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The dynamics of vulnerability: locating coping strategies in Kenya and Tanzania

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We investigate how smallholder farmers at two sites in Kenya and Tanzania cope with climate stress and how constraints and opportunities shape variations in coping strategies between households and over time during a drought. On the basis of this analysis, we draw out implications for adaptation and adaptive policy. We find that households where an individual was able to specialize in one favoured activity, such as employment or charcoal burning, in the context of overall diversification by the household, were often less vulnerable than households where each individual is engaged in many activities at low intensity. Many households had limited access to the favoured coping options due to a lack of skill, labour and/or capital. This lack of access was compounded by social relations that led to exclusion of certain groups, especially women, from carrying out favoured activities with sufficient intensity. These households instead carried out a multitude of less favoured and frequently complementary activities, such as collecting indigenous fruit. While characterized by suitability to seasonal environmental variations and low demands on time and cash investments, these strategies often yielded marginal returns. Both the marginalization of local niche products and the commercialization of forest resources exemplify processes leading to differential vulnerability. We suggest that vulnerability can usefully be viewed in terms of the interaction of such processes, following the concept of locality. We argue that coping is a distinct component of vulnerability and that understanding the dynamism of coping and vulnerability is critical to developing adaptation measures that support people as active agents.

KEY WORDS: Kenya, Tanzania, adaptation, household vulnerability, drought coping strategies, environmental change

Introduction

The concept of vulnerability is receiving increased attention in environmental change research, particularly in assessing the potential effects of dramatic events, variability and trends on both society and the environment (McCarthy *et al.* 2001). There is increasing demand for vulnerability assessments in order to identify the susceptibility of populations to food insecurity, for example, as a basis for Famine Early Warning Systems (FIVIMS 2001; Stephen and Downing 2001; WFS 2002). Undertaking empirical studies of present-day vulnerability can also play an important role in improving our understanding of the impact of long-term climate change and of measures to facilitate adaptation (Smit *et al.* 2000; Kelly and Adger 2000). This is especially important as adaptation has become a focus of policy through

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the UN Framework Convention on Climate Change in recent years. Reducing vulnerability is an effective precautionary step towards adaptation (Kelly 2000).

Although definitions vary, vulnerability generally refers to the potential to be adversely affected by an event or change (Kelly and Adger 2000). A distinction between physical vulnerability and social vulnerability is often drawn (Cutter 1996; Adger 1999; Wisner *et al.* 2003), whereby the former refers to exposure to stress and crises resulting from physical hazards, and the latter refers to the capacity of individuals and communities to respond to physical impacts. In the climate change literature, the Intergovernmental Panel on Climate Change (IPCC) identifies three components of climate vulnerability: exposure, sensitivity, and the capacity to adapt (McCarthy *et al.* 2001). Within this framework, we argue that coping capacity, in the sense of the responses that people employ in order to maintain well-being in the face of environmental stress, is a dimension that cannot be neglected.

Although coping capacity is often subsumed under adaptability, coping and adapting are two distinct processes, distinguished not least by timescale (Smithers and Smit 1997). The factors that shape capacity to cope on timescales of days, months and years, and hence, present-day vulnerability, may complement the factors that shape the ability to adapt over longer timescales. For example, coping refers to the actions and activities that take place within existing structures, such as production systems, whereas adaptation frequently involves changing the framework within which coping takes place (Adger 1996). The two processes are, of course, intrinsically linked. On the one hand, strengthening coping strategies is a prime means of facilitating adaptation. On the other hand, adaptation studies have often emphasized measures to reduce sensitivity by, for example, changing to forms of agriculture that are less climate sensitive, thus reducing the need for coping.

Although the importance of people's capacity to cope with and adapt to the negative effects of economic and ecological change is becoming increasingly clear (Cutter *et al.* 2000; Bohle 2001), there continue to be divergent views about the differential benefits of any adaptive measures (Adger *et al.* 2003; O'Brien and Leichenko 2003). Moreover, there is a serious lack of information with regard to how, in practice, effective adaptation measures can build on existing coping actions. The first step in remedying this situation is to examine the relationship between coping and vulnerability on the basis of present-day experience.

In this article, we consider how small-scale farmers in dryland East Africa cope with climate stress and draw out implications with regard to the vulnerability of these households and means by which that vulnerability might be reduced. The sensitivity of the African dryland environment, the variability of its climate and the marginalization of much of its people define a context that brings into stark relief the factors that determine vulnerability. Drought in sub-Saharan Africa has had catastrophic impacts in the recent past, and there has been considerable research into what might constitute effective response strategies to climatic variability (see, for example, Devereux 1988; Downing *et al.* 1989; Davies 1993; Swift 1993; Adams *et al.* 1998; Ziervogel 2004). In assessing the capacity to respond, we consider the consequences of short-term, seasonal drought at the household level, as this provides direct, experiential evidence. We investigate, in particular, the opportunities and constraints that shape patterns of coping. Finally, we consider implications for the process of adaptation and the policies that might facilitate the adaptive process.

Coping and vulnerability

Previous research has identified social characteristics such as gender, age, wealth status and education that are associated with vulnerability and has distinguished between vulnerable groups in society (for example, Mbithi and Wisner 1973; Cutter 1996). Much of this work has been based on the notion of entitlements, in the general sense of access to resources (Sen 1981; Drèze and Sen 1989). Adger and Kelly (1999) argue that the architecture of entitlements, or the pattern of access to resources, is determined both by material sources of entitlement and the context within which they are distributed, including formal structures and more diffuse 'rules of the game' and social and cultural norms. In addition to formal entitlements, many responses are based on informal rights based not on the law but on locally accepted notions of legitimacy (Gore 1993). In considering coping strategies, the ability to diversify livelihoods is critical to local welfare and may be particularly important in mitigating risk, uncertainty and contingencies (Mortimore 1989; Scoones *et al.* 1996; Ellis 1998). Social capital, or networks of trust and reciprocity within society, is also integral to coping capacity (Devereux and Næraa 1996; Adger 2000). Customary safety nets, in terms of the economic, social and political networks and the processes that affect them, are particularly important for coping strategies in sub-Saharan Africa (Adams *et al.* 1998). These diverse processes interact with physical exposure to shape local vulnerability at any point in space and time. Coping capacity can then be considered to be directly linked to entitlements, or the set of commodity bundles that a person can command, and thus consumption in the face of an adverse event.

Our ability to monitor human causes and responses has not advanced to the same level as our under-

standing and ability to observe physical aspects of environmental changes (Turner 1991). Bohle (2001, 4) observes that this 'side of coping has so far been widely neglected, especially in conceptual and theoretical terms'. Local variability in vulnerability and impacts is a complicating factor. A large body of literature has documented great social, spatial and temporal variations regarding the effects of many types of disasters (Quarantelli 1987; Wisner *et al.* 2003; Morrow 1999). Similarly, studies of past famines suggest that a drought can affect different areas and people within the same stricken area very differently (Mbithi and Wisner 1973; Jaspars and Young 1995). In a recent attempt to conceptualize the way in which components of vulnerability are linked to factors beyond the system of study, Turner *et al.* (2003) emphasize the role of place-based analysis. Investigating variations in vulnerability, processes operating at different spatiotemporal scales as well as nested scales of interaction are central to enhancing understanding of the human–environment system. Similarly, Cutter (2003) calls for increased transdisciplinary linkages, methodological pluralism, place-based knowledge and a practical focus on policy relevance in vulnerability science in order to meet new risks. Place-based studies can illuminate how different factors – at different scales – can interact and affect the ability of different households and even different individuals within households to cope and adapt. For example, O'Brien and Leichenko (2000), in identifying so-called 'double exposure', show how those members of society most vulnerable to global economic change may also be vulnerable to climate change.

The case study approach (George 1979; Yin 1994; Fotheringham 1997) provides, therefore, an appropriate means of exploring coping and vulnerability. Quantitative and qualitative data for two case study sites are analyzed here in order to define the character of the various coping strategies that are employed and to draw out implications for vulnerability. Understanding what determines local vulnerability in the framework of what has been described by Massey (1999) as a 'locality' allows us to extend the conceptualization of vulnerability to include the convergence of processes. Massey suggests that each locality, or unique set of geographical conditions of a place at a particular time, is a point of interaction between processes, both social and physical. This concurs with the observation of Smithers and Smit (1997, 131) that adaptation 'occurs amid a complex set of economic (micro and macro), social and institutional circumstances which establish a location-specific context for human–environment interaction'. In the context of our study, locality is a manifestation of vulnerability at a specific point in space and time and can be understood as a product of various processes operating at various geographic levels. Processes may converge differently at different points in space or time, creating a very different manifestation of vulnerability. A locality, or shapshot of vulnerability, can be investigated with the specific aim of distinguishing processes and how they interact.

The root causes of vulnerability are, as argued by Kasperson (2001), embedded in societal processes at broader scales. Hence, coping at the local level is inextricably linked to processes taking place at other geographic scales. Access to assets, for example, is closely related to the political economy of the region and coping options available to food-insecure people are contextual and determined by structural constraints (Rocheleau *et al.* 1995). This inherent link between processes operating within society and at other scales contributes to the dynamism and complexity in vulnerability and thus coping strategies at the local level. Campbell (1999) ascribes this dynamism to change over time in the key processes that influence vulnerability, such as political factors. For example, the combination of environmental and economic changes is altering the context under which farmers in southern Africa cope with climate variability (Leichenko and O'Brien 2002). Eakin (2003) shows how smallholder farmers' adoption of irrigation and re-orientation towards vegetable production for the market, which on the face of it reduces farmers vulnerability to rainfall variability, may expose them to a different set of risks and costs, making them more vulnerable than expected. Thus, the interaction between the many forces that shape vulnerability, such as natural environmental variability and change, socio-economic processes and the policy context (Appendini and Liverman 1994; Kasperson *et al.* 1999), also contributes substantially to the dynamic nature of coping strategies and vulnerability. It is these factors that we investigate in this paper.

The study considers how farmers respond to drought. Case studies were carried out over a two-year period in Mbitini Location in Kenya and in Saweni Sub-village in Tanzania (see Figure 1), focusing on household coping strategies as a response to climate-related food shortage (lack of food at the household level) during the 1996 drought and other events. The sites were selected because they have similar smallholder characteristics, but different sets of property rights, policy histories and differing levels of state and market penetration.

As exemplified in a study of Tanzania and Ethiopia by Dercon and Krishnan (1996), the comparative case study approach is particularly appropriate for studying interacting factors or processes that lead to variations in the outcome of a phenomenon. This method necessitates the selection of case studies, as

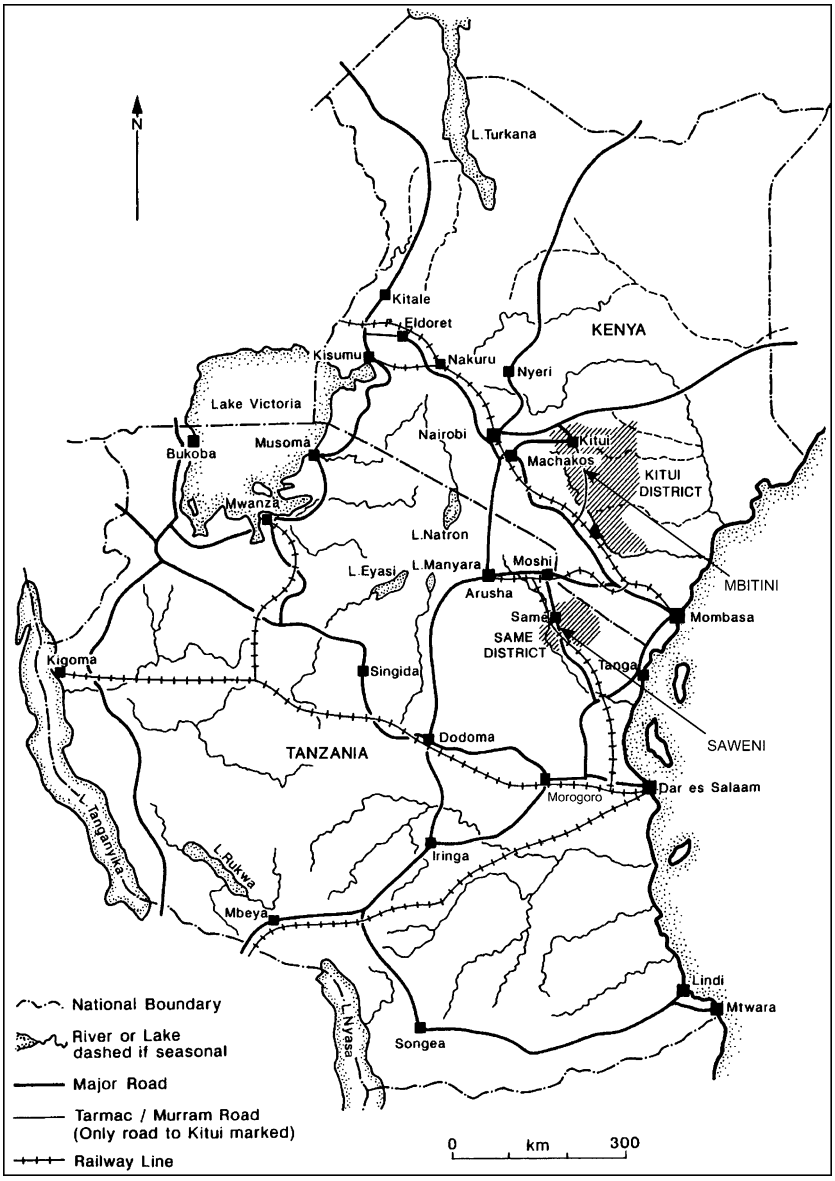

Figure 1 Location of study sites. Kitui District and Same District are shaded

defined geographically and temporally, that display the phenomenon to be investigated and which are similar in certain key variables. Mbitini and Saweni display the similarity required for this investigation, in terms of physical features, mode of agriculture, climate, vegetation and population. Case studies also need to differ in one or a few of the variables of theoretical interest, as the differences between cases are as important as the similarities. Of particular interest for this study is the difference in land distribution and agricultural policies between the two sites. Historically, Tanzania has followed a socialist policy orientation compared to Kenya; resulting differences in land tenure may affect the pattern of coping. Through comparison and in-depth site-specific studies we hope to draw out and isolate the interaction of different social, economic and political factors. Quantitative data enable analysis of the distribution of household coping characteristics and relationships between these variables. Combining

such analysis with analysis of qualitative data is crucial in order to understand the nature and dynamism of interactions between household characteristics, choices and coping strategies with social, economic and political factors.

For the purpose of this study, coping strategies refer to activities aimed at obtaining food or income during times of stress, either through production or through formal and informal exchange and claims. Coping strategies can be characterized as relating to production (agricultural and economic), social adjustments (reciprocal economic exchange), and biological strategies, including changing the diet or reducing consumption.

Previous studies of the coping strategies of small-scale farmers have argued that these strategies vary between households and also over time according to choices, objectives, opportunities and constraints (O'Leary 1980; Corbett 1988). Understanding how these facets are shaped by the interaction of different processes is key to understanding the changing patterns of vulnerability within a community and across a region. By examining the interactions that determine the evolving effectiveness of coping strategies, a richer, process-orientated and analytical understanding, rather than static description, of coping and vulnerability can be achieved. A central concern of the present study is to examine the dynamic nature of coping strategies and, hence, what we term the 'dynamic of vulnerability', a critical goal when considering society's evolving response to longer-term climate trends.

The case studies

Case study sites

The two case study sites are located in drylands affected by climatic variability and drought, where smallholder mixed farming is a dominant economic activity (Figure 1). Mbitini Location (henceforward referred to as Mbitini) is situated in Chuluni Division, Kitui District. Saweni Sub-village (referred to as Saweni) is situated in Saweni-Gavao Village, Hedaru Ward, Same District. The characteristics of the two sites are summarized in Table 1.

Both sites exhibit low and variable rainfall and experience regular drought-related harvest failure (O'Leary 1980; Kamau *et al.* 1989; Mvungi 1995). There is a bimodal rainfall pattern, with rains occurring from March to mid May, and from late October to December. The October to December rains are heavier in Kitui District, while the March to May rains are heavier in Same District. Same District

Table 1 The case study sites

Characteristic	Mbitini	Saweni
Area	129 km^2	20 km^2*
Population	16 789**	1300***
Average total rainy season rainfall	629 mm	448 mm
Altitude	800–1000 m.a.s.l.	700–1200 m.a.s.l.
Common crops	Maize (*Zea mays*), beans (*Phaseolus vulgaris*), pigeon peas (*Cajanus cajan*), cowpeas (*Vigna unguiculata*), millet (*Pennisetum typhoides*), sorghum (*Sorghum vulgare*), green gram (*Vigna aureus*)	Maize (*Zea mays*), bonavist beans, known locally as 'fiwi' (*Lablab niger*), and beans (*Phaseolus vulgaris*). Vegetables, bananas (in the highlands), sugarcane (*Saccharum* spp.), and coffee (*Coffea arabica*)
Common fruits	Mango (*Mangifera indica*), orange (*Citrus sinensis*), pawpaw (*Carica papaya*), banana (*Musa* spp.) and guava (*Psidium guajava*)	Guava (*Psidium guajava*), avocado (*Persea americana*), mango (*Mangifera indica*), orange (*Citrus sinensis*), pawpaw (*Carica papaya*) and mstafeli (*Pachystela brevipes*)
Average land size per household	4.2 ha	3.2 ha
Average household size	6.6	5.8

*The extent of the sub-village is not well demarcated, but can be estimated from the Administrative Map of Same District. The Administrative Map (1:250 000) was consulted at the Kilimanjaro Village Forest Project/Japan International Cooperation Agency Office, Same.

**Estimated for 1997, projected from the 1989 population census (DIDC 1997).

***Current population statistics were not available at the sub-village level, but the total population was estimated at 1300.

Sources: Republic of Kenya (1997a); United Republic of Tanzania (1996).

displays a greater spatial variation in rainfall than Kitui District because of the greater differences in elevation. There are variations within Kitui District as well, with most of the District experiencing less than 750 mm rainfall a year and some of the highlands receiving up to 1000 mm a year on average (Republic of Kenya 1994). The two sites have fairly similar physical attributes, although greater variation in topography in Saweni than in Mbitini results in greater variations in a number of physical and social variables within the Saweni site than in the Mbitini site. There are more permanent springs in Saweni than in Mbitini. Mbitini only has seasonal rivers, and households fetch water from sources up to 8 km away. Most Saweni households have a water source within 3 km of their home. Water, grazing and fuelwood are nevertheless contested resources in parts of the Same lowlands (Homewood 1995). Most households in both sites engage in small-scale mixed agriculture, that is, smallholder settled cultivation as well as keeping livestock and poultry (Mvungi 1995; Omari 1995). There is a great diversity in crops and agricultural activities on farms in both Saweni and Mbitini, and all households grow more than one crop, with maize as a dominant crop.

Both Mbitini and Saweni have undergone changes in their economy. Since the late 1970s, households in Saweni have increasingly purchased staples, particularly maize from Tanga and Moshi, in addition to growing food themselves. The per capita holding of livestock has fallen dramatically, and some lowland households are entirely without livestock (Mvungi 1995). Both in Saweni and Mbitini, off-farm income is increasingly important, but most households practice agriculture in addition to non-farming economic activities. Young people typically try to gain employment or start their own business, or engage in casual labour (Mvungi 1995). Male outmigration is common in both of the sites. This results in a high proportion of households headed by women. In Mbitini, for example, the ratio of men to women is 88:100. Households may receive remittances on a regular or irregular basis and migration may be permanent, or a much more temporary or seasonal phenomenon. Particularly in Mbitini, it is common that a household has a female resident head, with male members working and residing away from the household. In addition to a population growth rate of over 3%, migration is common at both sites. Dependency ratios are 0.46 and 0.49 in Mbitini and Saweni, respectively.

Same District and Kitui District have similar dry bushland vegetation and share many of the same indigenous species. The Somalia-Masai regional centre of endemism runs from Somalia through most of Kenya to central Tanzania and includes both case study areas. There is a great diversity within the districts with respect to habitat and vegetation types, as both lowland areas contain hills. In addition, Same District encompasses mountains that may account for further diversity in vegetation, although the highest elevations are outside Saweni. There are areas of uncultivated land in both sites and several indigenous plant species are utilized by farmer households as part of the agro-ecosystem. Firewood, building/carpentry material, thatching, fodder and medicine are important uses of indigenous plants.

There is great inter-household variation in land holdings in both sites. One of the important differences between Saweni and Mbitini concerns land tenure and distribution. Land tenure and distribution differ partly because in Tanzania more land remains under state control, while in Kenya private land tenure is more widespread. Saweni has village lands that fulfill several communal functions in terms of grazing and gathering of forest products. Forest is mainly confined to uncultivated private land in Mbitini, which has no village or other communal forest areas. While households are scattered fairly evenly within Mbitini, households in Saweni tend to be concentrated in clusters. Farmland and bushland surround these settlements, leaving larger tracts of uncultivated village land from which indigenous plant products can be accessed.

Harvest failures and drought

Harvest failures and incidences of food insecurity have been regular events, taking place at least once or twice each decade, both in Mbitini and Saweni, during the twentieth century, and have been identified as a convergence of social, political as well as natural factors. Coping strategies have been different each time and in each location. In 1951, in Mbitini, for example, the sale of sisal dominated as a coping strategy. In 1974/75, in Saweni, people ate indigenous fruit, engaged in casual labour and received American aid, while wild tubers were the main means of survival in 1992.

The 1996 drought in Kitui was particularly severe and followed a number of bad years, including the 1994 'Yua ya Maanchwano' or 'Famine of Maanchwano', a famine that led to demonstrations and an assault on the District Commissioner. Apart from in 1993, the harvests during the first half of the 1990s had all been poor and the June/July harvest in 1996 the poorest. During the March–May long rains in Kitui, only half the normal rainfall of 449 mm (1961–90 mean) was received and followed short rains (November–December 1995) that had also been well below the normal of 486 mm. The term famine locally signified widespread household food insecurity or exhausted food stocks and inability to buy sufficient food among a large part of the popula-

tion. At the time of the June/July harvest, only 70% of the interviewed households had food stocks, and the percentage rapidly fell to 50% by August and 10% by February (time of the next harvest). Food prices soared, meals were reduced (among 83% of households), and children dropped out of school (among 46% of households) due to hunger, non-payment of fees and participation in coping mechanisms. Households started to engage in a multitude of alternative sources of food and income, including collecting indigenous and exotic fruit, selling livestock and poultry, and doing casual labour on other peoples' farms, as well as relying on help from neighbours and family and receiving food aid. A few households relied on a skilled job, salary or remittances from household members working and living elsewhere, business, or producing honey, bricks, charcoal or handicrafts.

In 1997, the situation was still difficult, although the harvest was slightly better, almost 80% of households having food stocks in June, dropping to 60% by August and less than 10% by February. The situation was improving by November, however, as people could start to use premature crops as food, such as sweet potato leaves and beans. In 1998 most households had a bumper harvest in Mbitini due to heavy and well distributed rains from October 1997 to May 1998. The collection of indigenous fruit, casual labour, sale of livestock and poultry and help from neighbours and family ceased to be widespread activities, and other alternative economic activities to farming also became less frequent.

These same rains, named locally as 'El Niño rains', caused flood and destruction in many other areas in East Africa. Vunta, a mountain site some kilometres from Saweni, received 204 mm of rainfall in the space of 8 h during the night of 17/18 January 1998. There were several landslides in Saweni. While neighbouring villages suffered severe damage, leading to one village having to be completely relocated away from the slope, the effects in Saweni were more differentiated, some farmers losing crops while others getting a bumper harvest.

Like Mbitini, Saweni had experienced a number of poor harvests in the 1990s. While 1995 and 1996 were poor for most farmers, the June–August 1996 harvest was particularly poor in the higher altitude areas where 'there were no green leaves to be seen anywhere'. Some households in the lowlands did harvest, though relatively poorly. About 80% of interviewed households had food stocks in June 1996, dropping to 70% in August and about 30% by February. Some households had to reduce their meals (36% of households) and some children, though fewer than in Mbitini, had to drop out of school for one or more days (observed among 11% of households). Casual labour, sale of livestock and poultry, collection of indigenous and exotic fruit, as well as receiving assistance from neighbours and family and food aid, were widespread. Some also engaged in honey collection, skilled jobs, getting credit at the local shop, business, producing bricks, charcoal or handicraft, or relied on a salary or remittances. The 1997 harvest was described as good and more than 90% had food stocks in June. Close to the same percentage still had food stocks in August and nearly 70% of households had food stocks in February. Coping mechanisms, such as the use of indigenous fruit, sale of livestock and poultry and engaging in casual labour, became less widespread.

Data collection and analysis

Data were collected in three stages from September to October 1997, June to November 1998 and September 1999. A range of techniques was employed in order to generate information and to triangulate insights and to build up progressively an accurate and detailed picture of the dynamics of coping and vulnerability across households at each site. The techniques used included semi-structured interviews and open-ended discussions, household questionnaires, focus groups and community workshops and key informant interviews at each site. Secondary data were collected from existing statistical sources, and policy data were also compiled for each site, including population, number of schools and health clinics, agricultural and forestry harvest and pricing data, monthly primary school attendance records, monthly records of underweight children admitted to local clinics, and monthly and daily rainfall data. Table 2 summarizes the primary data collection strategy.

Two locally appropriate indicators of reduced consumption are reduced meals (two or less meals a day or meals reduced in quality) and school dropout rates (which increase as children are employed in coping strategies or due to lack of funds to pay fees). These indicators were studied along with socio-economic characteristics and coping strategies during the 1996 drought and compared to a 1997–98 non-drought reference period as key indicators of impact. Past studies of drought have observed that households may reduce meals in order to make food stocks last longer and to minimize the exchange of production capital for food. Reduced consumption may also, at a later stage, be a response to complete exhaustion of food stocks and poor alternative sources of food and income (Kennedy 1992; Jaspars and Young 1995). Reconnaissance and key informant interviews gleaned school dropout and reduction of means as relatively reliable indicators of a household being adversely impacted during drought in both sites.

Table 2 Data collection strategy

Activity	Selection	Kitui, Kenya	Same, Tanzania	Topic, focus of activity
1. Semi-structured interviews and open-ended discussions	Households of poor, medium and high socio-economic status	23 individuals at four sites in the District, including Mbitini	21 individuals at four sites in the District, including Saweni	Demographics, farm output, sources of income, sources of food and income during drought, plus a focus on past droughts, community groups, seasonal changes in farming activities, indigenous plant use, and livestock fodder
2. Household questionnaires	Random selection; individuals in households selected based on gender, age balance	52 households in Mbitini	53 households in Saweni	Harvests, food, income, use and sale of indigenous plants 1996–8; management of indigenous plants, meals and school attendance during harvest failures, contact with agricultural or forest extension agents, general socio-economic information
3. Focus group discussions	One women only, one mixed men and women	Two in Mbitini	Two in Saweni	Local patterns of coping, including drought responses and prices and marketing of local produce
4. In-depth discussions	Individuals from households classified as low and high drought impact	Six men, six women in Mbitini	Six men, six women in Saweni	Patterns of coping during drought
5. Key informant interviews	Local officials and leaders, agriculture and forestry extension officers, NGO personnel, shop keepers at each site	In Kitui District, Chuluni Division and Mbitini	In Same District, Hedaru Ward and Saweni	Contextual information on local development and policies
6. Community workshops	Public meeting held at each research site	In Kitui Town	In Same Town	To evaluate the main research findings from earlier data analysis and to collect information regarding the relevance of research findings to local policy measures

The way in which people ranked different coping strategies was analysed both quantitatively and qualitatively using a range of techniques. While statistical tests can reveal associations between individual household characteristics, qualitative data analysis was employed in order to examine the household 'story', the way in which the household context determined choices, objectives, constraints and opportunities in coping. In examining the relationship between coping strategies, the relationships between selected groups of activities were examined. For example, statistical tests of association were performed on interview data to investigate whether or not households that do not have access to favoured sources of income during drought, such as receiving salary or remittances, turn to activities that had fewer barriers to participation, in particular, those outside registration or remuneration by the government. Activities based on informal exchange, including casual labour, assistance from neighbours, and assistance from family and relatives, make up one group. Activities based on the use of indigenous plants constitute another group, exemplifying local resources that are mainly accessed informally.

Results

Three key issues emerged from the analysis of coping strategies employed by small-scale farmers in Kenya and Tanzania:

- the distinction between principal and complementary coping strategies;
- specialization as one basis for coping and the related issue of exclusion; and
- constraints on the adoption of coping strategies and accessing opportunities.

Principal and complementary coping strategies

The ability of a household to engage in what we term principal and complementary coping strategies is an important feature in the dynamic of coping and vulnerability. A household generally coped by engaging in a few favoured activities, often, in fact, one principal activity, or a multitude of less favoured activities that often complemented each other. The dynamic nature of coping at both sites was manifest in households switching between principal and complementary activities during the course of a drought.

The tendency of households in both sites to seek one principal coping strategy that can substitute for farming as a major regular source of food or income earner for food and other expenses, and to switch to complementary activities if the principal activity failed, was evident from data collected from individuals, households and focus groups. The pattern was reflected, for example, in survey respondents' tendency to mention one main activity when asked about drought sources of food and income, ranking this the most important activity and describing other activities as marginal. Qualitative interview data regarding the ranking of strategies for coping with drought, particularly those data obtained from the six respondents selected in each site for in-depth discussions on the topic, revealed some of the characteristics of principal and complementary strategies, as well as the constraining or enabling factors leading to variation in coping strategies between households and within the same household during the course of the drought. One of the focus group discussions in Mbitini explained how each household filled a niche according to which main alternative source of food or income it could employ during drought.

A principal coping strategy was characterized by providing a main source of food and income for a household, substituting for farming. It was relatively regular and reliable, more or less successfully providing for the basic consumption needs of the household over an extended time period, such as the whole or a large portion of a drought incident. Complementary coping strategies were opportunistic and often irregular, providing some food or income for shorter time periods, no one of the activities on their own successfully sustaining the consumption needs of the household over extended time periods.

Whether or not a strategy was categorized as principal (or complementary) depended on a number of different factors and the constraints and opportunities faced by each household. A number of principal activities were, nevertheless, consistently ranked highly in the household interviews. These included income from a regular business or shop, and skilled work, such as carpentry, particularly for men. The role that an activity played in household coping depended on the intensity with which the household could engage in the activity, as well as the availability of other opportunities. Casual labour, for example, represented a principal source of income only for households that were able to devote substantial amounts of labour time to this activity and that had no other, more favoured, principal sources of food and income open to them. A business involving the running of a local shop could attain principal status while a smaller, more unreliable business selling porridge to people waiting in a health centre queue would typically be a complementary coping strategy. The extent to which the sale of livestock attained principal status depended on the number of livestock that the household had and could afford to sell without compromising future livelihoods.

As opportunities changed, such as the loss of livestock sales as a source of income, a new activity could assume the role of principal coping strategy, or the household could be without one altogether. If one coping mechanism failed, another strategy was adopted. One farmer explained that if the drought were to persist, he would resort to charcoal burning since all his livestock had been sold or had died. A salary from a resident adult and remittances from a family member living elsewhere were perhaps the clearest examples of coping strategies assuming a principal role in drought livelihoods.

If no principal coping strategy was available, the household would engage in multiple, complementary activities. These activities would tide the household over when the principal activity failed. In other cases, they supplemented the principal activity by providing extra food or income to pay for minor expenses. Households switched between different complementary activities during the course of the drought as opportunities arose or constraints made particular activities unviable. Typical complementary coping strategies included the consumption and sale of indigenous fruit, casual labour, sale of poultry, sale of ropes (and some other handicraft), group activities yielding food or income, and receiving credit from the local shop. Due to its unreliable nature, food aid was almost exclusively a complementary strategy. In particular, in Mbitini, many of those households that received food aid received this only once, and then only small quantities, such as a few kilos of maize. Receiving help from neighbours and family was deemed a complementary coping strategy, except in a few cases where such assistance provided a reliable and regular source of income during drought.

Principal coping strategies tended to be high intensity and specialized. Cash income was an important attribute of most of the favoured, principal activities. This was partly because the cost of medical treatment, education and other social services was increasing as a result of policy changes at the national level related to cost recovery of social services, required to qualify for IMF or World Bank assistance (Therkildsen and Semboja 1995; Sutherland *et al.* 1999). In addition, most households had to buy food and could no longer rely solely on their own crops and exchange of food products with neighbours and relatives.

In contrast, diversity was a key factor in the viability of complementary strategies. While the additional income from these activities was significant to the households, it remained low and unreliable. For example, making ropes appeared suitable for many women because ropes could be produced in between domestic chores and farming. Ropes could be sold at a low price in the local market and produced a small income vital for regular household expenses, such as purchasing salt or vegetables. However, larger, more viable enterprises were not always an option. Many forms of casual labour or indigenous plant use that had a higher income potential, such as production that required larger amounts of timber, were not as easily accessible to most households.

While complementary coping strategies generally ranked poorly as a food or income source, they were sometimes ranked highly due to their versatility, flexibility and linkages with other coping strategies. For example, the irregular sales of livestock and poultry were ranked highly by some households, although this was not regarded as a substitute for agriculture or a sufficient income generator. Sales yielded money immediately (though prices varied), which could be invested in petty trade or business such as the sale of porridge, or which could be used to buy food, send a sick person to the hospital, or pay school fees. One female respondent in Saweni, for example, ranked the sale of chicken as the most important activity, followed by the consumption of exotic fruit and sale of bricks. None of these yielded enough income to sustain the household, but they were valued because they were activities that the respondent could undertake independently of her husband. Saweni respondents explained that indigenous fruit was ranked highly because it could be harvested by any member of the household and that fruit did well in drought conditions. The importance of such fruit for children, when meals were poor, was emphasized by Mbitini respondents as well as teachers.

Quantitative analysis of interview data confirmed that households that had a reliable principal source of income during drought, exemplified by salary or remittances, engaged in fewer drought activities on average than households that did not receive a salary or remittances. In Mbitini, the households that had external salary or remittances engaged in an average of 5.2 other activities. At the other extreme, households that engaged in charcoal burning, group activities or brick making during drought engaged in, on average, 6.6, 6.8 and 7.4 other activities. Similarly, households in Saweni that had a salary or received remittances engaged in an average of 3.0 other activities. Households that received assistance from relatives, got credit from shops or engaged in group activities engaged in, on average, 5.6, 5.9 and 6.5 other activities. Table 3 displays the negative relationship between the two sources of income and food during the 1996 drought in both Mbitini and Saweni.

Qualitative examination of the household interview data revealed that activities that often involved the use of indigenous plants (charcoal making, burning

Table 3 The relationship between receiving remittances/salary and other activities during the 1996 drought

Activity during 1996 drought	Relationship with receiving salary/remittances during 1996 drought			
	Mbitini		Saweni	
	Phi coefficient	Chi-square probability of relationship occurring by chance	Phi coefficient	Chi-square probability of relationship occurring by chance
Engage in casual labour and/or receive assistance from neighbours and and/or family $N = 51$	**–0.41**	**0.01**	**–0.42**	**0.01**
Use of indigenous plants in activities $N = 51$	–0.03	1.00	**–0.29**	**0.06**

Relationships significant at the 0.10 level in bold.

bricks, making handicraft, collecting honey and group activity) were almost exclusively confined to households without a salary or remittance. Table 3 shows that in Saweni, there was a clear statistical relationship between a household not receiving a salary or remittances and use of indigenous plants in drought-coping activities. Such a quantitative relationship was not evident in the Mbitini case, partly because a few households invested remittances in more intensive uses of indigenous plants, such as larger scale charcoal burning. Because indigenous plants were only available on private land in Mbitini, accessing indigenous plants was more likely to require a form of payment than was the case in Saweni, where indigenous plants were available on village land.

Specialization and exclusion

One important characteristic of the pattern of principal and complementary coping strategies is that of the emerging specialization by individuals in the context of a continuing overall strategy of diversification within the household. Specialization is increasing because of increasing monetarization of the local economy and the marginalization of local products in the market. This process is mediated by the social relations of gender. Specialization by an individual household member into one activity or a limited number of intensive cash-yielding activities could potentially yield a better income than each household member engaging in several marginal activities. If a male household member engaged in almost full-time casual labour or charcoal burning, this provided a steady income for the household, while a woman doing occasional casual labour received only a very small income. With one or more household members each specializing in an activity, the household had options during drought, yielding successful diversification and coping within a household. This development could also be seen as a sign of the value of household-based production declining and the household as a mode of production being undermined compared to larger more intensive modes of production based on economies of scale. Therefore, the preferred type of household diversification entailed individual members undertaking specialized but different activities. Households with higher numbers of adults and fewer dependants had an advantage in this regard. The degree of vulnerability depended, to a great extent, on the ability of individuals to specialize successfully.

Most of the rural population were excluded from acquiring the formal skills or denied access to the capital for the investment required for most principal and cash-yielding coping strategies. This exclusion emerged clearly both from quantitative and qualitative data analysis. In Figures 2–5, each economic activity (or category of economic activity) is plotted according to the number of sampled households that engaged in the activity during the drought and non-drought period for each site and how the households ranked the particular activity in terms of importance. The further to the right the strategy is situated in the boxplot, the higher the number of households engaged in that strategy. The higher the activity is placed in the plot, the better the rank or value. The higher right-hand corner of the plot signifies the highest importance in terms of a combination of many households engaging in an activity and ranking it highly.

The plots reveal a distinct trend. Drought activities could be separated into two main groups: first, those activities that only a minority of households undertook during the 1996 drought; and second, those activities that more than half the interviewed

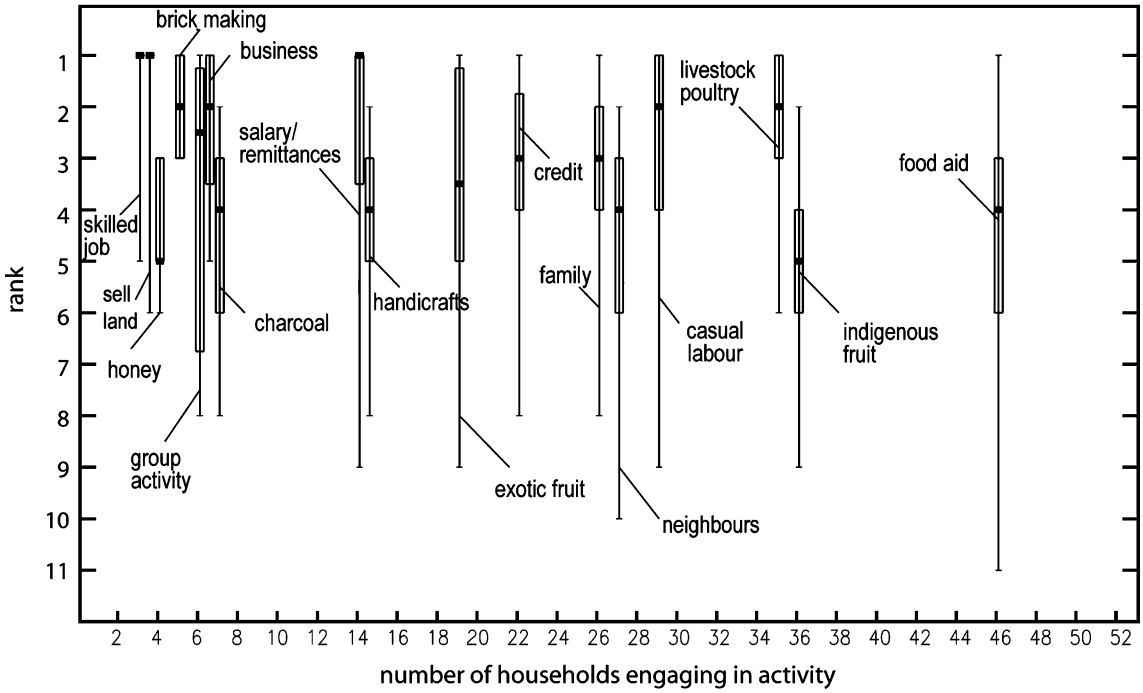

Figure 2 Household activities during the 1996 drought (from end of July harvest until beginning of 1997), Mbitini. Value 1 on the *y*-axis indicates the highest ranking and therefore the activity rated most important by the households in the given time period. The ranking of an activity is plotted in terms of the maximum and minimum rank (thin line) given by different respondents, the 25 and 75 percentile ranks (box), and the median rank (thick line). The *x*-axis shows the number of households that engaged in each activity during the given time period. The total number of households is 52

households undertook. Activities could also be grouped according to whether they, typically (as represented by the median), achieved a high ranking or not among the interviewed households. Significantly, these four groupings corresponded closely, and the following pattern emerged. First, there were certain activities that ranked highly, but to which not all households had access. Activities that were ranked high in Mbitini, but in which less than half the households engaged, include skilled employment (labelled 'skilled job' in Figures 2–5), selling land, making bricks, engaging in business, receiving a salary or remittances and obtaining credit. These activities typically required a particular skill or capital investment by the household. Second, there were certain more common activities in which households were not constrained by skill or investment needs, and which often operated through informal channels of exchange. Strategies that generally did not require particular skills or investment apart from normal labour included receiving assistance in terms of a bag of maize or other food or money from family members, such as parents, a daughter or a son; borrowing food from neighbours; doing casual labour in the neighbourhood; and collecting indigenous fruit. More than half of the interviewed households engaged in these activities, although only casual labour ranked relatively highly.

Figures 3 and 5 illustrate how the number of households engaging in coping strategies contracted in both sites during the non-drought period. Farming became the most common and highly ranked activity. The more reliable and specialized sources of food and income, such as salary and remittances and skilled jobs, were not abandoned among the households who had access to them, however. Though not as critical as during a drought, these are also important sources of income in non-drought periods. The coping strategies described here are drawn upon in response to various types of stress, climatic and non-climatic, faced by a household; for example, a household might appeal for remittances from an urban worker or use business profits for household consumption needs if a household member falls ill. In addition, continuing a specialized activity during times of less stress, even when farming is the favoured activity, makes sense from the perspective of securing future access to this activity as a principal

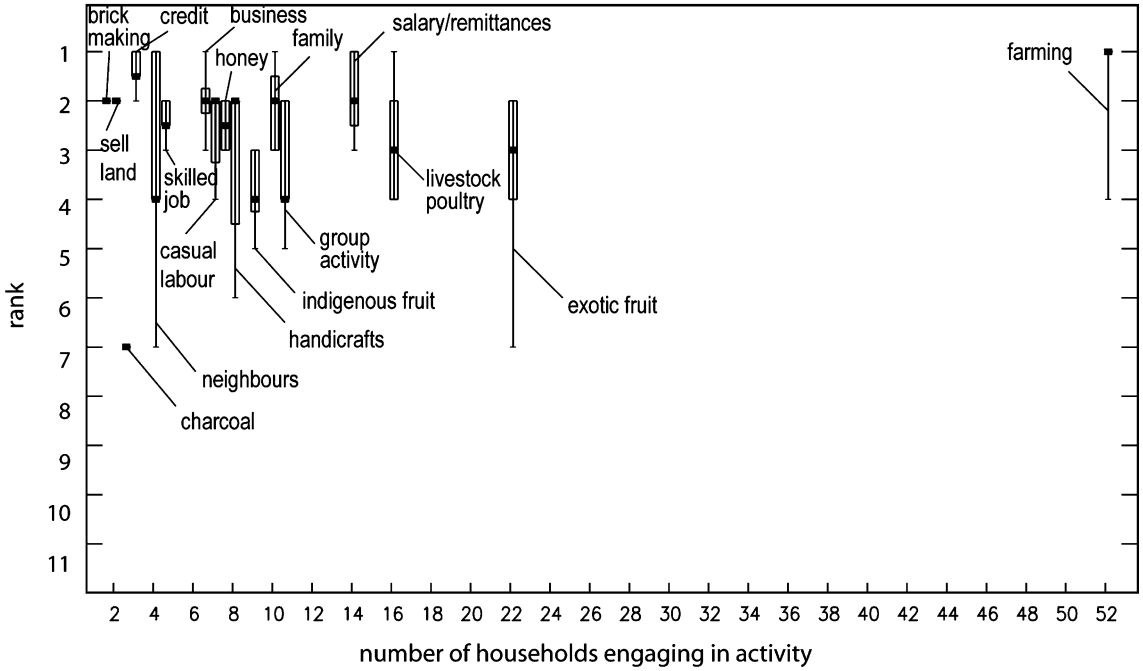

Figure 3 Household activities after the end of the 1996 drought (from end of 1997 until mid-1998), Mbitini. Value 1 on the *y*-axis indicates the highest ranking and therefore the activity rated most important by the households in the given time period. The ranking of an activity is plotted in terms of the maximum and minimum rank (thin line) given by different respondents, the 25 and 75 percentile ranks (box), and the median rank (thick line). The *x*-axis shows the number of households that engaged in each activity during the given time period. The total number of households is 52

source of coping. As Christoplos *et al.* (2001) observe, poor people's livelihood strategies are often more about addressing vulnerability and handling shocks than 'escaping' from poverty *per se*. The study of a severe stress situation, such as drought, brings into stark relief the way that diversity of income sources, and dynamic coping strategies, form the basis of rural livelihoods.

Constraints and opportunities

Social factors or processes excluded the majority of households from particular favoured activities. There were also a number of constraints on the activities in which most households engaged. While statistical analysis could not attribute adversity experienced during the 1996 drought to any one or distinct group of household characteristics, there was a clearer relationship with the ability to engage in particular coping strategies. Quantitative analysis confirms, for example, that there is a statistical relationship between household ability to draw on salary or remittances as an alternative source of income when the harvest failed in the 1996 drought and fewer impacts during that drought (based on the meals and school dropout data). As displayed in Table 4, households in both Mbitini and Saweni that had access to salary or remittances during the 1996 drought tended to be affected less negatively in terms of access to food, school attendance, or both. This variable explained 55 and 29% of the variance regarding the extent to which a household was affected during the 1996 drought in Mbitini and Saweni, respectively.

Gender had an important influence on how the trend of specialization by individual household members manifested itself in the effectiveness of household coping patterns and thus levels of adversity. The ability to devote continuous periods of labour to an activity was an important differentiating factor in coping. Men's activities, including skilled work such as stonemasonry, handicraft such as making stools, and running a shop or business, were sometimes carried out throughout the year. During non-drought times, these activities assume secondary importance to farming. Charcoal burning and brick making, as well as high-intensity casual labour, were full-time activities for some men during drought. Unlike most men, few women could devote themselves to a continuous and reliable activity.

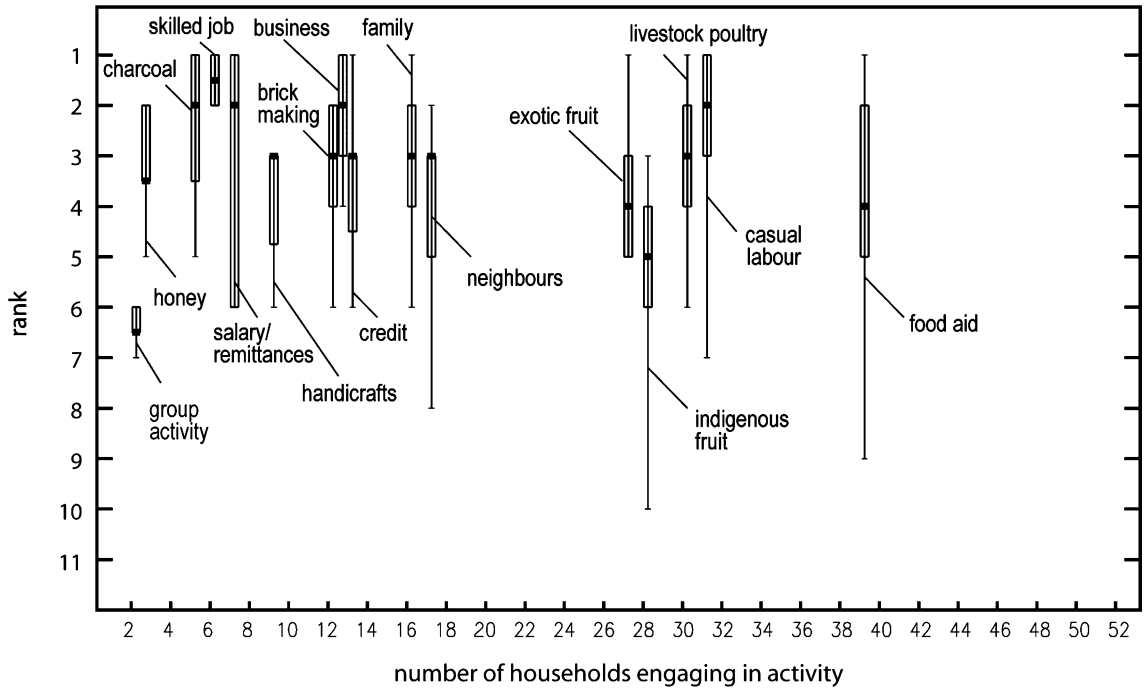

Figure 4 Household activities during the 1996 drought (from end of July harvest until beginning of 1997), Saweni. Value 1 on the *y*-axis indicates the highest ranking and therefore the activity rated most important by the households in the given time period. The ranking of an activity is plotted in terms of the maximum and minimum rank (thin line) given by different respondents, the 25 and 75 percentile ranks (box), and the median rank (thick line). The *x*-axis shows the number of households that engaged in each activity during the given time period. The total number of households is 52

Table 4 Salary or remittances as drought source of income and the impact on meals and/or school attendance of the 1996 drought

Site	Valid *N*	Direction of relationship	Value of Somers's D_{yx}	Approx. probability of relationship occurring by chance (df = 2)
Mbitini	48	Negative	**–0.55**	**0.001**
Saweni	51	Negative	**–0.29**	**0.08**

Relationships significant at the 0.10 level in bold.

A serious constraint that female-headed households faced was that, in most cases, a shortage of time available for outside labour prevented women from performing activities with sufficient intensity for these activities to serve as a principal income earner. Domestic responsibilities, including looking after children and providing meals, meant that most women did not have large blocks of time required to carry out certain activities, such as running a shop, nor the mobility required to travel far to undertake paid work or trade. In contrast, women's activities, including petty business, handicraft and collection of indigenous fruits, were often precarious. Few of these products yielded much money, and most female activities were maintained at a low scale. Such a gender division of labour in agriculture has been observed in many African rural societies (Davison 1988; Nypan 1991; Thomas-Slaytor and Rocheleau 1995). The heavy burden of labour for women who bear the brunt of responsibility for many agricultural tasks, such as fuelwood and water collection, environmental management, and domestic work, means women's time is severely constrained.

Social relations of gender further resulted in men having greater mobility, fewer domestic duties and

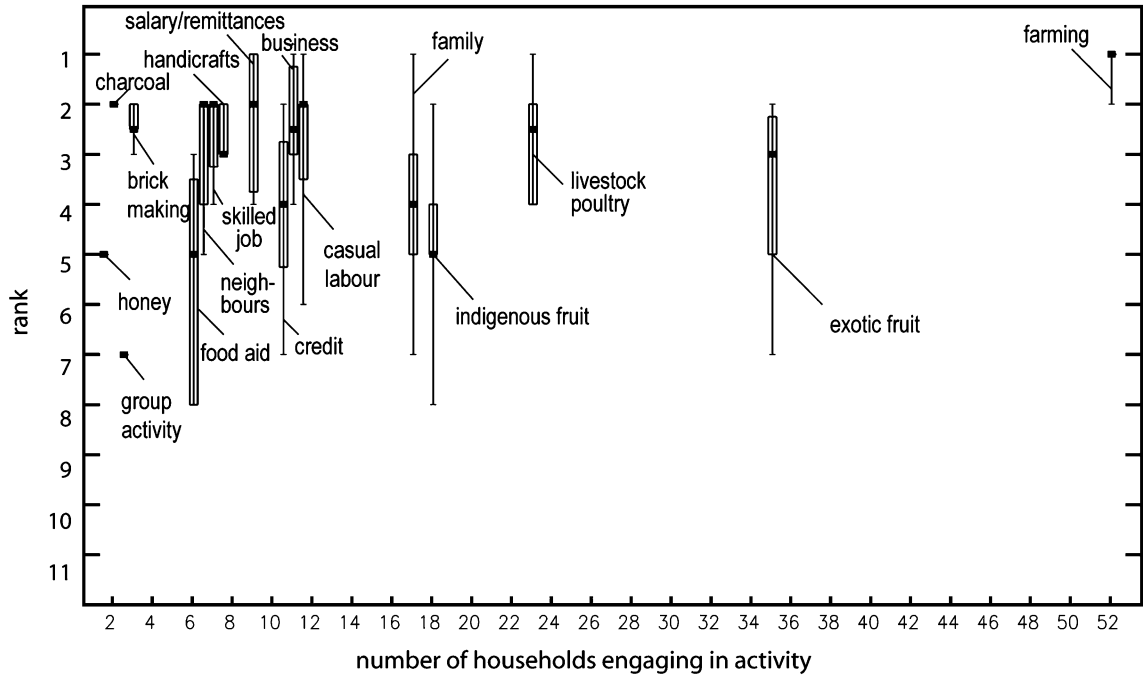

Figure 5 Household activities after the end of the 1996 drought (from end of 1997 until mid-1998), Saweni. Value 1 on the *y*-axis indicates the highest ranking and therefore the activity rated most important by the households in the given time period. The ranking of an activity is plotted in terms of the maximum and minimum rank (thin line) given by different respondents, the 25 and 75 percentile ranks (box), and the median rank (thick line). The *x*-axis shows the number of households that engaged in each activity during the given time period. The total number of households is 52

easier access to certain resources. For example, women very often did not have the resources involved in forming larger, more profitable formal businesses, nor the capital to invest in such larger-scale ventures. Small-scale businesses or skilled work with a very local market, such as tailoring, were unreliable during drought when people had little money. Women were further restricted by custom from engaging in certain economic activities (Thomas-Slaytor and Rocheleau 1995). At the two study sites, women were traditionally excluded from honey collection, carpentry and certain other types of skilled employment; some of the more reliable income-earning activities were not accessible to women because they were customarily performed by men. A woman could not, for example, hang or harvest a beehive. In Mbitini, wood-carving was a relatively higher input and output activity that often provided the principal source of income and was dominated by men. This domination may partly stem from the fact that women usually did not have the right to fell trees on their own family's farmland without the consent of a male head of household (Eriksen 1999). These various constraints and restrictions were compounded by the fact that women also generally had a lower level of formal education, especially in Mbitini.

The success of specialization by individual members of the household as a form of diversification for the household as a whole was contingent on strong bonds of commitment between household members. Female-headed households that received reliable remittances from a husband, for example, were among the households that did relatively well during the 1996 drought. Female respondents tended to be relatively unaffected by drought only if they had access to salary from regular employment. In Saweni, several of the women respondents were employed themselves, for example as teachers, while in Mbitini, many women depended on a salary from a husband who often lived away from the household. Female respondents, whose access to food was affected during drought, tended to be without access to a salary and instead diversified into a number of activities. If an individual who had specialized in one activity ceased to contribute to the household economy, the remaining members became more at risk.

The particular vulnerability of *de facto* female-headed households was related to the strength of

the commitment by the 'specialized' household member to the rest of the household. Contributions by children working elsewhere were erratic and even a spouse did not always provide reliable contributions. As a result, the importance attached by farmer households to complementary activities by a female adult depended on the reliability of receiving remittances or salary or other income from a male adult during drought. One Mbitini respondent confirmed that there were longer time periods during which she had to find sources of income independently. The respondent engaged in a number of activities, including charcoal burning and handicraft sale, while waiting for remittances from her husband who was working as a truck driver. If one activity did not do well, she would switch to another.

The vulnerability of female-headed households without a reliable source of income from salary or remittances was illustrated by a case from Mbitini. The woman's husband had died, her two daughters were both very ill (long term), and her only son had left for Mombasa in 1984 and had never returned. The respondent had two young children from her unmarried daughters to look after. Caring for her daughters and grandchildren was time-consuming, and she devoted most of any remaining free time to casual labour. The type of casual labour that she could mostly get, digging terraces, was very hard work and only paid 50 Kenya Shillings per day (in 1998, the equivalent of approximately US$0.70). This amount provided food for two days only and competition meant that she could not be assured of getting work every day. As a consequence, the respondent had been forced to sell three-quarters of her land as a source of income.

The strategy of depending on a male adult's salary as a principal source of food and income during drought, and complementing this with receiving credit and selling chickens, activities over which the woman normally had control, was common to several households in both Mbitini and Saweni. Male respondents, meanwhile, avoided reduced access to food during drought in a number of ways: by running a local business; by being able to perform skilled (and more highly valued) casual labour, such as building work, almost on a daily basis; or by selling larger livestock (cattle). Those male respondents whose access to food was affected tended to lack access to employment or more skilled casual labour. As with the female respondents, men also diversified into a number of activities.

Implications for adaptation

To what extent can the findings from these case studies be generalized? It is important to recognize that the detailed characteristics of vulnerable households cannot necessarily be transferred to other contexts. At the level of the factors and processes that determine patterns of coping and vulnerability, it is, however, possible to draw conclusions of wider significance. At the most abstract level, our findings demonstrate that vulnerability can be viewed as a function of the interaction of processes at a given place in time that forms the circumstances under which people cope. A complex mesh of interactive processes creates an ever-evolving distribution of vulnerability, differentiated within the community, as households fail to identify, or succeed in identifying and implementing, effective responses to environmental stress, within a socio-economic and political context that is itself constantly changing. Describing and explaining this dynamism represents one of the main challenges of developing the conceptual and theoretical framework of vulnerability.

As far as the challenge of managing adaptation to long-term climate change is concerned, there are specific lessons that the study of coping highlights. For example, the coping perspective developed here means that people are seen as active agents rather than passive victims of circumstances. It has been shown that, in the circumstances of these case studies, people's own strategies rather than interventions, such as food aid, were critical in managing climate stress. Rather than being passive victims, vulnerable people are a heterogeneous group, facing differing opportunities and constraints, and are actively engaged in diverse strategies to reduce risk (Scoones *et al.* 1996; Christoplos *et al.* 2001; Roncoli *et al.* 2001). Empowerment must be a key component of any adaptive strategy. There are, however, limits to human responses when faced with severe environmental stress, as Liverman (1999) observes. Various factors exclude sections of the population from adopting particular coping strategies. For example, gendered access to labour power, capital, natural resources and skills, and restricted mobility, exclude many women from successfully specializing in principal coping strategies. Policies and institutional arrangements should address the factors that enable people to respond, or are constraining them from responding, effectively.

At present, some policies may be maladaptive and actually work to re-enforce and enhance constraints. For example, the Tanzania and Kenyan policy focus on increasing the resistance of agriculture to climate variability, including promoting drought-resistant crop species and improving water supply to agriculture, might actually reinforce the exclusion of population groups in drylands (Republic of Kenya 1997a 1997b; United Republic of Tanzania 1997a 1997b). These policy efforts met with several challenges: farmers were reluctant to adopt certain drought-resistant species, partly because of their low

market and consumption values, and partly because of the high labour investment associated with the cultivation of these species. In addition, the high costs of increasing drought water supply, for example, meant that local efforts would have to be supplemented with external donor funding.

Meanwhile, relatively few investments go into improving the viability of coping strategies. Low income and poor marketing opportunities may have constrained the role of indigenous plant-based activities as drought coping strategies, for example, at the two sites, despite their accessibility and traditional role. Jodha (1995) has commented that weak market and infrastructural support is a particular constraint for dryland economic activities and their niche activities and products. Bebbington (1999) similarly observes that the reason that many development interventions are unsuccessful is inadequate understanding of the way that people make a living and build their lives. He argues that rural assets, which we have investigated in terms of coping entitlements, are implicated in empowerment and change.

The process orientation that the dynamics of vulnerability suggests has another important implication for adaptive strategy. Because of the diverse nature of the coping responses that are employed, and their dynamic nature, no one model for decision-making and policy intervention can easily be applied across any community. Indeed, such a rigid approach could well reduce opportunities for coping by limiting options. Undoubtedly, poverty alleviation and livelihood diversification must be part of the policy in a context such as smallholder farming in eastern Africa. But supporting a dynamic response suggests that measures intended to facilitate opportunistic switching between strategies, or that would counter the adverse consequences of wider social and political currents in limiting proven household options, would also be desirable. For example, Anderson *et al.* (2003) suggest that strengthening linkages between dryland economies and more humid and urbanized regions is critical to enhancing choice and opportunity in the drylands.

The evolving socio-economic context, such as economic liberalization and globalization, shapes coping strategies and imposes dynamism as the availability of different response options, or access to resources in a more general sense, changes. For example, our findings suggest that the use of indigenous plants was important in various forms of complementary coping strategies, representing an important safety net for the more vulnerable members of the community who were excluded from principal coping strategies. Differential access to indigenous plants in the two areas as a result of privatization of land, in part as a result of historical and recent political decisions, has been leading to greater (and increasing) constraints on several complementary coping strategies in Mbitini compared to Saweni. In Mbitini, almost all land was private and indigenous plant products were increasingly commercialized and obtained, either on-farm or bought from neighbours. In Saweni, meanwhile, there were large areas of village forest and grazing lands to which people have access during drought. Developing social capital, social relations and institutions, particularly related to formal and informal access to local natural resources, strengthening local biodiversity, arresting the declining diversity and availability of indigenous plants, as well as enhancing the value added, marketing and income opportunities of indigenous plant-based activities all represent a proactive approach to adaptation.

Finally, the dynamic nature of coping and vulnerability suggests that policy 'intervention' should respect the complexity of the myriad processes that determine the success or failure of coping strategies, and should adopt the primary aim of supporting the inherent creativity and determination of local people.

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