households with two family members have four acres of land, whereas households with 12 members have eight acres (Figure 11). Households with ploughs have significantly larger areas of fields than those without ploughs. Age of household head is not related to dryland cropping area.[16] This is somewhat surprising as young households have less access to cultivated land due to land shortage, but the conclusion is that other factors are much more important in determining acres farmed. Key informant interviews suggest that households who settled early have access to more land and other resources. Remittance income is not significantly related to field size. Though dryland cropping area per household increases with wealth quartile (Table 23), we interpret this as largely a consequence of better access to labour and labour-saving devices in wealthier households. Wealthier households put less household labour per acre into dryland fields than poorer households, as they have much better access to labour-saving devices and hire more labour.

For garden area, the only variable that apparently determines garden size is site, being larger in Mutangi ($F = 8.1$, $df = 1$ & 192), $p < 0.01$). Garden area is more equitably distributed amongst wealth quartiles (Table 23), and the size is often dependent on

Figure 11. The relationship between acres of land owned for dryland crops and household numbers for Romwe and Mutangi

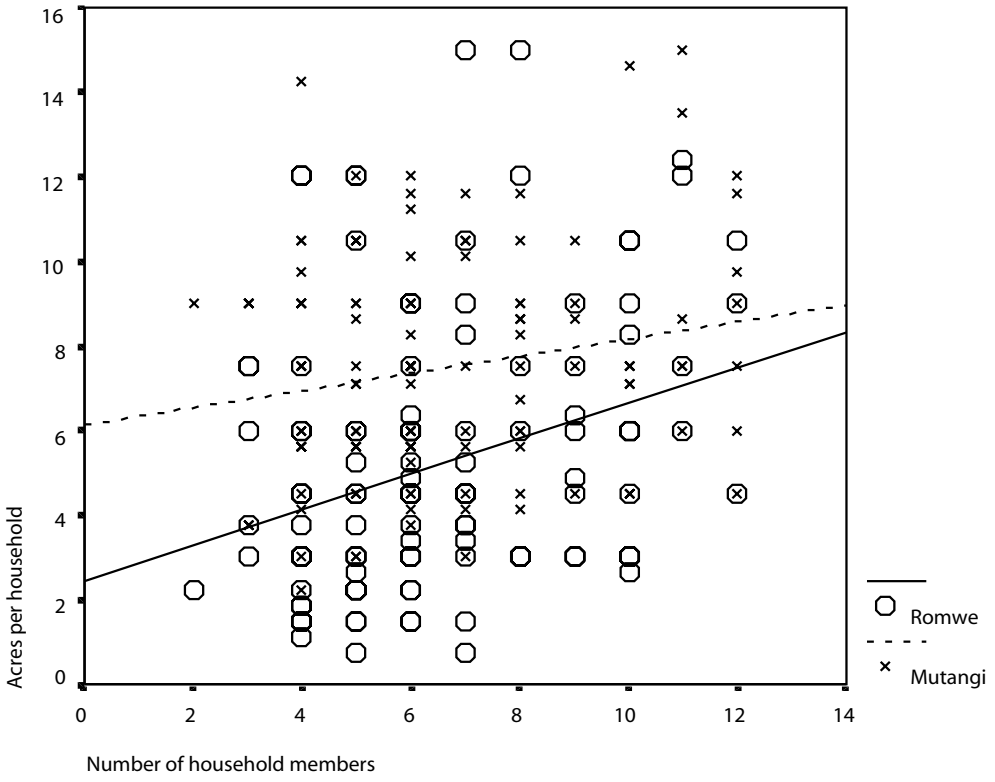


Table 23. Differences in household land holdings (acres) among wealth quartiles

Variable	Lowest 25%	25-50%	50-75%	Top 25%	Overall	One-way ANOVA
Dryland acres owned	4.85a	6.02ab	5.67ab	6.74b	5.83	*
Garden acres owned	0.37a	0.41a	0.37a	0.56a	0.43	* (Chi-square NS)
(% ownership of gardens)	*(78%)*	*(80%)*	*(74%)*	*(88%)*	*(80%)*	
Total land owned in acres	5.16a	6.48ab	6.11ab	7.28b	6.26	**

All Scheffe test: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; NS = level of significance is < 5%; * = level of significance is 5%; ** = level of significance is 1%

very household-specific factors, e.g., whether dryland fields are close to springs or rivers, whether a household entered gardening in the early years (and was willing to enter into conflict with the authorities because gardening near streams or in wetlands was illegal, but get access to the choice sites), etc.

From the 1940s, a series of land-use planning initiatives and enforced natural resources legislation increasingly constrained farming opportunities. For example, the Natural Resources Act of 1942 reinforced the ban on riverbank and wetland cultivation, thus restricting garden production. During the liberation war of the 1970s the restrictions imposed by State intervention in land-use management were no longer obeyed, particularly by younger people who had no access to land. 'Freedom farming' (*madiro*) became a popular protest around Chivi as people claimed land areas previously reserved for grazing (Nemarundwe *et al*. 1998).

Following independence in 1980, a number of policies pursued in the colonial era were revived. Bans on riverbank and wetland cultivation were again enforced and there was a policy to create consolidated gardens, some distance from streams.

The 0.4 ha garden at the Chidiso collector well in Romwe and the garden near Mutangi Dam are both examples of consolidated gardens. However, by the late 1980s the restrictions on garden cultivation were no longer being enforced in any systematic fashion and by the late 1990s all enforcement had ceased.

There is a high demand for more cultivated land. Young households complain of insufficient land. Land shortage has resulted in a number of infringements of the restriction of cultivation in grazing areas (Nemarundwe *et al*. 1998). In the early 1980s resettlement of people from communal land to land purchased from the commercial sector was pursued. The pace of resettlement had slowed by the late 1980s, and then in 2000 illegal occupations of commercial farms began in the name of fast-track resettlement. None of these resettlement attempts have had any impact on settlement patterns and household land holdings in the two study areas (Sithole *et al*. 2002). Cultivated areas cover 38% of the physical catchment in Romwe, and 52% in Mutangi (Kwesha and Mapaure 2001). For Chivi as a whole, Mutangi is more typical, as the district average is 65%.

So far our discussion has been mainly limited to quantity of land available, but land quality also differs both between sites and within a site. In general, communal areas are located in the agriculturally marginal zones of Zimbabwe, and Chivi is no exception. The soils are generally nutrient-poor sands. Romwe appears to have generally better crop potential than Mutangi, as it has higher rainfall, greater extents of richer soils and smaller area of the difficult-to-manage sodic soils (36% of the area of the Mutangi physical catchment). On the other hand, it does have more steeply sloping land (36% of Romwe physical catchment has slopes of more than 14%, while the average slope in Mutangi is only 0.8%). Maintenance of soil fertility and organic matter is a major problem because of relatively high costs to buy and transport inorganic fertiliser and a shortage of manure resulting from the loss of cattle and goats in the 1991/92 drought.

The distribution of arable land, in terms of total size, number of holdings and land quality appears to be based in a strong historical influence (Mandondo *et al*. 2002). Compared to immigrants, clans that have resided in the areas for longer periods tend to have either a greater number of fields, fields that are bigger or better quality land (e.g., good soils, better access to water points). Local inequalities in the distribution of land are therefore partly explained by access to influence and political power. People can fall into a four-tier hierarchy based on socio-political status — *voho, zvidza zvepo, vawuyi and vechirudzi*. Chiefs, headmen and *sabhukus* and their direct descendants constitute the v*oho* category, who should be included in all local meetings and decision-making processes. *Zvidza zvepo* is another category comprised of closely related kinsfolk of the ruling clans but not their direct descendants — e.g., people whose mothers derive from ruling lineages. Daughters of ruling lineages wield considerable influence when they get married and are normally referred to as *vatete*. The *vatete* whose bridewealth is used to obtain a wife for their brothers are more special and influential than the others and they are normally referred to as the *chipand*a. People settling into the area at a later stage are referred to as *vawuyi* (newcomers), and consequently generally have less privileged access to influence and land. Aliens from other countries (especially Malawians) wield least influence and status and they are referred to as *vechirudzi*. In practice, the less privileged often have means by which they incorporate themselves into the positions of influence within the local social fabric. They can use their available resources to entice the locals to accept them, as has been the case with Ms Antoyo from Malawi who, because of her trustworthiness, has been retained several times as the treasurer of various committees. Other people who settled in the area recently often volunteer to participate in community programmes, e.g., repairing village roads damaged by rain. They also receive recognition from the local leaders and powerful families in the community by not openly opposing their views.

Over time, arable plots have been continually subdivided into small units as plot owners pass on land to their adult sons. This has resulted in average area available for dryland crop production per household declining over time (though calculations based on remotely sensed data of cultivated area in Romwe (Section 5.4.3) and population

numbers indicates that the decrease has not been sizeable). In general, people complained about shortage of land and such complaints were more frequently made by households of newly married couples. From observations and discussions, it appears that the ruling elite and their extended families also have better-quality land at their disposal, though we have no quantitative data on this. This is partly because they belong to some of the older families of the area, with new arrivals receiving more marginal land, but it is also a consequence of their power in land allocation. Given that much of the land available for cropping is already under crops, and the remaining woodland is largely confined to rocky areas (Section 5.4.3), the pace of change of conversion from woodland to cropland is likely to slow. With a lack of opportunity for cropland expansion, intensification is likely to increase as a response to land scarcity (Boserup 1965; Angelsen and Kaimowitz 2001). However HIV/AIDS may change the above scenarios (Section 5.1.1).

Many families also have more than one type of dryland field, with contrasting physical quality. In Romwe this is particularly important for livelihood security, with the richer, heavier soil being highly productive in wet years, and drought prone in drier seasons, while the sandy soils achieve some production in dry years but are waterlogged and/or nutrient-limited in wet years.

5.4.2 Livestock

Livestock comprise an important store of wealth for households.[17] There are differences amongst wealth quartiles for numbers of cattle, goats and donkeys (Table 24), as expected, given that the wealth index is partially based on livestock holdings. However, there are a number of other components in the wealth index besides livestock, weakening the direct link between wealth and cattle. Twenty per cent of the households own 61% of the overall cattle herd, indicating how skewed cattle ownership is within the community. Thirty-four per cent of the households have only one or no cattle/donkeys, and therefore suffer with respect to draft power, as well as access to manure, milk and transport. Cattle ownership has a major impact on dryland crop production (Section 6.1.4). What determines livestock ownership patterns? We suspect that it is largely remittances that allow for livestock purchases; this is supported by an analysis of covariance, where remittance income was positively correlated to numbers of cattle ($F = 19.6$, 1 & 195, $p < 0.001$) (Box 8). Site, age of the household head and income from wages and home industries were not significant. Key informant interviews suggest that good incomes from cotton sales also allow for cattle purchases (e.g., Box 3). Windfalls of cash (as occurred in the disbursement from the micro-credit scheme, from gold-panning, and remittances from South Africa) were sometimes used to become involved in small livestock production (chicken, goats). Larger windfalls (e.g., from a bumper cotton harvest, a large remittance from the extended family) allowed cattle purchases. In the case studies, households with members in employment are frequently able to buy cattle.

Land pressure in Chivi District has resulted in an increasing proportion of land being used for farming, with consequent loss of woodlands and grazing area. The percentage of arable land increased from under 10% in the mid-1940s to over 20% by the early 1960s (Scoones *et al*. 1996). By the late 1980s, around 45% of the total area of the district was arable land, the rest being settlements, woodland, rough grazing or granite rock. The expansion of arable areas over the decades has meant that available grazing land has

Table 24. Differences in livestock ownership among wealth quartiles

Variable	Lowest 25%	25-50%	50-75%	Top 25%	One-way ANOVA
Number of cattle	0.27^{a}	1.44^{ab}	3.88^{c}	7.37^{d}	***
Number of goats	1.17^{a}	2.52^{ab}	2.82^{b}	7.78^{c}	***
Number of donkeys	0.23^{a}	0.32^{ab}	1.12^{bc}	1.74^{c}	***

All Dunnett C tests: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; *** = level of significance is 0.1%.

decreased. Livestock must increasingly rely on small patches of grazing within the landscape, found along riverbanks, in uncultivated valley sites, on remote hillsides, along roads and around settlements. Arable areas are now also an important source of fodder with field-edge grazing and crop residues important for dry season livestock nutrition (Scoones *et al*. 1996). For households this has meant declining herd sizes. Case studies indicate the severe loss of livestock, especially cattle, during droughts.

5.4.3 Woodland

There have been marked changes in land cover in southern Chivi in recent years, mostly involving the conversion of woodland and wooded grassland to cultivated land, reflecting the need for more land by a continually growing population (Peter Frost, pers. comm.). The proportion of cultivated land for an area centred on Romwe in southern Zimbabwe increased from 20% in 1984 to 33% in 1999. Woodland declined from 36% to 22%; wooded grassland dropped from 11% to 8%. In 1999, the remaining woodland was confined mostly to rocky ridges and hills (Figure 12). The decline in woodland resources translates into additional labour required to extract woodland products. In environments like Chivi in 1994 most households reported that it took under two hours for a firewood collection trip, while in 1999 it was more than two hours (Vermeulen *et al*. 2000 — Chivi was one of the study sites).

Romwe is more heavily wooded than Mutangi (Kwesha and Mapaure 2001). Natural vegetation covers 62% of the physical catchment in Romwe, and 47% of Mutangi's physical catchment (Figure 13). The Mutangi situation is more typical of Chivi as a whole, with the district average for natural vegetation being 35% coverage. In the Romwe physical catchment, miombo woodland on the rocky slopes and hills accounts for 52% of the landscape, the remaining natural vegetation is remnant woodlands and shrublands mainly along drainage lines. Although there is some evidence of woodcutting, the hill slope woodland is generally intact, unlike many other communal lands in Zimbabwe. In Mutangi, woodlands are much degraded, with the bulk of the woodland being made up of mopane woodlands along the drainage lines (31% of the physical catchment).

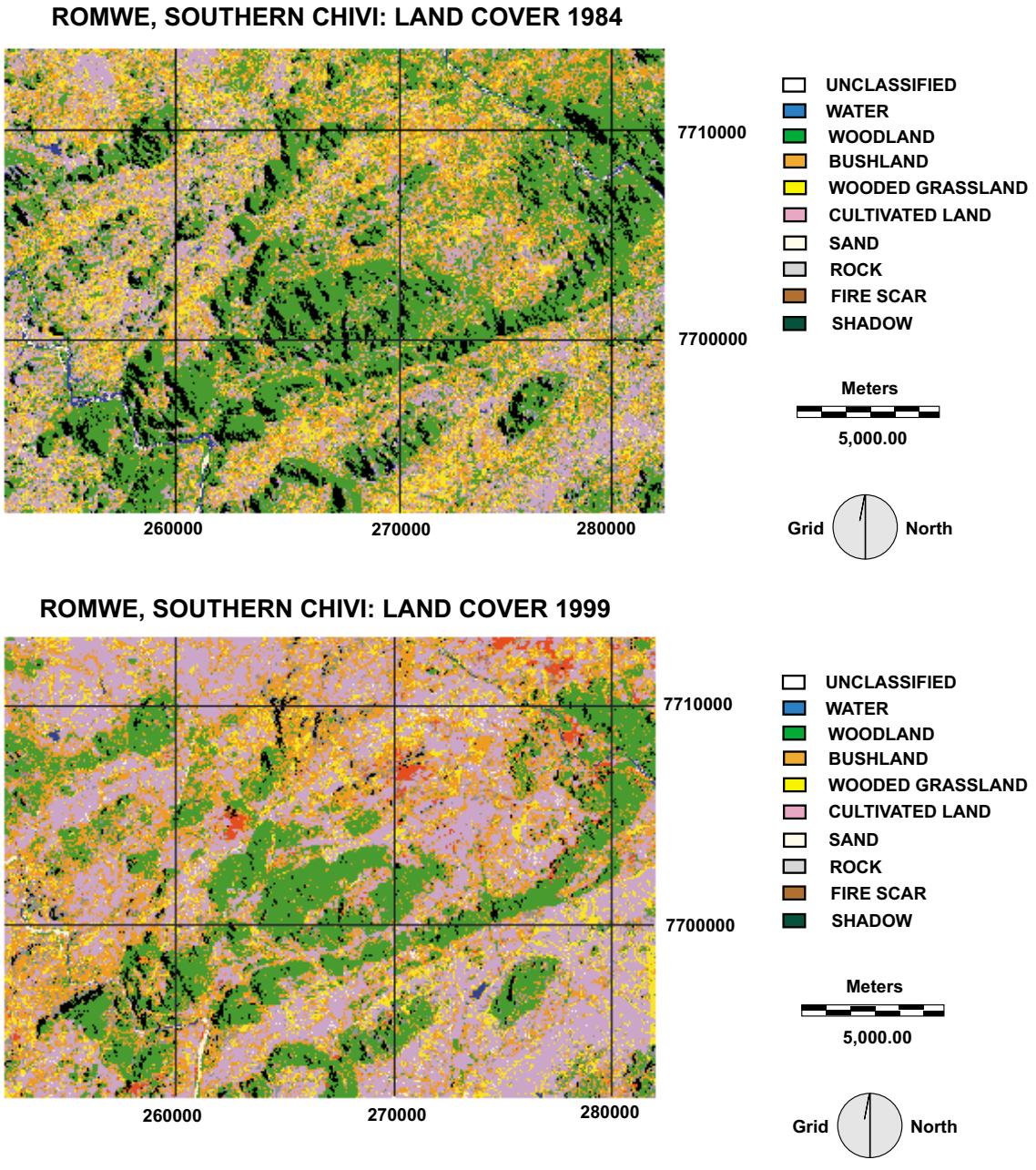
The preliminary evidence from ecological data from the Romwe woodlands, which are in a better state than the Mutangi woodlands, is that there are degradation problems, with lack of regeneration of the dominant species (Karin Gerhardt,[18] pers. comm.), presumably due to heavy grazing and cutting for poles. The upsurge of woodcarving in the area along the road to South Africa has resulted in a decline in the carving resource to the point where the most desired species largely come from other than communal areas (Oliver Braedt,[19] unpublished data; Braedt 2002).

The woodlands are a common pool resource, with a wide variety of operational requirements. There are a number of village-level rules, such as restrictions against the harvesting of unripe fruit; the cutting of some species; the collection of woodland products by members of other villages (unless permission is sought); the use of fires to harvest honey; access to sacred areas such as the Romwe Mountain; and the sale of products from the woodlands, especially timber products (Nemarundwe 2002c). In general, operational requirements relating to woodlands seem to be more numerous and specific in Romwe than in Mutangi (Mandondo *et al*. 2002). The two major woodland resource management structures found at the local level are the traditional authority and the modern administrative village development committees (VIDCOs). Each of these structures has a set of rules and regulations that relate to woodland resource use and management, with the more operative rules being those of the traditional authority.

5.4.4 Water

One of the primary constraints to economic and social development in these areas is the difficulty encountered in developing reliable water supplies (Lovell *et al*. 2002). Surface water is often contaminated with waterborne pathogens and, without storage structures, is generally not available on a permanent basis. Groundwater is important

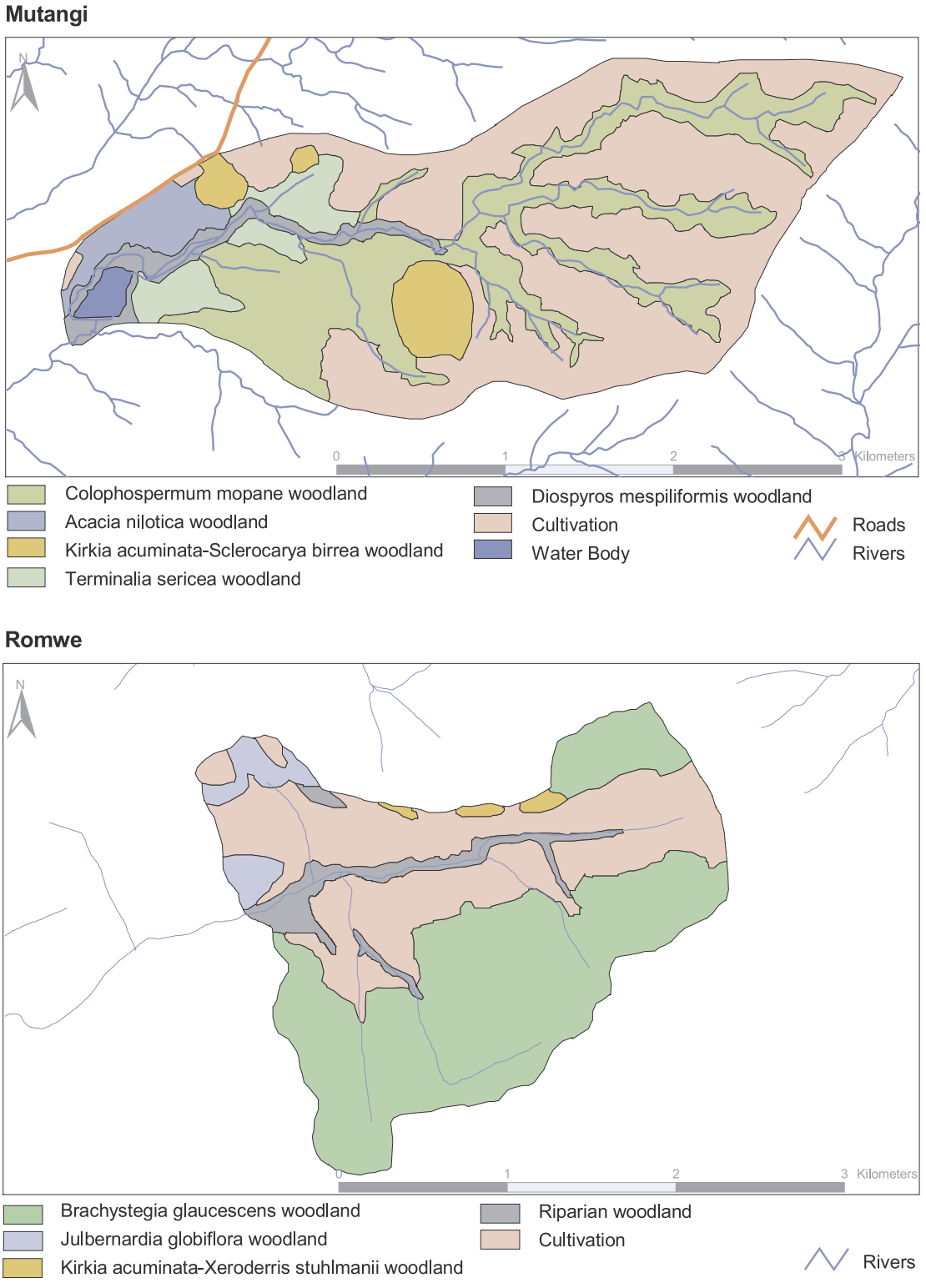
Figure 12. Land-cover change in southern Zimbabwe, as interpreted through remote sensing (source of data and interpretation: Peter Frost, Institute of Environmental Sciences)



because of its widespread extent and because for many people it provides the only source of water for long periods of the year. However, hard rock aquifers are spatially highly variable. Boreholes typically 5-30 m deep and cased in the regolith may exploit the fractured bedrock, but yields are low and unreliable unless interconnected fractures are intercepted that draw on the water stored in the regolith. In contrast, dug wells are completed in the regolith, but again yields are low and unreliable if sited where there is insufficient depth of saturated weathering or where low regolith permeability causes rapid localised draw-down of the water table around the well on pumping.

In similar regions in Asia and Africa there have been reports of water table declines. One of the reasons given is the increased abstraction rates as a result of rising populations and intensified production methods. Other reasons cited for the apparent 'loss' of

Figure 13. Vegetation types and land cover in Romwe and Mutangi physical catchments (Kwesha and Mapaure 2001)



water include a decline in rainfall and poor land management, especially cutting of trees and overgrazing (Moriarty 2000). However, the effects of changing vegetation on hydrology are complex. Deforestation can enhance ground water recharge where shallow-rooted crops and grass intercept less rainfall and consume less water than previous deep-rooted trees. At the same time, runoff and erosion may increase due to less surface cover and decline in infiltration. As shown by a recent review, the balance between these changes is not always clear (Calder 1999).

Water-livelihood relationships have been reported in detail elsewhere (Sullivan'*et al*. 2001), as water collection is a major labour-demanding activity (reported in Section 5.1.3 as part of domestic activities). Access of households to irrigation water and group gardens appears to be slightly better in the wealthier quartiles, but this is not significant (Table 25).

Table 25. Differences among wealth quartiles in household access to irrigation water

Variable	Lowest 25%	25-50%	50-75%	Top 25%	Overall	Chi-squared statistic Overall
Access to any kind of irrigation (wells, boreholes, private springs, dams with gardens)	67%	79%	81%	84%	77%	NS
Access to a group garden plot with irrigation	54%	64%	65%	74%	64%	NS

NS = level of significance is > 5%

Wells dug by specific households close to their homes or in their fields are regarded as belonging to that household (Mandondo *et al*. 2002). However, exclusive use of a well by a single household is highly unlikely. Water is regarded as God-given, and wells will thus be open to use by other specific households. Wells are shared with relatives, neighbours, church colleagues and friends, such that eventually everyone in the village has access to almost any well within reach. The well owners attach certain conditions to the use of wells. For example, permission has to be sought from a well owner before collecting water from a private well. In general, wells in crop fields are more accessible to the whole village, unlike wells near homesteads, which are usually fenced off. Other water sources include dams and boreholes. Dams will be available for the use of numerous villages, locally termed the social catchment. Members from villages outside the social catchment will not be able to use the dam for specific purposes, e.g., fishing, collecting large amounts of water. However, during droughts, use rights for specific purposes may be extended to other villages that are without water (e.g., for watering livestock and domestic use). Whereas a borehole may be located in one village, neighbouring villages are allowed access to it. This is not a written contract but an informal arrangement. If there is a critical shortage of water in some villages, especially during the dry season or in drought years, rules regarding access to water are loosened to accommodate the unfortunate neighbours. Similarly if a neighbouring village's borehole breaks down, access is given to residents to collect water from the local borehole.

5.5 Social capital

Woolcock (1999) defines social capital as 'a broad term encompassing the norms and networks facilitating collective action for mutual benefits'. There is emerging consensus that social capital is crucial for societies to prosper and achieve sustainability (Bebbington 1999). Social capital has been variously measured as the number of civic organisations, degree of 'trust' (civic norms and level of associational, degree of local rule compliance and degree of functioning of local institutions. In much ethnographic work the focus is on social processes that enhance people's abilities to access and

defend resources. Our work has been mostly on the qualitative aspects of social capital, i.e., on the social processes mediating access (Mandondo *et al*. 2002; Nemarundwe 2002a,b,c; Nemarundwe and Kozanayi 2002; Sithole 2002). In synthesising our work on institutions and the transactions accompanying social change (Mandondo *et al*. 2002) we have steered away from using the term 'social capital', thus following a recent trend among some writers who emphasise the limitations of the term (Portes 1998; Petrzelka and Bell 2000; Section 11.1). Nevertheless, given its widespread adoption in the sustainable livelihoods approach, we use it in the review here.

Given the complexity of local organisations, and the fact that organisations function in diverse ways and some superficially well-functioning organisations are fronts for resource acquisition by the elite, we see value in analyses, at least at the micro-level, of the kind by Putman (1993), where the number of civic organisations are correlated with income levels. Nonetheless, we did attempt some quantification since incorporating social capital was essential when modelling the livelihood system (Chapter 10). In the prototype model, we used a variable 'adherence to rules', which was measured as the percentage of participants adhering to rules, and in this case they were the rules of the micro-credit scheme. This influenced the sustainability of the credit scheme, and thus the availability of future credit (Cain *et al*. 2001; Sayer and Campbell 2002). By taking a tiny portion of the full gamut of social capital we felt that some quantification was possible (with the relationships defined by expert opinion, i.e., that of two researchers — Alois Mandondo and Nonto Nemarundwe). This approach was at the expense of any reality about the full breadth of issues that 'social capital' entails. In the final model, completed towards the end of the project where our understanding of social processes was greater, we used a more all-embracing approach. Here we had a variable termed 'functioning of local institutions', and this influenced numerous other variables. To take an example of one linkage, institutional functioning determined the amount of irrigated land, as detected when we facilitated garden expansion in the action research. Where organisations functioned efficiently, decisions about changing the garden area could be rapidly reached and then implemented, and visa versa.

Understanding the micro-political manoeuvrings identified in the various committees and in the community is probably crucial to the ultimate success of a development project, as these manoeuvrings affect how local institutions function, and the relative costs and benefits to different stakeholders (Sithole 2002). Development projects rarely have the time or resources to develop this type of in-depth understanding, however, with the result that their efforts are often subverted or diverted.

5.5.1 Norms

Part of the social capital of communities resides in the institutions that regulate practices with respect to common pool resources. These institutions are largely based on a system of norms, taboos and mores (Campbell *et al*. 2001b; Mandondo *et al*. 2002). For example, controls in woodlands prohibit felling of big trees (felling is perceived to 'undress' the landscape) and fruit trees, discourage clear-felling, encourage collection of dry wood for fuel instead of felling live trees, and impose volume restrictions on the extraction of resources. Selling wood is also considered unacceptable. For water resources, controls relate to hygiene, the volume of water that may be extracted, and the uses to which water may be put (Nemarundwe and Kozanayi 2002). Boundary relations are also complex, as is illustrated by the results of the village mapping exercises (Mandondo'*et al*. 2002). Mostly, boundaries are 'soft'. While people have a general idea where the traditional village boundary is, there were numerous instances of 'no-boundary' households in villages and of disputed boundaries. An extreme example of a 'no-boundary' household is Mr Isaiah Dobhani, who is under the jurisdiction of *sabhuku* Dobhani, lives in Matenhese village and has crop fields in Sihambe and Matenhese villages.

More detailed analyses reveal that there are complex kin-based webs of access, extending beyond source villages (Nemarundwe and Kozanayi 2002). For example,

consider the 'private' well owned by Mr D.J. Tamwa in Tamwa village. His wife Juliet, together with her sister Zenzo and brothers Paul and Lucky, use this well. Zenzo, Paul and Lucky's sons and daughters, including Fanuel Zinoni, Frank Zinoni and A. Mashanga also use the well. Daniel Tamwa, who is the well-owner's father also draws water from the well, as does his sister Janet and her son O. Chamunorwa. Sithole and Varumbi also use the well by virtue of being the well-owner's friend and neighbour, respectively. To close the well for private use would be unacceptable. The rules about use vary, depending on the status of other water resources in the area.

This example of the well illustrates some aspects of reciprocity, which is widespread in the society. It operates positively to mediate lack of labour, lack of livestock, illness and lack of cash. An interesting index of wealth, as identified by informants in the PRA wealth ranking, is the ability to offer food to guests. This illustrates the importance of being able to offer hospitality and gifts to those visiting the homestead. Outsiders will often remark at the amazing spirit of generosity by people in the study area. Despite poverty there will always be an attempt to offer a plate of food or some agricultural product. This culture of gifts represents one element of the importance of reciprocity.

Many instances of change in these norms have been documented at the study sites. These include the reduction in social controls on some activities (e.g., harvesting from sacred woodlands) and changing mores (e.g., the rise in petty theft, previously uncommon). The collection of firewood, poles for construction and fruits from Romwe sacred mountain was unheard of in the 1960s. There are also changes in the institutions related to the extended family. For instance, in the face of HIV/AIDS there is a breakdown of some traditional institutions and cultural practices that provide a safety net. In the past, members of the extended family would normally share the responsibility of looking after orphans and widows. The institution is, however, unable to cope with the dual pressure of rising burdens from HIV and the rising cost of living (see also Mabeza-Chimedza *et al*. 2001).

5.5.2 Committees

Part of the social capital is also present in committees. There are numerous committees, e.g., for different kinds of water points, controlling extraction and use; garden committees, controlling when irrigated water may be needed, crops to be planted, planting dates, responsibilities for fence repairs, etc; and catchment committees responsible for conservation and land use. All committees are linked to the traditional governance system, and in the case of serious transgressions, the committee members will often draw in the traditional leaders to bring pressure to bear on the violators. The organisational landscape is crowded, as illustrated by Frost *et al*. (2002) for Romwe. Overlapping organisational structures catering for different interest groups are superimposed on a complex pattern of resource use, with different villages using different combinations of resources in a specific village (Mandondo *et al*. 2002; Nemarundwe, unpublished data).

When examined closely, many instances of the failure of local organisations, defined in terms of local perceptions of failure, are apparent. We take the example of the Chidiso garden. For the past three years, no grease has been bought for the working hand pump at the Chidiso well despite its minor cost (it is only about US$0.50/month). The other hand pump broke down in 1997 and has not been repaired; yet all it needs is a bolt costing less than US$5. Meanwhile, members of the garden continue to queue at the only functioning hand pump, wasting scarce time. Members have called for the repair but there has been no response from the committee. Similar problems could be detailed for the fence around the garden. A donor-supplied toolbox, chemicals bought collectively for pest control, and money from leasing out the group's sprayer have disappeared, presumably to one or more of the committee members. The annual levies paid by project members are not properly accounted for. In many cases, the garden committee does not adhere to the constitution it has pledged to uphold. The committee members do not attend meetings called by members to discuss problems; meetings

called by the committee have an agenda set by the committee members; and meetings start three or four hours later than scheduled because a key member of the committee has not arrived. Yet the committee has not changed in 10 years! Members have expressed their dissatisfaction to the village head, who replied that that the only person who could have run the project productively was his late brother or his sister (all part of the ruling elite). A woman from the ruling elite, who is feared to be a witch, dominates the committee and the garden activities. The ultimate result of this organisational failure is reduced productivity in the garden due to longer queues for water, trampling by livestock due to lack of fence repairs, crop selection by the committee without consultation, and the garden lying fallow for long periods (e.g., 1999) because of poor decisions. Similar cases of organisational failure, largely unearthed during the action research, can be documented for other organisations (e.g., the micro-credit committee and the respective local leaders allocated much larger loans to themselves, were highly unlikely to pay back the loans, and misappropriated some of the loans repaid by other farmers).

5.5.3 Leadership and the exercise of authority

None of the norms are written down; rather, they are part of common knowledge. Such 'soft' controls are often augmented by direct enforcement by traditional leaders or committees, and the fear of censure by the spirits. All members within the community are expected to help report or apprehend violators. Most local leaders are part of or have influence over every committee in their area (see Mr Kefasi's case study in Sayer and Campbell 2002). The ruling elite, mostly dominated by men, can be characterised as having high social capital — a strong network or relationships that control many aspects of life, sometimes to the detriment of other households. This illustrates the notion that social capital is not always a positive social good to be encouraged as a solution to the problems of collective action (Portes 1998; Petrzelka and Bell 2000). This situation can be observed in Romwe, where the extended family of the elite are centrally involved in all local endeavours, sometimes to the disadvantage of other village members (Mandondo *et al*. 2002). The powerful in a community are not only those who derive power from being connected with the ruling lineage. Witchcraft is also an important component (see extended case study of Mr Kefasi in Sayer and Campbell 2002).

Rules and norms are interpreted and applied in a rather loose manner, even in the case of more formal social systems, such as committees. There are numerous instances of exceptions to the way rules or practices are applied. In some cases decisions cater for dire need, where households may be allowed to transgress the accepted norms to meet particular livelihood needs. In other cases, it reflects a misuse of authority by the ruling groups. For example, rules and regulations may be deliberately altered by those who are supposed to enforce them, in order to settle some perennial scores. In yet other cases it is petty corruption. For instance, Mr Mike, a firewood seller in Romwe (Box 5), normally collects his firewood for free, but the *sabhuku* has recently asked Mr Mike to pay a little commission to him for 'mining the woodlands'. Mr. Mike is contemplating paying the leader in kind — a packet of sugar and some tea.

Disputes over leadership and questioning the legitimacy of some traditional leaders has resulted in ineffective common property management systems at the local level. A case in point is that of three young men from Sihambe village who cut a restricted *Afzelia quanzensis* tree at the boundary of Sihambe and Chikanda villages. The boys were caught by headman Chikanda's police and taken to the village court presided over by the headman. The parents of the boys were asked to pay Z$50 each for convening the village court, which they did. After the case was tried, the boys were found guilty and were fined Z$500 each. Because the boys' fathers were absent from the village court hearings, they refused to pay the fine arguing that it was too much for first offenders. Informal investigations revealed that people were not happy with the ruling the headman made because they believe that he is not the legitimate headman because he also holds the *sabhuku* position. Theoretically, two different individuals should

hold the positions of *sabhuku* and headman. This study found that it is increasingly becoming difficult to enforce the rules, especially in common property resource areas.

At the research site in Romwe a few items of research equipment were stolen, most likely by unemployed local youths. Members of the research team were able to apprehend some of the thieves on two occasions. In both cases the local traditional leaders (who also form the catchment management committee) failed to prosecute the culprits. The first case involved theft of solar panels that were mounted in a small hill to power research equipment. Someone tipped off the research team about the culprit's identity was and the research team, as per protocol, informed the local traditional leaders. Unfortunately the leaders did not act, forcing the research team to 'arrest' the culprit; this eventually led to conviction and imprisonment. The culprit, not originally from Romwe, returned to the area after serving his term, against the wishes of the local traditional leaders. The local leaders did not try to evict him, fearing that such action would strain their relations with the culprit's host. The social milieu requires that local leaders exercise their power with extreme caution. In the second case of theft the culprit, a young man in his early twenties, was caught red-handed. Again the traditional leaders were unable to act, allegedly because the culprit is an orphan. It appears that unscrupulous young men are taking advantage of their positions in local society to violate long-standing norms of behaviour.

Development agencies and scholars often equate the lack of strict enforcement of rules in peasant production systems as evidence of institutional failure. However, the formal rule-based systems of writers such as Ostrom (1999) bear little relation to the realities of the systems in place in Chivi. Although the informality of the rules may allow for corruption and inhibit the pursuit of livelihoods, this institutional flexibility may also lower transaction costs and cater for the shocks and stresses (e.g., weather, deaths, loss of remittances, etc.) that impinge on livelihoods. Moreover, 'failure' is relative — what is seen as a failure by some village members may be seen as a success by others.

5.6 Reconstituting an integrated view of the assets of a household

By addressing each capital asset separately, as in the previous sections, we start to lose the integrated picture of a household. In this section we therefore try to bring some of the strands together again. One formal means to make the connection among the capital types is through systems modelling, and this we do in Chapter 10. In our prototype model we explicitly took a capital assets approach with variables such as produced capital, financial capital, social capital ('adherence to rules') and natural capital (water for crop production and soil fertility). In the final model we used the capitals perspective to ensure that we did not omit components of an integrated system. In that model all capital assets were covered, some in more detail than others. The variables used were:

- Human capital: labour, general education, farmer skills
- Financial capital: surplus capital (surplus after basic needs have been met for school fees, health, food and basic agricultural inputs)
- Physical capital: dams, tools, distance to markets
- Natural capital: soil type, aquifer quality and quantity, woodland cover, grazing quality, dryland and irrigated crop area, livestock numbers
- Social capital: functioning of local institutions

We are now in a position to answer some of the questions posed in the introduction regarding labour. Labour is generally in short supply in smallholder semi-arid systems (Mortimore 1998). To what extent are people in Chivi constrained by labour availability? Within the household, there are significant differences in portfolios of activities of women, men and children (Section 5.1.6). Most of the day is spent on domestic activities. Women spend the largest proportion of their time on these tasks, followed by men and

children. Dryland crops are generally the next most time consuming, with adult males and females spending roughly equal time, and children spending a smaller portion of their time. Instead, children spend a substantial part of their time on academic activities. These activities make up 4% of the time of males, but are almost absent among women. Leisure among women and children is approximately the same, whereas men spend approximately twice as much time on such activities. Livestock is almost the exclusive domain of men and children, with women spending very little time on this responsibility. In contrast, women are more involved in gardens than men and children. All family members spend approximately equal time on woodland activities and home industries, although these take up very little of their overall time budget. The large suite of activities that households engage in allows them significant flexibility to smooth out the demand for labour throughout the year. Results show that there is very little difference in sleep and leisure times between quarters, that wages do not increase during periods of lower leisure activities, and that almost all increases in any given activity are associated with decreases in another activity (i.e., activities are competitive). We conclude that there is labour scarcity, apparent even before the HIV/AIDS pandemic.

In this chapter we have started to see how capitals may be substituted for each other, to the degree that this substitution is possible. Thus human capital, as expressed by labour availability, influences natural capital (the amount of land that can be tilled). Financial capital, when available in large windfalls, is deployed to build human capital (education), to make improvements in physical capital (fencing for irrigation, house improvements, implements and utensils) and to purchase cattle, which produce a number of goods and services. Human capital in the form of leadership skills and time available for social functions has a major impact on social capital. Social capital mediates access to a wide range of resources (natural resources and, to some extent, labour and physical assets). We have presented detailed examples of how the functioning of social institutions affect the viability of micro-credit schemes and irrigated gardens. We have also seen how assets have to be combined and sequenced in people's own livelihoods. The complexities of organisations are apparent, a complexity that is likely to confound attempts by development projects to facilitate change. Thus an improvement in garden output may require attention to social capital (as measured by improved rule compliance), human capital (e.g., leadership issues in the borehole and garden committees; labour availability), physical capital (maintenance of the borehole and purchase of fencing to expand the garden) and financial capital (e.g., large windfalls of cash to raise funds for the fence and spare parts for the pump). In Chapter 6 we turn to how the assets are mobilised for productive activities.

We have started to discern some major axes of differentiation, in particular those related to gender, wealth and site. We see the ruling elite, dominated by men, having a strong control over the activities of the community. However, in a number of cases there are some powerful women also wielding considerable power (Nemarundwe 2002b). On the agricultural side, men focus on livestock and dryland cropping, while women focus on gardening and dryland cropping. Marked wealth differentiation occurs, with local people recognising the different wealth groupings largely on the basis of various capital assets. We see wealthier households committing more funds to building human capital and to purchasing physical and natural assets. The individuals from wealthier households appear to allocate less of their time to sleep/leisure than those in the poorer households. Individuals from poorer households spend more time on woodland activities than those in wealthier households. Not only do wealthier households have more labour units, they also devote more time to productive activities and academic pursuits. The elements of self-reinforcing cycles are emerging, where the wealthy are able to ensure that they become wealthier, or at least that they are well placed to withstand shocks to their system; while the poor are unable to invest in their future, and risk getting poorer, unless they are able to break out of the cycle. We have started to see some tantalising differences between Romwe and Mutangi. Field sizes in Romwe are smaller than Mutangi (Table 7) and population densities are higher (Section 2.2),

thus labour availability per unit area of land is much higher in Romwe. Also in Romwe, there are higher expenses for all agricultural operations. Evidence of greater intensification, i.e., higher inputs per unit area, in Romwe is appearing. Many of the following sections return to examine differentiation.

While the household survey data presents a static picture, the case studies and other work adds some dynamic elements. Landscapes continue to change as new woodland or grazing areas are opened up to cropland. Per capita components of natural capital, namely livestock and cropland, continue to decline. Disturbing signs of a rise in human mortality have emerged, as a consequence of HIV/AIDS and this is going to have a negative impact on labour, financial capital (loss of breadwinners) and future investment in education (Section 5.1.1). Another disturbing trend is the reduction in school-going children, especially at secondary level. We have also seen how institutions are evolving, both at a macro-level (e.g., changes in the status of traditional leaders) and at the micro-level (e.g., in response to 'Training for Transformation') (Section 5.5). Another change is the increasing involvement of women in a variety of trading activities (Section 5.1.1; see also 6.4.2), a phenomenon also recorded in other areas of sub-Saharan Africa (Monela *et al*. 2000). The scene is set to return to the theme of change in later sections, through the use of various temporal data sets (Chapter 9) and modelling (Chapter 10).

6. Household productive activities — the generation of cash and subsistence gross income

Given the assets that households have at their disposal, what productive activities do they undertake? In this chapter we describe the productive activities of households and the cash and subsistence (in-kind) benefits that households receive from those activities. What becomes clear is the variety of goods and services coming from the land and the diversity of income-generating activities. While differentiation data are presented in this chapter but we return to differentiation in Chapter 7 by looking at the gross income characteristics of different household types. Given the difficulty of calculating expenses for each of the livelihood sub-components, this chapter is based on gross income data, not net income. We return to use net income in a Chapter 8, where we deal with the total cash and subsistence income for each of the sectors. A limitation of the quantitative survey is that it largely concentrates on a single year, 1999-2000. Where possible we have supplemented it with qualitative data that indicate temporal trends, and return to temporal change in Chapter 9.

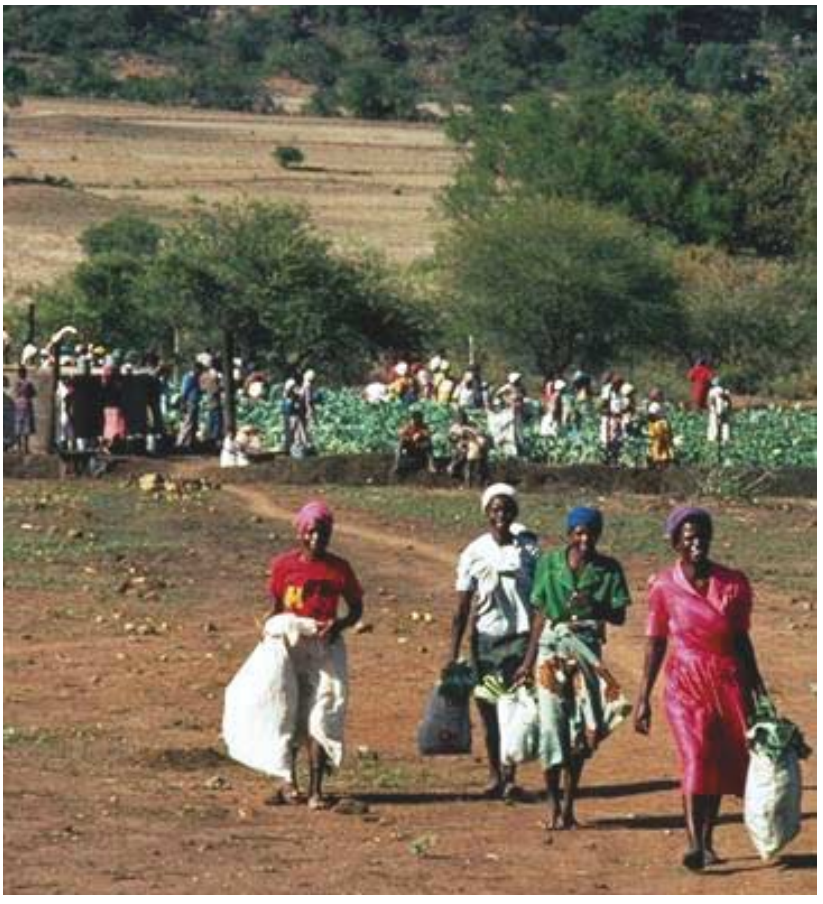
Our analysis is organised by six sectors: dryland crop production (Section 6.1), garden production (6.1), livestock production (6.2), woodland activities (6.3), remittances (6.4) and local wages/home industries (6.4). For each sector, we begin with a description of the production system. We follow this with a presentation of the price data that were collected to value the resources. We then combine the price and quantity data to value the contribution of each sector to livelihoods. We follow with an examination of the factors that influence the levels of income. After the different sectors have been described we summarise gross income patterns, intensification patterns and changes in gross income (Section 6.5).

6.1 Dryland and garden production

6.1.1 The production system

All households in the sample engage in dryland crop production (100%), with most households (84%) having access to gardens for small-scale irrigated production. Dryland production is centred on maize, but a wide spectrum of crops is grown, even within a single household. Gardening is usually based on hand or animal carried water drawn from dams, wells, boreholes, springs or rivers (Figure 14). In one case there is gravity-fed irrigation in Romwe at Barura Dam, and such a system is being developed for a garden next to Mutangi Dam. Dryland crop activities are particularly labour intensive during the period November to February, while gardening consumes most labour in the May to October period (Section 5.1.3). The farming systems of Chivi are described in rich detail in Scoones *et al*. (1996) and Chibudu *et al*. (2001). Even by the 1970s farmers in Chivi were using hybrid maize, but the rise in fertiliser use was negligible, with only 9% purchasing fertiliser in 1986 (Scoones *et al*. 1996).

Figure 14. The community garden in Romwe, supplied by hand-carried water from the Chidiso collector well. Dryland fields surround the garden, and the miombo woodlands at the base of the hill can be seen in the distance (photo: Bruce Campbell)



6.1.2 Dryland crop and garden prices

Although data for some prices are limited, results show that prices are fairly constant, with standard deviations generally being equal to approximately 25% of the means. Even for the diverse category of 'leafy vegetables', standard deviations are only 35% of the mean price (Table 26). There was only a difference between sites (one-way analysis of variance) for cotton prices. The problems of using just a single price are illustrated for garden produce, where women, the main sellers of such produce, get high prices if they manage to sell at a local market, and especially so on the Masvingo-South Africa road near Romwe. Prices received for inter-household trade are low, and usually based on credit.

6.1.3 Contribution of dryland crop and garden production to livelihoods

While slightly more than half of the gross income from gardening comprises cash, only about one-quarter of the dryland crop gross income is sold; most dryland crop gross income is subsistence (Table 27). Comparisons with the Cavendish (2002a) study from neighbouring Shindi Ward show that his numbers are lower than ours. This was expected, as his income figures are net of all inputs except labour, while our figures are gross income. Much of his crop production was classified as 'environmental income' or 'livestock income' for the purposes of his study.[20]

Table 26. Mean crop prices (Z$/kg)

	Number of observations[a]	Grand mean	5% trimmed mean	Standard deviation
Dryland Crops				
Cotton	47	11.18	11.13	3.16
Maize	37	3.87	3.81	1.50
Groundnuts (*Arachis hypogaea)*	18	11.05	10.88	3.14
Roundnuts (bambara nuts *Voandzeia subterranea)*	23	9.03	9.10	2.08
Rice	5	6.43	6.55	1.60
Pearl millet (*Pennisetum glaucum)*	2	6.11	6.11	0.79
Sweet reed (a variety of *Sorghum bicolor*)	6	5.11	5.01	1.77
Sunflower	13	4.23	4.19	1.30
Sorghum (*Sorghum bicolor)*	1	5.00	5.00	-
Beans (various sorts)	1	6.67	6.67	-
Sweet potatoes	1	6.25	6.25	-
Finger millet or rapoko – *(Eleusine coracana)*	1	12.04	12.04	-
Pumpkins	0	-	-	-
Garden Crops				
Tomatoes	75	9.00	8.57	4.04
Leafy vegetables (mostly rape)	111	5.54	5.42	1.94
Maize (mostly for green maize not ground)	4	8.75	8.70	3.70
Okra	0	-	-	-
Onions	0	-	-	-
Sweet Potatoes	0	-	-	-
Beans (various sorts)	0	-	-	-

[a.] Cases with zero observations of prices imply that the respective crops were not recorded as sold and therefore mainly used for household consumption.

Table 27. Average cash and subsistence gross income from crops per household per year (Z$)

	Subsistence income	Cash income	Total income	Equivalent figure from Cavendish[a] (2001) (1999 Z$ prices)
Dryland crops (quarterly recall data)	8489	2474	10963	
Gardening (weekly recall data)	1109	1211	2320	
Overall	9598	3685	13283	7902

[a.] Cavendish (2002a) presents his figures in terms of 'adult equivalent units'. Our data is on a per household basis. Given that there are an average of 5.2 adult equivalent units in a household, we multiply the Cavendish numbers by 5.2 to make it comparable to our results.

Cotton is almost the only crop that is important for gross cash income from dryland crops (Figure 15). Maize makes up more than 50% of gross subsistence income from these crops. The next most important crops are groundnuts and roundnuts, and then the various small grains (Figure 16). Looking at cash and subsistence gross income combined, maize contributes most, followed by cotton, groundnuts and roundnuts (Figure 17). Tomatoes completely dominate the sales profile for gross cash income from gardens(Figure 18), but are less important for gross subsistence income (contributing about 50% of income – Figure 19). They are followed by leafy vegetables (mostly rape), and then maize and sweet potatoes. Tomatoes are the highest contributor to gross income from garden crops (Figure 20). Other crops make up just over 25% of value and, amongst these, leafy vegetables are most important.

Figure 15. Contribution to cash gross income by different dryland crops

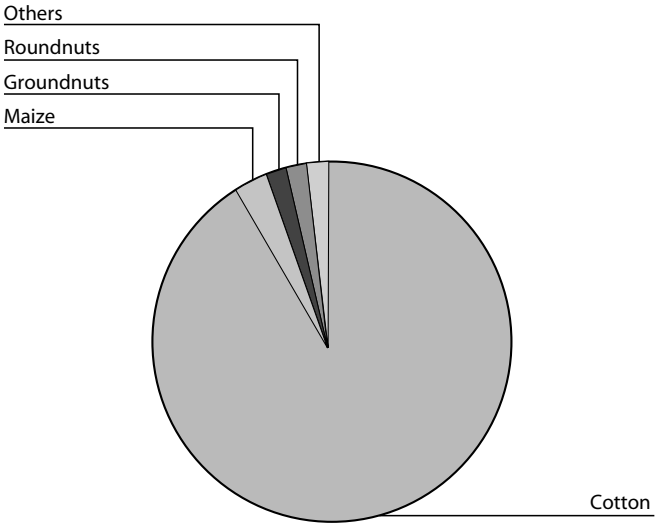


Figure 16. Contribution to subsistence gross income by different dryland crops

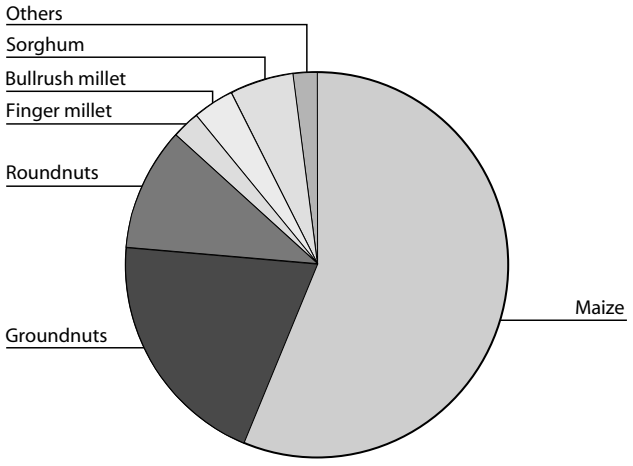


Figure 17. Contribution to total gross crop income by different dryland crops

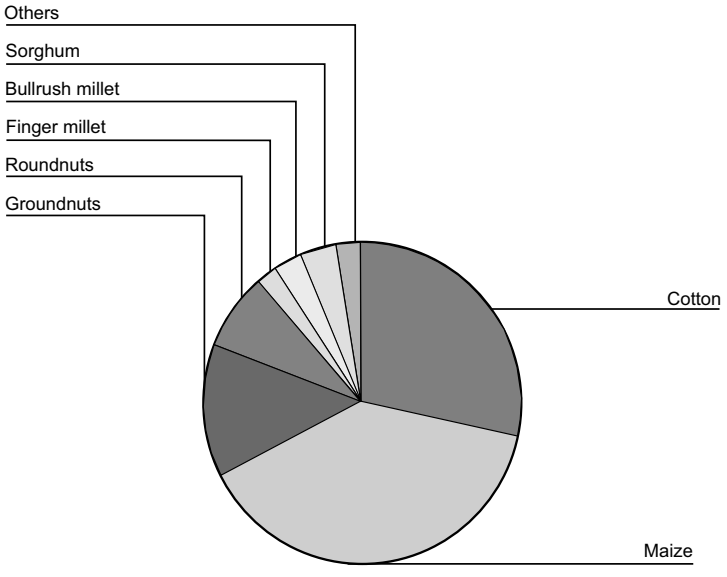


Figure 18. Contribution to cash gross income by different garden crops

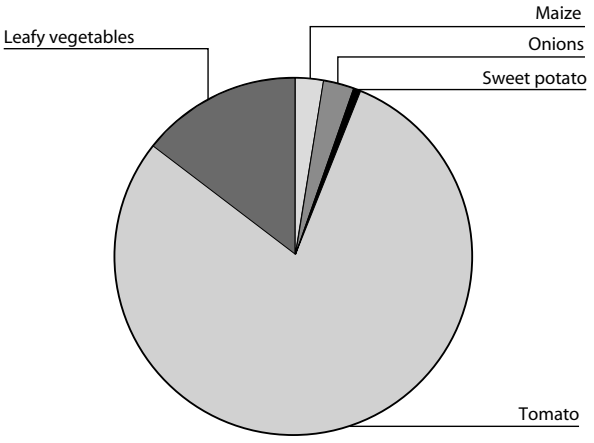


Figure 19. Contribution to subsistence gross income by different garden crops

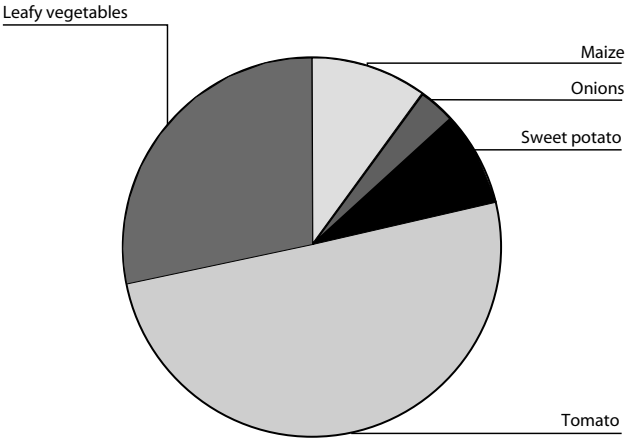
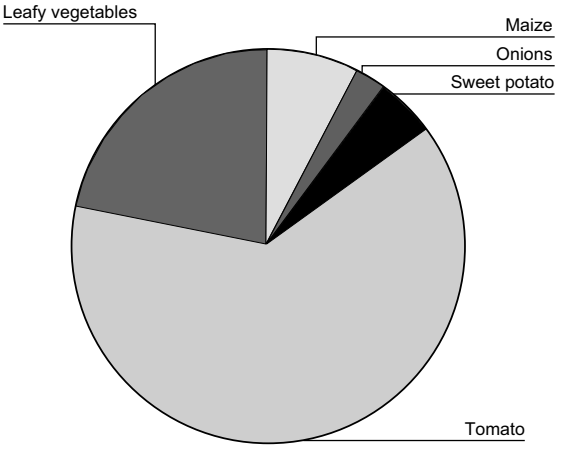


Figure 20. Contribution to total gross crop income by different garden crops



In all but one of the gross crop income variables presented in Table 28, the higher wealth quartiles correspond with higher levels of gross crop income, for sales and household consumption. The one exception is cash income from garden produce, where there are no significant differences among wealth quartiles (though the trend was the same as the other variables).

Garden production stands out in three ways — firstly it is something practised by a wide range of household types, is not limited to wealthier households, and is without

Table 28. Differences among wealth quartiles in average gross income from crops per household per year ($Z)

Variable	Lowest 25%	25-50%	50-75%	Top 25%	Two-way ANOVA, F test
Dryland (quarterly recall data)					
Cash	447[a]	1454[ab]	2232[b]	5721[c]	***
Subsistence	5159[a]	6794[ab]	7851[b]	14083[c]	***
Total	5606[a]	8248[ab]	10083[bc]	19804[c]	***
Gardens (weekly recall data)					
Cash	832	873	1248	1882	NS
Subsistence	791[a]	624[a]	976[ab]	2037[b]	***
Total	1624[a]	1497[a]	2224[ab]	3919[b]	**
Dryland and gardens					
Dryland and garden cash	1279[a]	2327[a]	3480[ab]	7604[b]	***
Dryland and garden subsistence	5950[a]	7418[a]	8827[a]	16120[b]	***
Total dryland and garden cash and subsistence	7229	9745	12307	23724	***

All Dunnett C tests: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; NS = level of significance is > 5%; ** = level of significance is 1%; *** = level of significance is 0.1%

strong wealth-related trends (Table 23). Secondly, a high proportion of its income is cash (as compared to dryland production). Thirdly, from the labour activities data, it is predominantly women who provide labour for garden production (Figure 21).

Gross crop incomes do not differ between Romwe and Mutangi (Table 29). There is one interaction of site and wealth for subsistence income of garden crops, which is due to significant variation among wealth quartiles in Mutangi but not in Romwe. Total dryland and garden crop incomes are about the same in the two sites, but the cash income proportion is higher in Romwe than Mutangi for both dryland and garden crops. The cash proportion being of total crop gross income in Romwe is 31% and 23% in Mutangi.

Figure 21. Women provide the bulk of labour for dryland cropping. Here a woman carries a bucketful of water 150 m from the Mutangi Dam to her garden plot (photo: Bruce Campbell)

Table 29. Differences between sites of average gross income per household per year from crops ($Z)

Variable	Romwe	Mutangi	Two-way ANOVA, F test	Significance of wealth-site interaction, F test
Dryland crops (quarterly recall data)				
Cash	2673	2144	NS	NS
Subsistence	8303	8795	NS	NS
Total	10976	10939	NS	NS
Gardens (weekly recall data)				
Cash	1418	867	NS	NS
Subsistence	964	1347	NS	**
Total	2382	2214	NS	NS
Dryland and gardens				
Dryland and garden cash	4091	3011	NS	NS
Dryland and garden subsistence	9267	10142	NS	NS
Total dryland and garden cash and subsistence	13358	13153	NS	NS

NS = level of significance is > 5%; ** = level of significance is 1%

6.1.4 Factors influencing crop income

We investigated the factors likely to influence gross dryland income in a household. In an analysis of covariance, by far the most important factor was cattle numbers per household ($F = 47.0$, $df = 1$ & 185, $p < 0.001$). This reflects access to draft power and manure. Much less important, but still significant, was access to non-farm cash income (cash from remittances and wages/home industries) ($F = 6.1$, $df = 1$ & 185, $p < 0.05$). Non-farm cash income is used to purchase inputs for production. Number of household members, site, ownership of a plough and number of acres are not significant. In a similar analysis for gross garden income, but excluding ploughs (as land preparation is not usually done by ploughs), the only variable that was significantly related to garden crop income was the size of the garden plot, reflecting access to good irrigation water ($F = 17.0$, $df = 1$ & 189, $p < 0.001$). Our action research on the micro-credit scheme indicated that loans were often used for dryland production, usually to purchase cotton inputs. One woman illustrated how she had used the loan to engage successfully in garden (onion) production (Box 4).

Similar analyses were done for cotton production, but as this is relatively limited to the wealthiest class, we only used that quartile in the analysis. Characteristics of the household head were particularly important in influencing cotton production. Age of household head was important, with young household heads (less than 40 years) producing approximately three times less cotton than older household heads (40-55 years) ($F = 4.7$, $df = 2$ & 39, $p < 0.05$). We interpret this as an asset issue, with younger households having fewer assets to draw on. Those with secondary education were producing outputs averaging Z$13245, while those with primary education were producing an average of $7175 and those with no education just $4768 ($F = 3.9$, $df = 2$ & 39, $p < 0.05$). The other significant variable was the value of remittances ($F = 5.0$, $df = 2$ & 39, $p < 0.05$). It was surprising that cropland area was not significant. We suspect that this a consequence of land quality being more important than land quantity, as cotton production is practised on particular soil types.

In the case studies people talked of the yearly fluctuations in dryland crop production and the unreliability of this as a source of cash and subsistence. Even in our project period we noted the impact of three very different seasons: a slightly above-average year (1998/99 — the season captured by the survey), crop failure due to waterlogging (1999/00) and crop failure due to drought (2000/01) (Section 9.2.1). In the past, serious crop failure was met by State assistance in drought relief, which was a combination of food, seed and fertiliser provision. This support has been increasingly withdrawn as the State coffers decline, so can no longer be seen as a safety net. Farmers also discuss changes in the crop mixes — noteworthy has been the rapid increase in cotton production in the last few years, followed by a decline (see also Figure 40). Some farmers have recently reverted to using open pollinated varieties of maize. Others have embarked on greater use of locally available organic fertilisers (leaf litter from the hills, soil from termite mounds) in the face of an ever-rising cost of inorganic fertilisers. People link these changes in production to the appearance of new opportunities, the costs of inputs and the prices paid for crops. Cotton became more lucrative when the market was deregulated, with the subsequent collapse due to lack of capital to purchase inputs. For gardens, case studies consistently record an increase in gardening activity; there is a long-term trend of more gardens being opened up. In the case of many new gardens they are being opened up for new, young families, but this is not the entire story as the rate of increase in gardens is higher than the population growth rate (Section 9.2.4). While some of the increase relates to the development of new water points, it is mostly due to lack of enforcement of natural resource regulations that limit cultivation along streams and in wetlands. Farmers note that in the colonial period and into the 1980s, the natural resource officers were very active, but now they hardly see them (Section 9.2.3; Nemarundwe and Kozanayi 2002). Garden production also fluctuates with rainfall; extreme droughts or a series of low rainfall years reduce surface or groundwater supplies, resulting in reduced planting.

For garden production a host of social processes influence production, as a considerable amount of production is in the community gardens, which are governed by committees, usually an agronomy committee (often women) and a water point committee (often men). Even for home gardens, there has to be considerable inter-household negotiation

in cases when water for gardening is drawn from a community water point. In the community gardens, the committee decides which crops to grow and when to plant. When water is scarce, the committee decides how to ration the water. The committee often purchases the pesticides for spraying, and a nominated individual often does the spraying of the whole garden. Some joint marketing may also be undertaken. If the committees don't function effectively, then production can suffer, as occurred in the Chidiso garden in the 1999 dry season (see also Section 5.5). Most people have a private garden and a plot in a community garden. Despite the more complex social environment for community gardens, local people use these for three main reasons:

- Shortage of reliable water sources. In the dry season some of the shallow wells dry up and the community relies on communally owned water sources, such as the dam and collector well.
- High fencing costs. If gardens are not fenced, livestock will eat crops in the dry season. With community gardens, an external donor meets the bulk of the fencing costs.
- Extension services are largely provided to groups of people and not individuals. By being part of a garden an individual is able to better interact with the extension worker.

Dryland production is much more of a household affair, though there are many inter-household arrangements (e.g., the borrowing of cattle and ploughs, assisting each other with harvest). In some cases of dryland production there are important committees, such as the cotton growers committee, that try to keep up to date with extension messages, information from the marketing company, etc. But even here, cotton production remains largely a household matter.

Households probably view dryland production as the central activity of their livelihood system. This was seen in the various needs assessments that were completed in the participatory fieldwork. From both study sites, participants made continual calls for a focus on dryland production for development activities. In Mutangi, top priorities for private fields were erosion, inadequate moisture and declining fertility. In the action research, considerable time was spent on soil and water conservation technologies, which farmers were introduced to during farmer-to-farmer visits to nearby areas where the technologies are being adopted. Despite the effort placed on this activity, the farmers did not show a great deal of interest in adopting any of the technologies. Many of the techniques require considerable labour, which as we have seen is not abundant (Section 5.1.6). The complexities of the climate, meant that the planned interventions, intended to address inadequate moisture, were discussed just before one of the wettest seasons in history (three such events in a century). An interest in alleviating inadequate moisture was seriously dampened!

6.2 Livestock production

6.2.1 The production system

Livestock produce a myriad of goods and services for household livelihoods and provide income for 78% of households. Besides food products, such as meat and milk, they also provide draft, transport and are a source of manure (i.e., fertiliser). Cattle are also used to pay dowry '*rooro*'. In some cases cattle can also be used to pay fines at traditional courts. A recent case is that of Mr. Dobhani, the *sabhuku* of Dobhani village. He was convicted by chief Madzivire of having caused the collapse and subsequent death of Mr Makiwa, one of the Dobhani villagers. He paid a fine of $7000.00 to the complainant (the late Makiwa's daughter).' A few months later Mr Dobhani was again back at a village tribunal. This time his crime was that he had slept with a neighbour's wife. The neighbour charged Dobhani a fine of four cattle, which the latter paid. There are also stories whereby cattle are used to appease avenging spirits. The belief in avenging spirits is strong among the Shona and the only way to avert the wrath of these spirits is to appease them using money or cattle. Goats have an important cultural role in which they are slaughtered and

eaten during a ritual ceremony called '*Masungiro*'. This is very common among the Karanga people of Chivi. This ritual ceremony is observed when a woman who is pregnant for the first time is sent to her parents to be given traditional medicine that is meant to enlarge the birth canal. Usually two goats are slaughtered for the function, all female goats.

Cattle, donkeys and goats are the main species of livestock; most households also have a small number of chickens, with a few households specialising in poultry production (Box 2). Animals are penned at night; manure accumulates in the pens and is collected in the dry season for application to crop fields. During the growing season the animals are carefully herded so that they do not destroy the dryland crops, which are largely unfenced (unlike the garden plots), and this is the time when labour for livestock is most demanding (for males and children) (Section 5.1.3). During the dry season the herding is not as rigorous, and the animals roam over much of the landscape. During this time a considerable amount of dryland crop residue is eaten *in situ*, though a minority of farmers collect the crop residue for pen feeding. There is almost no purchased livestock feed and there is no market for locally produced fodder. Livestock, including cattle, are generally sold locally through informal channels. The market is not large, and bears no similarities to the vibrant informal butcheries described by Mortimore *et al*. (2001) for semi-arid systems in Niger. Details of the Chivi livestock production system can be found in Scoones *et al*. (1996) and Campbell *et al*. (2000a).

6.2.2 Livestock prices

As was the case for crops, price information for livestock and livestock products is sparse (Table 30). However, results show that prices are fairly consistent, with standard deviations being approximately 25% size of the means. There were no differences between sites for any of the livestock price variables that had sufficient samples for analysis (one-way analysis of variance).

6.2.3 Contribution of livestock to livelihoods

Draft, transport and milk are the largest sources of gross income from livestock (Table 31). Almost all livestock products are for subsistence use, with very little cash income generated, except from sales of animals.[21] Draft is most important between December and February, particularly for the top quartile in Romwe in the fourth quarter, and has significant interactions with site and wealth (Table 32 and Figure 22). Manure also varies seasonally, with most income coming in the period from August to October, and then mostly for the top quartile. Thus livestock, in particular cattle, are very important for crop production.

Figure 22. A woman weeding a maize field with a cultivator drawn by oxen. The Romwe inselberg is in the background (photo: Bruce Campbell)

Table 30. Mean prices for livestock and livestock products (Z$/head unless otherwise indicated)

Class of livestock	Number of observations[a]	Grand mean	5 % trimmed mean	Standard deviation
Calf (bought)	1	5000	-	-
Calf (sold)	3	4167	-	764
Steer (bought)	4	3875	3806	1436
Steer (sold	1	4500	-	-
Heifer (bought)	13	4700	4572	1442
Heifer (sold)	4	5500	5472	707
Cow (bought)	3	5233	-	1250
Cow (sold)	0	-	-	-
Oxen (bought)	0	-	-	-
Oxen (sold)	3	7167	-	1041
Bull (bought)	1	4800	-	-
Bull (sold)	1	2000	-	-
Cattle (bought or sold)	*34*	*4841*	*4775*	*1468*
Goat (bought)	15	371	369	135
Goat (sold)	9	359	360	102
Goats (bought or sold)	*24*	*372*	*370*	*121*
Donkey (bought)	5	1700	1700	283
Donkey (sold)	4	975	961	377
Donkeys (bought or sold)	*9*	*1378*	*1381*	*489*
Livestock Products				
Cattle draft per hour	8	55	56	18
Cattle transport per hour	1	17	-	
Donkey draft per hour	0	-	-	-
Donkey transport per hour	7	37	37	22
Cattle Milk per litre	21	5	5	2
Draft per hour (donkeys or cattle)	*8*	*55*	*56*	*18*
Transport per hour (donkeys or cattle)	*8*	*34*	*34.25*	*22*
Manure per kg[b]	0	-	-	-
Meat per kg	3	42	-	28
Hide per kg	3	12	-	6

a. Cases with zero observations of prices imply that the respective items were not sold and therefore mainly used for household consumption.
b. We used Z$0.275/kg derived from another study in Chivi (Campbell *et al*. 2000a).

Table 31. Average cash and subsistence gross income from livestock per household per year ($Z)

	Subsistence income	Cash income	Total income	Equivalent figure from Cavendish (2001) (1999 Z$ prices)
Manure	382	0	382	
Milk	810	48	858	Cash only: 13
Meat	457	14	471	655
Transport	1062	36	1098	Cash only: 37
Draft	2588	86	2674	(transport plus draft)
Hides	16	0	16	Cash only: 0
Animal sales	0	228	228	361
Overall	5315	412	5727	2356

Table 32. Differences in average gross income per household from livestock, by quarters (Z$)

Activity	Mar-May	Jun-Aug	Sep-Nov	Dec-Feb	Overall	Repeated measure ANOVA, Greenhouse Geiser F test	Significant interactions with quarter, F test
Manure	20	93	242	27	382	***	Wealth (***)
Milk	413	170	245	30	858	NS	NS
Meat	164	106	72	129	471	NS	NS
Transport	305	253	210	329	1098	NS	NS
Draft	256	78	267	2072	2674	***	Site (***) Wealth (***)
Hides	5	3	3	5	16	NS	NS
Live animals	78	59	33	59	228	NS	Wealth (*)
Overall cash	120	120	34	139	413	NS	Wealth (*)
Overall subsistence	1121	643	1040	2513	5317	***	Site (*)
Total	1241	762	1073	2652	5731	***	Site (**) Wealth (*)

NS = level of significance is < 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%; Weekly recall data: draft, transport, milk; Quarterly recall data: manure, meat, hides, live animals

Both cash and subsistence income from most livestock products are shown to vary directly with wealth level, with income in the top quartile some nine times more than that in the lowest quartile (Table 33). This is to be expected, as the wealth quartiles are asset-defined, with cattle numbers being one of the important assets in the wealth index. Of the livestock products, it is only gross income from draft that differs between sites, with it being larger in Romwe (Table 34).

Table 33. Differences in average gross income per household per year from livestock, by wealth quartiles ($Z)

Variable	Lowest 25%	25-50%	50-75%	Top 25%	Repeated measure ANOVA, F test
Manure	59^{a}	170^{ab}	521^{bc}	773^{c}	***
Milk	25^{a}	1168^{ab}	949^{ab}	1273^{b}	NS
Meat	155^{a}	413^{abc}	316^{ab}	996^{c}	NS
Transport	59^{a}	232^{a}	1403^{b}	2677^{b}	***
Draft	889^{a}	2025^{a}	3090^{ab}	4656^{b}	***
Hides	6^{a}	12^{ab}	11^{ab}	37^{b}	**
Live animals	113	131	131	537	NS
Overall cash	166^{a}	230^{a}	301^{ab}	949^{b}	*
Overall subsistence	1140^{a}	3922^{ab}	6120^{bc}	10002^{c}	***
Total	1306^{a}	4152^{ab}	6421^{b}	10951^{c}	***

All Dunnett C tests: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; NS = level of significance is < 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%; Weekly recall data: draft, transport, milk; Quarterly recall data: manure, meat, hides, live animals

Table 34. Differences in average gross income per household per year from livestock, by site ($Z)

Variable	Romwe	Mutangi	Repeated measure ANOVA, F test	Site by wealth interaction, F test
Manure	350	436	NS	NS
Milk	873	834	NS	NS
Meat	448	512	NS	NS
Transport	1188	949	NS	NS
Draft	3387	1494	***	NS
Hides	17	16	NS	NS
Live animals	229	225	NS	NS
Overall cash	361	497	NS	NS
Overall subsistence	6132	3969	*	NS
Total	6493	4466	**	NS

NS = level of significance is > 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%; Weekly recall data: draft, transport, milk; Quarterly recall data: manure, meat, hides, live animals

6.2.4 Factors influencing livestock income

The cash income from livestock is largely comprised of income from small stock and chickens. Cattle sales are rare, and are the result of urgent cash needs or distress sales during droughts, when it is better to sell than watch an animal die (see also Kinsey *et al*. 1998). The size of gross income from livestock in any particular year is obviously determined by animal numbers. It is well recognised that wealth status is largely a function of the number of animals owned (Chapter 4). What allows households to accumulate animals? For cattle we suggest that it is largely access to sizeable remittance income and good incomes from cotton sales (Section 5.4.2). A major factor influencing livestock numbers is the pattern of rainfall, as many case studies attest. All households discuss the traumatic loss of livestock in the early 1990s. Data collected from dip tank areas indicate the wide fluctuations that occur in herd size (Figure 40). Droughts are great reducers of inequality, with the largest absolute losses in income in post-drought periods incurred by the farmers with many cattle. However, these farmers also have a great deal of resilience, and are usually in a better position to build up the herd again.

While many external stakeholders regard over-stocking and over-grazing as problems, farmers were not interested in any interventions that involved controlled grazing or supplementing livestock feed. Top on their agenda for the livestock sector was rebuilding the cattle herd to its previous numbers. Some farmers have recently benefited from donor initiatives aimed at rebuilding the local herd. SEDAP (South Eastern Dry Areas Programme) has given loans to a few local farmers to buy cattle. Other farmers recently bought cattle from their savings derived from gold panning and working on commercial farms in South Africa. In Romwe two people were able to purchase cattle after they received windfalls from the government as gratuities for fighting in the liberation war in the 1970s. Mr Elliot Makodza got a lump sum of $50,000 in 1997 and bought four cattle, which have since multiplied to more than 10.

Ownership of cattle is concentrated amongst the wealthiest households, but there are numerous processes whereby those without cattle get access to key livestock services, such as transport and ploughing. In many cases this is based on reciprocity. In some cases the poorer household may look after the cattle for the wealthier household (e.g., through providing a child to herd the cattle) in return for having their fields ploughed. In some cases, farmers have farm implements but do not have cattle. In these cases, farmers team up with cattle owners and till their fields together. Case study interviews suggest that increasingly the exchanges involving livestock are governed by cash transactions.

6.3 Woodland use

6.3.1 The woodlands as a source of goods and services

Woodlands are known to be an important source of livelihood for subsistence farmers, particularly among the poorer households and during times of drought (Arnold and Ruiz Pèrez 1998; Cavendish 2002b). The woodlands are a common pool resource, with the chief rules for their use being derived from the 'traditional' system (Campbell *et al*. 2001b; Mandondo *et al.,* 2002). Woodlands provide a variety of goods and services including building materials, fuelwood and food, and all households in the survey used woodland products. Forest foods complement the carbohydrates and calories that farmers grow themselves, and are important as a source of vitamins and minerals. There are also many unpriced services such as shade and spiritual values. In the discussion that follows, we present results for those products that have local prices, and thus exclude the unpriced services.

Tree planting occurs but is almost exclusively limited to fruit trees near the homestead (e.g., mango and papaya trees). It is also government policy that every year all households should plant a tree on National Tree Day. Some NGOs, including CARE, are promoting agroforestry activities but these are still in their infancy. It is not simple to grow trees given the need for watering in dry periods and the constant need to protect the trees from cattle and goats. One component of the fieldwork was action research on tree planting with the results reported elsewhere (Nemarundwe 2002a,b,c).

6.3.2 Woodland prices

Prices for a variety of woodland products, compiled from the quarterly and weekly recall data, show significant variability within each category of goods, with standard deviations in many cases approximately equal to mean values (Table 35). For poles, quarterly and weekly price estimates are consistent. High standard deviations in prices for these products are expected for several reasons. Firstly, markets for some products tend to be thin, sometimes resulting in little common knowledge about available prices. Secondly, prices are dependent on the location of the product being valued. For example, buying fuelwood from somebody who must walk a long way to collect it will likely cost more than buying fuelwood from somebody who has a ready source nearby. Given that households are different distances from goods and services, varying prices would be expected (Figure 23). Thirdly, there tends to be high variability in product quality within a single category of goods. For example, there are many types of fuelwood and fruits, some more desirable than others. Finally, there are various types of transactions. At the one extreme are the transactions among local households (i.e., within the same village), who purchase different goods and services from each other. These transactions may include concepts of reciprocity, especially where the sales are between members of a close network. This results in the agreed price reflecting only a partial measure of value. At the other extreme are the transactions involving marketing of local products to buyers from outside the surrounding community. This includes a wide range of buyers, from travellers on the major road markets to big well-established organisations, like parastatals and large private companies.

6.3.3 Contribution of woodland production to livelihoods

Gross income from quarterly recall data for woodland construction items are approximately half of the amount derived from weekly recall estimates (Table 36), a pattern discussed previously (Section 5.2.1). Although price estimates are similar for both types of data, quantities tend to be higher for weekly recall. For our analysis of woodland income we had initially thought of using quarterly data for large construction items as these are infrequently harvested, but given our findings throughout the survey, where weekly recall gives apparently better estimates, we have discarded the quarterly

Table 35. Mean prices for woodland products (Z$/kg)

Product	Number of observations[a]	Grand mean	5% trimmed mean	Standard deviation
Quarterly recall data				
Poles	19	0.77	0.71	0.68
Fibre/thatch	20	3.89	3.16	6.01
Wood for utensils	3	0.67	-	0.33
Weekly recall data				
Child firewood	62	0.33	0.29	0.26
Female firewood	36	0.46	0.44	0.28
Male firewood	185	0.24	0.21	0.22
Firewood (average over all household members)[b]	*276*	*0.28*	*0.25*	*0.21*
Child poles	*4*	*1.31*	*1.29*	*0.85*
Female poles	*15*	*0.62*	*0.52*	*0.62*
Male poles	*73*	*0.92*	*0.83*	*0.81*
Poles (average over all household members)[b]	*92*	*0.88*	*0.79*	*0.80*
Child fibre/thatch	*4*	*0.31*	*0.31*	*0.11*
Female fibre/thatch	*51*	*0.28*	*0.24*	*0.11*
Male fibre/thatch	*7*	*0.40*	*0.39*	*0.23*
Fibre/thatch (average over all household members)[b]	61	0.30	0.29	0.13
Child wild plant foods	5	18.90	18.64	13.82
Female wild plant foods	3	11.00	-	11.09
Male wild plant foods	10	24.90	24.22	26.66
Wild plant foods (average over all household members)[b]	*17*	*20.97*	*20.46*	*23.63*
Child litter	3	*37.12*	-	*54.70*
Female litter	0			
Male litter	2	4.06	-	5.57
Litter (average over all household members)[c]	*5*	23.82	20.90	42.79
Child wild animals	98	15.74	12.07	30.35
Female wild animals	12	100.90	87.08	134.93
Male wild animals	97	63.87	52.29	88.51
Wild animals (average over all household members)[b]	*196*	42.75	29.59	76.07

a. Cases with zero observations of prices imply that the respective crops were not sold and therefore mainly used for household consumption; b. Indicates values used in the final household budget; c. Z$0.275/kg was used for litter, making it equivalent to the manure price.

Figure 23. Distribution of sampled households in Romwe, showing location in relation to woodland cover, where the green represents mature and relatively undisturbed miombo woodland. The cash income from woodland sales is also shown (Z$ per household per year)

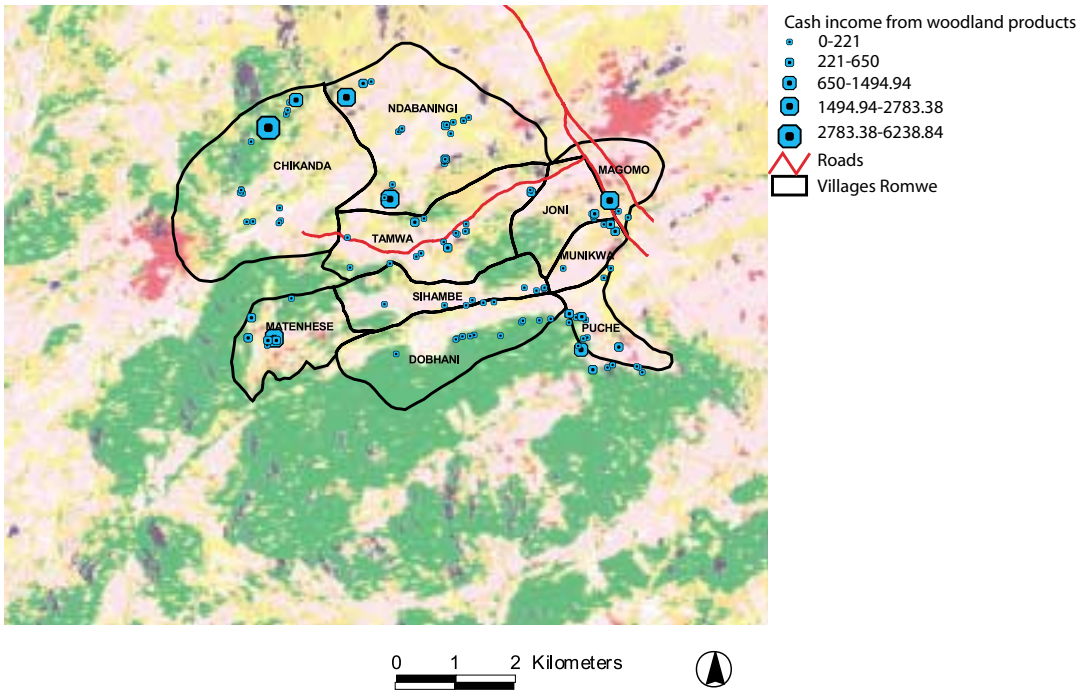


Table 36. Average cash and subsistence gross income from woodlands per household per year (Z$)

	Subsistence income	Cash income	Total income	Equivalent figure from Cavendish (2001) (1999 Z$ prices)
Quarterly recall data				
Wood for utensils	5	2	7	
Thatch	279	17	296	
Fibre and small construction items	3	0	3	
Poles	297	20	317	
All woodland construction items	*584*	*39*	*623*	*874*
Weekly recall data				
Thatch, fibre and small construction items	191	35	226	
Poles	927	120	1047	
All woodland construction items	*1118*	*155*	*1273*	*874*
Fuelwood	1293	131	1424	1446
Litter	13	2	15	31
Wild plant foods	843	10	853	1184
Wild animals	290	86	376	230
Overall	3557	384	3941	3764

data as we are in position to use the weekly recall data. The table also shows that a vast majority of the woodland products are used within the household, with only approximately 9% of the overall value of woodland products being sold for cash. The total value of cash and in-kind income received from the woodlands (from weekly recall data) is approximately Z$4000 per household per year, with this amount coming equally from fuelwood (35%), construction items (32%) and wild foods (mostly plants) (36%). Comparisons of weekly data results with values derived by Cavendish (2002a) show remarkable similarities. They can be very different in other semi-arid regions, as is demonstrated for parts of South Africa, where construction items are much less important (Shackleton *et al*. 2002).

Higher values for woodland products are received in the March to May quarter, but there is wide variation among woodland products and there are many site-specific patterns (as indicated by the many significant interaction terms) (Table 37). Both quarterly and weekly recall data show that poles are most heavily consumed in the March to May quarter, while thatch has is in more demand in the following June to August quarter. Fuelwood is most heavily gathered between May and August while the consumption of wild plant foods is least prevalent in the June to August quarter. Allocation of time to woodland activities is highest in March to August for males and June to August for females, indicating the time-consuming nature of pole collection by males, and firewood collection by both males (using scotchcarts) and females (headloading).

For almost all variables, the highest mean income values are in the lowest wealth quartile, but it is only for thatch/small construction items that this is significant (Table 38). In the case of thatch, wealthier households often have the means to purchase other types of roofing materials (e.g., asbestos or tin), as reflected in the variation in house/hut styles (Table 22). In addition, poorer households collect thatch for sale. The quarterly recall data for Romwe shows higher income from poles than for Mutangi, though the difference is not significant using the weekly recall data (Table 39). Similar patterns are found for wild plant foods, but income from fuelwood, wild animals and total cash from woodlands are higher in Mutangi.

Table 37. Differences in average gross income from woodlands per household, by quarter (Z$)

	Mar-May	Jun-Aug	Sep-Nov	Dec-Feb	Overall	Repeated measures ANOVA, Greenhouse Geiser F test	Significance of interactions with quarter, F test
Quarterly recall data							
Thatch	117	158	11	10	296		NS
Poles	176	49	25	69	319		NS
All woodland construction items	293	207	36	79	615		NS
Weekly recall data							
Thatch, fibre and small construction items	62	141	20	1	224	***	Site (**)
Poles	672	213	136	24	1045	***	NS
Fuelwood	415	376	347	287	1425	***	Site (***) Wealth (*)
Wild plant foods	282	80	201	289	852	***	Site (***)
Wild animals	121	169	33	52	375	**	Site (*)
Overall cash	180	118	49	37	384	***	Site (*)
Overall subsistence	1370	867	692	617	3546	***	NS
Total	1550	985	741	654	3930	***	NS

NS = level of significance is > 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%; litter, with very small amounts, not shown in this table, but incorporated in totals.

Table 38. Differences in average gross income from woodlands per household per year, by wealth quartile (Z$)

Variable	Lowest 25%	25-50%	50-75%	Top 25%	Repeated measures ANOVA, F test
Quarterly recall data					
Thatch	386[a]	325[ab]	270[ab]	204[b]	*
Poles	273	277	265	453	NS
All woodland construction items	659	602	535	657	NS
Weekly recall data					
Thatch, fibre and small construction items	313[a]	256[ab]	195[ab]	139[b]	*
Poles	1265	1024	1073	829	NS
Fuelwood	1471	1207	1487	1535	NS
Wild plant foods	1004	873	714	824	NS
Wild animals	369	537	323	275	NS
Overall cash	607	381	324	226	NS
Overall subsistence	3817	3542	3461	3372	NS
Total	4424	3923	3785	3598	NS

All Dunnett C tests: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; NS = level of significance is > 5%; * = level of significance is 5%; litter, with very small amounts, not shown in this table, but incorporated in totals.

Table 39. Differences in average gross income from woodlands per household per year, by site (Z$)

Variable	Romwe	Mutangi	Repeated measures ANOVA, F test	Significance of wealth X site interaction, F test
Quarterly recall data				
Thatch	320	257	*	NS
Poles	379	215	**	*
All woodland construction items	*699*	*472*	**	*
Weekly recall data				
Thatch, fibre and small construction items	216	241	NS	NS
Poles	1071	1006	NS	NS
All woodland construction items	*1287*	*1247*		
Fuelwood	1302	1628	**	NS
Wild plant foods	987	632	**	NS
Wild animals	184	694	***	NS
Overall cash	209	672	***	NS
Overall subsistence	3555	3534	NS	NS
Total	3764	4206	NS	NS

NS = level of significance is > 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%; litter, with very small amounts, not shown in this table, but incorporated in totals.

6.3.4 Factors influencing woodland income

The lack of difference among wealth quartiles for most woodland products (Table 37) is somewhat surprising given the greater amount of time that poorer households were shown to spend on woodland activities (Table 12). However, the lack of significance is probably due to high within-quartile variation and the variation in labour productivity among different households. For example, wealthier households have greater access to carts and livestock and thus can collect wood at much higher rates per trip.

For a number of woodland variables income is higher in Romwe, probably due to Romwe being more heavily wooded than Mutangi (Section 5.4.3). Mutangi has very different kinds of vegetation (e.g., mopane woodland, Figure 13); this could be the reason for the higher consumption of wild animals. In addition, it appears that the relative scarcity of woodland products in Mutangi generates higher income for woodland products that are more heavily marketed, while the abundance of woodland products in Romwe may hinder markets and sales. A number of families in Mutangi were recorded as selling fuelwood by the cartload. The participatory work suggests that it is poorer households that most resort to selling woodland products, though there are odd exceptions where quite considerable cash income is derived from woodlands (Box 5).

In an analysis of covariance to explore patterns of gross income from woodland, gross cash income was found to be significantly related to site ($F = 25.7$, $df = 1$ & 189, $p < 0.001$) but to no other variable, though cash income from remittances and wages/ home industries is almost significant (negatively related, $p = 0.085$), indicating the wealth-related trend of woodland sales. In the analysis of covariance of gross subsistence income, the only variable that was significant was number of household members ($F = 4.9$, $df = 1$ & 189, $p < 0.05$), which was positively correlated with subsistence income from woodlands. This probably reflects the need to have more woodland subsistence products in larger households (more houses, more cooking, etc.) as well as the availability of more labour to collect the products.

Case study investigations on temporal changes suggest that more households are turning to woodland resources as a source of income, though in general it is a marginal activity. Harvesting large quantities of woodland products for sale goes against the norms of the community, but local traditional leaders and the community are increasingly

likely to turn a blind eye, reasoning that given the harsh economic conditions 'people have to survive'. Cases such as that presented in Box 5 would once have been unheard of, but now there are many cases of the sale of woodland products. A special case is the rise in sales of woodcarvings, to which we return later (Figure 40), a phenomenon that was largely driven by the increased tourist traffic on the Masvingo-South Africa road. As with garden expansion, it has also been facilitated by the lack of enforcement of the regulations, in this case the lack of forestry officers enforcing the Communal Lands Forest Product Act which prohibits sales of forest products without a permit, and the Forestry Act which does not allow cutting and sales of certain tree species (including some of those used in the woodcarving trade). It also indicates further changes in social norms. Previously, woodcarving was the preserve of old men. Now young men dominate the industry.

Box 5. Mr Mike — wood vendor

Mr Mike is a middle-aged man with three children living in Romwe His eldest son has just completed four years of secondary education and is now staying in Harare with a relative. Once in a while he gets a chance to do some temporary jobs in the city and remits some of his earnings back to his communal area home. Mr Mike was retrenched from the sugar estates in 1992 where he had been working as a general hand. When he came home he could not get any arable land for growing crops. At the moment he owns about two acres of arable land around his homestead and has seven vegetable plots (totalling 42 m^2) in the community garden. He leases the arable land from his relatives and a neighbour who has more land than can be farmed. He pays an average of Z$600.00 per acre per year for the leased land.[22]

To augment his cash earnings from the vegetable garden, Mr Mike sells firewood. He collects dead fuelwood from neighbouring mountains and sells it locally or outside the catchment. His local customers are rich families or families with older members who are unable to climb the mountains to fetch firewood. He can also sell the firewood to neighbouring villages and shop owners. A scotchcart of firewood sells for about Z$150.00 and, depending on demand, he can sell up to three to four scotchcarts of firewood per month. He collects the wood freely. However, recently the local *sabhuku* asked Mike to pay a little commission to him for 'mining the woodlands' for which the *sabhuku*[23] is the custodian. The *sabhuku* did not specify the amount of money to be paid as a commission. Mr. Mike is contemplating paying the *sabhuku* in kind; he wants to buy him a 2 kg packet of sugar and some tea.

6.4 Wages, remittances and home industry

6.4.1 Seeking income from non-farm and off-farm sources

Almost all households have some sources of income that do not involve growing crops on their own farm or raising their own livestock. There is a wide range of activities in this group, including employment outside the area, local employment (e.g., agricultural work on other people's farms [Box 6]), temporary jobs for service organisations, local construction work) and cash-paying home industries such as carving, brick moulding, fixing bicycles/implements, making household utensils from scrap metal, thatching, soap making (Box 11), brewing beer, carpentry, trading in second-hand clothes and trading in purchased agricultural products or woodland products (Box 9 and 11), etc. Some of these are based on woodlands or support agricultural production. Remittances (in the form of cash or goods) are also common. Many households have one or more of their members in paid employment in the cities or on commercial farms. Some of these are based, usually illegally, in South Africa. The remitter is in some cases the head of household, but in many cases money is coming from sons (and to a lesser extent daughters), even married ones. Gifts are another source of money. Given the importance of reciprocal behaviour, gifts are frequently received and returned. While remitted amounts may be large enough to cover major purchases, gifts usually are small.

6.4.2 The patterns of wages/home industries and remittance income

Information on remittances (and gifts) was captured both through quarterly and weekly recall in the questionnaire. Information on local wages was collected with quarterly recall questions. A weekly recall question captured local wages and home industry as a source of cash.

Remittances are a better source of income than wages and home industries (Table 40). The weekly recall figures are generally higher than the quarterly recall figures, as expected. Our *a priori* expectation was that the weekly recall data for wages would be larger than the quarterly recall data for two main reasons. Firstly, the weekly data contains small-enterprise income while the three-monthly data does not. Second, it would be more difficult to miss reporting income over a shorter time period. Though comparisons across sites can be dangerous, reference to Cavendish (2002a) suggests that weekly recall may be required to accurately collect this kind of income information.[24] We have nonetheless reported the quarterly recall data, as we have extra details in this data (e.g., sources of remittances). In the final compilation of income data we use the weekly recall data wherever possible.

Wages/home industry income is higher in the dry season (i.e., June to November), while remittances show no clear seasonal pattern for the three-monthly recall data but show a distinct peak at the end of year in the case of the weekly data, coinciding with bonus time in the formal commercial and industrial sector and the Christmas period (Table 41). The numerous site by quarter interactions indicate the different seasonal patterns at the two sites.

Box 6. Mr C. Kefasi and family — labouring for other farmers

Mr Kefasi is a nephew of one of the local *sabhukus*.[25] He migrated from the area to Gokwe (a cotton-growing area) about eight years ago but returned to Romwe to take care of his bedridden mother.

When he returned he reclaimed his crop field from the person he had leased it to, but he has not had success with farming this land. This is mainly because he does not have draft power or money to procure even the basic inputs for farming, like seed. All his cattle perished during the devastating drought of 1992 and thus he now relies on relatives to supply animals for draft power. Instead of concentrating on farming, the Kefasi family prefers to be labourers on the farms of other local farmers. The family weeds and harvests crops for the richer families in exchange for cash or grain. The Kefasi family charges on average Z$15.00 per day, and is able to weed 15-20 'lines' (not more than 70 m long each), in this time.[26] Local farmers who are beginning to grow cotton also hire Mr Kefasi — he is able to teach them basic agronomic practices in cotton production. At times he is even hired to measure and mix the pesticides and spray the cotton. Providing hired labour to fellow farmers is something that is, as far as possible, greatly shunned by local people. Anyone who works or another farmer's field for a fee while their own field is fallow is viewed as being lazy, but Mr Kefasi represents a new type of labourer, who is relatively skilled.

His wife is involved in the trading of mopane worms in Beitbridge (see also Box 9). The couple sometimes receives money from their two daughters who live in towns. The daughters are not formally employed and so there is no clear pattern on the amount or the frequency of money sent.

Table 40. Average gross income from wages/home industries and remittances/gifts per household per year (Z$)

	Weekly recall data	Quarterly recall data	Cavendish (2001) (in 1999 Z$)
Wages & home industries	3004	Wages only: 986	Wages: 1370 Home industries: 782 Other: 1604 (inc. gold panning)
Remittances & gifts	5157	1939	4191

Remittances differ across wealth quartiles, but the quarterly and weekly data show different patterns for wages/home industry income (Table 42). Quarterly data show that wages play a significantly lesser role among the households in the top quartile, with no trend emerging from the weekly data. Remittances are exceptionally important in the top quartile. The magnitude of the mean values suggests that local employment does not contribute nearly as much income as remittances from family members living away from home. While mean wages/home industry income in Romwe and Mutangi appear to be different, this is not significant at the 5% level (Table 43).

During the course of a year many households will receive cash from wages/home industries (82% based on weekly recall data), but in any one quarter usually less than one-half of the households receive wages, indicating the informal nature of the local job market (Table 41). Similarly, remittances/gift payments are widespread (91% of households using weekly data) but irregular. The proportion of households receiving wages/home industries does not differ amongst wealth quartiles (X^2 test, $p > 0.05$), but there is a higher proportion of wealthier households receiving remittances ($X^2 = 10.4$, $df = 3$, $p < 0.05$) (Table 42).

Table 41. Differences in average gross income from wages/home industries and remittances/gifts per household, by quarter (Z$) (and percentage of households receiving wages or remittances in brackets)

Activity	Mar-May	Jun-Aug	Sep-Nov	Dec-Feb	Overall	Greenhouse Geiser F test	Significant interactions with quarter, F test
Quarterly recall							
Wages	233 (56%)	327 (47%)	297 (38%)	112 (34%)	986 (80%)	***	site (*)
Remittances	398 (52%)	474 (53%)	542 (40%)	546 (42%)	1939 (73%)	NS	site (*)
Weekly recall							
Wages & home industries	338	692	1240	732	3004	**	NS
Remittances & gifts	1035	644	853	2624	5157	***	Site (*) Wealth (***)

NS = level of significance is > 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%

Table 42. Differences in gross income from wages and remittances among wealth quartiles (average Z$ per household per year) (and % of households receiving wages or remittances in brackets)

Variable	Lowest 25%	25-50%	50-75%	Top 25%	Repeated measures ANOVA, F test
Quarterly recall data					
Wages	1041^{a} (90%)	1050^{a} (85%)	1213^{ab} (79%)	652^{b} (65%)	***
Remittances	642^{a} (67%)	1166^{ab} (70%)	1777^{b} (78%)	4143^{d} (86%)	***
Weekly recall data					
Wages & home industries	2759	2572	3955	2721	NS
Remittances & gifts	2080^{a}	3110^{a}	3562^{a}	11812^{b}	***

All Dunnett C tests: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; NS = level of significance is > 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%

Table 43. Differences in average gross income from wages and remittances per household per year, by site (Z$) (and percentage of households receiving remittances in brackets)

Variable	Romwe	Mutangi	Repeated measures ANOVA, F test	Site by wealth interaction, F test
Quarterly recall data				
Wages	1215 (78%)	505 (83%)	NS	NS
Remittances	2309 (78%)	1326 (68%)	*	NS
Weekly recall data				
Wages & home industries	3246	2602	NS	NS
Remittances	4421	6374	NS	NS

NS = level of significance is > 5%; * = level of significance is 5%

Table 44. Distribution of remittances by source (mean amounts per payment in brackets) and by quarter — quarterly recall data ($Z)

	Mar-May	Jun-Aug	Sep-Nov	Dec-Feb	Overall
Towns	73 (Z$698)	72 (Z$755)	73 (Z$1210)	86 (Z$1118)	75 (Z$917)
Other rural areas	19 (Z$476)	21 (Z$446)	20 (Z$719)	12 (Z$1100)	19 (Z$605)
Other countries	8 (Z$720)	7 (Z$1590)	7 (Z$1494)	2 (Z$1433)	6 (Z$1243)
Total number of remittances recorded	202	226	137	140	705
Each column adds to 100%					

There is little seasonal variation in sources of remittances, with most remittance payments coming from towns and urban areas in Zimbabwe. There are also no clear changes with season in terms of size of remittances received. However, sizes of remittances from other countries tend to be larger, while those from commercial farms or estates (in 'other rural areas') are the lowest. Table 45 shows that Romwe residents tend to receive proportionally more of their payments from remitters outside the country and from other rural areas (commercial farming areas), than residents of Mutangi. Wage income is largely from within Romwe and Mutangi. Where wages were recorded, between 58% and 81% of the wage earners recorded receiving them in the Romwe/Mutangi areas over the four quarters, with the remainder getting wages from nearby localities (e.g., Ngundu Halt, nearby schools or clinics, nearby commercial farms).

The importance of remittances to household livelihoods is a constant theme (e.g., Box 5, 6, 10 and 12), but case studies show that the patterns of remittances are changing. There are now fewer opportunities for employment and the amounts of remittances seem to have been declined (see, for example, the extended case study of Mr Kefasi in Sayer and Campbell 2002). In the last decade the consumer price index has risen rapidly, with salaries/wages in the formal sector rising by 40% less than the CPI, thus the level and purchasing power of remittances has probably been severely curtailed. If there is

Table 45. Distribution of remittances by source (with mean amounts per payment in brackets) and by site — quarterly recall data (Z$)

	Romwe	Mutangi	Overall
Towns	67 (Z$1039)	85 (Z$794)	75 (Z$917)
Other rural areas	24 (Z$582)	12 (Z$651)	19 (Z$605)
Other countries	9 (Z$1368)	3 (Z$674)	6 (Z$1243)
Total number of remittances recorded	380	325	705
Each column adds to 100%			

any marked movement out of the area for jobs now, it is the recent movement to South Africa. While this involves heads of households as well, young boys are migrating, some as young as 16 years (Box 7). Many of the younger migrants are dropouts from school. In South Africa there are prospects of working on citrus farms around the Messina area, close to the Zimbabwe border. In early 2001, 12 young men from Romwe's three villages centred on the physical catchment (126 households) were working in South Africa'— half of them dropouts from school — but the figure is now much higher, especially after the 2002 election. In general, their level of remittances has not been high but families have purchased some cattle with their earnings. The movement to South Africa is probably in response to the current economic malaise in Zimbabwe; if times improve people would be likely to flock back to Zimbabwe.

Box 7. Mr J. Chivaura loses most children to migration

Mr J. Chivaura has been deserted by four of his children. Three of them have crossed to South Africa while the fourth was less adventurous and went to work as a shop attendant in Chiredzi (about 130 km away). First to go was the eldest son who was in his early 20s. He had completed four years of secondary education in Bulawayo but since his graduation he was unable to get a job. His kid brother, who was in his second year of secondary education, dropped out and followed his brother to South Africa. The elder sister who had joined the National Youth Service (a service largely used by the government to meet its election needs) also left for South Africa, after promises of being incorporated into the army failed to materialise. Only one child remains with the parents. Remuneration in South Africa is much better than could be achieved locally, but does come with risks (a very high crime rate in South Africa, arrest and deportation, wild animals in the area to be traversed to gain illegal entry into South Africa). Mr Chivaura himself works as a general hand at the nearby Ngundu Halt.

The job of working for other farmers is on the increase and is becoming more acceptable. Previously it was regarded as an option for the destitute (as evidenced by Mr Kefasi in Box 6). Case studies indicate a rise in trading activities associated with a wide range of products; second-hand clothes are particularly important (e.g., Box 4, 9, 11 and 13). It is especially women who are becoming involved in such activities. It used to be mainly men involved in migration for non-farm jobs; now women migrate temporarily to sell or buy their wares. With windfalls of cash (such as funds from the micro-credit scheme), women may start a trading business. These changes are leading to greater diversification of activities within communities, and are going hand in hand with changing social norms (e.g., changing roles of women and men) (see also Scoones *et al*. 1996, Monela *et al*. 2000). Local women suggest that they become involved in trading to raise cash for social obligations (especially funerals), daily household needs and larger more intermittent needs (especially school fees). It should be noted that this is not a simple monotonic trend — it is overlaid on drought-related patterns. Thus, during and after droughts there may be an upsurge of non-farm activities (see also Scoones *et al*. 1996), but there is also a longer-term trend of increasing prominence of non-farm activities.

6.5 Gross income patterns — summary, evidence of intensification and change

6.5.1 Cash income

We estimated cash expenses at an average of Z$11,000 per household per year (Section 5.2). Using our sectoral analysis for dryland crops, gardening, livestock and woodlands, and the weekly recall data for wages/home industry and remittances/gifts income, we calculate a gross cash income of, on average, Z$12,600 per household per year. That the two numbers are similar gives us confidence in the data. It is quite clear that wages/home industries and remittances/gifts are particularly important components

of cash income, with less than 25% of cash derived from dryland crops (Figure 24). The breakdown of gross cash income by wealth quartile shows that the top quartile is the only one in which households derive more than one-third of their cash income from crops (Figure 25). This is also the quartile that has by far the highest remittance income. For the lowest quartile it is particularly wages/home industries that are important as a source of cash. It is only for the woodland sector that cash income is apparently highest in the lowest quartile.

Figure 24. Sources of gross cash income

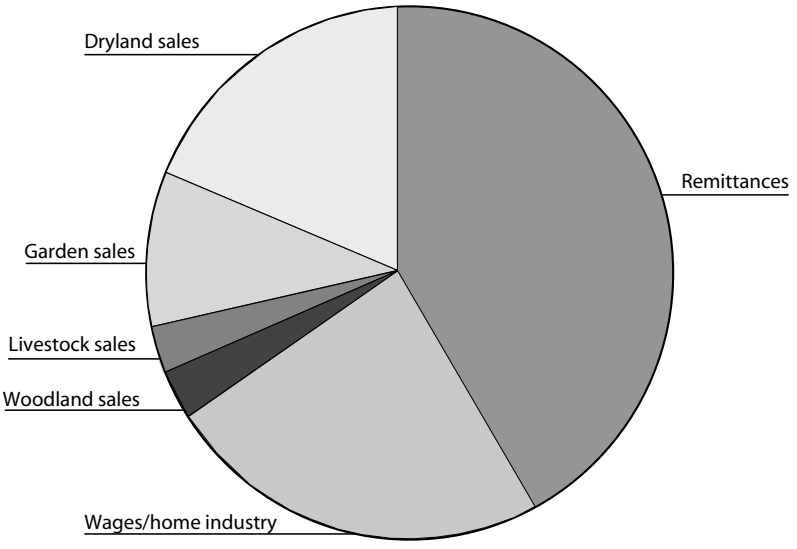
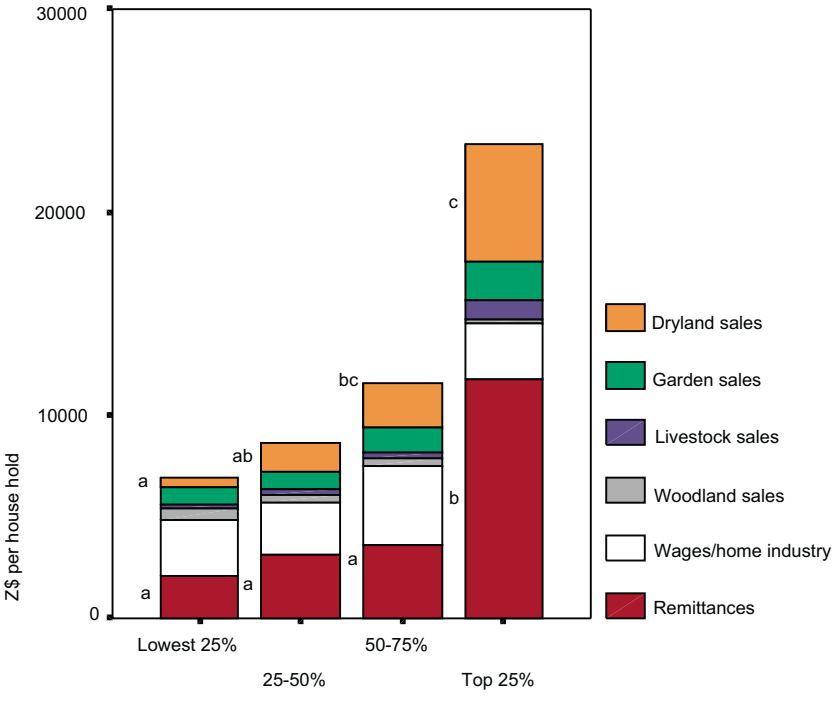
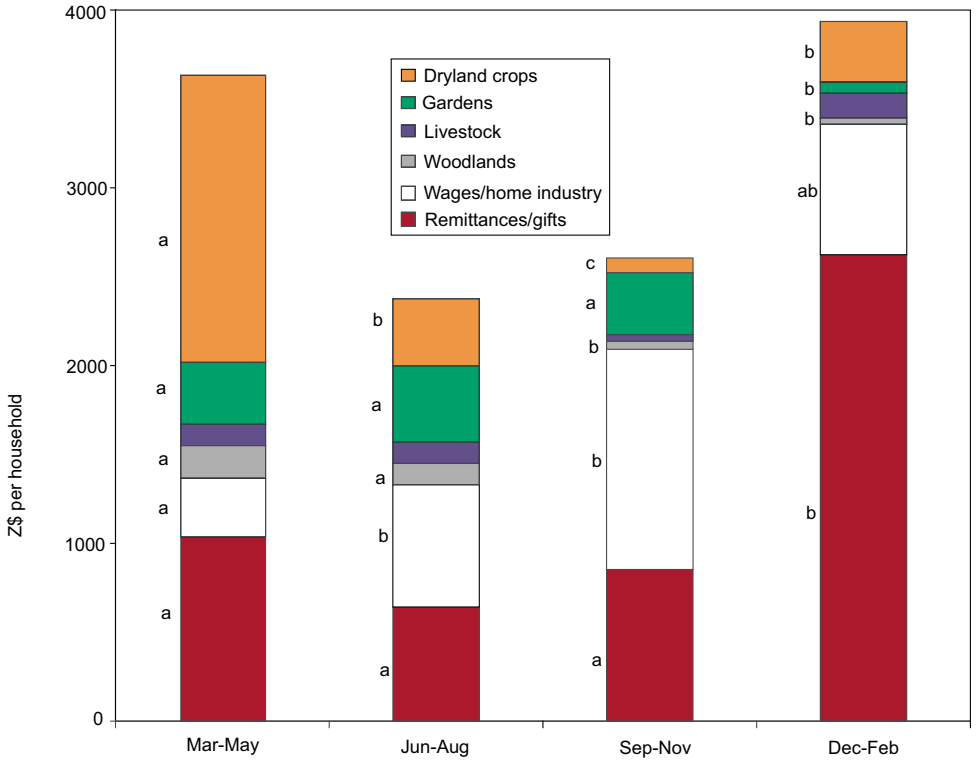


Figure 25. Sources of gross cash income by wealth quartile (one-way ANOVA indicates that remittances, livestock and drylands are significantly different amongst wealth classes. Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level - Dunnett C test)



The sources of cash into households during the course of the year varies (Figure 26). During the harvest season, the bulk of cash comes from crop sales, while in the Christmas season the major cash source is remittances. It is during the dry season from June to November that households are especially constrained by cash. In this period, income from wages/home industries and gardens is at its highest.

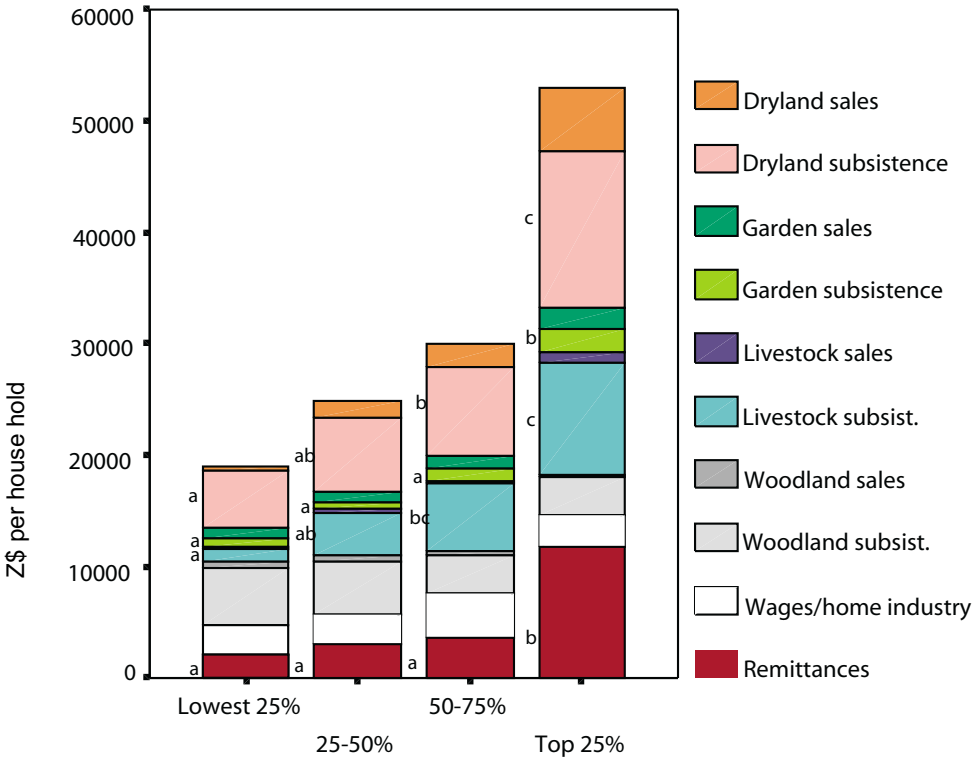
Figure 26. Quarterly sources of gross cash income (one-way ANOVA indicates that all sources, with the exception of livestock, are significantly different amongst quarters. Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level - Dunnett C test)



6.5.2 Wealth-related patterns

It is evident that the wealth quartiles differ substantially in the importance of cash and subsistence incomes (Figure 27). There are generally four types of relationships among wealth and sectors. Firstly, there are sectors that produce gross income that increases continuously with wealth. Dryland and garden subsistence crops, livestock cash and subsistence and, to a lesser extent, garden cash income exhibit this relationship. Secondly, there are some activities where larger gross income is derived more by poor households than wealthy households. We see this relationship only among woodland activities, especially in the case of woodland cash income. Thirdly, in some sectors the gross income among wealth quartiles is almost constant, as is the case for wages and home industries, woodland subsistence income and perhaps garden sales. Finally, we see two income components that are primarily contributing to only the top quartile — remittances and dryland cash crop income.

Figure 27. Sources of gross cash and subsistence income by wealth quartile (one-way ANOVA indicates that remittances, livestock sales and subsistence, garden subsistence and drylands sales and subsistence are significantly different amongst wealth classes. Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level - Dunnett C test)



6.5.3 Site differences — evidence of intensification

One axis of differentiation relates to site, which is a complex variable related to such things as agricultural potential (higher in Romwe), markets (slightly closer to Romwe) and woodland cover (higher in Romwe). Table 46 shows that many income components are higher in Romwe, though often not significantly. Garden sales income is higher in Romwe, probably due to the proximity of an informal market, while gardening subsistence income is higher in Mutangi probably due to the larger area devoted to gardens in that area. More of the crop income (drylands and gardens) in Romwe (31%) is from cash than in Mutangi (23%). There is also higher livestock subsistence income in Romwe, reflecting greater use of draft power. We have earlier indicated that labour inputs per acre and level of land leasing are higher in Romwe (Sections 5.1.3 and 5.4.1). Woodland cash income is higher in Mutangi. Cash expenses for crops are also higher in Romwe.

Romwe has greater intensification in crop production (more labour, draft power and cash inputs per unit area), greater crop-livestock integration and greater monetisation (more land leasing, purchased inputs and cash outputs relative to total outputs). This may be due to the closer market to Romwe than Mutangi (Ngundu Halt), but it may also be due to the better cropping potential in Romwe and/or higher population densities (and resulting land scarcity) (Sections 5.1.1 and 5.4.1). It appears that the relative scarcity of woodland products in Mutangi has made them marketed, cash-generating goods so the cash market in woodland products is better developed. There was no difference between Romwe and Mutangi for wages/home industries (weekly recall data). Remittances/gifts are higher in Mutangi, which probably explains the higher cattle numbers in that site, with consequent greater hiring of livestock labour to undertake herding. The fact that the greater numbers does not lead to greater use of draft power reflects less crop-livestock interaction in Mutangi.

Accumulation of cattle numbers probably does lead, on average, to less productive use per head of cattle (especially for draft and transport), as the numbers are accumulated in a few households (see Box 8). In Mutangi 37% of households hold more than four animals, while in Romwe only 27% hold more than four.

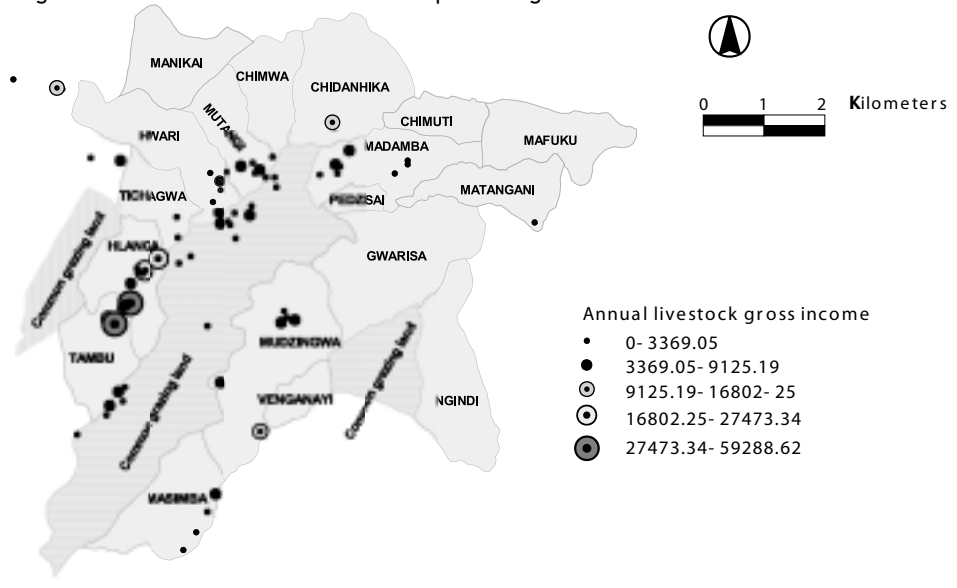
Table 46. Summary of the differences in gross income between sites and wealth quartiles (average Z$ per household per year)

Variable	Romwe	Mutangi	Overall	Two-way ANOVA, F test		
				Site	Wealth	Site X wealth interaction
Remittances	4421	6374	5157	*	***	NS
Wages/home industries	3246	2602	3004	NS	NS	NS
Woodland sales	208	672	383	***	NS[a]	*
Woodland subsistence	3555	3534	3547	NS	NS	NS
Livestock sales	361	497	413	NS	*	NS
Livestock subsistence	6132	3969	5317	*	***	NS
Garden sales	1418	867	1211	NS	NS	NS
Garden subsistence	964	1347	1109	NS	***	**
Dryland sales	2673	2144	2474	NS	***	NS
Dryland subsistence	8303	8795	8489	NS	***	NS
Overall cash	12327	13156	12642	NS	***	NS
Overall subsistence	18954	17645	18462	NS	***	NS
Total	31281	30801	31104	NS	***	NS

NS = level of significance is > 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%;
[a]p = 0.098

While our main site analysis is the comparison of Mutangi and Romwe, there are also many within-site spatial patterns. The complexity of the spatial patterning of income is demonstrated in Figure 28 for livestock income in Mutangi, and in Figure 23 for woodland sales income in Romwe. There is higher income in certain areas, but we have not analysed such spatial patterns further as there are too few samples in particular villages to explore the causative factors of the patterns.

Figure 28. The spatial distribution of livestock income (Z$ per household per year) in Mutangi, showing the location of households in the sampled villages



6.5.4 Temporal changes and social processes mediating production

While the quantitative data illustrate the activities and income in the 1999-2000 year, the qualitative data from case studies illustrate the dynamic nature of each sector. Dryland crop incomes vary from year to year with rainfall, while slightly longer-term changes in the combinations of crops are in response to price signals and availability of inputs — most notable is the rise (and fall) in cotton production over the last few years. Garden production is on the increase, with the opening up of new gardens. While woodland subsistence income appears not to have changed much over the years, there has been a rise in commercial activities in the woodlands. Non-farm activities have also undergone substantial change in the last few years. Employment opportunities in the formal sector have declined, as have the levels of remittances. In previous eras, young men would invariably travel away from Chivi in search of jobs in the formal sector. This is no longer the case, though there is some movement of youngsters to South Africa and some may try their luck in the informal sector in Harare or one of the other towns in Zimbabwe. Those remaining try farming, generally on very small plots, and/or try various home industries (e.g., woodcarving). There has been an upsurge in trading activities, some linked to farm production but most of it non-farm, with women becoming more involved. While this may be a long-term trend it is overlaid on year-to-year fluctuations, with a rise in non-farm activities during and immediately after droughts.

Cash income stands at less than US$0.20 per person per day, with greater pressures in the dry season. This has to be set in the context of declining remittances and a livelihood system that is becoming increasingly monetised. Some transactions that were previously governed by reciprocity now governed by cash exchange (Section 5.5), and services previously provided free by government now requiring payment (secondary schools, health clinics, withdrawal of drought relief — Section 2.3). In addition, there are the long-term trends of reduced levels of natural capital (land, livestock and woodland - Sections 5.4.1, 5.4.2 and 5.4.3), which could lead to a lower potential to produce, in the absence of greater intensification (inputs per unit area) and improved outputs (per unit area). Intensification is limited by labour availability (Section 5.1.6) and usually requires cash inputs (e.g., for fertilisers, the prices of which are rising steeply). The lack of markets, e.g., for garden produce, limits the degree to which high inputs are justified. Drought relief, a key safety net, is being reduced — vulnerability is presumably increasing. We thus have a system that is set to change further, partly in the quest for cash. We have seen the growth in off-farm and non-farm activities — this growth is likely to continue. The patterns of intensification across sites, when combined with case-history information and patterns of increased use of water in production, do suggest that intensification is advancing. We will return to intensification, and its likely limits, in later sections.

Linked to the changes in productive activities is a series of changes in social processes and institutional arrangements. At the higher level, there has been a breakdown in the enforcement of national legislation (limiting gardening on wetlands and the commercialisation of forest products). At the community level, local leaders are turning a blind eye to some activities that transgress the local rule system (e.g., selling products from woodlands) citing the dire economic situation that their subjects face. Younger men, now more in evidence in the community as a result of declining external opportunities, are also forces for change — challenging the authority of the older men and the elites. Reciprocity is still important but cash is governing more transactions among households. Labouring for other farmers is becoming slightly more acceptable; the stigma of farm labour being the activity of the destitute is being eroded. At the household level, women are moving into new activities such as trading, involving them moving temporarily away. Bryceson (2002) also records that women often dominate the greatly expanding sector involving non-agricultural income. Woodcarving illustrates a different trend, where there is a rise in commercial activity of young men. We return to these themes of change in Chapter 9, with additional quantitative data for some variables.

7. Exploring household strategies

It is apparent from the case studies that households have a rich diversity of livelihood strategies. We see households that concentrate on gardening (Box 11), dryland crop activities with emphasis on cotton (Box 3), cattle raising (Box 8), woodland activities (Box 5), trading (Box 9), local employment (Box 6), or off-site employment (Box 12). At another level, however, the differences among households are quantitative rather than qualitative, with households largely involved in the same set of basic activities but with quantitatively different amounts of time spent on and returns from each. Even in the boxes presented here there is never total specialisation. One activity may support another (e.g., intensive horticulture providing some of the cash to buy non-farm traded items) or a suite of activities with some concentration on a particular sector will provide for total income. In this chapter we explore the household types that can be recognised by looking at clusters of associated characteristics. This is an alternative approach to assessing how household characteristics change in terms of single axes of differentiation (e.g., wealth asset status, site, sex of the head of household).

Box 8. The Dapani family — livestock owners

Mr Dapani passed away in 2000, leaving his wife in charge of the household. The late Mr Dapani used to work for the Department of Veterinary Services. From his earnings he purchased a number of cattle. Before the drought of 1992, the Dapani family was among the families in Romwe that had many cattle. One informant recalled, 'Dapani had many cattle. If they were moving in a single file the line could stretch for more than a quarter of a mile.' Dapani enjoyed seeing his herd grow, never selling or slaughtering them. He used to say''I find it easier to weep if my beasts die than when a person dies.' The drought nearly wiped out his entire herd. After the drought he started to restock, again using the earnings from formal employment. Currently, the Dapani family own more than 15 head of cattle.

The family owns between 4 and 5 acres of poor sandy soils that are also prone to waterlogging. For the past few cropping seasons, the Dapani family has not been productive in their crop enterprises. Mrs Dapani claims that it does not make economic sense to invest much in the soils because even after applying fertilisers waterlogging remains an issue. Occasionally the Dapani family leases pieces of land for farming from Matenhese village to grow crops like roundnuts.

7.1 Quantitative analysis

We used a multivariate cluster analysis method to group our sampled households into household types, each with its particular mix of activities to make up a livelihood strategy (sector incomes are the variables in the analysis). The 10 household types recognised are described in Table 47, which also shows how these types relate to the wealth quartile classification that we have used throughout this book. The wealth quartile classification is based on assets such as livestock numbers and shelter type, variables that have been shown to relate strongly to wealth classes derived from PRA

Box 9. Mr and Mrs Ncube — wage-earning, trading, gardening

Mr Ncube is 34 years old. He works as a field assistant for the Institute of Environmental Studies in Romwe, near his home. He has two children, both below five. He does not have a large field away from his home site, like most men of his age in the area. The only arable land he has is an acre of sandy soil around his homestead. The soil becomes waterlogged easily if it rains. For the past two cropping seasons his crops were a complete write-off. The family also owns seven vegetable plots (totally 42 m^2) in the community garden where they grow vegetables for their own consumption and for sale.

Mr. Ncube's savings from his work are not enough to sustain the family so his wife engages in trading of various types: sugarcane, mopane worms, second-hand clothes, sour milk and vegetables. She got some of her start-up capital from her husband's savings and a loan from the local micro-credit scheme. She commutes between her home and Beitbridge (a distance of about 200 km).

She buys sugarcane and vegetables from productive local farmers and sells them in Beitbridge. There is demand for these products in Beitbridge, which is much more arid than Romwe. She buys sugarcane at Z$10 each while a bundle of vegetables costs her Z$5. She sells these for double the price.[27] For any one trip, by bus, she buys about Z$1000.00 of vegetables and Z$3000.00 worth of sugarcane. She buys also second-hand clothes, mopane worms and sour milk from Chikombedzi, which is about 150 km from Romwe and 40 km way from the Mozambique border. The second-hand clothes are illegally smuggled from Mozambique where, it is said, they are donated by the international community for the benefit of the war and flood victims in that country. She sells the second-hand clothes in Beitbridge where numerous traders converge. She buys sour milk from farmers in the small-scale commercial farming areas around Chikombedzi, buying about Z$500 worth and selling it for Z$700. The mopane worms she buys for Z$700 and sells them for Z$900. For any one trip she can earn up to Z$12000, a trip takes her three weeks. She only does this from March to October each year, i.e., in the dry season. While in Beitbridge she stays in the open, like most other vendors. She is, however, planning to rent a room at Beitbridge where she will be safe with her baby who is still a toddler.

Table 47. Household types and their distribution across wealth quartiles

Household type (see Table 48 and Table 49)	Lowest 25%	25-50%	50-75%	Top 25%
1 **Lowest income**, woodland sales, **mixed**, very low remittances	39.4%	34.0%	22.3%	4.3%
2 **Medium** income, **crops, remittances**	18.2%	27.3%	18.2%	36.4%
3 **Medium** income, **high livestock sales**, medium drylands sales	4.5%	4.5%	40.9%	50.0%
4 Highest income, Remitters, high **drylands subsistence**, medium gardeners	7.1%	14.3%	21.4%	57.1%
5 Medium income, **wage earners**	33.3%	50.0%	16.7%	
6 **Lowest income, wages and gardens**, very low remittances	33.3%	44.4%	11.1%	11.1%
7 Highest income, medium remit, **livestock farmers**, gardeners, medium drylands sales			20.0%	80.0%
8 Medium income, **sales of gardens and livestock**, very low remittances			50.0%	50.0%
9 **Medium** income, medium **crops**, very low remittances	11.8%	17.6%	41.2%	29.4%
10 Highest income, medium remit, **dryland agriculturalists (high sales)**, high livestock sales		14.3%	14.3%	71.4%

results (Section 4.1; Price 1994; Scoones 1995). Thus we have a close relationship between wealth classes defined by assets (largely physical and natural) and household types defined by sector income. Further evidence for this relationship came from a discriminant analysis. This was conducted to explore which 'independent' variables could be used to separate the households into the household types. The only variable that related to the household types was wealth quartile, indicating the strong relationship between physical assets and gross income characteristics. Variables with no significant discriminating function included age, gender and educational status of the head of household, number of household members, ethnic group, leadership role and site. Household types #1, #5 and #6 are largely concentrated in the lowest wealth quartiles, while household types #4, #7, #10 and, to a lesser degree, #8 are largely concentrated in the higher wealth quartiles.

Household type #1 comprised about 50% of all the sampled households, had the lowest total income and had low income from all sectors of activity (Table 48). Most of these households had a mixed income source (drylands, gardening, wages/home industries), while others focussed slightly more on a particular source, e.g., home industries (Box 2), gardening, etc. Household type #6 is also extremely poor, but relies more on wage labour to survive (Box 6). In this case the wages/home industry incomes are coming largely from fellow farmers. At the other extreme, the high-income households comprised only 14% of the sample and were scattered in three household types, #4, #7 and #10, which had high income in terms of remittances, livestock (Box 8) and/or dryland crops. Household type #5 stands out as it derives most of its income from wage labour and small-scale home industry (Box 9), while household type #8 is most reliant on gardening (Box 11).

Table 48. Average gross income per household per year by household types ($Z)

	Household type										One-way ANOVA
Income source	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	
Remittances	1808^{ab}	10118^{c}	5608^{abc}	**17806**^{d}	3097^{ac}	1664^{ab}	8786^{bc}	1635^{a}	1979^{ab}	5100^{abc}	***
Wages/home industries	1728^{a}	1303^{a}	1257^{a}	3053^{a}	**13570**^{b}	4076^{a}	562^{a}	171^{a}	3465^{a}	1177^{a}	***
Woodland sales	622	154	108	113	405	227	103	585	282	90	NS
Woodland subsistence	3554^{ab}	3502^{ab}	2875^{a}	4734^{b}	3653^{ab}	2262^{a}	2369^{a}	2564^{ab}	5398^{b}	2528^{a}	**
Livestock sales	235^{a}	434^{a}	**895**^{ab}	221^{a}	0^{a}	5^{a}	**2864**^{b}	**1291**^{b}	138^{a}	**521**^{ab}	***
Livestock subsistence	2079^{a}	2636^{a}	11894^{b}	5442^{ab}	2857^{a}	912^{a}	**26132**^{c}	11488^{b}	2723^{a}	11898^{b}	***
Garden sales	781^{a}	838^{a}	660^{a}	864^{a}	382^{a}	2900^{a}	3298^{a}	**10242**^{b}	1146^{a}	1895^{a}	***
Garden subsistence	756	681	914	1896	374	2477	2441	1260	1268	736	NS
Dryland sales	245^{a}	106^{a}	5340^{bc}	1486^{ab}	3436^{abc}	5782^{bc}	7448^{c}	2846^{abc}	1109^{ab}	**16971**^{d}	***
Dryland subsistence	4659^{ab}	11555^{bcd}	7414^{abc}	**16955**^{de}	7760^{abc}	3262^{a}	7668^{abc}	6756^{abc}	14318^{cd}	**23883**^{e}	***
Total	16648^{a}	31341^{abc}	37206^{ab}	**52587**^{de}	44887^{bcd}	23573^{ab}	**61683**^{cde}	38842^{abc}	31845^{abc}	**66020**^{e}	***
Number of households in class (n=189)	94	11	22	14	6	9	5	4	17	7	

Bold figures indicate the household type with the largest value for particular income sources, while underlined figures indicate lowest values; All Dunnett C tests: means followed by a common superscripted letter imply the mean difference is not significant at the 5% level; NS = level of significance is > 5%; *** = level of significance is 0.1%

The percentage of households receiving income from the different sectors indicates that most household types have a mixed livelihood strategy, relying on income from many of the sectors (Table 49). What differs amongst households is generally not the presence or absence of a particular income source, but rather the absolute amount received. Nonetheless some income types are missing or are low in some of the household types. For instance, household type #6 (local unskilled wage earners) and #8 (focussing on gardening) have a low percentage of households with remittances — these are poor and medium-poor household types, respectively. Wages/home industry incomes are not generally received by household type #7, a wealthy group that relies chiefly on livestock incomes and, to a lesser extent, remittances. Many households in a number of the groups do not receive woodland cash income, but woodland subsistence income is a feature of all households. Livestock cash income is received by more than 50% of the households in only one of the household types (#8). Livestock subsistence income is much more frequent. Many household types do not have high percentages for cash income from dryland crops, but all households rely on dryland crops for subsistence.

Table 49. Percentage of households in a household type that obtain income from a specified source

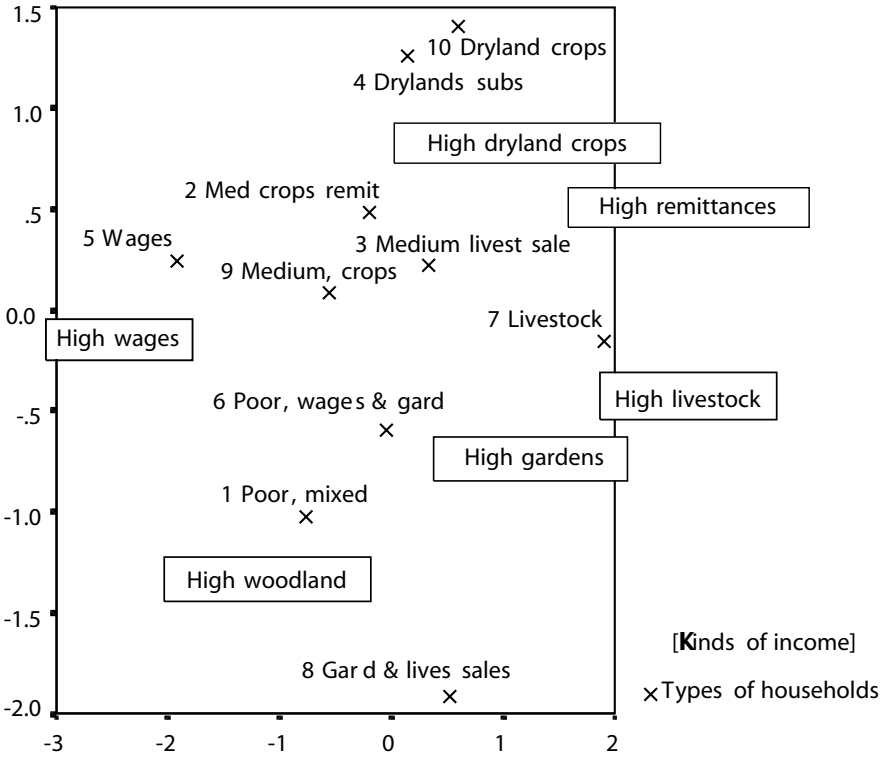
	Household type										
Income source	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Overall**
Remittances	89	100	95	100	100	55	100	50	94	100	90
Wages/home industries	84	91	82	79	100	78	40	75	94	72	83
Woodland sales	65	54	36	29	50	78	40	50	77	14	57
Woodland subsistence	100	100	100	100	100	100	100	100	100	100	100
Livestock sales	14	9	41	7	0	11	40	75	18	29	19
Livestock subsistence	63	91	100	100	66	55	100	100	88	100	76
Garden sales	49	28	50	43	33	89	40	100	53	29	49
Garden subsistence	81	91	86	71	100	100	100	100	82	86	84
Dryland sales	36	19	82	50	50	89	80	75	59	100	51
Dryland subsistence	100	100	100	100	100	100	100	100	100	100	100
Percentage of households below food poverty line	100%	46%	77%	7%	50%	78%	60%	75%	41%	0%	74%
Number of households in class	94	11	22	14	6	9	5	4	17	7	

Similarities and differences among the household types were explored using principal components analysis (Figure 29). The major axis of differentiation, the x-axis, shows the continuum between wage-earning household types (on the left side) to livestock-dependent household types (on the right side). The y-axis shows the continuum from dryland-dependent household types (at the top) to household types with more woodland income (at the bottom). Remittance income is shown to be highly correlated with dryland crop and livestock incomes, while garden income is more correlated to woodland and livestock income. We thus have a sequence of household types ranging from low income in the bottom left quadrant to high income groups in the top right quadrant. The former are more likely to have woodland, garden and wage/home industry income as important, while the latter are more likely to have livestock, remittances and dryland income as important. The highest woodland sales are in the lower wealth quartiles, people resorting to woodlands when most other options have failed (Box 5).

7.2 Summarising the trends and patterns

The bulk of the households have a diverse portfolio of activities and a very low income (Type #1). The slightly less poor, most with slightly higher remittances or wages/home industries, may specialise in crop production with emphasis on cash crops (#6), in

Figure 29. Similarities and differences among the household types, as identified by principal components analysis. The closer the income variables to each other in the two-dimensional space the more they are correlated. The closer the household types to each other the more similar are they in income characteristics. Household types placed close to specific income variables, indicate that those household types are characterised by that particular income variable



subsistence dryland crop production (#2), livestock and dryland cash crops (#3), livestock and gardening (#8) or dryland production (#9). The wealthiest households, all have large remittances and/or wages/home industries, with high to very high values for dryland crop production. Of these, some have especially high dryland cropping and remittances (#4), wages/home industries (#5), livestock (#7) or dryland cash crops (#10). We found a close relationship between wealth status (as defined by natural and physical assets) and income characteristics.

Inevitably, there are different types of households, with different livelihood strategies and different patterns of resource use (Drinkwater 1991; Scoones *et al*. 1996; Cavendish 2002a). We should note that differentiation is not as marked as in many other rural places around the world. Basically all households are involved in a similar set of activities — dryland cropping, small-scale irrigated gardens, some wage/home industry and remittance income, and use of woodland products. This is unlike, for example, many areas of rural India where there are completely different classes of rural poor, some of whom may be pastoralists, others cultivators, and others who specialise in home industries. Even the ethnic differences in Chivi (Shona/Ndebele) do not translate into major differences in livelihood strategies.

The different household types do not really represent various stages in evolution, but rather different levels of access to resources and different levels of cash income from wages/home industries or remittances. We see them as different states in a state and transition model, rather than as sequences in an evolutionary model. We would rather recognise multiple pathways of development and the possibilities of reversals than recognise an evolutionary sequence. For example, when there is good access to irrigation water (usually due to being one of the original families in the area and having had access to the better springs or wells), then gardening usually becomes a

major focus (e.g., #8). In the case of a sequence of dry years when gardening has to be reduced, the livelihood strategy is likely to alter dramatically, and the household moves into a different state. In good years remittances and wages/home industries may not be significant for such a 'gardening' household, as the security of water may allow a household to more or less specialise in garden production. Come a sequence of dry years, and the household may have to enter some non-farm activities. Some transitions between household types can be recognised. Household type #1 is generally where households get stuck, and a position to which they are forced into in the case of severe stress and disturbance. If they should be fortunate to receive wages/home industry income or remittances then they can move to a new level. With severe drought, cattle die and households are forced to rebuild. If external injections of cash are still occurring then the households are able to bounce back, but with the loss of a remitter through death or retrenchment, a household slips in its ability to produce, and is seriously hit when a drought strikes.

Some households are using their remittances to enter cash crop production while others focus more attention on livestock. The action research on the micro-credit scheme allowed us to investigate with the use of cash windfalls, though the amounts were not very high. Investments vary between household types, with some focussing their investments on livestock, others on gardening, others on dryland cash crops and still others on trading activities. The specific context determines the route a household chooses, with important context variables being access to good irrigation water, access to additional cash (those having this were more likely to pursue cotton production), whether the loan recipient was male or female (in the case of the latter, investing in stocks for trading and gardening was common, while it was males that largely decided on cotton investments) and amount of labour available (those with limited labour indicated that they would not enter cotton production). In our sample, it is especially household type #10 that undertakes significant cash cropping, accounting for 30% of total gross income.

8. Net income and poverty

We now turn to net income, that is, gross income less non-labour costs. As described earlier this is a standard measure of welfare in rural household studies (Section 3.2.2). We first look at total net income and poverty status, reflect on local perceptions of poverty and explore factors important in moving people out of poverty. We then explore the variation in net income and its components, using similar techniques as used to study gross income (Chapter 6). We also investigate the degree to which households depend on environmental resources. Finally we summarise, reflecting on the links between assets and production.

8.1 Total net income

Our results for net income are very similar to those of Cavendish (2002a; Table 50). Perhaps the major difference is for livestock income. This can be explained by a methodological difference — Cavendish valued 'grazing services' by assuming 70% of the feed comes from grazing areas (as opposed to crop residues eaten'*in situ* or at the pen), and then proceeded to value cattle by examining the prices of animals and converting this to a stream of benefits over time. We collected data on actual livestock productive functions (milk, draft, etc.) and used these to calculate livestock income. We therefore allow for the situation where owners have large herds but do not use them very productively, as does occur (e.g., Box 8). Our work does have one omission — we should augment crop production by the amount of crop residues that go into the livestock system (this was not done by Cavendish either) and remove this amount from livestock production as it represents an in-kind input. We were unable to estimate the amount of livestock feed derived from crop residues as it is mostly consumed *in situ* on the fields. In addition, there is no market for crop residues, so estimating a price would have been difficult. Our results are based on average annual prices for each product and service, and these can vary both within and between years. If dryland crop prices were 25% lower than the prices we used, then dryland crop production would fall from our calculated 25% of total income to 18%, indicating the kind of variability we can expect in the numbers. In the modelling chapter (Section 10.3) we indicate some of the sensitivity to price variables.

Just over 50% of total net income (cash and subsistence) comes from agriculture (crops and livestock), while about a third comes from wages/home industry and remittances/gifts (Figure 30). Other studies show that between 30% and 50% of rural household income in sub-Saharan Africa is typically derived from non-farm sources (Sahn 1994; Reardon 1997), while Bryceson (2002) reports values of 60% to 80%, and suggests that this indicates continued movement into non-agricultural activities. These other studies have generally paid less attention to problems of recall than the present study and have disregarded woodland subsistence activities. Thus they have generally underestimated woodland income, especially the large subsistence component, and

probably also subsistence livestock and garden income. If we subtract subsistence woodland income from total income and set livestock income to the national average (10%), then income from wages, home industries and remittances comes to 45% of the total. Our year of study was an above-average cropping season; in seasons with dryland crop failure the proportion would rise to about 70%. For cash income only, a massive 70% came from wages, home industries and remittances — and that was in an above-average agricultural season. We have to ask: where in the system will interventions make the most impact — in the agricultural or non-farm sectors? About 45% of total income is cash income. This figure would be higher if we excluded woodland subsistence income from the total income. The high percentage indicates the degree to which these local economies are monetised.

Different family members receive different components of the income generated by households. We don't have quantitative data on intra-household decision-making, but we do have data on who initially collected the income and qualitative insights. A considerable portion of the total cash income (40%) is collected by women: a small amount comes from dryland crops, but much it from gardening, home industries income and remittance income. While women may collect income from chicken rearing, most of the income from other types of livestock goes to men. Increasingly, largely through their activities in the garden and various home industries, women are taking control of a greater proportion of household cash income. Women dominate the trading of garden produce — there are famous stories of women who managed to send all their children to school through roadside marketing of different crops, especially roasted maize! On the other hand, with fewer men obtaining employment outside the household, there is a contraction of the number of *de facto* female heads of household.

Table 50. Average cash and subsistence net income per household per year by sector (Z$)

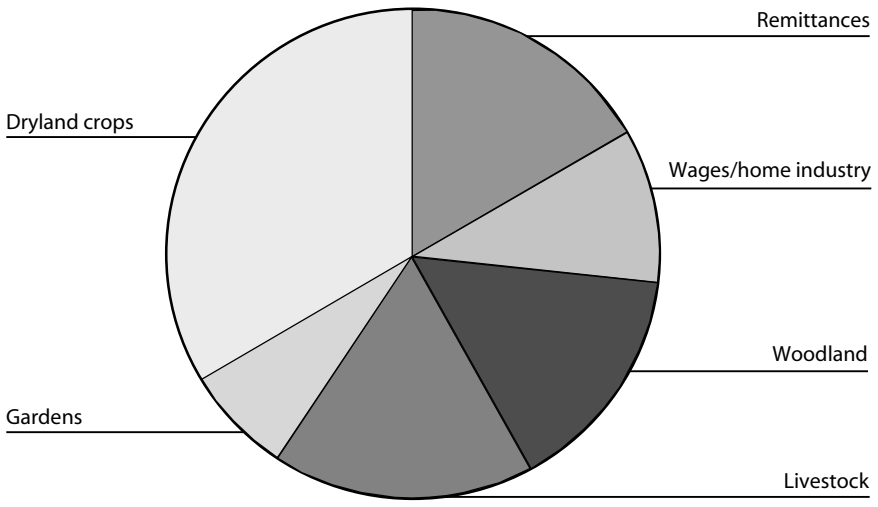
	Net subsistence income			Net cash income	
	This study	Cavendish (2001) (in 1999 Z$)	This study	Cavendish (2001) (in 1999 Z$)	
Dryland crops	4340	6339	1155		661
Gardening	927	501	1090		218
Livestock	4916	1979	393		425
Woodlands	3404	3107	380		657
Wages & home industries	-	-	3004	Wages:	1370
				Home industries:	1047
				Other (inc. gold panning):	1604
Remittances/gifts	-	-	5157		4191
Total income	13587	11926	11179		10173

For crops this is calculated from the actual volumes of different crops sold and consumed. For livestock it is calculated from the volumes of products sold and consumed and the amount of draft power hired out. For woodlands it is the products sold or consumed. Some of Cavendish's values are excluded in our analysis (e.g., soil for pottery and bricks)

8.2 Poverty

Total net income is equal to US$670 per household per year or US$1.80 per household per day. Using the Income, Consumption and Expenditure Survey (ICES) carried out by the government of Zimbabwe in 1995/96 (Cavendish 1999b), an upper poverty line — the consumption poverty line — has been estimated to be Z$45,000 per household per year.[28] This allows for basic food consumption and some allowances for housing, clothing, education, health and transport. A lower poverty line — the food poverty line — represents the income required to meet basic nutritional needs, and is about Z$28000 per household per year. Even the food poverty line is above our average income of

Figure 30. Sources of total (cash and subsistence) net income



Z$25278 per household per year, indicating the pervasive poverty in the area. Seventy-one per cent of the households in our samples are below the food poverty line, while 90% are below the consumption poverty line. Development agencies are generally focussed on the poorest of the poor. In the case of Chivi, the bulk of the population could be considered prime targets for poverty alleviation strategies. Even the wealthiest quartile has a mean income of less that US$1 per day per person.

Poverty has many meanings. From informal interviews and participant observation, Witness Kozanayi has pieced together the following concept of poverty. In the Romwe community, poverty is believed to manifest itself in a number of ways. Shortage of basic food (maize meal and vegetables) is a prime indicator. The food should be adequate to cater for family members and visitors throughout the year. Social capital is built through frequent inter-household visits, and any visit to a house is met by the offer of food. Thus having food for visitors is regarded as an indication that the household is not in deep poverty. Key signs of poverty are lack of livestock for draft power and lack of money to pay for basic services such as hospital fees and medicines. Lack of decent housing for the family, and lack of a reliable source of cash income are other indicators of poverty. Local people also associate poverty with witchcraft, in that households may move into poverty because of a bad spell or may move out of poverty by obtaining a lucky charm. '*Urombo uroyi*'' — 'poverty forces people to engage in menial activities'. The poor are willing to 'take anything that comes into the net as fish'. We see the poor eking out a living through working for others for very low remuneration, e.g., the children end up being herd boys for the rich farmers.

Kozanayi notes that the poor have many handicaps that make it impossible to break the fetters of poverty. To do so requires cash. With cash there is the assurance of a constant supply of food on the table, decent housing, and livestock can be acquired or draft power can be hired. Lack of cash is the major problem facing the poor in the community. The major source of reliable cash income is non-farm activities, notably employment in big cities. Farming, though it is often thought of as the lifeline of rural people, is regarded by households as very risky, unreliable and costly. Inputs like seed, fertiliser and pesticides are all expensive and beyond the reach of anyone who does not have a reliable source of cash income, presumably from the cities. As a result the poor people in the community end up leasing their crop fields to the rich families of the community or selling their labour in exchange for food. Therefore the only meaningful window of opportunity for the poor is to engage in non-farm activities in local business areas, cities and mines, and in cross-border trading, e.g., in second-hand clothes. Local perceptions suggest that the major

problem facing the poor when it comes to seeking employment in towns is that they do not have''connections' in these towns.

The rich in the Romwe community can afford sufficient food and farming inputs and have cash to cover all their basic household and social needs (e.g., school fees, hospital fees, funeral expenses). They usually have a cash income from relatives and family members in towns. With money, they live a decent life by local standards. Aspirations for farmers differ from person to person, depending on resource endowments. Some very poor farmers wish for nothing more than enough food to keep body and soul together. A widespread local view is that this group lacks self-motivation and resources, such that even if an opportunity comes their way they are unable to take it up. The less poor to relatively rich farmers desire and struggle to be the economic role models. Their dream is to earn reasonable amounts of money to be able to afford food, decent clothes and houses, and school fees for their children. This group struggles to emancipate themselves from the vicious cycle of poverty by trying to do what the richest households do, but most of the time they depend on the soil for survival. They invest in farming (time, manure, seed, etc), but often get very little return from the inputs. The rich, in most cases, survive on cash income from cities and therefore strive to increase the number of their family members who work in towns. Having a diversity of options and a diversity of members in non-farm activities are some of the ways of maintaining livelihoods in the faces of shocks to the system, be they weather-related, deaths in the family or retrenchments of key household members. Thus, we see the attention by households to maintaining diversity of options. In our modelling efforts we therefore focussed on vulnerability, as a measure of livelihood outcome (Section 10.1).

Reflecting on the household types we identified, only two (household types #4 and #10) have escaped poverty, with almost all of their member households above the food poverty line (Table 49). These household types are characterised by high remittances and high crop sales, respectively. But these two household types comprise only about 10% of the sample. A further three households types (#9, #2 and #5) have less than 50% of their members above the food poverty line. These five household types make up 29% of the sample. They all have high crop production, high remittances and/or high wages/home industry income. A stepwise logistic regression was carried out on household types, where we made two classes — one comprising household types #4 and #10 ('escaped from poverty') and one with the other household types ('below the poverty line'). What allows some households to escape poverty? The independent variable used in the equation first was remittance income, once again stressing the importance of access to this source of income. The next variables entered were, in order, dryland subsistence income, dryland sales income and site — households that have escaped poverty have good subsistence production and poverty is less pronounced in Mutangi. The intensification we have been noted in Romwe does not lead to less poverty. If the income and site variables are removed from the analysis, the first variable to enter was number of cattle and sex of the head of household. As is indicated below (Section 8.3.4) sex of the head of household is important, as households with males away from the village have high remittance incomes. Livestock represent an asset that is critical to crop production, but it is also a proxy for remittance income, as remittances partially drive livestock purchases (Section 5.4.2). If these variables are also removed from the analysis then area of cropland enters the regression as the most significant variable, indicating that access to land is also important in allowing households to escape poverty. If we conduct a similar analysis on the poverty food line itself, i.e., trying to determine which variables determine whether households are above or below that line, we arrive at similar conclusions with the two most important variables being remittance and dryland subsistence income. Removing the income variables from the analysis leaves number of cattle and educational status as the only other important variables. Once again education is implicated in helping households move out of poverty. Removing the cattle number variable (if it is considered a proxy for remittance income) leaves area of dryland fields and educational status as important.

8.3 Patterns of variation in components of net income

8.3.1 Relationships to wealth quartile

A number of analyses of covariance were conducted on net income variables (Table 51). The variable that was consistently related to the various income variables was wealth quartile, as expected. The wealth quartile variable reflects asset wealth, which includes livestock numbers, ownership of carts, ploughs, etc. This is probably a self-reinforcing circle with access to assets allowing households to improve income, and to reinvest in further assets. In contrast, lack of access to assets is not conducive to achieving a high income, which further prevents asset accumulation. These kinds of households are in a poverty trap that is difficult to break out of.

The differences among wealth quartiles in sources of net income are considerable (Figure 31), with the patterns similar to those for gross income. The top quartile has more than two times the income of the lowest quartile; particularly noticeable is the difference between the top quartile and the three other quartiles. We have also displayed the results using another wealth class classification — where wealth quartiles are defined by total net income of the household rather than asset levels (Figure 32).[29] This accentuates the differences between poor and rich; now the top quartile has nearly five times greater net income than the lowest quartile. It is the asset-based social strata that are recognised by local people, as indicated in the participatory rural appraisal wealth-ranking exercise in which livestock numbers featured as a critically important variable determining the local perception of stratification.

Case-study interviews indicate a general consensus that the rich are getting richer, while the poor are getting poorer; thus differentiation is thought to be increasing (see also Section 9.1.6). Statements such as 'structural adjustment is for the rich' are made; local perceptions are that the rich are able to capitalise on the liberalised economy. The rich are seen to be moving into lucrative activities such as cotton production; it is recognised that the capital required for this activity means that the poor and even the slightly less poor are unable to participate (Box 10).

Box 10. Mr Piteri — accumulation in the face of adversity

Mr Piteri is a retired teacher. He is one of the richest people by local standards. He has two sons and a son-in-law who are working in South Africa. His other son-in-law works in Harare for a big company. His sons and sons-in law give him considerable support through remittances.

He has acquired all the main farm implements. He has managed to buy a truck that is hired by local people, especially to ferry the terminally ill and the dead from hospital, but also to transport crops for sales in bumper years. He also uses his truck to ferry firewood and vegetables from Romwe to Masvingo, where higher prices can be realised. In Masvingo he owns a house, part of which is rented to lodgers. In 2002 he joined other villagers who went gold panning near Masvingo. In addition to gold panning, he was also using the opportunity to sell foodstuffs and water (in 20 litre containers) to the gold panners. Sale of water in these regions is unheard of but the gold panning location was remote and arid, and he saw an opportunity to make money. He used his truck to ferry the water from nearby water sources.

He leases fields from a number of farmers in neighbouring villages so as to broaden the array of soils available to him. During the 2001/2002 cropping season he hired one field from a farmer in Tamwa village and another from one in Sihambe village. This was in addition to his own land holdings (more than 6 hectares). In the Sihambe field he grew cotton (because the soil is heavy texture) while in the Tamwa field he grew roundnuts as the soils were lighter (and are waterlogged in high-rainfall years). He is one of the most prolific cotton growers in the area. He has also sunk three perennial wells in his fields, allowing him to produce crops all year round.

8.3.2 Reliance on environmental resources

The relative proportion of net income from various sources indicates clearly how the different asset-based wealth quartiles rely on a different spectrum of activities (Figure 33). Income from dryland and subsistence crops never exceeds 25% of total income, with a greater proportion of this for cash in the wealthier households. Nearly 25% of income is livestock income in the two higher quartiles but is below 10% in the lowest

Figure 31. Sources of net cash and subsistence income by wealth quartile (one-way ANOVA indicates that remittances, livestock sales and subsistence, and drylands sales and subsistence are significantly different amongst wealth classes. Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level — Dunnett C test)

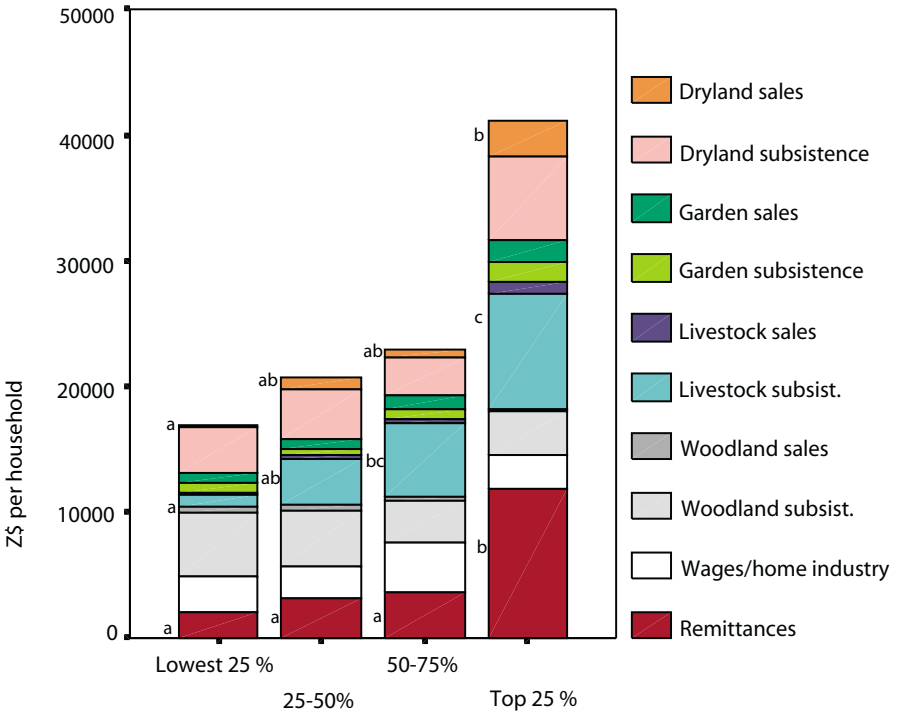


Figure 32. Sources of net cash and subsistence income by wealth quartile, where wealth quartile is defined by net income, not assets (one-way ANOVA indicates that remittances, wages/home industry, livestock subsistence, garden sales and drylands sales and subsistence are significantly different amongst wealth classes. Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level — Dunnett C test)

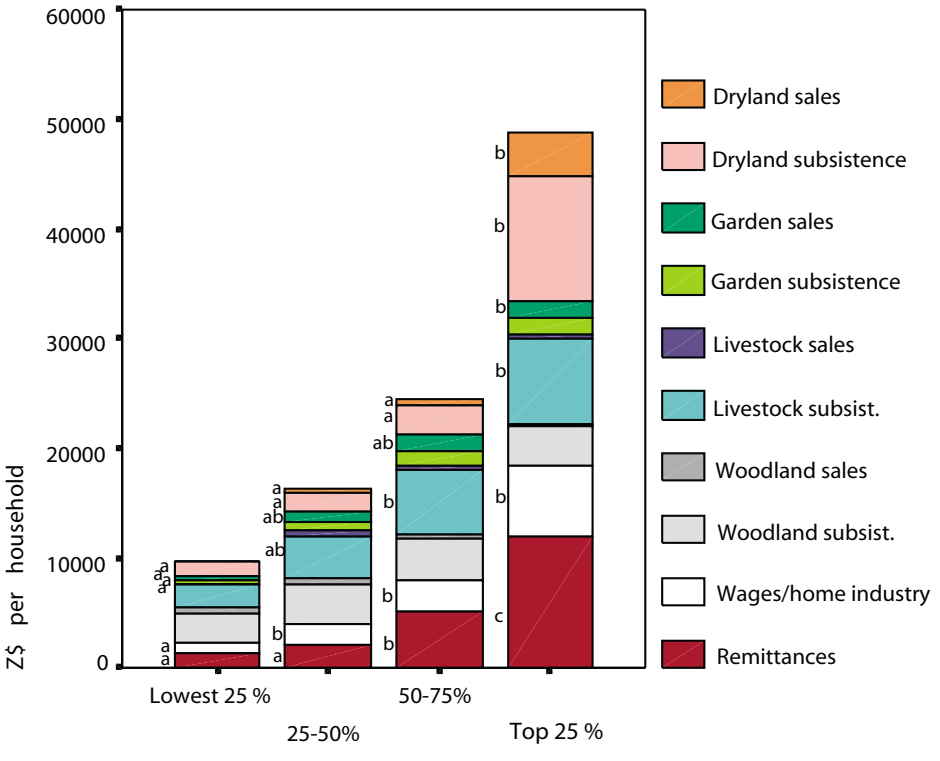
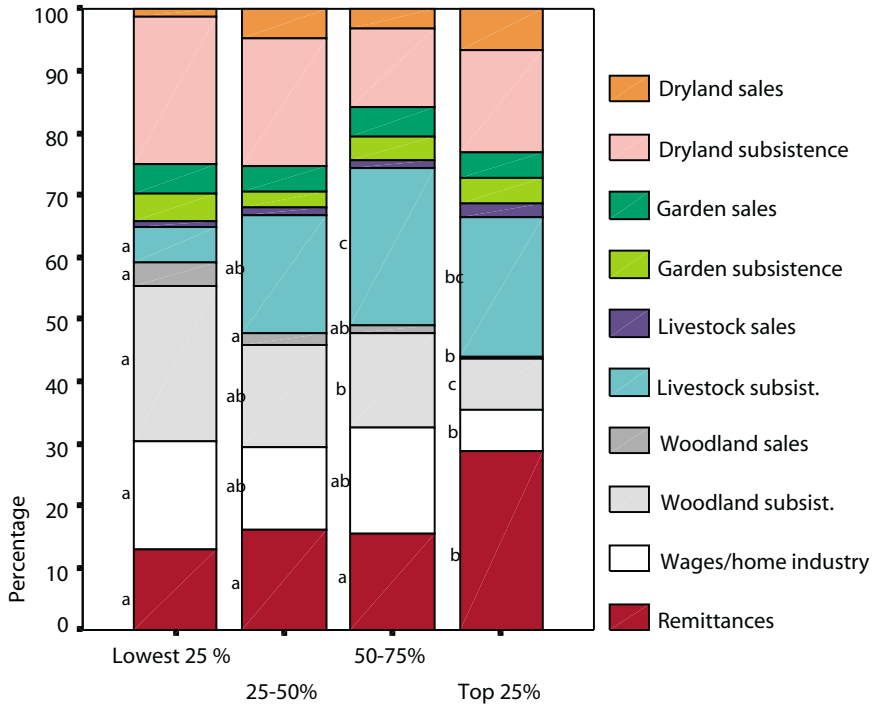


Figure 33. Sources of net cash and subsistence income by wealth quartile (one-way ANOVA indicates that remittances, wages/home industries, woodlands sales and subsistence, livestock subsistence and drylands subsistence are significantly different amongst wealth classes. Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level — Dunnett C test)



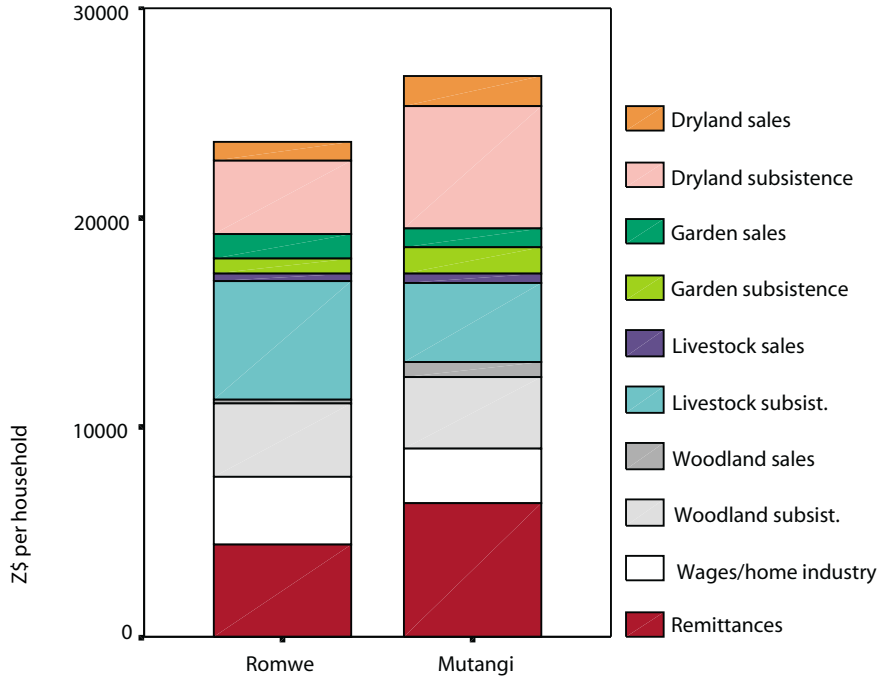
quartile. Nearly 30% of income is woodland-based in the lowest quartile, but is less than 10% in the top quartile. About 30% of income is cash income from wages/home industries and remittances in all wealth quartiles. Considering that livestock income is largely based on rough grazing, the common pool resources of the woodlands and grazing areas provide 30% to 40% of income in all wealth quartiles, with this income being predominantly grazing in the top quartiles and predominantly forest products in the lowest quartile. In these landscapes water can also be classed as a predominantly common pool resource — it is essential for garden production, which contributes nearly 10% of total income in all the wealth quartiles. Thus common pool resources are providing between one-third and one-half of all income. Similar conclusions about the importance of environmental resources for livelihoods are drawn by Monela *et al*. (2000), Shackleton *et al*. (2000) and Cavendish (2002a). Given their contribution to household livelihoods it is surprising the extent to which environmental resources are disregarded by some analysts (e.g., Tomich *et al*. 1995 hardly any mention the role of resources from the forests and woodlands).

Given that households are mostly well below the poverty line, and that forest products (here we exclude grazing) are more important to the poor than the less poor, we consider forest resources as a safety net, preventing households from slipping even further into poverty. Case studies indicate that the safety net function is even more pronounced in drought years or in times of some other calamity. Wunder (2001) notes situations where forest products are poverty traps, not safety nets; when reliance on forest products prevents people from diversifying. This is not the case in these dry forests. Woodlands are one of the assets that can be used to diversify. We would regard life in the communal lands as being the poverty trap, and woodland use as being one of the symptoms of that poverty trap (Section 11.4; Figure 47)! For a few individuals (e.g., the master carvers in the era when tourism was flourishing) woodlands may be more than a safety net. These few individuals are able to sustain a good standard of living from woodland-based activities (the same applies to some well-known thatchers, some firewood dealers that have secured a market, etc.).

8.3.3 Differences between sites

After wealth quartile, site was the variable most often significantly related to income (Table 51), reflecting the different socio-economic and ecological characteristics of the two sites (summarised in Section 6.5.3). Figure 34 shows the differences between the sites, and though they appear substantial, it has to be remembered that it is only total net income, woodland net cash income, livestock net subsistence income and garden net subsistence income that are significantly different in the covariance analysis. All these variables, excluding livestock subsistence income, are higher in Mutangi. The patterns of intensification of crop production alluded to in Section 6.5.3 are not leading to any degree of poverty alleviation in Romwe, in fact Mutangi may be in a slightly better position as a result of its lower cash input costs, resulting in higher net income. If all wealth quartiles are examined, the better-off status in Mutangi is largely due to differences in only one wealth quartile, the top wealth one.

Figure 34. Differences in average net income between sites per household per year (Z$) (one-way ANOVA indicates that woodlands sales and drylands subsistence are significantly different amongst sites)



8.3.4 Other variables correlated with income

The variables other than wealth quartile and site that were included in the analyses of covariance were not consistently related to income, even when wealth quartile was dropped from the analysis (results in brackets in Table 51. Wealth quartile can be dropped from the analysis because it is a complex index related to many other variables; by dropping it from the analysis other relationships can be explored).

a. Importance of remittances

The level of remittance income was positively correlated with dryland subsistence income and dryland cash income (Table 51), reflecting that some remittances come as crop inputs (fertilisers, seeds) and cash remittances are used to purchase inputs for crop production. The backbone of cash crop income is cotton production. An analysis

Table 51. Analysis of covariance of net income variables. Each column reflects an analysis of covariance[1]

Variables used in the analysis of covariance	Income source											
	Total Income	Remit-tances	Wages	Woodlands		Livestock		Garden		Dryland	
				Sales	Sub-sistence	Sales	Sub-sistence	Sales	Sub-sistence	Sales	Sub-sistence
Having a leadership position	NS(*)	NS (NS)	NS	NS	NS	NS (NS)	NS (NS)	NS (NS)	NS (NS)	NS (NS)	NS (NS)
Education of household head	NS(*)	NS (NS)	NS	NS	NS	NS (NS)	NS (NS)	NS(*)	NS (NS)	NS (NS)	NS (NS)
Number of household members with secondary education	NS (NS)	NS (NS)	NS	NS	NS	NS(*)	NS (NS)	NS (NS)	NS (NS)	NS (NS)	NS (NS)
Sex of household head	NS (NS)	** (***)	NS	NS	NS	NS (NS)	NS(*)	NS (NS)	NS (NS)	NS (NS)	NS (NS)
No. of household members	* (NS)	NS (NS)	NS	NS	NS	NS (NS)	NS (NS)	NS (NS)	NS (NS)	NS (NS)	NS (NS)
Age of household head	NS (NS)	NS (NS)	NS	NS	NS	NS (NS)	*(**)	NS (NS)	NS (NS)	NS (NS)	NS (NS)
Acces to irrigation water	NS (NS)		NS	NS	NS	NS (NS)	NS (NS)	*(*)	*(NS)	NS (NS)	NS (NS)
Access to a group garden scheme	NS (NS)		NS	NS	NS	NS (NS)	NS (NS)	*(NS)	NS (NS)	NS (NS)	NS (NS)
Ethnic group	NS (NS)	NS (NS)	NS	NS	NS	NS (NS)	NS (NS)	NS (NS)	NS (NS)	NS (NS)	NS (NS)
Wealth quartile	**	***	NS	NS	NS	*	***	**	**	NS	NS
Acres of dryland fields	NS (NS)		NS	NS	NS	NS (NS)	NS (NS)	**(*)	NS (NS)	NS (NS)	NS (NS)
Site	** (NS)	NS (NS)	NS	***	NS	NS (NS)	NS(*)	NS (NS)	**(*)	NS (NS)	NS (NS)
Remitances						NS (NS)	NS (NS)	(*)NS	(**) NS	NS (**)	*(**)
Wages						NS (NS)	NS (NS)	NS (NS)	*(*)	NS (NS)	NS (NS)

[1]The results shown in brackets are those once wealth quartile was removed as a variable; NS = level of significance is > 5%; * = level of significance is 5%; ** = level of significance is 1%; *** = level of significance is 0.1%

of covariance of cotton income shows income significantly related to wealth quartile and remittance income ($p<0.05$) (see also Section 6.1.4). Remittance income was, however, negatively correlated with garden income — gardens are much smaller enterprises and are more equitably spread across the wealth quartiles.

b. Access to irrigation

For garden income, there was a significant correlation between income and access to irrigation water (having access to a collector well, borehole, dam or well) (Table 52). Similarly, those with access to a group garden scheme had higher garden income.

Table 52. Differences in average net income per household per year, based on access to irrigation water (Z$)

	Good access to irrigation water	Poor access to irrigation water
Garden sales	1365	837
Garden subsistence	1256	734
Sample size	150	43

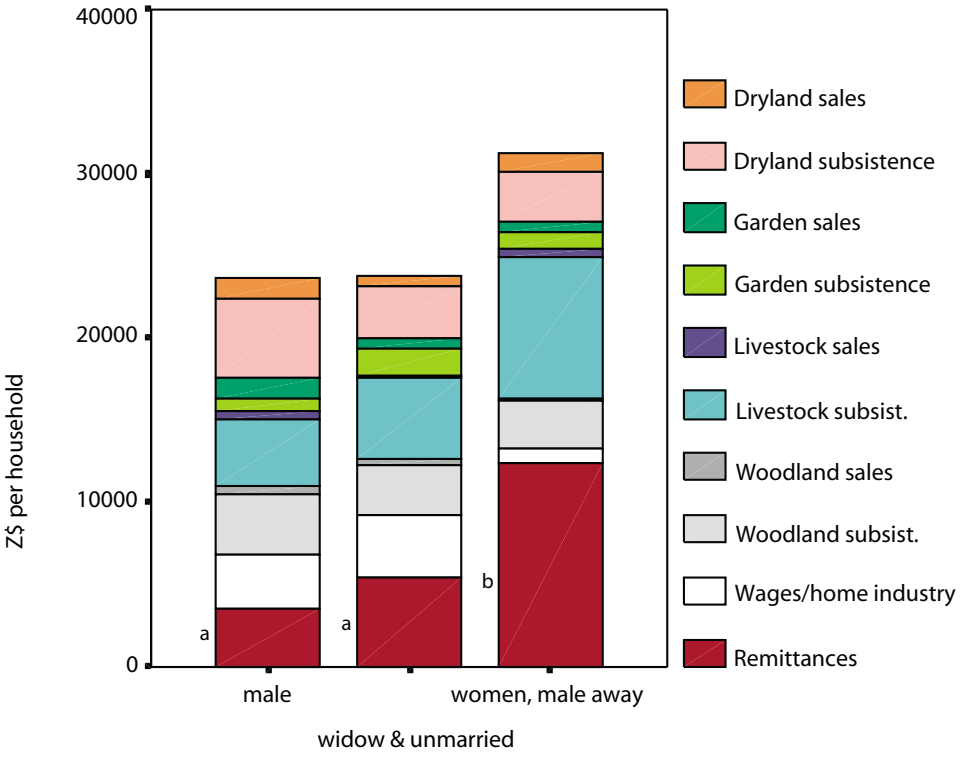
c. Sex of the household head

Sex of the head of household was significant in a number of cases (Table 51). Seventy-one per cent of households are male-headed, 14% are *de jure* female-headed (widows and unmarried/divorced women) and 15% are *de facto* female-headed (males are away at work at some other location). The sex of the head of household has some important impacts on the household income profile (Figure 35). It is remittance income and livestock subsistence income that differs significantly amongst the categories, being much higher in the *de facto* female-headed households. Thus we see the pattern that males away from home are remitting funds that are invested in livestock. Access to remittances is undoubtedly one of the key variables that can lift a household out of poverty. Seventy-four per cent of male-headed households are below the food poverty line, while only 56% of the female-headed households are in this state.

Looking at the percentage distribution of types of households (Table 47) in relation to gender , it was apparent the *de facto* female heads of household were well represented in the high-income household types (especially #4, but also #10 and a lesser extent #7). They are also well represented in one of the medium income classes (#3) where livestock sales are high. *De jure* female household heads are well represented in one of the high-income classes (#7) where livestock income is important (presumably these have accumulated livestock when the husband was alive or have ongoing remittance income from a son) and are also well represented in one of the low-income groups (#6) where wages/home industries and gardens are an important source of income.

Why are *de jure* female-headed households not poorer than male-headed households, as is often reported in the literature? In the past widows were inherited by the deceased person's younger brother but this tradition no longer applies, largely because of the HIV/AIDS epidemic. If they have been married a number of years, then they do not usually go back to their home area. They inherit the fields of the husband and continue as a household in their own right. Widows may be given special roles in the community, as they are able to travel around easily, unlike married women. Thus there are some widows and unmarried women who have harnessed the benefits of development projects, e.g., Mrs Mutadzi, an NGO community mobiliser (Box 11), and Mrs Mbiza, a powerful woman in many committees, including the Chidiso collector well committee. The latter has two sons employed in towns who remit funds (one of whom has a car). Thus the old generalisations about widows and female-headed households being poorer than most other households do not necessarily hold.

Figure 35. Differences in average net income per household per year as a function of gender of the household head (Z$) (one-way ANOVA indicates that remittances and livestock subsistence are significantly different between gender classes. Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level — Dunnett C test)



Box 11. Mrs F Mutadzi — successful intensive agriculturalist

Mrs F. Mutadzi is a widow. When her late husband, a soldier, died she inherited a one tonne open truck, cattle, a well-built house and about four acres of arable land. About half an acre of the arable land is situated near her homestead. Mrs. Mutadzi has four children and is one of the most successful and productive farmers in the community, mostly on the basis of garden production. She also holds many influential positions in local organisations. Among the numerous portfolios that she holds are community mobiliser for CARE Zimbabwe and vice chairperson of the local micro-credit scheme committee.

Mrs Mutadzi diverts water that spills from the community dam onto her own land around her household. With this water she is able to grow a variety of crops throughout the year, e.g., leaf vegetables, sugarcane, green maize, bananas and beans. She makes sure she supplies crops in the off-season in order to fetch high prices. She mobilises her own labour force and hires local people to assist her in times of peak labour demand. She sells her produce to traders who buy in bulk and sell in towns such as Beitbridge. Many of the traders are local but some come from as far as Masvingo town (90 km away). If the local market is saturated she can use her truck to transport her produce to neighbouring markets like Ngundu Halt (15 km away). From her irrigated plot she gets more than Z$50,000 per year.[30] She does not get that much from her dryland fields. She is managing to pay tuition for children who are at secondary school.

Mrs Mutadzi has increased the number of activities in her portfolio. Recently (2001) she attended a course on how to make soap. Soon after the course she started to make soap, which she sells locally and in neighbouring villages. Last week she sold her soap in Bhuka, a small-scale irrigation scheme, some 70 km away from Romwe. The farmers at Bhuka are in the process of harvesting their winter wheat crop. Mrs. Mutadzi exchanged soap from wheat and managed to acquire six 50 kg bags of wheat on her first trip. She is now selling the wheat in Romwe. At Bhuka she buys it for $600/bag, while in Romwe she sells it for $900/bag. She is expecting to raise more than $10,000 from the six bags she has. Mrs Mutadzi is one of the few local farmers who quickly seizes an opportunity if it arises.

Recently some jealous members in the community advised the dam chairperson to ban Mrs Mutadzi from using the water that spills from the dam. They claimed that Mrs Mutadzi was diverting water meant for cattle in the community. The dam chairperson banned her ('with the blessing of the community') and she appealed to CARE Zimbabwe (the organisation that sponsored the rehabilitation of the dam). After the intervention of CARE and the Zimbabwe Farmers' Union the ban was lifted.

d. Other variables

In the covariance analysis, variables that were only correlated with a single income variable include having a leadership position, education of the head of household, number of household members with secondary education, acres of dryland fields, number of household members, age of the head of household and amount of wages/home industry income received (Table 51). Ethnic group showed no relationship to income. It appears that the Ndebele-speaking people in the Romwe area follow very similar livelihood activities to the majority Shona.

In the covariance analysis, it was only livestock subsistence income that varied significantly with age of the head of household, reflecting the accumulation of assets over time by households, though other variables appeared to show age-related trends (Figure 36). If one-way ANOVA analyses are conducted against age of the head of household (instead of the analysis of covariance), then wages/home industry incomes also are significantly different, with younger households having higher wage/home industry income. These age-related patterns are partly a consequence of age of the head of household being positively associated with wealth quartile, with poorer households having more of the younger heads of households (33% of the lowest quartile are under 40, while only 16% of the top quartile are under 40).

The lower total net income of households with heads without any formal education is striking (Figure 37). Having access to education improves the chances of sizeable wage/home industry income. There is a significant association between wealth status and educational status, with the higher quartiles having better educational status (Table 9), so some of the apparent education patterns are related to other factors. Smaller-sized households have lower income than larger-sized households (Figure 38), a pattern also linked to wealth quartile, as wealthier households, being the more mature households, have more household members (Table 8).

Figure 36. Differences in average net income per household per year as a function of age of the household head (Z$) (one-way ANOVA indicates that wages/home industries and livestock subsistence are significantly different amongst age classes. Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level — Dunnett C test)

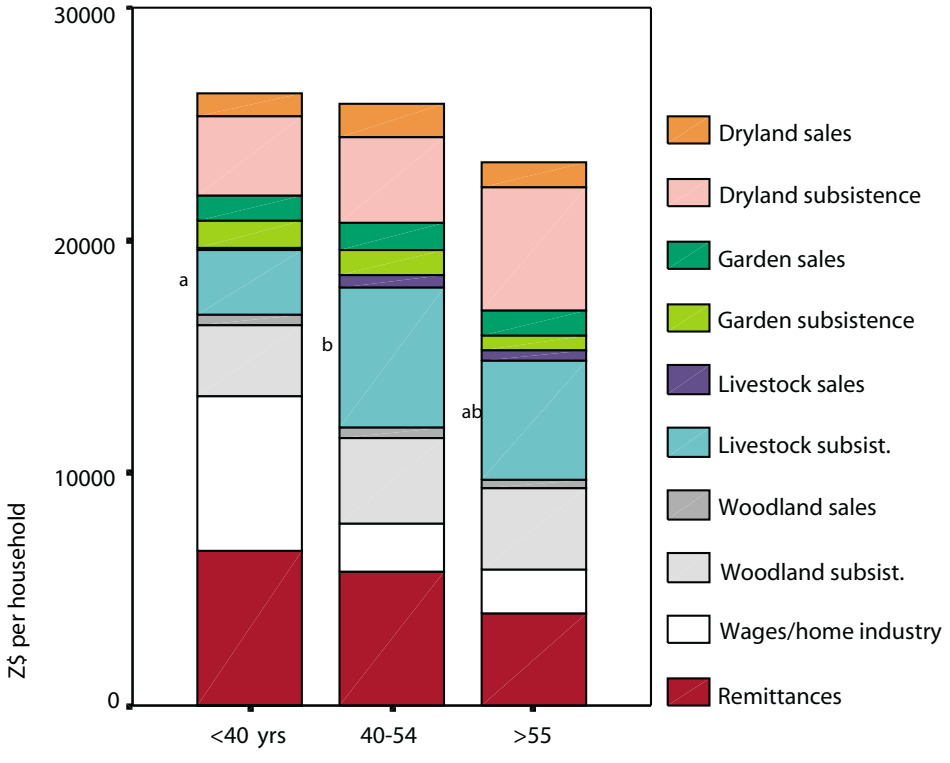


Figure 37. Differences in average net income per household per year as a function of educational status of the household head (Z$) (one-way ANOVA indicates that wages/ home industries, woodlands subsistence and garden sales are significantly different amongst educational classes. Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level — Dunnett C test)

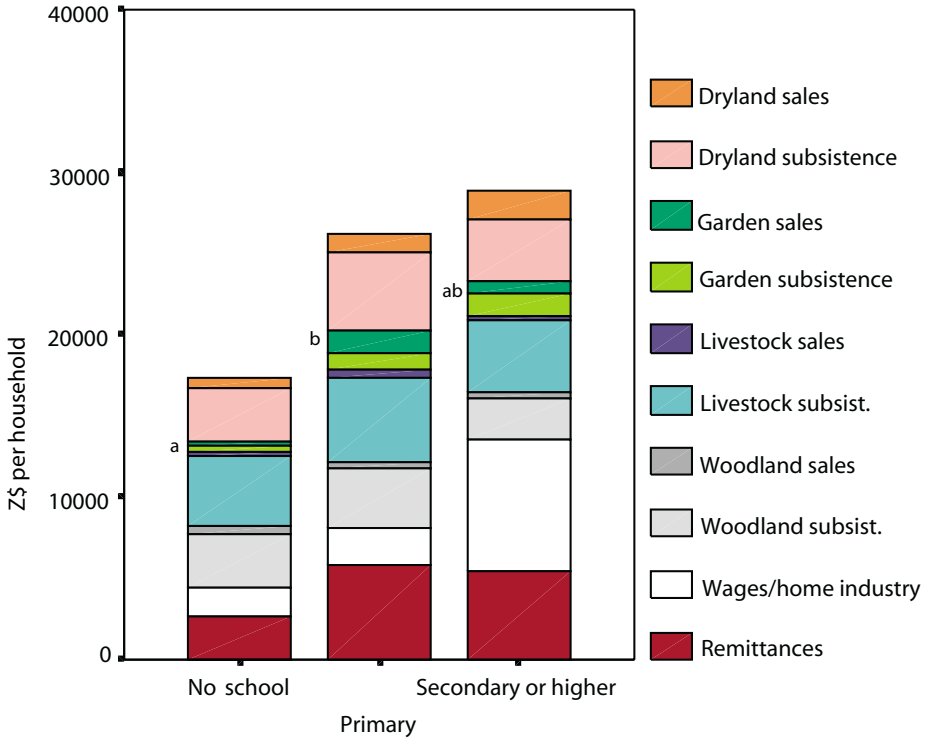
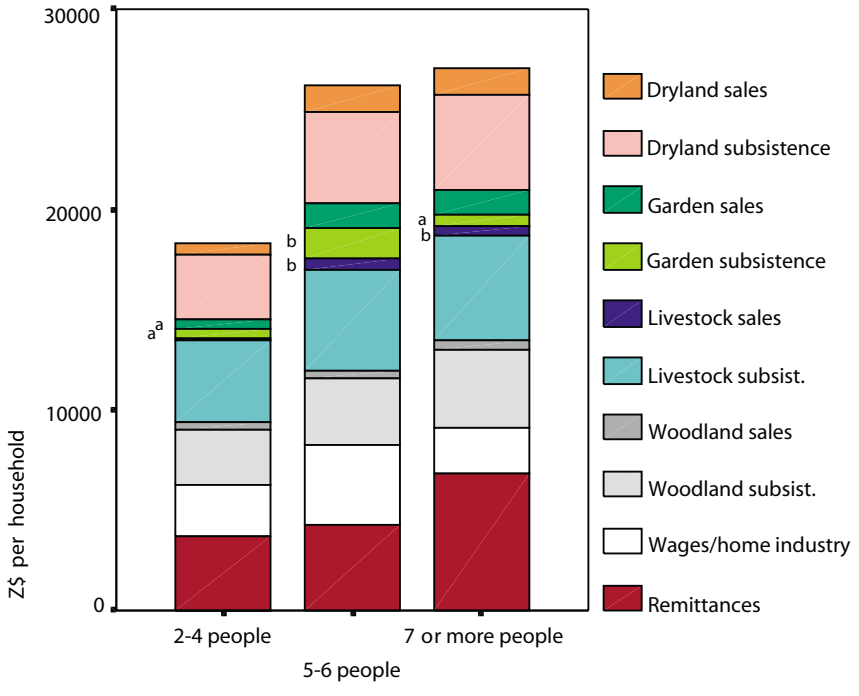


Figure 38. Differences in average net income per household per year as a function of number of household members (Z$) (one-way ANOVA indicates that remittances, woodlands subsistence, livestock sales and garden subsistence are significantly different amongst household size classes. Means followed by a common superscripted letter imply the mean difference is not significant at the 5% level — Dunnett C test).



8.4 Building and balancing capitals to derive income and reduce risk

Rural livelihoods in smallholder systems throughout much of Africa depend on a mixture of activities. These activities include livestock and crop production, harvesting of woodland products, casual labour, a variety of small-scale, non-farm income-generating activities (e.g., brick making, craftwork, gold panning) and receipt of remittances from relatives working in urban areas (Clarke *et al*. 1996; Scoones *et al*. 1996; Cavendish 1999a). There is a constant change in emphasis among these activities as households respond to exogenous factors, such as policy shifts, prices and drought. Woodland resources often become more important components of income profiles of rural people during times of stress (Townson 1995; Clarke *et al*. 1996; Falconer 1996; Arnold and Ruiz-Perez 1998).

The capital endowments of households interact to determine their well-being outcomes. We record a close link between income and assets (the latter captured in the wealth index). With low capital endowments there are limits to what a household can produce. Thus the stock concept of capital is closely related to flow measures of poverty, such as income. We find many limitations in the ability to expand natural capital — land for cultivation is limited; land for cattle is limited and the frequent droughts return livestock herds to low numbers; irrigation water is at a premium (though could be further developed with major investments); and no household can accumulate large areas of irrigated land. Labour is used to the maximum. Secondary education is declining, with household cash budgets too constrained to cover school fees. The State is continuing to withdraw from its service role. Injections of cash from agricultural output from the previous cropping season are limited to a small sub-population of the communities that have very special characteristics (e.g., access to cash for inputs, access to fields with particular soil characteristics). The prognosis is gloomy. Not that households are being apathetic— we see the rise in home industries as ample evidence of their ability to react. Achieving agricultural surpluses in such contexts is not simple; only the wealthiest quartile (with the highest levels of labour and other assets) has any capacity to achieve surpluses (Reardon 1997; Reardon and Barrett 2001). And even here the evidence is that much of this surplus is driven by external non-farm injections of cash (remittances and wages/home industries). Some intensification is occurring, but it has yet to show that it has any poverty-reduction potential.

There are some big differences between the wealthy and the poor in total net income, and the composition of income differs quite markedly amongst households, reflecting the diversity of livelihood strategies. In particular, while wealthier households have much larger remittance income and crop cash income, poorer households receive more cash from woodland resources. One factor driving differentiation in total net income is whether a household has access to remittance income that can be reinvested in farming activities and education. Education, in turn, further improves the chances of the household improving its wealth status. This is not to say that the bulk of remittance income is spent on production inputs. Cash resources are primarily used to maintain the household's basic consumption needs; only after these are met is investment in crop inputs and livestock possible (DorÈ 1993, Scoones *et al*. 1996; Section 5.2.1). The importance of education in boosting access to jobs, total income and cash crop production has been demonstrated (Sections 5.6, 6.1.4, 8.2, 8.3.4d and 10.3; Tomich *et al*. 1995), however, it is difficult to know if some of these trends will continue. Conventional sources of employment, which were largely a function of the family's ability to invest in education, are becoming less common. And many years of investment in education do not guarantee a job in the shrinking economy. Rather, remittances from South Africa and money raised by gold panning, and other such activities, are becoming more important. These are open to anyone, even those from poor families with little education. The current economic conditions and the unconventional sources of cash income may reduce the gap between the rich and the poor.

Key informant interviews regarding temporal change suggest that cash income from dryland crops is extremely risky, given the unreliable rainfall in Chivi. The large injections of cash from cattle sales are generally crisis sales, with small stock income

and income from chicken rearing being more reliable. Gardening income is also more secure than dryland crop income, but can decline dramatically after a series of bad years when water reserves have deteriorated. Remittance income is in decline with unemployment rising and real wage rates not keeping up with inflation. Social networks of kin and neighbours mediate some of the risks associated with loss of cash income, but such networks have lost some of their functions. And there is a rise in non-farm income . Droughts can have a greater impact on the assets and productivity of the wealthier households than the poorer households, as the wealthy have more to lose. However, as the wealthy have a variety of assets, they are able to recover relatively rapidly after droughts (and other crises) (Section 9.1.6; Turner and Williams 2002). Local people say differentiation is increasing.

While it is true that very few families rely on farming alone, it is clear that Chivi is a predominantly rural landscape, and that agriculture still is a driving force behind much decision making, with men making many of those decisions. Thus at community meetings men continue to dominate, and talk inevitably gets around to the need for improving dryland cropping. But changes have taken place and all the pointers suggest further major changes. There is increased activity of women and young men in various home industries; we also see a rise in confidence in these groups, especially the young men, who are beginning to openly question the authority of the older men.

9. Temporal changes in livelihood strategies

Having described the livelihood system in detail, it is sobering to consider that all the quantitative data are only a snapshot for the growing season 1998/99 and the subsequent dry season. A single year of data may be better than nothing but, in these highly dynamic systems, it is of limited use. Supplementing it with qualitative data has helped to show how livelihood strategies change. In this section we synthesise and summarise the qualitative insights about livelihood changes, and supplement the discussion with additional quantitative data, where available (Section 9.1). We then go on to identify five key drivers of change (Section 9.2). Section 9.3 concludes, stressing the extreme dynamism of livelihoods in semi-arid systems.

9.1 Livelihood changes

9.1.1 Summary of changes

Elements of change can be identified in numerous aspects of the capital assets and livelihood strategies. They can be long-term trends; they can be shorter-term trends, or they can be fluctuations from year to year. Here we present the changes by the different capital assets and sectors, with a final section exploring some integrative variables describing livelihoods.

Human capital

- The extension system, widely expanded in the 1980s, had all but disappeared as an active force among farmers by the late 1990s (Section 2.3).
- Free education was withdrawn by the late 1990s, with payments for secondary schooling representing a major constraint and resulting in withdrawal of students from school (Sections 2.3 and 5.1.2).
- Rise in human mortality in the last few years (Section 5.1.1).

Financial, physical capital

- Formal credit, widely expanded in the 1980s, but had disappeared by the 1990s (Section 2.3).
- Free seed and fertiliser, as part of drought relief efforts, was less available by the late 1990s (Section 6.1.4).
- Subsidies for seeds and fertilisers withdrawn in the 1990s (Section 2.3).
- Crop marketing no longer subsidised by the late 1990s (Section 2.3).

Natural capital

- Long-term trend of declining size of dryland fields (Section 5.4.1).
- Long-term trend of declining per capita cattle numbers (Sections 5.4.2 and 6.2.4).
- Variability of cattle numbers in relation to drought events (Section 5.4.2).
- Long-term trend of declining woodland and grazing areas (Sections 5.4.2 and 5.4.3).

Social capital

- Changes in the status of traditional leaders — authority being increasingly questioned by young males (Sections 2.5 and 6.5.4).
- Young males, as a result of lack of opportunities in the outside world, increasingly likely to stay in the community (Section 6.5.4).
- Some exchanges previously governed by reciprocity now governed by cash (e.g., for processes governing labour, cattle services — Sections 5.1.6, 5.5 and 6.2.4).
- Mechanisms for mobilising labour through customary group work parties now less frequent (Section 5.1.6).
- Some abilities for collective action now in place (Section 5.1.6 and 5.2.2).
- Less compliance with regulations imposed by the State — for gardening locations and woodland commercialisation (Sections 6.1.4 and 6.3.4).
- Less compliance with some local institutions — e.g., sales of products from woodlands (Section 6.3.4); reduction of the role of the extended family (Section 5.5).
- Providing wage labour for other farmers having less of a stigma as being an activity of the destitute (Section 6.4.2).

Agricultural and natural resource activities

- Yearly fluctuations in labour and inputs devoted to dryland crops and yearly fluctuation in outputs (Section 6.1.4).
- Drought relief in response to poor crop yields no longer so reliable (Section 6.1.4).
- Short-term changes in crop mix, e.g., cotton rises and falls in importance (Section 6.1.4).
- Long-term trend of increased gardening activity (Section 6.1.4).
- Garden activity can decline dramatically after a series of bad years when water reserves have deteriorated (Section 6.1.4).
- Large injections of cash from cattle sales are generally crisis sales, e.g., in response to drought (Section 6.2.4).
- Loss of livestock income after bad droughts (Section 6.2.4).
- More households turning to woodland resources as a source of income (Section 6.3.4).

Remittances, wages and home industries

- Formal employment possibilities severely curtailed and remittance income in decline (Section 6.4.2).
- Increased numbers try finding income sources in South Africa (Section 6.4.2).
- Rise in trading of a wide range of products, as a long-term trend as well as in relation to droughts (Section 6.4.2).
- Increased activity of women in trading (Sections 5.1.2 and 6.4.2).

Integrative aspects of livelihoods

- Continuing livelihood diversification (Sections 6.5.4 and 8.4).
- Intensification advancing (Sections 6.5.3 and 6.5.4).
- Increased monetisation (Section 6.5.4).
- Women increasingly involved in cash-generating activities (Sections 5.1.1 and 6.4.2).
- Transactions previously governed by reciprocity now governed by cash exchange (Sections 5.1.6, 5.5 and 6.2.4).

- Services previously provided free by government now requiring payment (secondary schools, health clinics, withdrawal of drought relief - Section 2.3).
- Wealth differentiation
- Differentiation increasing (Section 8.3.1 and 8.4).
- Droughts are reducers of inequality, with the largest losses in income in post-drought periods incurred by the farmers with many cattle (Sections 8.4 and 9.1.6). The wealthy generally have larger labour resources, more cropping area, greater levels of important physical assets (e.g., ploughs) and higher remittances, allowing them to draw on these resources to recover.
- Inability to achieve surpluses - given decreased level of natural capital (land, livestock and woodland) and reduced disposable income (for inputs), the chances of achieving surpluses are lower (Sections 6.5.4 and 8.4).
- Gender and age relations (Sections 6.5.4 and 8.4).
- There is increased activity of women and young men in various home industries (Sections 5.1.1, 6.3.4, 6.4.2 and 8.1).
- Rise in confidence of young men to openly question the authority of the older men (Section 6.5.4).
- New roles for women in the household economy, e.g., requiring them to temporarily move away, playing a greater role in the household cash economy (Section 5.1.1).

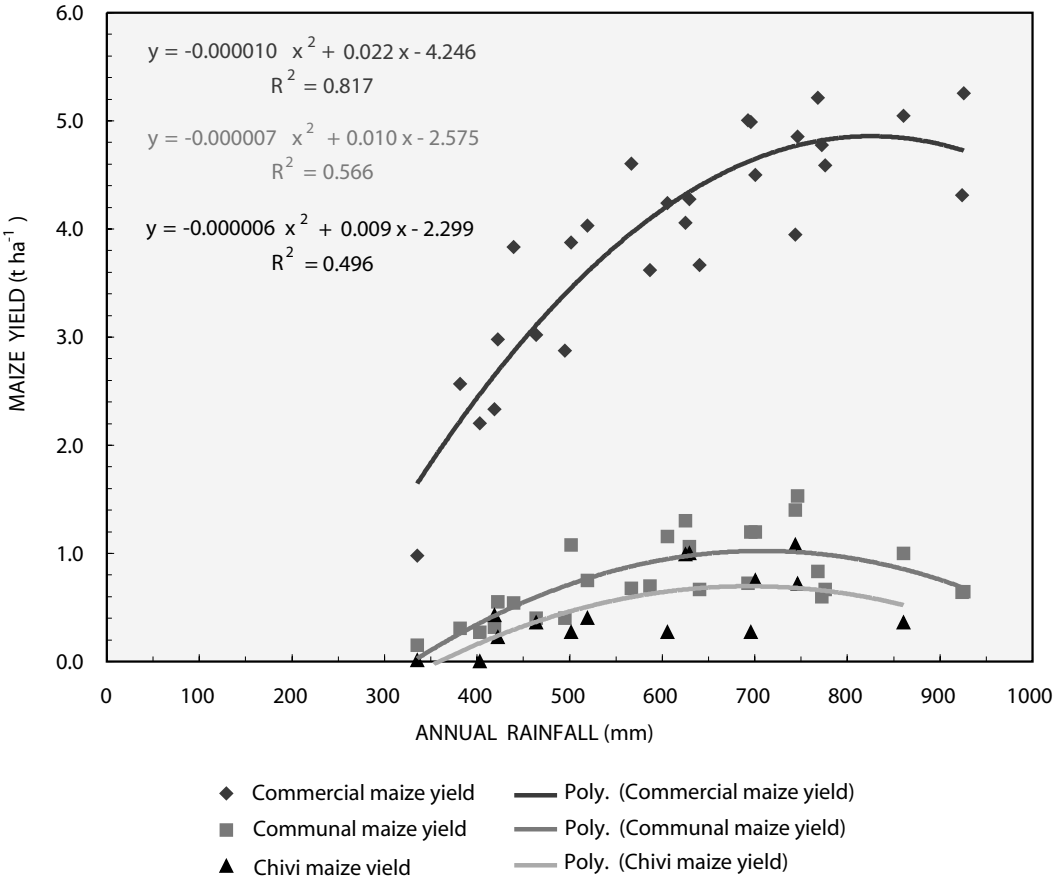
The change in livelihoods is all-embracing, covering the full spectrum of capitals and activities. In the ensuing sections, we supplement some of these changes with quantitative data. In many ways the above list could be seen as a litany of woes (for a similar list for Masvingo Province, see Mabeza-Chimedza *et al.* 2001). On the one hand, the fact that the sites described are places where there has been considerable development work (attention from CARE, the micro-credit scheme, local capacity-building, infusion of cash from employment of local enumerators, etc.) indicates that the situation for areas receiving less attention may be even starker. On the other hand, the fact that households continue to survive and adapt indicates their remarkable resilience in the face of horrendous odds.

9.1.2 Dryland crop production

The implications of variable rainfall for dryland crop production are reflected by maize yields (Figure 39). Also illustrated are the extreme differences between communal and commercial agriculture, with much higher inputs in the commercial setting. Farmers in Chivi get little yield at about 450 mm and below, while above 800 mm there is a yield decline due to waterlogging and nutrient leaching. We also use this relationship for building the rainfall-crop linkage in the systems model (Chapter 10). Given that about 50% of the farming area is devoted to maize, if we model maize production over time using the polynomial regression derived for Chivi (shown in Figure 39), we capture a good deal of the change that occurs in the dryland cropping system. Assuming that this 50% does not change over time, we illustrate how maize outputs have changed over three decades of Chivi rainfall (Figure 40). We contrast this with annual household needs for grain. People are said to consume 220 kg per person per year (Frost and Mandondo 1999; Mortimore *et al.* 2001), although any calculation based on such generalised absolute numbers is open to extreme criticism. Dryland maize supplied 53% of crop income (cash plus subsistence) in 1998/99. Assuming that cash crops are used to purchase grain, then maize must supply 53% of the 220 kg per person per year. Thus at the very minimum, maize output should exceed the 'grain poverty line' shown in Figure 40. In about one-third of the years households fall below this line, but the situation is not as dire as suggested by the official food and consumption poverty lines.

We have detailed information on the crops grown in the central valley of the Romwe physical catchment (136 ha of cropland), with annual mapping of all crops grown

Figure 39. Maize yield as related to annual rainfall for Zimbabwean commercial farms, Zimbabwean communal areas and Chivi communal area. Data derived from that collected by the national extension service for the nation and Chivi as a whole



in each field (Figure 41). Cotton is largely grown in the northern part, as that is where the heavier soils are found. Rice is more frequently grown on the southern side where waterlogging is more common. The data illustrate the rapid changes in crop composition that can take place. We see a sharp rise in cotton up until 1999/2000, and then a massive decline in 2000/01 (Figure 40). There was a sharp decrease in roundnut and groundnut production up until 1999 and then a recovery. Fallow area rose rapidly in 2000/01.

9.1.3 Gardening

It is difficult to acquire quantitative data on temporal change, but building on the data of Moriarty and Lovell (1998), we illustrate the rise in number of gardens in the area of Village Development Committee D in Romwe (this comprises six traditional villages) (Figure 40).

9.1.4 Livestock production

Livestock numbers also fluctuate widely, but show a different pattern to crops (Figure 40).[31] Crop production goes up and down in consecutive years, but livestock take some time to recover after being decimated by drought. Longer-term trends for Chivi show that cattle numbers fluctuated at about 0.15-0.25 head per hectare for the period 1930-1960, then there was a rapid rise to about 0.45 head per hectare in 1975, and thereafter fluctuations, with big decreases in the early 1980s (to 0.3 head/ha) and in the early 1990s (to below 0.2 head/ha) (Scoones *et al*. 1996).

Figure 40. Three decades of change in Chivi in (a) crop systems and (b) livestock and woodcarving. Maize output calculated from a rainfall-output relationship, based on Chivi rainfall. Field areas for cotton, fallow, roundnuts and groundnuts from 136 ha mapped area in Romwe. Livestock numbers recorded at a dip tank nearby Romwe at Ngundu. Woodcraft markets were counted along the road running through the edge of the Romwe study site. Gardens were counted in one of the villages in Romwe

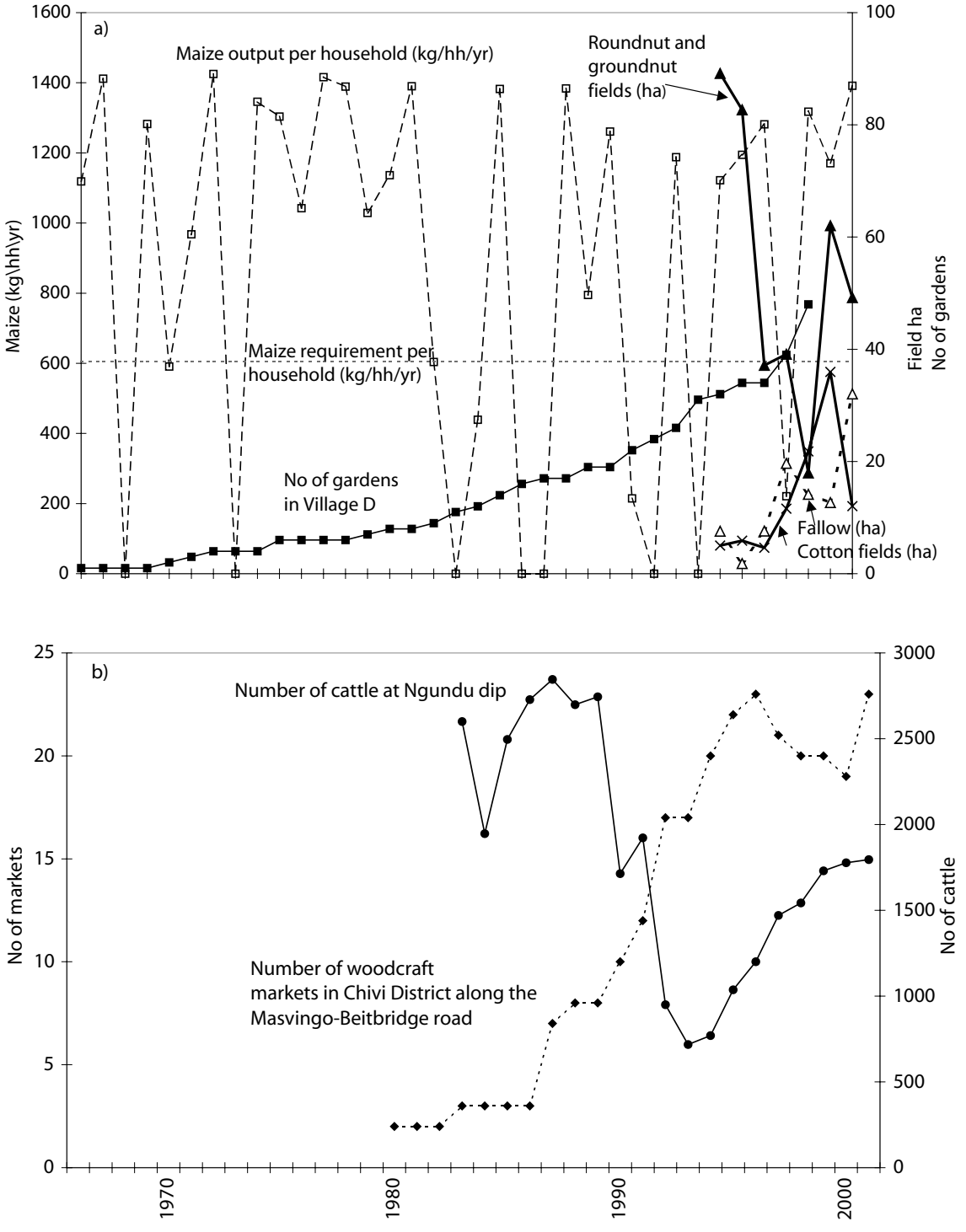
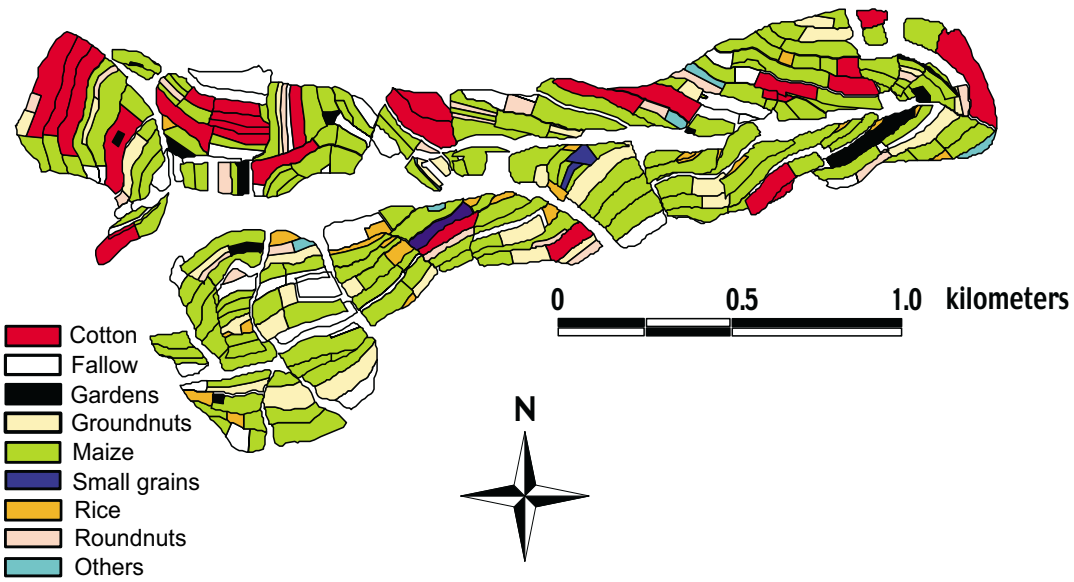


Figure 41. The distribution of crops in fields in the central valley of the Romwe micro-catchment in 1998/99, the season that was covered by the household questionnaire. The fields of Sihambe village are north of the central uncropped area, and the villages of Dobhani are in the south. Mapping of individual fields has been on going over the period 1994-2001



Cattle mortality should be less than 1% at present, as it is a recovery period following the drought of 1991/92 — grass is in ample supply and the rains have been average to good (e.g., see mortality rates given by Scoones *et al*. 1996). Mortality for the cattle herd visiting Ngundu Dip was less than 1% in 1997 and 1998, but had risen to 2.6% in 1999 and 3.4% in 2000, with many dying from tick-borne diseases (Table 53).[32]

Table 53. Livestock population dynamics for 1997-2000 for eight dip tanks in southern Chivi[33]

Year	Number of owners	Livestock numbers	Number of births	Number of deaths	Number slaughtered	Number sold (at official auctions)	Number moved in	Number moved out (including sold locally)
1997	1 866	9 846	1075	6	25	0	50	40
1998	2 007	11 334	1 394	83	98	0	545	179
1999	2 293	12 954	1 844	341	168	0	442	157
2000	2 462	14 135	1 389	490	162	3	344	176

9.1.5 Woodland activities

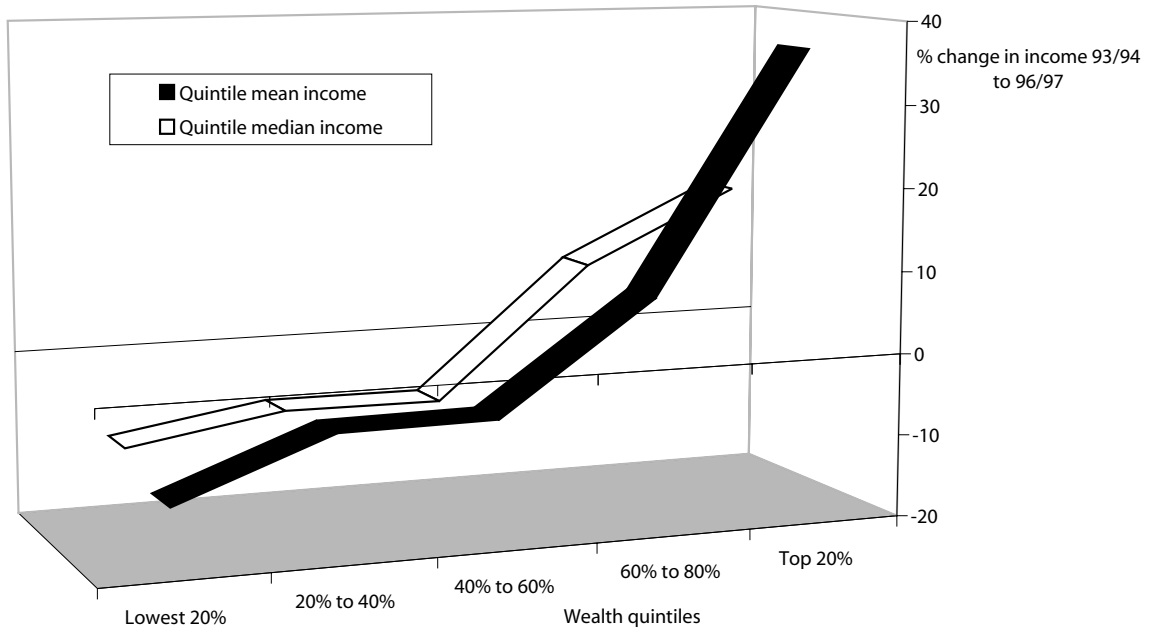
Our only quantitative data for changes in woodland activities comes from the Masvingo-Beitbridge road, which runs through the Romwe study area. There has been a rapid rise in woodcraft markets (Figure 40).

9.1.6 Changing incomes and differentiation

Cavendish (1999b) provides rather conclusive evidence in support of the case studies that point to increasing differentiation (Figure 42). In his very detailed study of 197 households in neighbouring Shindi Ward in the years 1993/94 and 1996/97 the mean income stayed about the same, but this hides the change in distribution of income. He

also recorded some major shifts in income between 1993/94 and 1996/97. There are various processes that promote increasing differentiation. Cash income increased over the period, with greater levels of crop sales (especially cotton), greater sales of livestock and livestock products, but most significantly a rise in cash remittances (up 42% over the period). Of the rise in cash income, 74% accrued to the top quintile. The rise in cotton production recorded in Romwe suggests a similar trend (Figure 40), with increased monetisation of dryland production, but the benefits from this have been concentrated in the top quartile. The collapse of cotton in the last year (2000/01) indicates the degree to which monetisation is dependent on a buoyant national economy (Section 9.2.2).

Figure 42. Percentage change in net income between 1993/94 and 1997/97 for Shindi Ward, Chivi (Cavendish 1999b)



Cavendish (1999b) also recorded a major decline in consumption of own-produced goods, notably those from crop production, a reduction that was spread fairly evenly over the wealth quartiles. There was a rise in the value of livestock graze and browse (also accruing to the wealthier households) and a drop in income from gold panning. The year 1993/94 was just after a very bad drought and the 'discovery' of gold in the Runde. Gold panning is hard and dangerous work and with the easing of the drought and the declining availability of gold, households withdrew back to the farms.[34] Livestock numbers recovered over the period giving rise to greater grazing values for the wealthier households. The higher remittances fuelled inputs for cash crop production and the wealthier households switched from food crops to cash crops. The key changes in the distribution of incomes between 93/94 and 96/97 were dominated by drought and drought impacts, and the rise in remittances. Recovery by wealthy households is only hampered in the cases where circumstances change dramatically (e.g., through death of a remitter or breadwinner). The case studies suggest that wealthier households can afford to hold on to their produce until prices have gone up locally or outside the area because they have other sources of income in their livelihood portfolios. They also have better access to information on prices, from their children working in towns, and can make more sound marketing decisions than the poor.

9.2 Drivers of change

In this section we suggest that there are some key drivers of change, namely: (a) rainfall; (b) macro-economic changes; (c) changing institutional arrangements and social processes; and (d) demographic processes and HIV/AIDS. Most of these descriptions of drivers of change hide a complex of causative factors, which we attempt to highlight the ensuing discussion.

9.2.1 Rainfall

Rainfall is the key resource in semi-arid rainfed agriculture and a key driver of change. Thus when the rains arrive, how much rain falls, how it is distributed within the season, and when the season ends are critical to dryland crop production. The semi-arid systems are highly variable in their rainfall from year to year (Figure 3), and even within the rainy season. Our three years of study clearly illustrate this. The production data for dryland crops in our household survey are from 1998/99, when rainfall was 15% above average. The following season 1999/00 was one of the wettest of the century in Romwe, with widespread waterlogging and flooding. Mutangi received half the rainfall that was received at Romwe in that season. In the 2000/01 season the rainfall amount was above average with Romwe receiving 756 mm and Mutangi 626 mm. But the rainfall was poorly distributed, resulting in much crop failure. In 2001/02 annual rainfall was about 450 mm, with widespread crop failure. The implications of variable rainfall on crop production have been illustrated above, as have the impacts on livestock numbers (Sections 9.1.2 and 9.1.4). Rainfall also affects garden production, but in a more complicated way as the dam and groundwater storage levels mediate its effects. In particularly bad droughts, or as a result of a sequence of bad years, water reserves are reduced and garden production has to be curtailed, with preference given to watering livestock. But those who do not own cattle and depend on gardening for survival this outcome is not welcomed by. Each time the dam committee at Barura has curtailed area under crop production as a water-saving measure major conflicts have arisen. Once, the dam chairman opened the outlet valves of the dam in a rage of fury after he felt that he had been bewitched by people who were opposed to his decision of using the remaining water in the dam for livestock. Thus the repercussions of rainfall variation are felt through the whole socio-ecological system.

9.2.2 Macro-economic changes

Smallholder farmers are linked to the national economy through remittances derived from other sectors of the economy, prices of agricultural inputs and products, and services provided by government. Zimbabwe has been implementing various macro-economic policies in an attempt to improve the welfare of its people (Section 2.6). In the 1980s there was fiscally driven redistribution, import substitution and government controls, while in the 1990s emphasis was on getting prices right, through structural adjustment programmes. The period immediately after independence in 1980 saw major improvements of social services, such as health, education and infrastructure, and agriculture performed very well. However, in the second half of the 1980s, the economy declined forcing the government to adopt, in the early 1990s, structural adjustment. While this led to improvements in some of the formal sectors of the economy, the results for smallholders were far from satisfactory (Addison 1996; World Bank 1996; Oni 1997). In the late 1990s and into this century the economy declined even further, when drastic moves were taken by government to bolster its failing political support. This period saw inflation reach 100% by 2001, collapse of many industries and companies, rapid rise in unemployment, and breakdown in law and order.

What was the effect on Chivi of the changing macro-economy? Cavendish (1999b) found no evidence of a reduction in remittances between 1993/94 and 1996/97. This was at the time of the implementation of the Economic Structural Adjustment Programme (ESAP) when it was widely assumed that rural households had been

negatively impacted. Many of his households were working in the sugar cane producing private sector in the Chiredzi area, a sector that was positively affected by ESAP. He thus recorded higher remittance income in his sample, but this was concentrated in the top quintile. He concluded that it is hard to find concrete evidence of a negative impact of ESAP in Shindi; if anything the remittance rise is a success of ESAP rather than a failure.

However, the national economy has gone into a severe decline since Cavendish's study, even more so since our survey (according to the World Bank statistics, GDP growth was 0.1% in 1999,' 4.9% in 2000, and a further such decline was expected in 2001).All the key informant interviews on this topic express nothing but alarm about the likelihood of jobs in the formal sector and the increasing cutback of workers. We therefore think that remittance incomes are currently declining. In addition, free or subsidised government services are being rolled back. Cash is at a premium — we calculate that cash income stands at less than US$0.20 per person per day. The need to raise cash and the lower rates of out-migration by young males is having repercussions throughout the livelihood system. Many of the changes we see can be linked to these processes — increased monetisation, changing gender relations, changing social norms, diversification into non-farm activities and greater differentiation. There is ongoing diversification. In Romwe and Mutangi gold was important for a short period in the early 1990s as the drought hit, woodcarving became an important income source for a few households close to the road to South Africa, and there has been upsurge of various trading activities (Figure 40). Recently there has been a great movement to South Africa by young boys looking for work. When households are asked about how their livelihoods could be greatly improved, they often talk about the non-rural opportunities. Ultimate success is regarded as when a household no longer needs to depend on rural activities. This happens for the lucky few. An exceptional example from Romwe is illustrated in Box 12.

Figure 43. Items sold on the Masvingo-Beitbridge road made from *Afzelia quanzensis*. Hardwood trees are no longer easily found in the communal lands because of the upsurge in woodcarving (photo: A.B. Cunningham)

National policies and the changing national economy alter the terms of trade in rural areas by influencing input prices and agricultural commodity prices. We did not have any details on input and output prices, but the fairly rapid changes in cropping patterns of cotton, roundnuts and groundnuts (Figure 40) suggest that farmers respond quickly to changing economic opportunities. Some of the reasons given by farmers for the general decline in groundnut and roundnut production are the high cost of seed (the main reason), the recurrent waterlogging in some areas, land shortages and, for roundnuts, labour scarcities. Soon after flowering, the roundnut flowers should be covered by soil and this is labour intensive. Groundnuts and roundnuts are predominantly food crops; they are being partly replaced by a cash crop (cotton). Increasingly, cotton is becoming popular with communal farmers (Chipika and Kowero 2000). Despite the high production costs and the considerable skills cotton production requires, farmers are interested in this crop because of the high returns and the fact that it provides one of the few sources of cash (Chipika and Kowero 2000). Cotton is also drought tolerant making it suitable in the area. The collapse of cotton in 2000/01 is said to be due to the lack of funds to buy inputs, a symptom of the poor state of the national economy (and the resulting reduction in remittances), as well as the previously poor agricultural season (due to waterlogging). Structural adjustment also brought market liberalisation. One important impact was the floating of the exchange rate. The Zimbabwe dollar decreased in value, making it attractive for South African tourists to come to Zimbabwe (Braedt and Standa-Gunda 2000), and for Zimbabweans to work in South Africa in order to earn South African Rand. There was an upsurge in tourists, which precipitated a rapid rise in woodcraft markets in Chivi (Figure 40). Liberalisation also led to some other positive changes for rural people — changing tariff structures saw the country flooded by second-hand clothes. In the 1990s the informal trade in clothing blossomed, and for the first time second-hand clothes were available in the study area and members of the community, mainly women, were themselves involved in trade (Box 9).

One negative aspect has been the rolling back of government services in rural areas, including the previously free health and education services, agricultural extension and veterinary services (including cattle dipping). The slow recovery of the cattle herd after the drought of the early 1990s (Figure 40), illustrates the impact of the reduction in veterinary services. The herds are not recovering as rapidly as they should, partly because of increased mortality. Slower recovery of cattle numbers then feeds through to the livelihood system, with lower subsistence incomes and fewer cattle-related inputs to the cropping system (manure, ploughing services).

9.2.3 Changing institutional arrangements and social processes

The Rhodesian government vigorously enforced environmental legislation, and this remained the case for the first few years after independence. After the first decade of independence much of the legislation was not enforced, apart from occasional raids and inspections by natural resource, agricultural and forestry officers. Some of the enforcement functions were transferred to District Councils, where by-laws for natural resource use were established. District Councils do not have the resources to enforce the by-laws (Mandondo 2001). Two important pieces of legislation were those related to streambank and wetland cultivation, and the sale of forest products. In the case of the former, cultivation had to be undertaken more that 30 m from a stream and no cultivation should take place in a wetland (*dambo*). This placed serious limitations on gardening activities. For forest products, they could only be used for subsistence, with any sales requiring a permit (which was not easily acquired).

The cutback in enforcement of limits on wetland cultivation has seen the blossoming of garden production (Section 9.1.3). This is not to say that the legal problems with cultivation are completely gone. For example, even to this day, people who have gardens along the stream from Barura Dam in Romwe have been warned by officers of the State extension agency to burn all their gardens since they are too close to the stream. In villages where the farmers had been given directives from natural resource

and extension officers, the farmers were reluctant to acknowledge that they owned gardens along streams. The rise in the woodcraft market and other trade in forest products has also been made possible by the lack of enforcement of the law regarding forest products.

Another national policy change is that related to the powers of the traditional leaders. They have undergone waves of disempowerment and empowerment since the arrival of white settlers in the country. Currently they are being re-empowered, but the extent to which this will have major impacts at the village level is still to be ascertained. Social processes in the villages are probably playing a greater role than national legislation in the changing role of traditional leaders. Traditional leaders remain central to daily village life and they are behind many important decisions that influence the livelihoods of villagers, but their powers are being challenged and traditional rules are not as strictly adhered to. Young men are openly questioning their authority. With the ongoing changes in gender roles, we predict that the scene is set for women to also begin to challenge the authority of the male elite. Economic hardships faced by households provide another reason for change. Leaders are more likely to turn a blind eye on some activities that would have previously been regarded as unacceptable, as they understand that people are pressed to raise cash through many different means. Changing mores are also noted — petty theft, which was largely unheard of previously, is now more frequent. For a number of cases of theft we documented the reverberations that this caused in the community, including loss of face of traditional leaders for not being able to control the situation. In some cases witchcraft was implied, and the underlying cause of theft was reasoned to be economic hardship.

We see a system in social flux— changing gender relations, changed relationships between the young and the old, decline in reciprocity, reduced respect for 'traditional' rules, etc. While some of this can be related to the changing economic circumstances and changing policy, much of this change is a reflection of ongoing modernisation processes, which are spreading and deepening throughout rural life (Berry 1993; Ashley and Maxwell 2001; Bryceson 2002). Many of the institutional changes are closely related to intensification and diversification (see next section), as has been discussed for declining reciprocity and increased privatisation (Boserup 1965; Tomich *et al*. 1995).

9.2.4 Demographic processes and HIV/AIDS

With the slowly rising populations, the lack of an outlet in the formal sector for young men, and the limited land redistribution in Zimbabwe not providing opportunities for people such as those in Chivi, endowments of natural capital — land, livestock, common land for grazing and woodland products — continue to decline. These are factors set to drive intensification— people have to manage with less land, and in so doing they change their technologies and labour investments (Boserup 1965; Angelsen and Kaimowitz 2001). If we can make the assumption that the site differences we recorded correspond to likely temporal patterns of change, then we find evidence of many elements of intensification. Further evidence of intensification is the rise in irrigated agriculture and cotton production (Figure 40) — both these require greater inputs (e.g., labour, pesticides, etc.) than the predominant crop — dryland maize. However, most of the quantitative data that we have compiled on temporal change illustrate trends that are much faster than the demographic changes that are taking place. For instance, the average growth in the number of gardens for the period 1970-1999 is 12% p.a., in woodcraft markets is 19% p.a. (1982-1996), and cotton 48% p.a. (1995-2000) — all much higher than the population growth rate in the area (2% p.a. in 1992). Thus most of the changes we are observing are not primarily a result of population increases.

Box 12. From rags to riches: the case of the Ranganayi family

In the 1980s and 1990s, before its chance break, the Ranganayi family was like many other households in the catchment. This family was actively involved in community projects like the Chidiso collector well garden and it struggled to grow rainfed crops. In the early 1990s one of the daughters of the Ranganayi family migrated (illegally) to the UK to work as a domestic servant. While in the UK, she took a course in nursing and finally married. She was then in a position to remit money home and in 1999 she bought a house for her parents in the town of Masvingo. In 2000 she extended the house to 10 rooms. Some of the rooms are being leased to lodgers. The lodgers pay monthly rent, which gives the Ranganayi family a constant cash income. At the end of 1999, the entire Ranganayi family, apart from two sons moved to Masvingo. The Ranganayi family have leased their plots in the community garden to a neighbour and last year Mr Ranganayi and his wife did not actively participate in crop farming in the dryland fields, leaving that work to the two sons. Meanwhile Mr. Ranganayi's eldest son, a soldier recently returned from the conflict in Congo, bought a number of household goods for his family's rural home, e.g., television, hi-fi and solar panel. At the moment Mr Ranganayi is running a kiosk at a local junior school in Masvingo and is in the process of raising money to buy a grinding mill. His daughter and eldest son are the chief financiers of all his projects.

We have noted the rising mortality in our study sites, most likely due to HIV/AIDS (Sectionn5.1.1). The demographic impact is reduced family sizes, higher dependency ratios and slower population growth rates. We postulate that HIV/AIDS is going to have major impacts in the next decade. The researchers living in the study area attended all funerals as part of their social connectedness to the community, and through observation were able to see some of the impact of the high mortality rate. They also explored the impacts of deaths on livelihoods through key informant interviews. Deaths are negatively affecting local livelihoods in a number of ways (Box 13). In some families the remittance earners are dying, resulting in an immediate cessation of remittances into the household. This in turn results in a reduction of crop production as there is no money to purchase farming inputs, like fertilisers and seeds.

There were labour scarcities even before the recent HIV/AIDS pandemic, but the disease has accentuated the situation. In the past some of the labour demand was met by group labour, but the importance of this source of labour has strongly diminished (as elsewhere in the semi-arid regions, e.g., Mortimore 1998). Rich farmers may be able to afford to hire labour, but the poor are unable to turn to hired labour. HIV/AIDS affects labour availability because of the considerable time needed to care for the terminally ill, time devoted to funerals and the loss of household members. Funerals traditionally take four days, during which friends and relatives visit the household. Any one person will spend an average of about 4-6 hours at a funeral. As households are closely connected in the study areas, and are also well connected to neighbouring villages and to a wife's family in another rural area (if she comes from another village), a considerable amount of time can be spent attending funerals. One consequence of the pressures of time is less willingness and/or ability of households to attend development-oriented meetings. Another result is pressure on the social norms to change; we are already seeing new attitudes to funerals, with less time devoted to each event. Because of the drought and economic hardships, farmers are now advised to eat at their homes before they attend a funeral. In the past an important part of the ceremony was the provision of food by the bereaved family to all mourners.

When poor farmers lose a breadwinner, a plethora of problems develop — they reduce the area cropped, children drop out of school because of the lack of school fees and to help in the home and fields or to work for richer farmers, and adults may go to work for other farmers (thus worsening the labour crisis within the household). Malnutrition is also said to increase. The rise in movement to South Africa to seek work has also been linked to the high mortality rates. As the poor are more dependent on forest products than the rich, it is possible that HIV/AIDS is putting further pressures on the woodlands. A number of residents in the study area have reverted to selling woodland products, such as timber and firewood, to raise money to care for HIV/AIDS

patients. A more immediate effect on the woodlands is the rise in firewood use as a result of maintaining a fire over the night at funerals, where people are expected not to sleep, but to show solidarity with the deceased by singing and dancing throughout the night. In times of death a number of local rules are waived, e.g., the rule about the volume of wood that can be collected at any given time. Cross-village use of carts to ferry firewood, a practice that is not usually allowed, is also permitted in the face of death.

Ubiquitous deaths in the area have also strained the meagre financial resources available to households because of the cost of providing care for the terminally ill. Those who fall sick in urban areas and eventually lose their urban livelihood return home to their rural area. Households use their limited cash (e.g., from the sale of vegetables, goats, chickens, or from paid labour to seek medical treatment.35) When death eventually strikes, the local households will again use their already-strained resources to buy coffins, provide food to people who come to bury the deceased, etc. One of our case studies indicated that 50% of a loan from the micro-credit scheme had been used for funeral expenses, indicating a relatively serious loss of potential production (Box 4), but arguably being used to maintain and build social capital.

There is a traditional ritual carried out one year after the burial. This ceremony is observed by non-Christians. It is called *masukafoshoro* — which literally means cleansing the shovels. During this ceremony a cow or bull is slaughtered (the value of which is worth half the average annual cash income of a household). The meat is cooked and eaten by all the people who assisted in the burial. Many cattle are killed every year as part of the *masukafoshoro* ritual, and we did see a rising rate of cattle slaughters in the livestock data, from below 1% in the first two years of data to above 1% in the last two years of data (Table 53), another factor contributing to poor recovery of livestock herds after drought.

9.3 Dynamic livelihoods — where to?

We have built a picture of highly dynamic livelihoods. This dynamism is partly due to the inherent nature of life in semi-arid regions where rainfall is so unpredictable, as well as a result of long-term trends in population growth, with resulting reduced natural assets — one of the forces for greater intensification (rising inputs per unit area) (Boserup 1965). But much of the dynamism is a function of broader social, political and economic processes, many of which are happening rapidly. And then there is HIV/AIDS, the wild card of change; with potentially numerous impacts on livelihood systems. There are also multiple pathways of change; some households becoming more specialised on particular productive activities, wealthy households taking different paths from poor households, women doing different activities from men. It is not difficult to predict that the livelihood system in two decades will be very different from that of today — changed social norms, perhaps greater intensification, probably more monetised economies, greater diversification and more differentiation. It is, however, not apparent that poverty will be any less. Can anything be done to reduce poverty? What are the key intervention points? We now turn to systems modelling to identify the variables that most influence livelihoods (Chapter 10) and then reflect on what the development community can do to alleviate poverty (Chapter 11).

Box 13. The Zigari family — struggling in the aftermath of death

The Zigari family lost the head of the household five years ago. The family now consists of the mother, three boys and three girls. The eldest child, a boy of about 20 years, moved out of the house to stay with his uncle, where in return for help he receives basic sustenance. Another boy, about 16 years old, dropped out from school last year, in his second year of high school, when his mother could no longer afford the fees. He started working for another household outside the study area as a herd boy. His mother has since lost contact with him — she suspects that he crossed the South African border to find work. Another boy is doing his first year of secondary education. During school holidays and weekends he works for a wealthy household as a herd boy and general hand. The eldest daughter fell pregnant last year while she was in Kwekwe, a town 200 km away, where she was doing her secondary education. The mother could not afford to pay boarding fees at the school, so she was staying by herself. The father of the child refused to take responsibility for the pregnancy, so the daughter has returned to her rural home, having dropped out of school, and with an extra mouth to feed in the household. Another girl completed her 'O' level certificate (after four years of secondary education) but failed to attain the standard to proceed to further education. She has also returned to her rural home. The youngest girl is still at primary school.

The family has a garden with water provided by a private well inside the garden. The well rarely dries up in a normal year and the household is able to grow vegetables for sale, such as onions, cabbages, green maize and tomatoes. By local standards, the family's production level is low, largely due to a lack of key inputs like fertilisers and pesticides. The family also has seven beds in the Chidiso collector well community garden, each of 6 m^2. In addition to the vegetable gardens, the family also owns a dryland field of about four acres. For the past three cropping seasons, a large part of the field has been left fallow due to lack of inputs. The land is usually hand tilled but last year an uncle ploughed a quarter of the field for free. But this ploughing was only done towards the end of December, by which time planting was long overdue.

The family does not own any cattle. It had nearly 10 cattle but these all perished in the 1991/92 drought. The household owns less than 10 goats. If there is a pressing need for money, the household sells a goat. It has a number of farm implements that are no longer functional, including a harrow and scotchcart.

The mother took over the role of breadwinner following the death of her husband. She started trading second-hand clothes three years ago. She bought second-hand clothes from Beitbridge and sold them locally. She accepted money or grain as a form of payment. When she started this business it was very rewarding. She could make four or five trips per month. However, the past year has seen an influx of people entering the activity and a steep rise in bus fares, forcing her out of business. In addition, her health has declined and she has been in and out of hospital. Now she and her eldest daughter are involved in selling fresh farm produce at Museva Business Centre, including roasted maize, tomatoes, onions and leaf vegetables. Some of these products are from the household garden but she also purchases from nearby irrigation schemes. They work six days a week.

She was part of a poultry project with another woman in the area but they only raised one batch of broilers together, after getting funds from the micro-credit scheme. Mrs Zigari claims that the mother of the other woman disapproved of their alliance because, as a widow, Mrs Zigari had no moral grounds to do business with a young woman.

10. Modelling livelihood change[36]

10.1 The Bayesian Network approach and model structure

As described earlier, an integrated model (Bayesian Network — BN) was produced over the period of the three-year project. An iterative process culminated in a four-day workshop in which nine researchers finalised the model (Section 3.5). The focus of the model was on investigating the best ways to improve the cash income of poor people, as this was considered to be the key to other livelihood improvements. In previous sections we have indicated the key role that cash plays in local livelihoods, and how the local economy is becoming increasingly monetised (Sections 6.5.1 and 6.5.4). We also explored 'vulnerability', which is an amalgam of cash income level and the resilience of that income. Rather than considering the community as a whole, we explored how people might move between wealth quartiles, in particular, how people might move from the 25%-50% quartile into the 50%-75% quartile. Consequently, the variables representing the income-generating activities were separated into two levels, one representing the average cash income earned by the medium rich from that activity and the other representing the average cash income earned by the medium poor. Similarly, the livelihood assets feeding into the income-generating activities were divided into two categories. The first represented the level of assets required to achieve a medium-rich level of income generation ('good asset status'), while the second represented the level of assets required to achieve a medium-poor level ('poor asset status'). The nodes and linkages of the final integrated model are shown in Figure 44. A number of the relationships had to be built on the basis of very limited data.

Conceptually, the livelihood assets determine the level of production that can potentially be achieved. These are combined to produce a potential total production level, depending on the number of activities undertaken, which itself is dependent on the availability of labour. As we have seen in Section 5.1.6, labour is at a premium, and the situation is unlikely to improve, thus this is a key variable to include in the model. The production potential is then modified by market factors to give realisable cash income. Vulnerability context variables, environmental factors and community characteristics feed into all elements of the model, as appropriate.

10.2 Main driving variables of vulnerability and cash income

A sensitivity analysis was performed on the model to identify the variables in the system that most strongly control peoples' livelihoods. An initial analysis indicated that household vulnerability was highly sensitive to the macro-economy and to the rainfall regime (Table 54). Another key variable, but of much lower magnitude, was 'community institutions' (i.e., social capital), the degree to which local institutions are functioning or not functioning (Section 5.5). This variable was considered to have impacts throughout the production system, and has been the focus of study by a number of the researchers on the project (Mandondo *et al*. 2002; Nemarundwe 2002a,b,c; Nemarundwe and Kozanayi 2002; Sithole 2002). Such community infrastructure affects livestock production through inter-household herding arrangements and access to

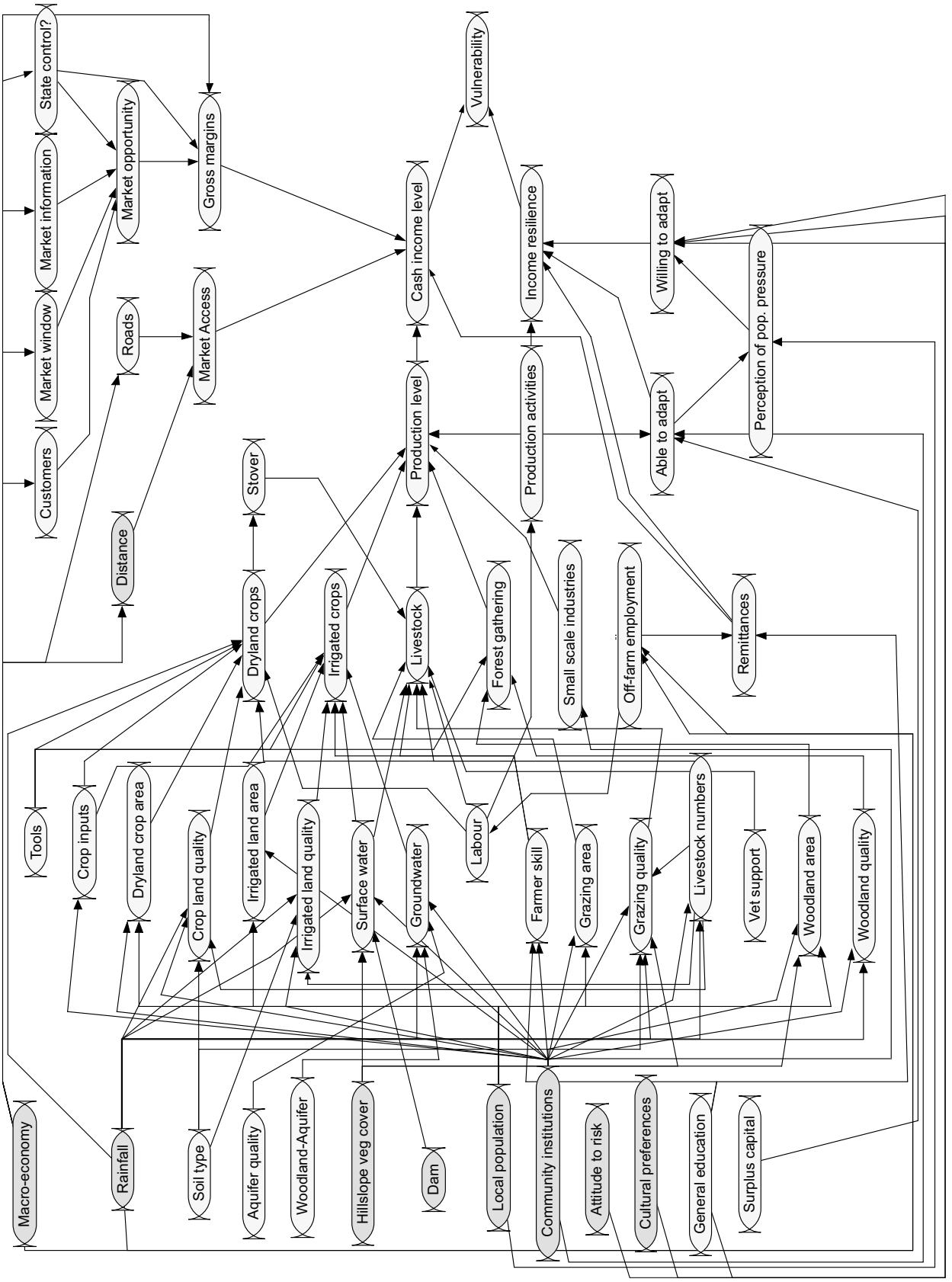


Figure 44. The nodes and linkages of the Bayesian belief network used for the final integrated model (Cain *et al.* 2001)

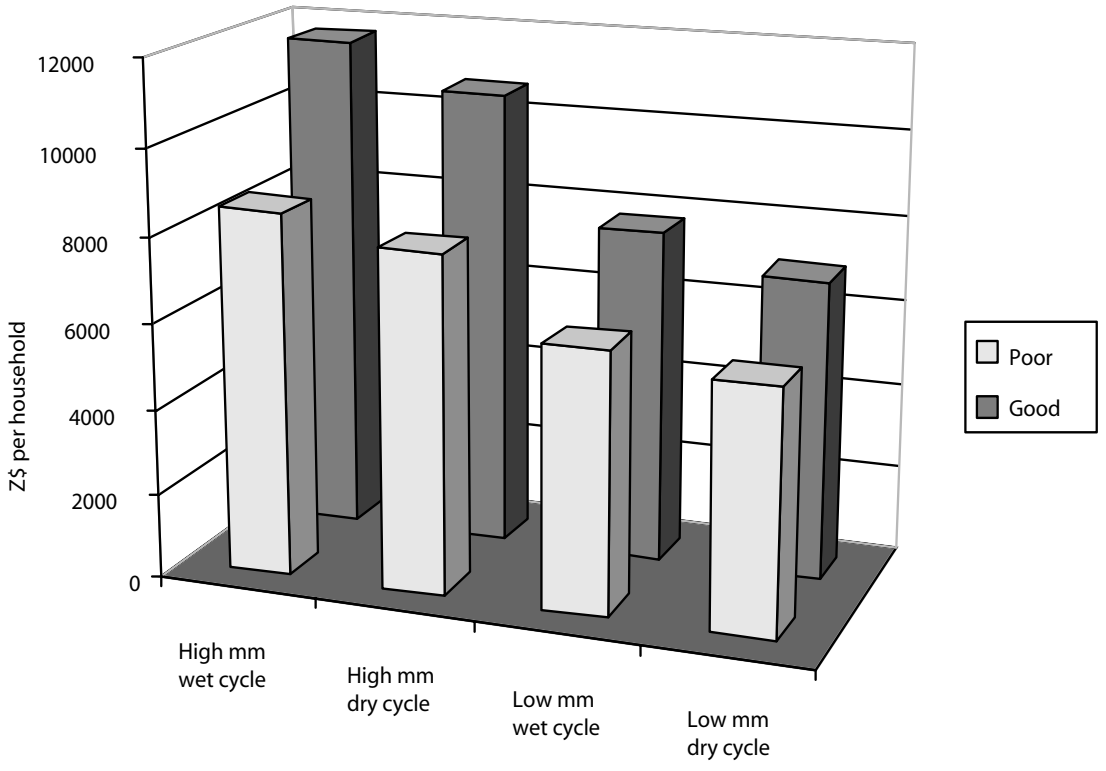
veterinary assistance. It has an impact on crop production through opportunities of the community to have a voice in demanding assistance for extension; joint input-purchasing arrangements; the provision of water from community-run water points; and joint marketing arrangements. Woodland production is affected through the local rule framework for use of common property systems, etc.

The impact of the main variables on cash income varies with different conditions (Figure 45). Cash income increases by 67% from a low rainfall year in a dry cycle to a high rainfall year in a wet cycle. A good macro-economy, defined as one with 8% annual growth (as has been experienced by Zimbabwe in the past) increases cash income by up to 37%, when compared with a poor macro-economy (0% growth). On the other hand, the changes achieved by moving from a system with non-functioning institutions to one with functioning institutions only increases cash income by up to 8%. There are, however many interaction effects. The difference between cash income in a dry year-low rainfall system and in a wet year-high rainfall system is only 49% in a bad macro-economic context but is 67% in a good macro-economic context — farmers can benefit from good rainfall when the macro-economy is thriving. Similarly for institutional development; we estimate this can make a difference of only 4% to 6% when the rainfall is low, but 7% to 8% when rainfall is high.

10.3 Livelihood assets and markets

Given that rainfall and macro-economic states are so overriding in their effects, these were held constant at the conditions current at the time of the study for the next series of analyses. The situation was a poor macro-economy (which has further declined since our livelihood data was collected) and a high rainfall year during a wet period. Community characteristics and other contextual variables within the model were also set to what was believed to be their 'current' state.

Figure 45. Changes in net cash income related to rainfall and the state of the macro-economy (results from the Bayesian Network model, for the situation where community institutions are functioning)



Perhaps unsurprisingly, the model then indicated that market factors were far more important than any other variable in influencing vulnerability (Table 55). This was especially the case with gross margins, whose impact on community vulnerability was an order of magnitude greater than any other factors. This was largely because market factors were thought to have a very direct effect on income (and hence vulnerability), whereas livelihood assets have an indirect effect, being mediated via income-generating activities. The analysis also indicated the sensitivity of our income results to the prices used in Section 6. Under poor macro-economic conditions in a dry year, we estimate that only 5% of farmers achieve 'good' gross margins. If this could be raised to 25% of farmers, average cash income could be increased by an estimated 22%.

The model showed that no single livelihood asset was capable of having a major impact on vulnerability. This is an important conclusion, as it suggests that development options should target a wide range of livelihood assets rather than focussing only on a few. However, the project team agreed that it was still useful to identify those assets that had the greatest impact on livelihoods. Of the assets included in the model, labour and general education were found to be by far the most important. Closer investigation showed that labour was the most significant as it had a strong impact on dryland crop productivity (potentially the highest cash income earner of the local options), but also because it allowed more income-generation activities to be undertaken. The importance of labour was something that we could have predicted prior to the survey, but the study did show that labour demand did not differ much seasonally (Section 5.1.4), indicating the pervasiveness of labour scarcity. General education was found to be almost as important because it affected both farmer skills and the ability to secure more highly paid non-farm employment. These two assets were followed by roads, cropland quality, farmer skill, surplus capital (surplus after basic needs for education, health, food and agricultural inputs have been met) and livestock numbers, in that order (Table 55). The root mean square change of other variables was negligible. The results suggest foremost that, in terms of the capital assets framework (other than social capital), development should attempt to alleviate labour bottlenecks (perhaps through labour-saving devices and technologies) and should not introduce new technologies requiring large inputs of labour. Secondly, the importance of maintaining investments in education cannot be over-stated. The significance of labour also underscores our prognosis in the previous chapter (Section 9.2.4), where we suggest that HIV/AIDS is likely to have major impacts on local livelihoods.

Table 54. Sensitivity analysis of 'vulnerability' for selected variables

Variable name	Change in root mean square for findings entered for the variable
Macro-economy	0.0386
Rainfall	0.0295
Community institutions	0.0058
Hill slope vegetation cover	0.0008
Soil type	0.0005
Attitude to risk	0.0004
Cultural preferences	0.0001
Aquifer quality	0.0000
Woodland-aquifer connectivity	0.0000

Note: The larger the change in root mean square the larger is the impact of that variable on vulnerability'.

Table 55. Sensitivity analysis of 'vulnerability' for selected variables, with the rainfall regime and the macro-economic state held constant (high rainfall in a wet year and poor macro-economy)

Variable name	Change in root mean square for findings entered for the variable
Gross margins	0.0275
Labour	0.0057
Market access	0.0045
General education	0.0043
Roads	0.0015
Crop land quality	0.0015
Farmer skill	0.0009
Surplus capital	0.0009
Livestock numbers	0.0009

Given the assumed conditions of a high rainfall year during a wet period, it was not surprising that water resources development did not feature more prominently. However, even when rainfall conditions were changed within the model to the worst possible state, water resources did not appear to have a significant impact. Further investigation led to the conclusion that this was because the model assumed that surface and groundwater resources only affect irrigated cropping and livestock farming and these have a low potential as cash income earners. This highlighted a limitation of the model in that it only considered cash income generation as its criteria for success while, clearly, both irrigated cropping and livestock farming are crucially important for subsistence income security.

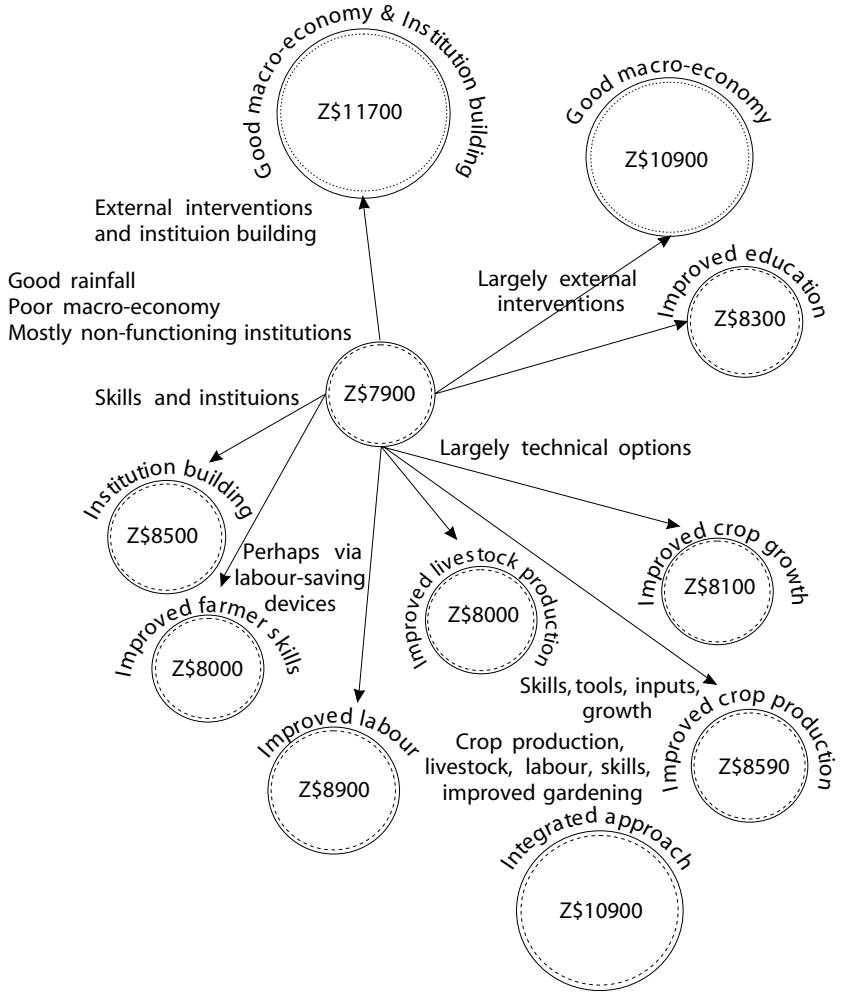
10.4 Raising cash income

In a wet year with high rainfall and poor macro-economy, the model estimates that cash income should be about Z$7900 per household. What can be done to improve cash income status? The various options are represented in Figure 46. By far the greatest impact on local livelihoods will occur if the macro-economy is in a better state. Applying any number of technical options, including improving dryland crop production (e.g., ensuring inputs are available, or new varieties of crops requiring fewer inputs), livestock production, garden production, farmer skills and alleviating labour bottlenecks, will only be as successful if we can shift the system from a poor to a good macro-economic status. Undertaking improvements in any one of the production systems will make very minor impacts on cash income, with most effect on dryland crop production. Institution building alone also makes a sizeable cash income improvement, through its potentially positive effects on numerous production activities (this conclusion would also hold if we considered total income, rather than just cash income).

10.5 Exploring livelihood improvements in dry years

The above analysis has largely focussed on what can be done when at least one of the constraints has been lifted, that is, we have assumed that we are dealing with high rainfall in a wet period. Our starting cash income was Z$7900. Given poor rainfall in a dry period we expect that cash income will be reduced by 30%, a sizeable reduction, which also comes with a massive decline in subsistence dryland crop production and, perhaps, high livestock mortality. Our model suggests that it is the same constraints that will need to be alleviated under these conditions, namely market limitations,

Figure 46. Options (each of the arrows) that can be used to improve cash income status from the current state. Where the development option implies changes in household assets, the option means improving assets to those of a medium wealthy household. Circles represent cash income, and are proportional in width to the magnitude of that income



labour constraints, farmer skills (for irrigated production in particular), and non-functioning institutions.

During dry years, one aim will be to achieve greater subsistence production, and one of the options is to improve use of groundwater resources by opening up additional high-yielding water points (Section 11.3f). Our systems model does not incorporate subsistence income, so we explore this option with spreadsheet calculations. We estimated income profiles for Romwe in a dry year and explored the impacts of doubling garden area. Our dry year is assumed to be 475 mm of rainfall (50% of years in the last two decades have been below this amount). Under such circumstances we assume a 37% decline in gross income from the current levels of dryland production (based on the relationship developed in Section 9.1.2 for maize). The resulting net incomes from dryland production are very low after expenses are subtracted from the gross amounts. Our results also assume that garden production would be maintained at current levels in a dry year. This is likely in the case of single dry years in otherwise 'normal' periods, but in long dry spells surface and groundwater reserves would be depleted (Lovell *et al.*, 2002). However, even in the drought of the early 1990s, one of the worst in the

century and coming at the end of a long dry spell, the Chidiso collector well in Romwe was operational, but with reduced capacity.

Making the above assumptions, if the garden area is doubled, this would provide a major boost to average crop income (dryland and garden, for both subsistence and cash) in dry years, causing an increase of nearly 60% over what would have been achieved without the extra gardens. The increase (about Z$2000) would unfortunately not compensate fully for the losses in dryland production caused by the dry year (about Z$4000).

10.6 Main conclusions from the Bayesian Network

The model was produced prior to undertaking any of the statistical analyses of the livelihood data that have been presented in the bulk of this book, and a number of relationships had to be specified on the basis of very limited data. When the model was produced, the only livelihood data available were the means of variables in different wealth quartiles. That the livelihood analysis and the detailed statistical analysis reach fundamentally similar conclusions give us some endorsement that our 'belief' network is relatively robust. Systems models can, of course, never replace empirical work (including empirical modelling). On the basis of these modelling results, we suggest that future empirical analyses of rural livelihoods need to further explore the multiple relationships between farmers and the macro-economy, and between income and social capital.

The main conclusions that we draw from the modelling approach are:

- An integrated approach, covering several production sectors, is required to make any sizeable impact on cash income.
- Institutional (social capital) building can be as important, if not more so, than any focus on a particular production system.
- Market development is critical to improved cash income; we need to open up new markets, further develop current markets and improve gross margins.
- Macro-economic and rainfall effects on local livelihoods appear to outweigh the effects that can be achieved through rural development initiatives.
- In terms of the capital assets other than social capital, it is critical to alleviate labour bottlenecks, avoid technologies that are excessively labour-demanding and continue to give attention to education.

11. Making a difference

In this research, we embraced the now well-established sustainable livelihoods perspective as the entry point for analysis and action. We now examine the usefulness of such an approach (Section 11.1). The major part of this last chapter looks to the future in terms of what the development community can do to achieve the poverty-alleviation goals it has set itself. In the second section we examine the resourcefulness of farmers, their apparently infinite ability to rise to new challenges. However, we do not see this as meaning poverty will disappear — we conclude, rather pessimistically, that the current processes of intensification (i.e., greater inputs per unit area) and diversification are not leading people out of the poverty trap in semi-arid regions (Section 11.2). In the third section we look to the causes of poverty and the options that can be used for poverty alleviation in semi-arid regions (Section 11.3). In the final section, we question whether rural development can really make any sizeable impact on poverty in semi-arid environments (Section 11.4). Our answer is not positive — an answer that is unpalatable to most rural development practitioners. We look to where we can in fact make a difference.

11.1 The sustainable livelihoods perspective — should we be bolder?

Our study has used the sustainable livelihoods framework (Carney 1998) as the entry point for data collection and analysis. As a means of fully understanding the components of livelihoods we found the approach useful (Ellis 2000 and Farrington 2001 articulate the value of the approach for rural development work). However, there are points of detail of the framework with which we disagree. One example of this is the lack of attention to scale and the use of 'social capital'. Thus, for instance, physical assets can be household assets such as ploughs and district-level assets such as road infrastructure, while social capital is largely a 'community' level construct. In contrast, institutional arrangements at district and higher levels of scale are not part of 'capital' but are considered in the 'institutions' component of the framework, as part of the processes that mediate the conversion of assets into livelihood outcomes. Social capital appears better placed under the 'institutions' component of the framework ('transforming structures and processes') than as a capital asset (Angelsen and Wunder 2001). Another problem is that social capital may be interpreted in a rather economistic sense and be reduced to such simple measures as 'the number of civic organisations'. The work on social capital in our study, which avoided the use of the term, illustrates the meaninglessness of such measures (Section 5.5; Mandondo *et al*. 2002; Nemarundwe 2002a,b,c; Nemarundwe and Kozanayi 2002; Sithole 2002). Whether there is an organisation or not is much less important than the functioning of that organisation, the power politics shaping the role of the organisation, the number of people actually involved in the organisation, etc. Social capital is not always a positive social good to

be encouraged as a solution to the problems of collective action (Portes 1998; Petrzelka and Bell 2000). One group's social capital may be to the detriment of another group. While the term 'social capital' gives rightful attention to the need to invest scarce resources in building social networks, in other senses we would rather see it as one of the many factors that influence the deployment and transformation of financial, natural, physical and some kinds of human capital.

We also take some exception to the use of 'human capital', following Sen's (1997) critique that it is too economistic — too focussed on the productivity of labour (Section 5.1.6). It should rather be about human capability, the ability of people to facilitate change and be the architects of change, and it should be about the need, where necessary, to empower people to change their circumstances. When human capital is viewed this way, then it is another concept that is better thought of as a means to deploy and transform financial, natural and physical capital, rather than as a capital asset in and of itself. However, we recognise that we tread a fine line here, as there are large schools of thought that talk about investing in human capital to increase ability (in fact, some measures of productivity are very close to 'ability').

From the perspective of the external agents, is the integrated management of livelihood assets a means to eliminating rural poverty? DFID NRRD (1998) suggest that the sustainable livelihoods approach needs to be tested and transformed into practice. They go on to suggest that one approach to development is to improve the understanding of the asset base of a particular rural system and then develop a suite of options for interventions. Our experience in this project of using the sustainable livelihoods approach as a means to guide analysis and intervention (our action research) suggests that the use of the framework does lead to the search for integrated development options, and is more appropriate than *ad hoc* piecemeal approaches (Section 11.3). However, without care, it can mean getting lost in descriptive analysis of every variable in a complex system.

The sustainable livelihoods literature states that a livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base. There have been massive changes in the last two decades and households have 'coped' (Section 11.2.2). We could say that households in Chivi are 'maintaining' their assets. There is some reduction in various components of the natural capital (e.g., Section 5.4.3), but given a belief in the treatise by Boserup (1965) and her followers this may not necessarily be a problem. Those following the neo-Boserupian thesis would argue that that environmental degradation is at worst an intermediate step as communities, faced with diminishing resources for extensive agriculture, move towards a more intensive mode of production (Section 11.2.1). Thus, on the basis of the definition of sustainable livelihoods, we could deduce that households in Chivi to have sustainable livelihoods, or if they have not achieved sustainable livelihoods yet, it is only a matter of time as systems develop along the Boserupian pathway. But we have widespread and unacceptable poverty! Aiming for 'sustainable livelihoods' appears to set the target too low. It appears to us that the sustainable livelihoods approach is inherently neo-Malthusian, in that it wants to maintain the natural capital stock. Economists would recognise a spectrum that assumes varying degrees of substitutability between different capital stocks. The neo-Malthusians are towards the 'no substitutability' extreme, while the human capitalists are towards the 'complete substitutability' extreme. Accordingly, neo-Malthusians tend to believe in 'strong sustainability' (make sure you sustain all capital stocks) while human capitalists tend to believe in 'weak sustainability' (maintaining the aggregate of capital stocks, because deficiencies in one stock can be substituted away by gains in others). It seems like results of this study lean towards the human capitalist perspective, in that there has been substitutability between capital stocks.

As a research approach, in the context of the need to promote development, the sustainable livelihoods approach does not go far enough. A similar conclusion is drawn by Mortimore *et al*. (2000) who call for a systems approach to research. They take

exception to the narrow focus on natural resources as stocks awaiting transformation into livelihoods. They point out the numerous components of natural stocks that need to be considered (local management, access issues, nature and efficiency of technologies, sustainability of management). We concur with Chambers (1994) that we need a new professionalism. We differ in some of our emphases. We do not have the space to argue this point here, but elsewhere (Sayer and Campbell 2002) we use the Chivi experience (among other examples) to suggest that for research and development to have an impact we need a major shift in our research approaches, the elements of which are:

- Changed objectives: supporting adaptive capacity (rather than focussing on productivity gains).
- Action research as a key element, with attention paid to social learning and adaptive management principles and empowering approaches.
- New kinds of organisations to deal with complex systems. For example, the breakdown of the gap amongst research, extension and development agencies; better developed partnerships between researchers and their clients; attention to creating learning organisations and to knowledge management; recognition of the importance of facilitation.
- Multiple scales of analysis and intervention, from household to international levels, where appropriate.
- A key role for institutional analysis and intervention (focussing on rules, norms, organisations, policies, legal frameworks).
- A sustainable livelihoods perspective.
- A systems perspective and the use of systems tools, but using approaches that do not create a maze detail.

11.2 Resourceful farmers in a changing world

11.2.1 The new paradigm — from pessimism to optimism?

Natural resource use systems tend to be viewed and analysed within two largely incompatible frameworks (Moriarty 2000; Benjaminsen 2001). On the one hand is the neo-Malthusian worldview that sees more or less intractable problems surrounding a nexus of increasing population and a rapidly degrading environment (see, for example, Cleaver and Schreiber 1994; Mabogunje 2002). On the other hand, a neo-Boserupian view, based on the work of Boserup (1965), finds evidence for evolutionary and internally driven change in farming systems, in which environmental degradation is, at worst, an intermediate step as communities, faced with diminishing resources for extensive agriculture, move towards a more intensive mode of production. Moriarty (2000) suggests that these two worldviews determine the operating mode of the development community. The first view defines much of the past development effort, while the neo-Boserupian paradigm underlies many more recent approaches to development that emphasise indigenous knowledge and the seeking of internal remedies through participation and empowerment. While the former type of development initiatives have generally proved unsuccessful, our argument will be that the latter are also likely to be insufficient to truly alleviate poverty.

Our understanding of livelihood strategies in African semi-arid regions has been greatly advanced by a number of scholars. Particularly important is the work of Mortimore and colleagues in systems in eastern and western Africa that have undergone transformation as a result of intensification (e.g., Mortimore 1993; Mortimore and Tiffen 1994; Mortimore *et al*. 2001). The work of Scoones and colleagues has done much for our understanding of the dynamic nature of livelihoods in these systems, most of that work having been based in southern Africa (e.g., Scoones *et al*. 1996; Scoones 2001). Ellis (2000) and Bryceson (2002) have added considerably to the knowledge about diversification of livelihoods, while Berry (1993) focuses our attention

on social networks and processes as mediating access to various forms of capital. Mortimore (1998) notes that in many places the trend of land degradation has been halted and reversed, and there is greater sustainability of the livelihood system. The systems he describes are characterised by land-use intensification, economic diversification and institutional change. We see indigenous management of technological change — farmers take up options when the options meet recognised needs and are efficient in terms of the factors of production. He notes that for too long it has been assumed that semi-arid regions are constrained primarily by inherent productivity limitations (such as poor soil and unreliable rainfall), and as such it is assumed that there is inadequate pay-off to land-improvement investments. Some of the drivers of change are high population densities (e.g., in excess of 200 people per km^2), urbanisation and the growth of markets.

The neo-Malthusian worldview does not offer much room for optimism. The neo-Boserupian perspective, on the other hand, is clearly enviro-optimistic. (However, intensification does not necessarily lead to sustainable resource use, e.g., Templeton and Scherr 1999; Boyd and Slaymaker 2000; Reardon and Barrett 2001). The neo-Boserupian perspective also tends to be livelihood optimistic. For example, Chambers (1993), in a forward to the reprint of Boserup's classic, writes 'the book gives some hope. … it suggests that agricultural intensification may offer scope for many people to gain adequate and sustainable livelihoods'. We will argue below that the 'downward spiral' of the neo-Malthusian worldview is undoubtedly incorrect, but we do not see the poverty status of rural households changing fundamentally in semi-arid regions as part of the neo-Boserupian processes, if indeed such processes are occurring. In the following sections, we first recognise the extreme resourcefulness of farmers in semi-arid regions, recognising the possibility of internally driven change (Section 11.2.2). In the next section, we reject the neo-Malthusian viewpoint, but we also question the value of a neo-Boserupian viewpoint given the complexities in the system (Section 11.2.3). In that section, we also outline our reasons for pessimism.

11.2.2 Infinitely resourceful Chivi farmers in a dynamic world

Overall, a very similar picture emerges in the present two study sites and the site of Cavendish (2002a). These results suggest that there is a high degree of uniformity among rural households in southern Zimbabwe and that the results presented here may be considered to be typical. The livelihood data, case studies and our experience of living in the study sites for three years suggests that households have a rich and varied livelihood portfolio, with displays of infinite resourcefulness to make ends meet. Who would have suggested in the 1980s that within the next decade there would be a minor gold rush, an unprecedented upsurge in woodcarving, a flourish of trading activity, and a new migration to South Africa? As this study and others have demonstrated, rural households typically have a wide livelihood portfolio, encompassing a range of activities (Scoones *et al*. 1996; Mortimore 1998; Scoones 2001; Cavendish 2002b). It is not uncommon for a household to be involved in livestock raising, growing a range of crops, collecting forest products for subsistence needs and sales, building social capital and being involved in a variety of reciprocal transactions with fellow community members, having one or more family members in non-farm employment remitting money to the household, and having one or more members involved in some home industry (e.g., brick-burning, carpentry, craft production, beer brewing, etc.). Crop and livestock production remain important to most households, contributing about 50% of total net income, while about 35% is from wages/home industries and remittances/gifts, and 15% from woodland products. About 45% of total net income is cash income, with nearly half of that from remittances.

Is labour in short supply, as suggested by Mortimore (1998) for smallholder semi-arid systems? Within the household, there are significant differences in portfolios of activities of women, men and children (Section 5.1.6). We have concluded that there is labour scarcity, apparent even before the HIV/AIDS pandemic. There is not even

much relief during particular periods of the year. While social processes do mediate the supply of labour, these processes are unable to really make a huge difference.

Are forest products still important to households? Widespread poverty is ameliorated by access to environmental resources, largely common pool resources. There is an almost perfect match between the characteristics of the poorest of the poor and the economic characteristics of forest products (Cavendish 2002b). Rural households, especially outside the richer quartile, generally face low availability of capital, are prone to risks and have little formal education. While indigenous knowledge about the environment and resource use may be high in rural areas, skill levels for dealing with external markets are generally low. Many forest products are common pool resources, with some showing very little exclusivity (Shackleton *et al*. 2000; Campbell *et al*. 2001b; Cavendish 2002b). Many of them can be brought into a marketing chain with minimal capital investment. In the face of risk, forest products are often a source of sustenance or can be used to raise cash in the case of emergencies. While forest products are important to households in 'average' years (as indicated by our survey results), the case studies suggest that households especially turn to forest products when all other options fail. Most forest products do not require high skill levels to bring them into production. It can therefore be predicted that it will be the poorest of the poor who will rely mostly on forest products, and this has been demonstrated, with forest resources making up about a third of net income for that group and less than 10% for the wealthiest quartile (see Arnold and Ruiz Pérez 1998, Cavendish 1999a and Shackleton *et al*. 2000, for similar findings). Where forest resources need greater capital investment, then it is the wealthier households that are able to exploit them. For example, Cavendish (1999a) has shown that poorer households more generally produce small carpentry items, while wealthier households make larger items. Small animals (e.g., insects, birds) are relatively more important to the poor while larger animals (e.g., antelope) are more important to the wealthier households. There are often strong income elasticities[37] for forest products. In areas where rapid changes in household welfare occur, it can be expected that there will be rapid changes in forest use patterns.

How are livelihood portfolios changing? Available evidence suggests continuing livelihood diversification, continuing intensification of production and continuing monetisation of the rural economy (summarised in Section 9.1). There is no clear single trajectory of change — there are multiple pathways, including reversals, and multiple causalities. Wealthier households differed in their responses to those of poorer households. For instance, the former, using an extreme example, diversified by out-migration to the UK, while the latter sought unskilled labour in Ngundu Halt. Many women began trading clothes while many men began woodcarving. Some of those with access to good soils were able to move into cotton production; those with poor soils did not have this option. Cotton production increased spectacularly and then declined just as dramatically. The patterns of livelihood change, with their concomitant changes in institutions, illustrate the responsiveness of farmers and the community to external signals, and their resourcefulness despite the low levels of capital assets. The message of extreme responsiveness is also that of Bryceson (2002) and her colleagues.

11.2.3 Malthusian or Boserupian: Pessimism or Optimism?

We firmly reject the neo-Malthusian perspective. Many past interpretations of communal areas in Zimbabwe, as elsewhere in Africa, have followed neo-Malthusian reasoning (summarised for Chivi and Zimbabwe in Scoones *et al*. 1996), but we find little evidence for a downward spiral triggered by rapid population growth (Cleaver and Schreiber 1994; Mabogunje 2002). We have not focussed our attention on environmental variables, and so can say little on this. We do record population-related reductions in per capita cultivated area, village grazing land and village woodlands (Section 5.4), but the quantitative trend data that we have gleaned on household activities indicate rates of change many times greater than population growth rates (Section 9.2.4), implying

that other drivers of change are more important than population. We can find little evidence for 'agricultural stagnation', or of 'the vicious cycle of poverty leading to environmental degradation, which leads in turn to even greater poverty' (Bruntland 1987). Instead of stagnation we would want to recognise resourcefulness. Garden production has expanded considerably in the last two decades and cotton production has risen dramatically in the last few years. This does not suggest stagnation. Thus we reject the pessimism displayed by those adhering to a neo-Malthusian viewpoint.

However, we also have trouble with the neo-Boserupian thesis. In this thesis populations increase, and the resulting land scarcity is seen as a major determinant for technological change and agricultural development (Boserup 1965; Benjaminsen 2001). But it goes hand in hand with the growth of urban areas and the development of markets that penetrate the rural areas (Mortimore 1998). In our study, the patterns of intensification may in many instances be unrelated to the key drivers of the Boserupian sequences (it has to be recognised that Boserup also acknowledged that land scarcity was not the only factor driving intensification). The rapid rise in irrigated garden production may be more a result of the lack of enforcement of the legislation regarding stream bank cultivation, than intensification processes *per se*. The upsurge in cotton production represents intensified production, but is barely linked to population growth. Rather its growth has to do with improved market access, pricing policies and targeted extension support. And then the subsequent collapse of cotton represents extensification.

Little attention to diversification is paid in the neo-Boserupian literature. Ellis (2000) and Bryceson (2002) place diversification centre stage. Mortimore (1998 and Mortimore *et al*. (2000) also give considerable attention to diversification. Bryceson (2002) documents the impacts of structural adjustment and market liberalisation policies, and suggests that they have left households scrambling for cash. The response has been an unprecedented rise in non-farm activities and the wholesale diversification of livelihoods. A similar phenomenon is recorded in Malawi by Orr and Mwale (2001) and other parts of the world (Berdegué *et al*. 2000). But this is not to say that these processes are new — they have been ongoing in Rhodesia from the early days of colonialism in the first part of the 20th century (Scoones *et al*. 1996). Very early the colonial government put in place measures to stimulate monetisation of the peasant economy (largely to create labour for the expanding enterprises of the colonial state). At least as far back as the 1960s remittances were already an important component of livelihoods (Johnson 1968).

Intensification and monetisation will take different paths in different places, thus the commercialisation of woodland products is greater in Mutangi, but intensification and commercialisation of dryland and garden crops is higher in Romwe. The differences between Romwe and Mutangi suggest that the paths of change are complex, driven in different directions by a range of factors — distance to markets, dryland crop potential, state of woodland resources, and the rise in tourism and new craft markets near tourist routes. The qualitative and quantitative trend data suggest a host of drivers of change: breakdown of enforcement of environmental legislation, changing local norms and mores, changing state of water resources for irrigation, HIV/AIDS, opportunities in the wider economy, 'discovery' of gold, factors favouring a specific crop, and new opportunities for trading (e.g., second-hand clothes).

Any simple model of change, e.g., that of Boserup (1965), may give us some useful insights but is severely limited when confronted with the complexity of rural production systems, with their multiple pathways of change and multiple causalities. Following Mortimore (1998) and Benjaminsen (2001), we suggest that a more appropriate model of such systems is that they are non-equilibrial and opportunistic; they are systems in constant transition. Elements of the system can display long-term changes in slow variables (e.g., population growth, reduction of 'sacredness' of landscape features), rapid directional (at least for a certain period of time) changes in fast variables (e.g., rapid expansion of a specific crop such as cotton in response to particular market signals), fluctuations in response to some determinants (e.g., rainfall) and

reversals of states. Different households, depending on their capital assets, will be moving in different directions. Rural economies and societies appear as a shifting kaleidoscope of activities, household types, conflicts, alliances, and manoeuvres, in which it is difficult to discern the direction a particular household type will next take, who is in control, what the next strategy will be and what the impact on the asset base will be (Berry 1993).

Despite our alignment with the neo-Boserupian thesis, or our embracing of a non-equilibrial model of rural production systems, we don't see much room for optimism. Yes, households are coping with a multitude of changes as well as driving change themselves. But the relatively optimistic outlook of livelihood outcomes painted by those describing the responsiveness of households (during the processes of intensification and diversification) can be challenged. If there have been any changes in livelihood status since the 1980s, then it has probably been negative (Mugabe 1998; Mabeza-Chimedza *et al*. 2001). We have dire poverty now — will intensification make a substantial difference, or will it always be the case that households are largely only 'coping'. We see greater monetisation with respect to crop production in Romwe than Mutangi, but there is no noticeable difference in poverty status, except perhaps for a portion of the wealthiest quartile (Sections 8.2 and 8.3.3). Farmers are highly adaptable, opportunistic and infinitely resourceful, but this does not change the fact that they are extremely poor (Box 14).

Box 14. Opportunistic farming or desperation?

'I have a lot of difficulty with what they used to call 'coping strategies', the kind that researchers waxed lyrical about. If you lost half your herd during a drought, you 'coped': cut down your consumption and migrated to better pastures and watering holes. If you lost the rest of your herd, you 'coped' by migrating to donor-provided feeding camps. What were, in reality, horrific stories of desperate families trying to survive were euphemistically described as 'management strategies', 'coping strategies' or 'opportunistic farming'. But I am not convinced that the development community (researchers and agencies) is prepared to look squarely at these issues — a heady mixture of hope and optimism drive their belief (narrative) that they can make a difference at the grassroots level.' Dale Doré, Shanduko.

Some would suggest intensification is likely to come with greater risk. Mortimore (1998) suggests 'the teasing question of the limits to intensification must be raised'. Risk in these semi-arid regions is of considerable significance (Mortimore 1998; Scoones *et al*. 1996). Risks can be in the form of extreme weather conditions which can decimate crop and livestock production (Box 8), jolts to the household economy brought on by illness and death (Box 13), and rapid changes in the external economic climate (e.g., changes in prices, reduced numbers of tourists, withdrawal of government drought relief). The intensified system could be more at risk from drought and other causes of production failure. So, for example, the replacement of drought-resistant food crops with cash crops may be an appropriate strategy where government provides security from drought through drought relief, but can prove disastrous in the situation of withdrawal of drought relief. We are not sure that our concern about risk is very serious — history has taught us that households are highly adaptable. This suggests that in the face of new challenges, they will find the means to cope with and adapt to the emerging situations.

Pessimists may also suggest that differentiation may increase during the intensification process to the point where inequity is unacceptable. Cavendish's (1999b) analysis shows how differentiation is markedly increasing. Cash income was much higher in 1996/97 than in 1993/94, but 74% of the increase was in the wealthy quintile. It appears that intensification of production and monetisation, in this case cotton production, is increasing differentiation. The net income of the poorest households showed a marked decline from 1993/94 levels. Our key informant interviews also suggest

a marked increase in differentiation. We find that dryland cash cropping is concentrated in the hands of a minority of the wealthiest households. We have to ask to what extent the benefits of intensification and diversification are being captured by the wealthy minority in rural areas (Mortimore *et al*. 2001). Berry (1993) finds that increasingly, in Zambia and Kenya, households are being divided into those with access to the means of production and those without. Orr and Mwale (2001), working in Malawi, also recorded increasing differentiation. They found positive changes in livelihoods for the majority of households and linked this to market liberalisation, but found that a quarter of households were worse off.

Intensification is based partly on market expansion, driven by urbanisation and rising population (Mortimore 1998). What if markets remain distant for much of the foreseeable future? What if population densities are still relatively low? The intensification model assumes that markets will develop and grow, partially as a result of urbanisation and population growth. Chivi is relatively close to a large population centre (Masvingo with 60,000 persons) more but the Chivi farmers are unable to penetrate this market to any degree. Thus, areas more isolated than places like Chivi, which translates into the bulk of semi-arid regions in Zimbabwe, are even more unlikely to exploit urban markets. Zimbabwe could perhaps be peculiar in that it has a large-scale commercial farming sector and a well-developed formal marketing system, making it difficult for smallholder farmers to out-compete the larger producers (the problems posed by dualistic agricultural sectors are discussed by Tomich *et al*. 1995, Mortimore *et al*., undated, among others). Another peculiarity is the well-developed urban electricity grid making towns relatively, but not completely, independent of woodfuel (Campbell *et al*. 2000c). Thus towns like Masvingo do not require wood from distant places like Chivi to supply their needs. Areas in Chivi do supply wood to the Chivi district centre and Ngundu but the volumes are small and the trade benefits few households. It is apparent that some of the successful cases from other parts of Africa are under very different sets of conditions. For example, parts of the Kano site (Mortimore 1998) are 35 km from Kano, which has a population of 2 million people. Machakos District borders Nairobi and is closely linked to markets, especially for the export of fruit and horticulture.

Chivi population densities are in the order of 50-90 people per km^2, much lower than the densities of the intensified systems in eastern African, let alone those in western Africa. Assuming a population growth rate of 1.98% (largely pre-HIV/AIDS — 1992), the population in Romwe will only reach 200 persons per km^2 (the densities in some areas of Machakos in 1979) in about 40 years, while in Mutangi this level will only be achieved in about 60 years. To reach 300 persons per km^2 will take 60 to 80 years.[38] But, in any case, population density is not everything. The highest rural population densities in the region are in Malawi, which, excluding war-torn Mozambique and Angola, is also the country with the greatest rural poverty (World Bank 2001).[39] Population growth alone is not going to alleviate poverty.

Mortimore *et al*. (2001) suggest that intensification can even occur under drier conditions than found in Machakos and Kano. Working in semi-arid regions in Niger (about 500 mm annual rainfall) where population densities are up to 60 persons per km^2, elements of transition to more intensified production systems were apparent, linked to the growing urban demand in Nigeria, focussed in Kano. But this transition was occurring within the constraints of a drier rainfall and greater risk. The authors conclude that the market is an essential condition, providing incentives and means to invest. Boyd and Slaymaker (2000) also deduce that markets are essential for intensification. We suggest that market conditions in places like Chivi (and the more numerous remoter locations in southern Africa) have decades to go before the development of markets that can successfully be tapped into by small-scale farmers. The complexities of the nexus between population density and intensification are indicated in the analysis by Templeton and Scherr (1999), who also point out that the specific outcomes may be dependent on macro-economic conditions. Tomich *et al*. (1995) record the success stories for intensification and transformation, but these are largely in high-potential areas — drylands in Africa stand out as particularly challenging.

11.3 The causes of poverty and options to alleviate poverty

We have seen that poverty is widespread in Chivi, with almost the entire population falling below the poverty line (Section 8.2). Rural poverty in semi-arid regions is seldom a result of a single factor or even a cluster of closely related factors (Peter Frost,[40] pers. comm.). It is the result of the combination of a suite of social, economic and environmental components and processes operating at a range of scales. On the basis of our analysis we suggest that these include:

- Adverse biophysical conditions, resulting in, among other things, low agricultural potential and disastrous livestock crashes (Sections 9.1.2, 9.1.4 and 10.2).
- Insufficient high-quality land, a result of colonial land allocation patterns (though the extent to which larger land areas can be managed is also determined by the following factor) (Section 5.4.1).
- Labour scarcities, even more so in the face of the HIV/AIDS pandemic (Sections 5.1.6, 9.2.4 and 10.3).
- Economic remoteness — with presumably higher transaction and input costs, and few investments because returns to investments are low compared to other places (Sections 2.3, 10.3 and 11.2.3).
- Lack of credit markets as a result of little or no collateral (Sections 5.2.2).
- Few employment opportunities and low levels of education and skill (e.g., Section 8.4 and 10.3)
- Low incomes; inability to purchase some basic needs (e.g., medicines, secondary school education) (e.g., Section 8.2).
- Poor macroeconomic conditions (Sections 9.2.2 and 10.2).
- The HIV/AIDS pandemic — resulting in the loss of breadwinners, labour scarcities, rising costs (Section 9.2.4)
- Low levels of empowerment (Mandondo *et al.*, 2002) (e.g., Sections 5.5 and 10.2).
- Declining woodland resources leading to the need for greater investments (e.g., labour) to acquire basic products (e.g., Section 5.4.3).

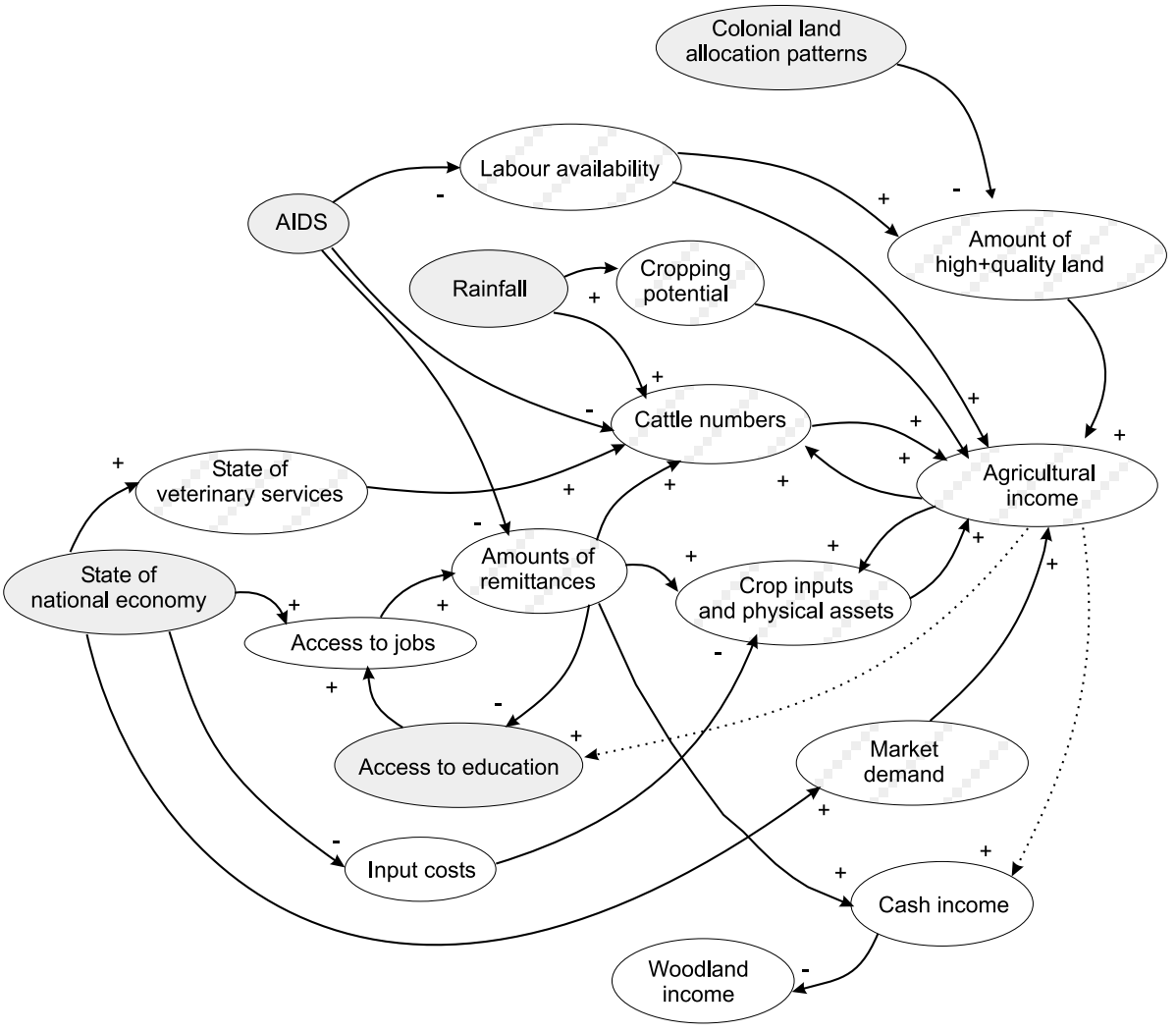
We have reduced the causes of poverty to about 10 factors. Even though this is a gross over-simplification, the causality of poverty can be seen to be exceptionally complex with a web of interrelated factors (Figure 47). These factors operate at different scales, from national (and international) levels to local levels, and different temporal scales (e.g., yearly random fluctuations in climate, long-term trends in declining woodland resources, sudden switches in macro-economic policies). They also have different impacts on different classes of households. There are multiple linkages between farmers and the state that affect patterns of resource allocation, agricultural performance, mobility and diversification (Berry 1993).

We now turn to exploring development interventions that may be relevant for semi-arid systems. Most could be generally applicable to semi-arid systems, except the one dealing with land redistribution, which is a specific problem facing Zimbabwe. While for poverty reduction it is necessary to focus on particular sectors of the rural population, we have shown in the case of Chivi that almost the entire population falls below the poverty line (Section 8.2). This will be the situation in most of the semi-arid regions in southern Africa.

a. Providing an enabling environment

The poor are more vulnerable, more risk-prone and more powerless. So the focus must be on greater income stability, risk buffering, and ability to participate in local decisions (Gill Shepherd,[41] pers. comm.). If a single goal can be distilled for development then it is to support the adaptiveness of the system, allowing farmers to respond to change and exploit opportunities (Mortimore *et al*. 2001). Those farmers who have lifted themselves out of poverty (the few in the upper wealth quartile) have done so largely

Figure 47. The linkages of key variables determining wealth status. The fully shaded variables are those out of our control in rural development projects (but which can have major implications on rural development). The variables with patterned shading are those that we have data on; + = a positive relationship between the linked variables; - = a negative relationship between the variables



on their own initiative. Given opportunities, farmers are able to exploit them. Perhaps of paramount importance is the development of an enabling policy environment in which indigenous capital can be effectively mobilised and the merits of technological options can be explored by the farmers themselves (Mortimore 1998). Farmers' knowledge and experience should be valued, and thus research and extension services need to be overhauled to cater for the needs of farmers rather than as a means of developing and extending technologies in a paternalistic manner (Drinkwater 1991; Mortimore *et al*. 2001). Another key to development is the nurturing of markets so that they penetrate economically remote areas (Section 10.3). Support through market information and the development of marketing organisations will allow households to respond positively to markets, and thus allow them to drive development themselves (Mortimore *et al* 2001; Turner and Williams 2002).

b. Strengthening institutions and organisations

Research results on developing strategies for effective institutions for common pool resource management reveal that local-level organisations are better placed to govern resource use than district-level organisations (Mandondo 2000, 2001). It was noted

that local organisations were undermined by State authorities (especially the Rural District Council), who largely dictate the by-laws on use of natural resources. As a result local organisations lack ownership of these by-laws and thus there area no incentives to enforce them. On the other hand, we recorded numerous problems with the functioning of local organisations. In the systems model the functioning of institutions was identified as a key variable determining livelihood outcomes. Given these circumstances, one of the key interventions is to work on strengthening local organisations for effective management (Mandondo *et al*., 2002).

c. Land redistribution

Greater equity of access to productive land is important, especially in the context of Zimbabwe's inequitable land distribution (Drinkwater 1991). A constant theme when talking to younger men was the lack of land for them to farm in Chivi. However, it goes beyond saying that the redistribution will have to go well beyond the current efforts in the country. In our study sites there were exceptionally few farmers benefiting from the recent 'fast-track' resettlement, and most had negative experiences (Sithole *et al*. 2002). Given the chance, a number of households would gladly be resettled, rather than stay in communal areas. Kinsey (1999) has provided substantial evidence of the poverty reduction potential of land reform for new settlers. Whether it can ever be at a scale large enough to positively affect those remaining behind in the communal areas is open to doubt.

d. Labour-saving devices

We have seen that labour is at a premium and that labour-saving devices could improve livelihoods.[42] Labour constraints usually result in households abandoning their garden plots during peak periods when they are working in dryland fields. Thus systems of groundwater extraction and watering that are less labour intensive are required if most households are to fully utilise groundwater-irrigated gardens. On the other hand labour-saving techniques in the drylands would free up time for gardening. Overcoming some of the labour constraints could yield large returns, as labour intensification has not progressed very far. As there is no clear seasonality in labour availability, any new project will have to compete with present activities to produce greater returns.

e. Rural credit markets or diversification?

The financial capital of households in Romwe and Mutangi, and elsewhere in the semi-arid regions, is extremely limited. A micro-credit scheme, whose objective was to offer households in Romwe a loan facility for the purchase of production inputs and also to start small projects, was operative, and the success stories resulting from the use of funds demonstrate the importance of cash injections into the system. However, the poor local management of the funds and the high likelihood of defaulting as a result of unforeseen disasters, usually weather-related, highlight the limitations of any micro-credit scheme. The success of installing credit markets has been intermittent and uneven despite decades of attempts by government and NGOs (Ellis 1999, 2000). In the semi-arid regions, where output is so dependent on the vagaries of the weather, the likelihood of a sustainable credit scheme is highly unlikely. Remittances also act as cash injections but households do not have to pay them back. The remittances come as part of the strong links with the extended family. Similarly, home industries and local wage labour provide much needed cash, some of which is used for purchasing inputs. It is likely that investments to support the development of credit markets will yield less than investments to support diversification of non-farm income.

f. Gardening

Gardening is not a large part of Chivi livelihood portfolios, either in terms of time or gross income, largely because of water constraints, labour scarcities and lack of good markets. However it is an important component of overall livelihood strategies, especially for women, as it provides a degree of food security and is a source of cash

income. Given labour constraints, and the heavy labour demands of garden production (Section 5.1.3), water resource development will mainly improve livelihoods of households that do not have sufficient land for gardening. The aim would be to give irrigated gardens to those who are without any gardens or to those who lack access to good sources of irrigation water (Table 25). Comparing Romwe and Mutangi garden sizes (Table 7) suggests that garden sizes could be increased in Romwe by about 40%, while looking at ownership data suggests that 40% of people are without access to group garden plots and 20% without access to good irrigation sources (both variables have been shown to have positive effects on income — Section 8.3.4b).

Water for irrigation can come from groundwater or surface water. Hydrological studies in Romwe revealed that only a negligible proportion of groundwater resources are being utilised for livelihood activities (Lovell *et al.*, 2002). In Mutangi irrigation from the dam could be expanded by five times (Mugabe and Hodnett 2001). Overcoming the water constraints by developing totally new sources of groundwater and surface water is likely to be costly, and would have to be driven by development funds (Lovell 2000). In the cost-benefit analyses we conducted to explore the feasibility of expanding use of irrigation water, garden gross margins was the important criteria determining feasibility (Lovell *et al.* 2002). There are possibilities of expanding the existing groundwater and surface water schemes, rather than developing new sources, and this can be cost-effective, largely with local investment. Development work in expanding the community garden in Romwe only cost Z$20 000.

Because the market for garden produce is already flooded with products, the main advantage of expanded garden production would be for subsistence, unless new markets can be developed or penetrated. For Romwe, we investigated the possibility of expanding the market by initiating negotiations at the construction site for what will be Zimbabwe's largest internal dam and at a nearby hotel and restaurant focussing on the road traffic between Masvingo and South Africa. Both were non-starters for the Romwe community, requiring products that were already in abundance or specialised products in very small amounts. And there are many communities closer to these two potential markets.

Through action research in Romwe, the Chidiso irrigated garden was increased from 0.4 ha to 0.8 ha, doubling the beneficiaries from 50 to 104 households (in a community of 126 households). The initiative was largely community-driven, a process requiring facilitation because of problems within the committees controlling the community garden (Section 5.5). While some committee members wanted the increased garden area for themselves, most community members were happy to see new beneficiaries enter the scheme. Given the close family networks, many of the new beneficiaries were related to current members. The above action did not require any major investment, as the water source, a very reliable collector well, was already operating and being maintained by the community. This development is improving food security and promoting equity (the new members are generally poorer households from the catchment), but is not making a fundamental difference to the poverty status of the community (Section 10.5). It would be ideal to open up additional such water points, and a further handful could be opened up in the 4.5 km^2 Romwe physical catchment, but such development would require major financial investment and the identification and expansion of new markets for garden crops.

A similar initiative was undertaken in Mutangi, facilitated by CARE. This saw a new 2 ha garden being developed for the Mutangi Dam, more than doubling the garden area, as well as providing gravity-fed water to the new garden. Being based on surface water, this development work is less viable as a food security measure in times of extended drought, but does provide water at a lower labour cost (Figure 48). Labour saving is significant; it could allow garden production even during the peak of dryland cropping and alleviate labour bottlenecks, particularly those faced by women.

While these kinds of developments will not make major changes to the current poverty status, they do improve livelihoods. If similar initiatives can be undertaken at other dams, then impact can be considerable as more than 600 small to medium dams have been constructed in the drier parts of the country over the last 30 years.

Figure 48. Watering day at the old garden at Mutangi Dam. Considerable labour is required for watering, as people have to carry the water 100 to 200 m from the dam to the current garden (photo: Martin Hodnett)

In both Romwe and Mutangi, water movement for irrigation is generally by bucket or drum, involving a large amount of time. The cost-benefit analysis for mechanising water supply from groundwater in Romwe indicated that this option was not appropriate at the current time, given the low value of garden outputs (Lovell *et al*. 2002). However, the development of a gravity-fed system in Mutangi was possible and was implemented by CARE.

g. Livestock production

Boom and bust in livestock production appears unavoidable. From a technical perspective, a higher level of management of the herd size would probably lead to greater financial profitability (Campbell *et al*. 2000a), but the transaction costs of achieving such management of a common pool resource are presumably very high. Previous attempts by the colonial government to impose controlled grazing practices in the 1940s were highly unpopular and are still referred to by current inhabitants (given the strong oral traditions).

Moreover, the need for controlled grazing practices and other feed-related interventions is only necessary when livestock populations start to rise to the point that a drought year can have significant impact on numbers. Thus, to talk to people about feed resources and livestock numbers at the current time is met with disinterest, as numbers are presently well below any critical limit. We discussed the possibility of using some of the irrigation water for raising fodder crops but this was seen as a very low priority; in the new area created for irrigation in Chidiso garden the community opted for additional vegetable production.

Because of declining veterinary services in the area, cattle mortality has increased dramatically, and the cattle numbers are not recovering to the extent they should from the drought (Section 9.1.4). We believe this may be the condition that could stimulate a new cattle management system, whereby the cattle owners get together, set livestock fees and use the fees to ensure that their animals receive the appropriate dipping and other veterinary services. Such institutional change may also provide the setting for wider management of common pool resources. Considerable facilitation would be needed to establish accountable management structures for such a scheme. In Tanzania, in the Babati area (reportedly a success in terms of woodland management — Matose and Wily 1996), local communities collect household taxes and livestock fees

and send a proportion of these to the district council. The money remaining with the community is used for local development, maintenance of dipping facilities, etc. Livestock fees were associated with the Rhodesian government and therefore great sensitivity would be needed if they were to be discussed in Chivi.

Cattle are largely held by the wealthier households, so any intervention to improve livestock productivity would have less impact on the poorer households. Judging from how the micro-credit funds were used, it does seem however that interventions and extension on poultry and other small livestock will be readily accepted in the communities.

h. Woodland products

Woodland activities are especially important for the poorest group, but even then it is only 30% of total income. While the woodlands are important as a security in times of drought and other disasters, we found no evidence that they are able to lift significant numbers of people out of poverty. The returns on labour achieved in woodcarving are not too bad, being roughly twice the minimum wage, but the market cannot absorb any more sellers and the resource is declining. Fiscal measures, such as payments of stumpage fees to producer communities, for managing the resource reduce the returns to unacceptable levels (Braedt, 2002; Standa-Gunda *et al.*, 2002). This situation is likely to be similar for many of the woodland-related activities. For a few individuals (e.g. the master carvers) woodlands may be more than a safety net. In our causality diagram for wealth status (Figure 47) we see woodlands as having a very small role in poverty alleviation (other than via the grazing functions of woodlands), with, in general, households turning to woodlands to generate cash when other cash sources are low.

Attention for the woodland sector in environments such as Chivi will largely have to focus on maintaining the safety net role. In general, we recognise that there are very low incentives to manage natural resources in the commons, and there are almost no technical or institutional interventions that could be used to change this situation. Removing ineffective national and district-level regulations related to woodlands and grazing areas, and empowering local leaders, will be a step in the right direction. Local organisations will need to be able to deal with conflicts between commercial extractors (e.g., for sale of woodcarvings, firewood) and the larger community, between those wanting to clear woodlands for crop production and those wanting to maintain the woodlands, and between the need for high grazing areas and the need to maintain regeneration of important woodland species. It will also be necessary to focus attention on upstream-downstream issues and build institutions to protect environmental services valued by downstream inhabitants while at the same time providing incentives for upstream users (Frost *et al*. 2002). This will be a major challenge.

i. Overall strategy

The multi-faceted nature of poverty highlights the need for integrated approaches to development. Initiatives aimed at alleviating poverty but which focus on isolated factors, e.g., policy failures, institutional weaknesses, inaccessibility of markets, gender imbalances in access to opportunities and decision-making, poor crop performance, pests, infertile soils, aridity, environmental degradation, management of common-pool resources, etc, are at the risk of failure if other factors are not adequately addressed at the same time. An important point is the very strategy that households find it necessary to protect themselves from catastrophic losses (diversification) also makes it hard to help them in a particular sector. They are so diverse that influencing only one sector does not have much impact. For instance, assume that agriculturalists could improve net dryland crop income by 20% (across all crops), which would be a major achievement. This would only result in a 5% improvement in total net income, and presumably the increase would be concentrated in certain kinds of households (e.g., most likely the wealthier). We conclude that there is no silver bullet to development, that an integrated, multi-sectoral approach to development is critical, with different but complementary activities across a wide spectrum of sectors (see also the conclusion

to the systems modelling — Section 10.6). A number of analysts suggest that such an integrated approach is necessary ('broad-based approach' — Tomich *et al*. 1995; 'systems approach' — Mortimore 1998; Mortimore *et al*. 2000). However, there is a continuum of perspectives from those focussing more on sectoral solutions, usually yield-enhancing technologies, to those focussing more on support for the national economy as a means to advance poverty alleviation (as embodied in the recent 'Poverty Reduction Strategy Programmes'). Getting the balance right in a broad-based approach is a tremendous challenge.

The timing and sequence of interventions and support will be crucial. In addition there should be adequate timeframes. As approaches to empower the people and the development of social capital are so critical, three-year project timelines are hardly sufficient to make any impact (Mandondo *et al*., 2002). Transitional arrangements, e.g., to ensure market access, may need to be made over some considerable time period.

11.4 But, can rural development really make a difference?

> '…environmental management, ... while resting in the hands .. of millions of smallholders, is ultimately dependent on the economic environment in which they make their decisions.' Mike Mortimore, Drylands Research[43]

The donor community has set an ambitious target for poverty alleviation in developing countries: the reduction of people living in extreme poverty by half between 1990 and 2015 (World Bank 2001).[44] Can this be achieved through rural development? The statement by Mortimore above summarises our perspective on rural livelihoods — put simply, the future is firmly in the hands of the farmers themselves and the best the development community can do to make a difference is through modifying the economic environment. In this study we have recorded the importance of non-farm activities, chiefly represented by remittances, in driving the farming system. In our modelling efforts we have concluded that macro-economic and rainfall effects on cash income appear to outweigh the effects that can be achieved through rural development initiatives (Section 10.6). Reviewing temporal change, two of our four drivers of change are rainfall and the macro-economy (Chapter 9). We reject the pessimism of the neo-Malthusian viewpoint, and build a view of smallholder farming systems as opportunistic and non-equilibrial. But this does not lead us to an optimistic outlook. We don't see intensification bringing people out of poverty. This is not to say that the development community can do nothing — by listing possible interventions in the previous section and in the modelling chapter, we recognise that there are things that can be done. But we don't believe that those things will have major impacts on poverty alleviation and, to be cynical, we find it strange that experts like ourselves, with daily wage rates equivalent or greater than the annual incomes of most of our client households, are proposing interventions that may raise income minimally. As an example, in this work we facilitated the doubling of the size of a community garden, after considerable transaction costs (Mandondo *et al*. 2002). Assuming that the intervention is sustainable, this would provide a major boost to average crop income (dryland and garden, for both subsistence and cash) in dry years, bringing about an increase of nearly 60% on what would have been achieved without the extra gardens, but the increase (about Z$2000) would unfortunately not compensate fully for the losses in dryland production caused by the dry year (about Z$4000) (Section 10.5). And the above increase translates into only an average of US$0.03 per day per person (though it is a 15% rise)!

While this book is focussed on households, it is always necessary to see the household within the broader framework: of national policies, of a specific macro-economic framework, of international tourist markets, of global climate, etc. (Campbell *et al*. 2000b). In the previous section, we did what was expected — to identify types of rural development options that are likely to improve the livelihoods of people. To end there would have, however, dodged our responsibility. We can identify options to improve

livelihoods but would any of them, or even all of them together, lead to a significant decline in poverty? We would conclude negatively. If we really want to lift many people beyond US$1 per day income, then a successful, integrated rural development initiative is insufficient. Our overall conclusion is that there are very few options for significantly reducing poverty in semi-arid regions. The poverty alleviation targets set by the international community are extremely ambitious, and the current rates of donor investment will not go very far to meeting these targets. Our analyses suggest that rainfall variation and the state of the macro-economy appear to have a greater impact on livelihood status than any of the rural development interventions. Many other analysts stress the importance of the non-farm, and even non-rural, nature of livelihood strategies (Tomich *et al*. 1995; Mortimore 1998; Ellis 1999; Bryceson 2000; Orr and Mwale 2001), implying that rural development *sensu stricto* will not be enough.

A few households in the study areas (a proportion of the wealthy quartile) have managed to lift themselves out of poverty. They have higher educational status, larger livestock holdings, significant cash crop production and high remittance income. But there are considerable barriers to these enrichment activities — outside jobs are not easy to come by, secondary education is expensive, input costs for cotton production are high. We have a serious poverty trap for remote, poor rural households (Cavendish 1999b). Remittances are crucial — they allow cattle purchases, production investments and investments in education (see also Cliffe 1992; Doré 1993; Scoones *et al*. 1996; Ellis 1999). Thus access to escape routes from the local system is probably more important than any intervention that can be implemented in the local system. The state of the national macro-economy is crucial, as well as the state of the South African economy and the ease with which Zimbabweans can access jobs in South Africa. Urban and industrial development is an essential co-requisite to rural development, to create employment opportunities and to serve as a source of remittance income. Mortimore *et al*. (2001) also conclude that support via a stable macro-economic environment is vital. Investment in education and skills development is fundamental to giving people chances to access and create non-farm opportunities (Tomich *et al*. 1995; Ellis 1999; Berdegué *et al*. 2000; Bryceson 2000), but would need to go hand in hand with job creation through an expanding economy.

Ultimately, we would want a world without communal lands! The richest nations, and even the not so rich nations, have a minor proportion of their people in the rural areas. In South Africa, a middle-income country, there are communal areas where farming has been all but abandoned, where households in the communal areas live on remittances from the industrial sector (Bryceson 2002). Farming is not sufficiently lucrative to attract local investment. We need to recognise migration as a legitimate long-term strategy (Mortimore *et al*. 2001).

While our analysis paints a bleak picture for meeting the poverty alleviation goals set by the international community, and while we are less than satisfied that rural development will go very far in significantly reducing poverty, that is not where we want to leave our analysis. 'The pessimist is retrospective in outlook, and his world is bounded by the predicament of the present. But the critic's outlook is reflective, and seeks to understand the present, and to look into the future based on his understanding of the past' (Alois Mandondo,[45] pers. comm.).

> Referring to Zimbabwe's people '… however despairing objective circumstances might seem, the reproduction of life lies in not surrendering to the bleakness' Michael Drinkwater, CARE International[46]

In the Utopian distant future, and in the Zimbabwean context, we would want, as Doré (1993) has argued, tenure reforms towards a more 'unimodal' agrarian structure — making big commercial farms smaller and communal farms larger — where the surplus labour is largely absorbed into the non-agricultural urban sector. The pre-condition for this (or even only a portion of this dream), however, is very high growth rates in the manufacturing and service industries driven by high investment levels to create the

additional employment (Haggblade *et al*. 1989). This, of course, presumes a conducive political climate, macro-economic stability, and good luck: good rains, buoyant commodity prices, lowering trade barriers, and so on. But we have to remind ourselves that three-quarters of the world's poor are rural, and that number will fall only slowly in the years to come (Ashley and Maxwell 2001). As we wait for Utopia, we can:

- attempt to improve macro-economic conditions, make sure safety nets are protected while not building poverty traps (Wunder 2001);
- remove restrictive policies that limit the opportunities of farmers (Mortimore 1998; Arrighi 2002; Bryceson 2002);
- put resources into education and skills development and develop policies to open up non-farm opportunities (Tomich *et al*. 1995; Berdegué *et al*. 2000; Bryceson 2002);
- build sustainable linkages between rural areas and other sectors of the economy;
- always use an integrated approach (covering several production sectors, multiple scales);
- pay particular attention to institutional building;
- open up and develop markets (Turner and Williams 2002);
- provide appropriate support for input markets (credit, seeds, fertilisers) (Reardon and Barrett 2001);
- improve gross margins;
- pay attention to labour constraints; and
- ensure that the poorest of the poor are considered.

Endnotes

[1] Center for International Forestry Research

[2] Department of Rural Economy, University of Alberta

[3] Institute of Environmental Sciences, University of Zimbabwe

[4] This is a type of well that has horizontal boreholes radiating at different points from the main well shaft. The advantage of this construction is that it facilitates the collection of water from fissures in the surrounding rock. The well is relatively shallow (e.g., 12 m) and is a very reliable water source, but is more expensive to construct.

[5] A loading reflects the degree to which the original variable contributes to the derived variable.

[6] By using fewer variables, fewer cases are removed due to listwise deletion that occurs in PCA when any one particular variable has a missing value.

[7] We cannot compute simultaneous confidence intervals around the estimates because the observations are repeated between quarters on the same cases.

[8] Only combined results for Romwe and Mutangi are presented as analyses showed no significant differences at the 5% level between these two areas.

[9] Values were deflated by using linear interpolations of the inflation rate over the course of the year. For example, first quarter values were deflated by 7.5% (i.e., the midpoint between 0% and 15% inflation during the first quarter), while second quarter values were deflated by 22.5% (i.e., the midpoint between 15% and 30% inflation during the second quarter).

[10] Full results of the partial correlation tests are on the project CD-Rom (Sampurna *et al*. 2002) with one example of the 12 tables shown in Appendix 3.

[11] Received after 9 years of schooling.

[12] At the time of this case study the exchange rate was 1US$ = Z$55, but when the loan was received the exchange rate was US$1 = Z$37.

[13] At the time of this case study the exchange rate was 1US$ = Z$55

[14] At the time of this case study the exchange rate was 1US$ = Z$55

[15] It would be unwise to enter total income or overall cash income as a proxy for wealth as these include crop income, and therefore we would have circularity of reasoning in our analysis — what comes first: larger field sizes or larger crop incomes?

[16] Even if number of household members are removed from the analysis.

[17] Livestock could be classed as financial, physical or natural capital; they represent financial capital that can be mobilised when there are large cash expenses to be met; they are physical assets when it comes to transport and ploughing; they are largely raised on natural browse and graze and provide the ecological link between grazing and cropland, via manure.

[18] Uppsala University, Uppsala, Sweden

[19] Institute of World Forestry, Hamburg, Germany

[20] In order to calculate 'environmental income', grass, as an input to livestock production, and litter and termite soil, as fertility inputs to crop production, were subtracted

from livestock and crop income respectively; cattle manure, draft power and transport were livestock income and subtracted from crop production (Cavendish 2002a).

[21] The proportions of income derived from different livestock products are not expected to match up closely with those from other studies, as our reported values are gross values. Many studies that are cited are net of various elements, e.g., for draft power the value of the cattle inputs are net of labour and capital costs (as in Campbell *et al*. 2000a). Cavendish's (2002a) values for livestock consist of cash income plus a valuation of livestock browse and graze obtained from the grazing lands.

[22] At the time of this case study the exchange rate was 1US$ = Z$55.

[23] *Sabhuku* is the local traditional leader, also referred to as *kraalhead*

[24] Cavendish (2002a) used a combination of short and long term recall, with extensive periods spent living at the site collecting data. Therefore, we believe his data to be highly accurate.

[25] *Sabhuku* is the local traditional leader, also referred to as *kraalhead*

[26] At the time of this case study the exchange rate was 1US$ = Z$55.

[27] At the time of this case study the exchange rate was 1US$ = Z$55.

[28] In 1999 Zimbabwe dollars

[29] It should be noted that Cavendish (2002a) uses household net income to stratify his sample into quintiles, and thus differs from our asset-based wealth classes. However, his valuation of livestock is based on their stock value rather than their productive functions, and thus at least part of his wealth class classification is actually based on assets.

[30] At the time of this case study the exchange rate was 1US$ = Z$55.00

[31] Livestock numbers are from the Ngundu dip tank, which services an area adjacent to Romwe. Data collected from the veterinary officer at Ngundu Halt; the statistics for the dip serving Romwe were not in a satisfactory state.

[32] Personal communication, Mr Jacob Matanda, Veterinary officer for Ngundu area.

[33] The 8 dip tanks are found in 5 Wards in southern Chivi: Dimbiti (Ward 26), Shindi (Ward 26), Gororo (Ward 28), Nyambirai (Ward 28), Madzivire (Ward 25), Chebvumbi (Ward 25), Gwamuri (Ward 24) and Chiramba (Ward 23). Data collected from the veterinary officer at Ngundu Halt.

[34] Even now there are a few farmers from the Romwe social catchment who are panning gold along Runde River.

[35] The research assistants often purchased some of these goods as part of their social obligations to the community.

[36] We owe much of this section to Jeremy Cain (formerly Center for Ecology and Hydrology).

[37] That is, when income rises, the demand for many forest products changes sharply.

[38] Of course, given the arguments in this book it would be laughable to assume that this prediction will in any way be borne out — we believe in 'surprise' (Holling 2001). HIV/AIDS, total economic collapse of the commercial farming system or, alternatively, massive industrial development are some of the processes that may see Chivi transformed beyond recognition.

[39] Using national statistics is of course open to criticism, as the statistics are poor and hide much variation. Malawi has a long history of disenabling macro-economic, sectoral and development policies (Orr and Mwale 2001; Mortimore *et al*., undated). As in Zimbabwe, much of its soils are exceptionally poor.

[40] Institute of Environmental Studies, University of Zimbabwe

[41] Overseas Development Institute, London

[42] We intend to do much more quantitative study of the links between labour and income (Zindi, forthcoming).

[43] Mortimore (1998)

[44] For simplicity, extreme poverty is defined as an income of less than US$1 a day, representing 95% of our sample!

[45] Institute of Environmental Studies, University of Zimbabwe

[46] Drinkwater (1991)

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Appendix 1. Unit conversions for the livelihood survey

	Informal Units	Standard units
Area	Contour	1.5 acres
Crops	Scotchcart of maize	5 bags (250 kg)
	Bucket of maize	15 kg
	4 unshelled buckets g/nuts (1 shelled bucket)	15 kg shelled g/nuts
	3 unshelled buckets roundnuts (1 shelled bucket)	15 kg shelled roundnuts
	1 tea cup beans	500 g
	1 bucket beans	30 kg
	1 bale cotton	250 kg
	1 bundle vegetables	500 g
	1 cob maize	100 g
	Bucket of tomatoes	10 kg
	1 onion	500 g
	Bucket of sweet potato	10kg
Fuelwood	Scotch cart	250 kg
	Wheelbarrow	45 kg
	Headload/bundle	25 kg
	Individual log	4 kg
Poles/fibre	Scotchcart	250 kg
	Individual pole	4 kg
	Bundle/headload	25 kg
Wood for utensils	Average item	15 kg
Litter	Bucket	5 kg
	Scotchcart	250 kg
	Wheelbarrow	30 kg
Wild fruits/ animals	Bucket	5 kg
	1 kg sugar packet	0.25 kg
	Bundle	1 kg
	Individual	0.2 kg
	Cupful	0.2 kg
Thatch	Bundle	5 kg
Time	1 acre	3 hours of draft power or 4.5 hours per contour 1 cartload worth of transport 1.5 hours (calculated on the basis of the questionnaire survey — households reporting cartloads and hours were assumed to have on average the same amount of time devoted to transport — the average time used by households reporting hours was 1.5 hrs)
Meat	1 cow, oxen	100 kg of meats when slaughtered
	1 goat	15 kg of meats when slaughtered
	1 hen	1.5 kg of meat
Manure*	Cartload	340 kg
	Wheelbarrow, bag	68 kg
Hides	1 cow, oxen	20 kg
	1 goat	2 kg
	Unspecified	10 kg

* Derived from previous study in Chivi (Campbell *et al*. 2000a)

Appendix 2. Exchange rates for Zimbabwe dollars at the mid-point of each quarter of data collection

Date	US$ equivalent
Mid-January 1999	39.6
Mid-April 1999	38.3
Mid-July 1999	38.1
Mid-October 1999	38.6
Mid-January 2000	38.3

Appendix 3. Partial correlation table for adult male time use in March-May 1999 (for full results of the partial correlation tests see the project CD-Rom, Sampurna *et al*. 2002)

Activity	Garden	Dryland crops	Livestock	Woodland	Domestic	Leisure	Academic
Garden	1						
Dryland crops	-0.07**	1					
Livestock	-0.12***	-0.19***	1				
Woodland	-0.03 NS	-0.13***	-0.09**	1			
Domestic	-0.11***	-0.26***	-0.15***	-0.10**	1		
Leisure	0.00 NS	-0.11***	-0.21***	-0.05 NS	-0.23***	1	
Academic	-0.09 **	-0.29***	-0.19***	-0.12***	-0.15***	-0.18***	1
Home industries and wages	-0.04 NS	-0.11***	-0.06*	-0.02 NS	-0.05 NS	-0.07*	-0.05 NS
Sleeping	0.02 NS	-0.09**	0.10**	0.01 NS	-0.13 ***	-0.11***	-0.35 ***

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