

Living with Uncertainty: New Directions in Pastoral Development in Africa

(Preface and Chapter One)

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ITDG:London, 1995

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Preface

IAN SCOONES

Many of the core assumptions that provided the basis for range management and pastoral development in dryland Africa have been challenged in recent years. Such terms as 'vegetation succession', 'carrying capacity' and 'land degradation' have come under critical scrutiny. It is now accepted that many dryland ecosystems do not follow equilibrium dynamics. Instead, such systems are characterized by high levels of temporal and spatial variability in biomass production. In these non-equilibrium systems, pastoralists must avoid risks by moving herds and flocks to make best use of the heterogenous landscape; they must destock and restock in response to droughts; they must seek economic diversification to support their livelihoods; and they must defend complex rights of access to grazing and water resources.

In the past, pastoralists have been blamed for the assumed environmental destruction of the drylands. But new ecological thinking highlights how this is most unlikely. The risks of environmental degradation in non-equilibrium environments are limited, as livestock populations rarely reach levels likely to cause irreversible damage. Rather it is large shifts in rainfall that are seen to be the major factor determining the availability of grass in the rangelands. Most traditional pastoral management can now be seen to be environmentally benign, and indeed customary institutions for land management are potential models for the future.

But this does not mean all is well in the drylands of Africa. Recurrent drought, civil war and economic decline characterize too many pastoral areas. The appalling record of previous attempts to support pastoral development has convinced governments and donors alike that development investment in the pastoral drylands offers little hope. The contributions to this book argue that this is misplaced pessimism. Not only are there major costs to ignoring areas which support significant human and livestock populations, but also there appears to be a growing consensus on the basic ingredients of a new approach.

The new thinking in range ecology sheds light on many of the long-running debates about development policy and practice in pastoral areas. It highlights how and why many earlier interventions failed and points to new ways forward. A concern with variability, uncertainty and flexible responses focuses attention on the ways in which government policies

and development interventions can encourage the efficient tracking of the environment through opportunistic management.

Living with Uncertainty builds on the foundations provided by a recent rethinking of range ecology. It represents the second phase of a research project that started with a review of ecological research now published in the book, *Range Ecology at Disequilibrium* (Behnke, Scoones and Kerven (eds.) 1993). This book, drawing on ecological work carried out in Africa over recent years, provides firm support for the contention that many dryland pastoral areas are characterized by non-equilibrium dynamics and that many pastoral livestock and land management strategies can be interpreted as being a direct response to this. The question then follows: so what? What are the practical, policy and development implications of the new ecological thinking? These questions are the subject of the chapters in *Living with Uncertainty*.

The book arose out of a workshop held in June 1993 when a group of researchers and development practitioners concerned with pastoral development issues came together to elaborate new directions for pastoral development suggested by recent rethinking of range ecology. The chapters in this book are edited versions of the theme papers commissioned for this workshop. They are complemented by several other overview and commentary chapters which attempt to draw some of the issues together into a more coherent whole.

The book starts with an overview paper by Ian Scoones which introduces many of the themes discussed in the following chapters. This is followed by a chapter by Jim Ellis which provides a brief historical introduction to the ecological debate that underpins all of the contributions to the book. The next chapter by Gregory Perrier examines issues of planning and development in pastoral areas. He argues for the need for flexible and responsive planning processes that are in tune with pastoralists' needs.

The following three chapters deal with ways of encouraging an effective tracking strategy. Wolfgang Bayer and Ann Waters-Bayer discuss the various means of ensuring alternative feed supplies for rangeland animals. Livestock-crop farming linkages, supplementary feeding and range improvement strategies are considered. John Holtzman and Nicolas Kulibaba tackle the question of livestock marketing. They argue that increasing the efficiency and competitiveness of the marketing system is the surest way of offsetting price and supply instability. Together with Camilla Toulmin, they also note that social welfare interventions to prevent destitution are also necessary in highly variable environments. Toulmin's paper looks at destocking and restocking through the drought cycle. She examines the importance of indigenous systems of tracking, as well as the potentials for external intervention, with an assessment of recent non-government organization experience in this area.

Charles Lane and Richard Moorehead examine the issue of resource tenure in pastoral areas. They show how most conventional theories, particularly the 'tragedy of the commons' model, are inadequate explanations for actual practice. They provide a strong argument for supporting

customary tenure arrangements, with the promotion of conflict resolution mechanisms.

The institutional dimensions are taken up by Djeidi Sylla. With an examination of project experience in pastoral institution building from across Africa, Sylla offers a thorough critique of past approaches. He points to the need for a diversity of pastoral organizations, recognizing that different groups may be appropriate for different tasks. For instance, permanent organizations may be formed around regular, common tasks while *ad hoc* bodies may tackle episodic events or issues of concern to more specific interest groups. Such local groups may federate into wider associations, offering opportunities for policy lobbying and advocacy work.

In the next chapter, Jeremy Swift examines the appropriate roles for state intervention and locally led development. He argues that in highly dynamic ecosystems it is important to decentralize power and responsibility to the lowest level consistent with the provision of services and maintaining accountability. The state's important residual role is therefore focused on providing the legislative framework for conflict resolution, as well as the provision of basic infrastructure and services.

The final chapter is a commentary by Stephen Sandford who offers his reflections on the potential importance of the new directions for pastoral development elaborated in the rest of the book. He concludes that the new directions offer an important way forward, but there remain significant challenges.

These challenges must be met through practical experience in the field, as well as encouraging the dissemination of new thinking through educational establishments. Without the re-equipping of a new generation of range managers and development professionals working in pastoral areas, the mistakes of the past will undoubtedly be repeated. This book will, we hope, go some way towards providing a new framework for practical action.

1. New directions in pastoral development in Africa

IAN SCOONES

Rethinking range ecology: some implications

The last few years have seen a major rethinking of some of the hallowed assumptions of range ecology and range management practice. What were once the hallmarks of the discipline are now being questioned. The utility of terms and concepts such as 'vegetation succession', 'carrying capacity' and 'degradation' are being reassessed, particularly for the dry rangelands where system dynamics are dominated by highly variable rainfall and episodic, chance events such as drought (Ellis and Swift 1988; Westoby *et al.* 1989; Behnke and Scoones 1993; Ellis this book).

This 'new' thinking¹ highlights in particular the differences between so-called equilibrium and non-equilibrium environments. Equilibrium environments are those that show the classic feedback mechanisms normally assumed in mainstream range management. In such settings vegetation change is gradual, following classical successional models (Clements 1916; Stoddart *et al.* 1975). Livestock populations are in turn limited by available forage in a density-dependent manner, so that excessive animal numbers, above a 'carrying capacity' level, result in negative effects on the vegetation. In the longer term this is assumed to cause more or less permanent damage—degradation or desertification. Such environments are typically found in wetter areas with more predictable patterns of rainfall.

By contrast, in non-equilibrium environments range degradation is not such an issue. Production potentials of both grassland and livestock are so dominated by rainfall (or other external variables) that the livestock populations are kept low through the impact of drought or other episodic events. Livestock, under such conditions, do not have a long-term negative

¹ As with most 'new' thinking there are some long-term precedents. Indeed ideas about non-equilibrium dynamics in ecosystems can be traced back to the early 1970s (for example, Holling 1973; May 1973, 1977). Parallel shifts have occurred in other areas of the natural sciences where interest in non-linear dynamics and chaos has provoked much debate (Gleick 1987; Ruelle 1991).

effect on rangeland resources.² Such non-equilibrium environments have highly dynamic ecosystems and are typified by the arid or semi-arid zones where rainfall variability is high.

In practice, the distinction between these contrasting environments is often blurred. There is clearly a gradation between these two separate ideal types. In some sites more stable, predictable equilibrium dynamics may occur in a run of wetter years, with non-equilibrium, uncertain, event-driven patterns emerging when a dry period strikes. Equally in any one area there may be certain areas which commonly show a more equilibrial pattern (e.g. relatively wetter bottomland sites where primary production varies little between years) within a wider landscape of dry rangeland which shows non-equilibrium dynamic patterns with high levels of inter-annual variability (Scoones 1993).

Pastoral populations in Africa largely live in dry environments with dynamic, non-equilibrium ecologies. Indeed 59 per cent of all ruminant livestock in Africa are reported to be found in arid and semi-arid areas. This represents a significant proportion of Africa's agricultural production. The total value of livestock products is estimated to be 25 per cent of the total agricultural output, equivalent to US\$12 billion in 1988 (USDA 1990). If livestock benefits of manure and draught power are also included, this figure may increase to 35 per cent of total agricultural GDP (Winrock 1992). In other words, in considering the importance of arid and semi-arid production systems and the significance of dynamic, non-equilibrium ecologies we are talking of significant areas of land, supporting large numbers of pastoral livelihoods and contributing a large amount to national economies.

Recent ecological thinking suggests a number of propositions that potentially have far-reaching implications for the way we must conceive the theory and practice of range management and pastoral development in Africa and indeed other dryland areas of the world with significant pastoral populations. Three propositions summarize the recent rethinking of range ecology (Behnke 1992; Behnke *et al.* 1993; Sandford this book):

- Many arid and semi-arid grazing ecosystems are not at equilibrium and external factors (e.g. drought) determine livestock numbers and vegetation status. Grazing therefore has a limited effect on long-term grass productivity. In such situations opportunistic or tracking strategies are environmentally benign and waste less feed.
- The productivity of African rangelands is heterogeneous in space and variable over time, therefore, flexible movement is critical.
- African pastoral production systems are influenced by a range of differentiated livelihood objectives. Therefore blueprint interventions aimed at boosting single outputs (e.g. meat) using simplistic management tools

² However, impacts on tree resources are more complex, as heavy browsing or extensive lopping may affect long-term productivity due to slow regeneration rates (Bayer and Waters-Bayer this book).

(e.g. fixed carrying capacity) as part of standardized models (e.g. ranches) are unlikely to work.

The new ecological thinking suggests a number of key principles for management and policy in the drylands of Africa. The high level of variability seen in dynamic ecosystems requires an emphasis on flexible responses to uncertain events, and mobility to allow the optimal use of a heterogeneous environment. Contingent responses are critical to successful survival in a hostile and uncertain environment. Because of unpredictability, prescriptive planning and imposed solutions will not work and locally derived responses are the key to success.

Recommending that development should take note of the need for flexibility, mobility and local level solutions is hardly new. Indeed much of the social science critique of development in pastoral areas has focused on just these issues (cf. Monod 1975; Horowitz 1979; Galaty *et al.* 1981; Swift 1982; Sandford 1983). Ethnographers of pastoral societies equally have documented in great detail the way pastoral livestock keeping is adapted to environmental variability (e.g. Gulliver 1955; Dupire 1962; Dyson-Hudson 1966; Spencer 1973; Dahl 1979). What we are now seeing is a convergence of concepts, of interpretations and of analyses between the natural and social sciences. This convergence of course parallels what pastoralists have known and acted upon all along. The sad irony is that it is only now that the non-pastoralists, who dominate the professions which advise on and plan for pastoral areas, are catching up.

The last 30 years have seen the unremitting failure of livestock development projects across Africa. Millions of dollars have been spent with few obvious returns and not a little damage. Most commentators agree that the experience has been a disaster, so much so that many donors and other international agencies have effectively abandoned the dry zone in their development efforts. For instance, USAID, once a major donor in dry Africa and the supporter of many ill-fated livestock development projects, has dramatically reduced its support in this sector. Similarly the International Livestock Centre for Africa (ILCA) redirected its research focus away from dry areas and now concentrates on milk and meat production in the 'high-potential' zones (ILCA 1987-92). So should development agencies (international donors, national governments, NGOs) abandon the drylands as a 'no hope' area? Or should we reconsider, and analyze in detail why the failure has been so consistent and what lessons can be learned from the convergence of recent ecological thinking, social science critiques and pastoralists' own practices?

This book takes a positive view for three reasons. First, the costs of abandoning pastoral areas are potentially enormous. Second, many of the reasons for development failure are clear. Third, recent ecological thinking offers new perspectives and new insights that just might offer a way forward.

Conflict and civil strife dominate many pastoral areas today at great social cost, in parts of Somalia, Kenya, Ethiopia, Uganda, Mali and other areas. Such costs are borne most heavily by the residents of the pastoral

areas, but also by national governments and the international community who, in a variety of ways, bear the costs of insecurity and famine. Without a recognition of the problems of pastoral areas and support for development needs, problems of insecurity are likely to increase (Hjort and Salih 1989; Markakis 1993).

The reasons for the failure of many of the development projects imposed on pastoral areas from the 1960s are increasingly clear. In some quarters the lessons are being learned and a new era of more appropriate and apparently successful projects are emerging (Oxby 1989; Grell 1992; Vedeld 1993). The new thinking in range ecology puts much of this debate in sharper focus. In essence, the history of livestock development in Africa has been one of equilibrium solutions being imposed on non-equilibrium environments. The ranch model (and its many variants) has long dominated the curricula of professional training in range and livestock management. As a consequence the ranch model has been highly influential in development practice. But ranches with fenced paddocks, water points and reseeded rangeland are classic components of equilibrium systems. Management is focused on keeping things as stable as possible through the regulation of animal numbers and balancing grass species composition ('increasers' and 'decreasers'). Such management is ill-suited to highly dynamic ecosystems. Of course, ranchers and pastoralists making a living in dry areas recognize this. They have to, because textbook solutions do not work. They either adapt or abandon the ranch model recommendations and evolve alternative solutions that are viable. This has occurred in the US, where the ranch model originated, as well as in Africa (Gilles 1993).

The problem is that the learning experiences of pastoralists or ranchers and the intricate knowledge that is embedded in practical action is so often overlooked or ignored by development agencies. At the same time, year after year graduates of universities and training colleges in Africa and elsewhere emerge into the world of practical development as planners, policy makers, extension workers, NGO staff, expatriate advisers and so on with a blueprint model for livestock development that is basically unworkable in many settings. The institutional learning process in many donor agencies and government departments is often so slow and so poor that field experiences are rarely fed back into revising strategies and approaches. Senior professionals, who have learned much through bitter experience on the ground, are quickly promoted up and away from practical implementation activities. Livestock keepers themselves, those with the most direct experience of practical management of all, are rarely consulted let alone fully involved in programme design and implementation (Perrier this book). The consequence is that failures are repeated and repeated, apparently *ad infinitum* (Roe 1991a,b, 1993).

However, there are some encouraging signs which are beginning to gain wider currency among the development community. For instance, the World Bank has provided support for pastoral associations in the Sahel (Shanmugaratnam *et al.* 1992; Sylla this book). This followed a critical analysis of pastoral investment approaches which firmly rejected the ranch model (de Haan 1991). Similarly, the German development agency (GTZ)

is emerging as a leader in exploring new ideas in field settings with pilot projects in the Sahel.

A discussion of new directions for pastoral development prompts a convergence of many strands of thinking, a weaving together of ideas and concepts that have diverse origins yet similar implications. This book concentrates on one strand, exploring the applied implications of recent ecological thinking for practical policy and management issues. There is little point in proclaiming the emergence of a new paradigm of thinking in range ecology without exploring the implications. This book attempts to ask the basic question: how will recent ecological thinking change policy and practice in pastoral development in Africa? This is a major challenge in a complex area and this book is clearly only a preliminary attempt. A significant hurdle lies in the effective translation of languages between disciplines. Ecological issues provide a starting point for the debate (see Behnke *et al.* 1993), but the policy and management implications of recent thinking are mediated by political, economic, social and cultural considerations. Finding a way of bridging between issues and interpretations will be key in finding practical ways forward. This overview chapter thus attempts to pick through a variety of interlocking and overlapping debates and suggests a number of key policy and management themes that will guide new directions in pastoral development in Africa.

This overview chapter draws on the themes developed more fully in subsequent parts of the book. The chapter starts with a discussion of planning alternatives followed by an examination of livestock-crop interactions and fodder supplementation. The discussion then turns to tracking strategies with a look at movement, destocking and restocking, as well as marketing options. Issues of resource tenure, institutional development and administration are considered next. The chapter concludes with a discussion of the investment and policy implications of these new directions in pastoral development.

Unpredictable change: alternatives to conventional planning and intervention

Pastoral areas are typified by high levels of unpredictable variability. From one season to the next you cannot know what will happen. Contingent responses to uncertain events characterize pastoral strategies. This involves seizing opportunities and avoiding hazards (Westoby *et al.* 1989). The more uncertainty there is at the local level, the more planners try to impose order through generalized development solutions. Millions of dollars have been spent trying to make unpredictable environments more predictable (e.g. through expensive early warning systems or irrigation schemes). Rather than addressing the issues of variability and uncertainty head-on, the development debate becomes dominated by unworkable, generalized solutions derived from simplistic analyses of complex problems (Roe 1991a). So, for instance, range privatization follows from the tragedy of

the commons or ranch development follows from technology transfer and modernization approaches.

Under conditions of environmental uncertainty, planned intervention of any sort becomes problematic. Conventional planning and mainstream development intervention are premised on assumptions that the future can be predicted, inferred from patterns that have occurred in the past. Blueprint plans are designed and development investments approved on this basis. But is this mistaken under such conditions of variability and uncertainty?

Blueprint or adaptive planning?

There are two basic alternatives for planning in an uncertain world. The first aims to reduce uncertainties to probabilistic descriptions of variability by the collection of more and more data on more and more variables. The assumption is that more information will allow the prediction of outcomes at least in a probabilistic way. The result will be, it is hoped, a better defined problem (appropriately differentiated and accounting for recognized complexity) allowing for more effective plans. These are still blueprint plans, but better informed ones.

The alternative is to accept that uncertainty and indeterminacy are fundamental and central (Wynne 1992). No matter how much information is collected in a sensitive and differentiated manner, there is no way that all possible outcomes can be predicted and planned for. Rather than aim for 'complete' information (elaborate, multi-variate surveys) prior to intervention, it is better to act incrementally and initiate a learning process that monitors experience and feeds back lessons (Korten 1980; Schön 1983). This is adaptive management. Adaptive management relies on principles and guide lines rather than blueprints and prescriptions; it relies on a continuous learning process, rather than time-separated planning, implementation and monitoring/evaluation (Holling 1978; Walker *et al.* 1978; Walters and Hilborn 1978; Walters 1986).

These two options are obviously not mutually exclusive. For instance, adaptive management approaches may rely on pre-defined contingency planning: a suite of blueprints that allow response to a variety of circumstances. In other words, formal planning and policy-making may provide a framework within which adaptive management can operate. Despite the potentials for overlap between these two approaches to planning, the differences between them are fundamental and have important implications. If the variability that characterizes pastoral systems is unpredictable and uncertainty prevails, then we are forced to explore approaches to planning and intervention that involve adaptive and incremental change, based on local conditions and local circumstances.

These must be based on an in-built learning process, assuming that knowledge is never complete but action is always necessary (Korten 1980). Norman Uphoff comments on the adaptive learning process approach that evolved during the rehabilitation of a failed irrigation system in Sri Lanka:

With a learning process approach we did not expect to impose a linear logic on a non-linear world. Blueprints would not succeed because the situation was inherently uncertain and relations of cause and effect were probabilistic and contingent (Uphoff 1992b:397).

The learning process in uncertain environments is episodic. Particular events, such as droughts or disease outbreaks, provide important learning occasions. Establishing the facility to learn during and respond to episodic events requires new forms of institutional and organizational arrangement. Such set-ups must be both flexible and locally based, they must be able to change in response to both successes and failures, and they must be open to the risks and possibilities of failure.

Rethinking planned intervention in pastoral areas

There is a need to rethink planned intervention in pastoral areas (cf. Long and van der Ploeg 1989). Global solutions (e.g. the ranch model) imposed on local problems do not work. The assumption that Western science and technology can provide planned solutions to particular problems under conditions of high unpredictability and immense variability is clearly unfounded. Yet the domination of Western science has engulfed so much of the development process (Marglin and Marglin 1990), putting forward technical solutions to political problems such as poverty. Blueprint solutions so often ignore the important contextual issues of politics, history and culture that necessarily impinge on technical development.

Such imposed, blueprint plans are almost inevitably rejected, either openly or by more subtle means (Scott 1985, 1990). For instance, in Lesotho, Ferguson (1990) shows how local resistance to imposed plans involved both active sabotage and simple non-compliance. He argues that blueprint plans are not simply the result of poor or inadequate information. Instead, plans reflect political ambitions, whereby livestock development in Lesotho has acted as a smoke-screen for other agendas being played out in the development arena, ones involving the expansion of state control or the assertion of authority by local elites. Blueprint, technicist, imposed plans thus suit the wider political objectives of these actors. It is this political dimension to conventional planning approaches that helps to explain the tenacity of the blueprint planning approach.

A learning or process approach to development accepts that there are multiple sources of knowledge to draw on, both locally and externally derived; there are a diversity of perceptions and interpretations of a particular situation; there are always a variety of interests in a range of alternative options; and the process of development and change is inevitably one of negotiation, sometimes conflictual, sometimes consensual (Long and Long 1992; Scoones and Thompson 1993, 1994). In other words, development planning must recognize the variety of actors involved and accept that planning is ultimately a political process of consensus building between often divergent interests. Hybrid plans or evolving adaptations will be the most likely outcome rather than pre-specified blueprints. Such

process planning, if facilitated skilfully, may offer unexpected and potentially successful solutions for the challenges faced in pastoral areas.

New methods, skills and professionalism

Process planning and adaptive management require new methods, new skills and, above all, a new professionalism (Chambers 1992, 1993). Conventional livestock development has been dominated by such technical disciplines as animal breeding, veterinary science or improved forage agronomy. The applied discipline of range management has had some influence, although, as we have seen, its contribution has been almost exclusively geared towards equilibrium settings. Social science inputs have been fairly limited, with economics perhaps contributing most when questions of livestock marketing and trade are considered. Insights from institutional sociology, organizational management, social anthropology or law have been marginal. There is now a need to rethink the disciplinary balance of research expertise in livestock development. This is not to say that technical research is not required. It certainly is; there are many issues ranging from veterinary epidemiology to fodder improvement that require sustained, well-supported basic research (Winrock 1992). However, for this research to be well focused, providing the right answers to the right questions, it must be complemented with other inputs. But perhaps more importantly, there are a number of key issues that require particular social science attention. The uncertainty that dominates dryland environments means that local solutions are key, demanding flexible responses in diverse institutional settings and negotiation of interest groups with arbitration of disputes.

But perhaps even more important than reviewing the disciplinary mix of researchers is a re-examination of the context for research. Conventional, blueprint approaches to planning assume a stable world within which technical solutions can be implanted. The technology transfer model assumes that there is a more or less linear flow of information and ideas from basic researcher to applied researcher to extension worker to pastoral producer (Chambers 1983; Chambers *et al.* 1989). This transfer mode is reinforced by the structural separation of basic and applied research activities. The linear mode is also reinforced by the separation of research and extension activities, with extension expected to take 'off-the-shelf' messages or packages and deliver them to producers (e.g. through the Training-and-Visit system) (Moris 1991; Pretty and Chambers 1993). Aspects of this system may be appropriate to equilibrium environments (such as the rainfed lands of the so-called Green Revolution areas of Asia), but the transfer of technology approach is wholly inappropriate for the highly variable, unpredictable and complex environments found in pastoral areas. The context for research and extension must be changed for such settings.

Tracking a variable environment: how to support opportunistic management strategies?

In uncertain environments fodder availability fluctuates widely over time and space. Grass production may range from zero to several tonnes per

hectare, depending on rainfall. Such variation is spatially differentiated, with some areas showing more stable patterns of primary production while others are highly unstable. Making use of such a variable fodder resource requires tracking. Tracking involves the matching of available feed supply with animal numbers at a particular site. This is opportunistic management. Opportunistic management involves seizing opportunities when and where they exist and is thus highly flexible and responsive. Effective tracking may be achieved in four ways:

- Increasing locally available fodder by importing feed from elsewhere or by enhancing fodder production, especially drought feed, through investment in key resource sites.
- Moving animals to areas where fodder is available.
- Reducing animal feed intake during drought through shifts in watering regimes, reducing parasite loads or breeding for animals with low basal metabolic rates.
- Destocking animals through sales during drought and restocking when fodder is available after the drought.

These four strategies are discussed in turn in the following sections.

Existing livestock management strategies in dryland Africa combine all four of these options to varying extents (Box 1). Drought feeding strategies involve extensive lopping of browse species or the collection of tree pods. In some parts of Africa, particularly in North Africa where feed grain is heavily subsidized, livestock keepers maintain animals through the importation of supplementary feed. Indigenous zebu cattle are physiologically adapted to low feed intake with metabolic shifts allowing reduced need for survival feeding. The same applies to camels and small stock. Movement is central to the survival strategies of transhumant pastoral systems. Equally, local level movement is important in agropastoral systems. Drought sales of livestock are also important, although often a last resort.

Tracking is not easy and in most cases not very efficient (Sandford this book). Tracking strategies also run counter to elements of the conventional wisdom of many range managers and livestock development specialists. The mainstream view argues that a safe conservative strategy is desirable because it reduces the risk of large-scale fluctuations in numbers and output; it buffers the potentially environmentally damaging effects of temporary overstocking; and fits within the ranch model of development where particular interventions ('improved' breeds, fences, paddocks, rotations) can be implemented most effectively.

Unfortunately, a conservative stocking strategy is also inefficient and can impose heavy costs. Over time, extended periods will occur where fodder is left unused. Low stocking rates may result in additional burdens with reduced grass palatability due to undergrazing and increased fire risks. On occasions when grass production collapses completely, the conservative stocking level will itself be too high to be sustained in a limited area. Such occasions may be devastating for a rancher who, hemmed in by fences, has little option for flexible movement and is unpractised at responding to such rare events. In addition, conservatively stocked ranches

Box 1. Pastoral tracking strategies

During drought

- Long-distance transport of animals to feed-surplus areas (trekking, truck transport, etc.)
- Feed supplementation (lopping, hay-making, concentrate purchases, etc.)
- Cereal stores to prevent needless distress sales of livestock
- Animal health care (e.g. dosing with anti-helminthics), recognizing that animals die more of disease than starvation in drought
- Diversification or switching of species composition within the family herd
- Herd and family splitting
- Supplementing or diversifying income from other livelihood sources besides animals

After drought

- Investment/re-investment of surpluses from other activities in livestock (especially small stock with high reproductive rates)
- Transfers of animals within social networks (whether with kinship basis, or with stock associates, etc.) on which individuals have legitimate claims

invariably have lower financial returns than opportunistically managed 'traditional' systems on a per area basis (Table 1).

The primary trade-off, however, may not be between opportunistic, tracking strategies and conservative, ranch management strategies. Conventional ranching systems represent less than five per cent of the total livestock population in Africa (Winrock 1992). In most cases they follow conservative regimes for very good reasons. Despite the rhetoric of some protagonists, ranching is not an alternative for most African livestock systems. While this has been recognized by some of the major donor agencies (cf. de Haan 1990), the ranch model, in various guises, continues to be promoted by both national governments and donor agencies.

The most important trade-off is between efficient and inefficient opportunism or tracking. The development challenge is thus not the transformation of pastoral systems into ranching systems, but increasing the efficiency of tracking (Sandford this book). How can this be done? There are a number of development options suggested by this analysis that can be grouped under the four tracking strategies outlined above. Again such options are not mutually exclusive, but each derives from an acceptance that, in order to improve the livelihoods of livestock keepers living in a highly variable, often uncertain environment, enhancing tracking opportunities and reducing the chances of livelihood loss through drought (or other episodic events) are key principles for designing practical options.

Feed alternatives to rangeland during drought

Most fodder research has concentrated on the enhancement of range productivity in 'normal' years. Reseeding with legumes or planting of fodder trees appear to provide some promise of boosting productivity in more humid agro-ecosystems, but such technologies have rarely proved viable in drier situations, especially when repeated droughts or intense grazing wipe out vulnerable grass and legume species or kill trees (Bayer and Waters-Bayer this book). The attempts by fodder agronomists or agroforesters to provide equilibrium solutions for non-equilibrium settings has thus proved very disappointing.

Understanding how most pastoral herds use the fodder landscape in dry areas, however, suggests an alternative strategy for such interventions. In dry seasons or in dry years, animals depend on relatively small patches within a wider dryland landscape. These are the 'key resources' that sustain animals in times of fodder shortage (Scoones 1994). Traditional tracking strategies usually involve strategic movement to such sites. It is these areas, rather than the open range, that should be the focus for fodder improvement. Enhancing (or even creating) key resource areas through investment in fodder management, reseeded and environmental rehabilitation appears to offer chances for productivity enhancement in good years and survival feeding in poor years (Barton 1993). For it is in such key resource areas, characterized as they are by a more equilibrium environment (often run-on sites with highly available soil water and nutrients), where legume seeding and tree planting (of existing species using existing management techniques) may have some chance of success.

Depending on the livestock species, browse may also act as an important key resource. The availability of coppiced trees and shrubs in dryland areas is often critical to the nutrition of livestock in times of drought (Le Houérou 1980; Barrow 1991). Tree pods in particular may be an important protein supplement that increase appetite and ensure maintenance of animals during periods of stress (Coppock and Reed 1992; Oba 1993). To many mainstream range managers trees within rangeland areas represent 'bush encroachment'. Great effort has been invested in cutting down such trees, removing in many cases the very browse resources that can allow animals to cope with drought. In dynamic ecosystems, the trade-offs between productivity under good rainfall conditions (where bush decreases grass growth through competition under conventional equilibrium dynamics) must be balanced against productivity under drought conditions, where non-equilibrium conditions apply and the browse component of the fodder landscape is critical. Thus for pastoralists attempting to track a highly variable environment it is important to sustain a scrub woodland where browse fodder is accessible to animals within range areas.

Pastoral-agricultural linkages

Some commentators argue that closer links between pastoral and agricultural systems and the evolution of integrated, mixed farming systems is both inevitable and highly desirable on the grounds of efficiency (McCown *et al.* 1979; McIntire *et al.* 1992). But does close crop-livestock interaction

Table 1. Comparisons between ranching and pastoral production systems in Africa

<i>Country</i>	<i>Comments</i>	<i>Sources</i>
<i>Zimbabwe</i>	All studies show that the value of communal area (CA) cattle production far exceeds returns from ranching. If actual stocking rates are used, CA returns are 10 times higher per hectare.	Danckwerts (1974) Jackson (1989) Barrett (1992) Scoones (1992a)
<i>Botswana</i>	Communal area production (in cash, energy and protein terms) per hectare exceeds by at least three times per hectare returns from ranches, even though technical production parameters are lower. The difference in soil erosion levels between the two production systems is negligible, despite differences in stocking rate.	Rennie <i>et al.</i> (1977) Carl Bro (1982) Hubbard (1982) De Ridder and Wagenaar (1984) Abel (1993)
<i>Mozambique</i>	Traditional systems have higher overall returns per hectare because of the multiple benefits of draught, transport, manure, milk and meat compared to the single beef output from ranches.	Rocha <i>et al.</i> (1991)
<i>South Africa</i>	Cattle production systems in the Transkei show higher returns per hectare, but lower productivity indicators, compared to ranches in the commercial white farming sector.	Tapson (1991, 1993) Richardson (1992)
<i>Kenya</i>	Gross output levels in individual ranches and undeveloped group ranches are comparable. Maasai multi-product outputs are higher than ranches on a per hectare basis.	De Leeuw <i>et al.</i> (1984) Bekure <i>et al.</i> (1991) Western (1982)
<i>Tanzania</i>	The productivity of pastoral herds in the Ngorongoro Conservation Area were found to be comparable to commercial herds. The patterns of productivity were similar to those found in Kenyan Maasai herds. Similarly high levels of productivity were found among livestock in Sukumaland.	Birley (1982) Homewood and Rodgers (1991) Homewood (1992)
<i>Uganda</i>	Recalculations of figures to include the full range of costs and benefits show that dollar returns per hectare under pastoralism are two times higher than for ranching. Dollar returns per animal are a third higher.	Ruthenberg (1980) Behnke (1985a)
<i>Ethiopia</i>	The pastoral Borana system has higher returns of both energy and protein per hectare compared to industrialized ranching systems in Australia. Australian Northern Territory ranches only realize 16% of the energy and 30% of the protein per hectare compared to the Borana system.	Cossins (1985) Upton (1989) Cossins and Upton (1988)

Table 1. Continued

Country	Comments	Sources
Mali	Transhumant pastoral systems yield on average at least two times the amount of protein per hectare per year compared to both sedentary agropastoralists and ranchers in the US and Australia.	Breman and de Wit (1983) Wilson <i>et al.</i> (1983)

imply the potential for improved tracking? Various arguments are put forward to justify crop–livestock integration. Below I will examine three of these.

Mixed farming systems are more efficient. This claim is based on a number of related arguments. The first relates to the ‘inevitability’ of intensification due to population pressure. As increases in population occur the premium on land grows as does the availability of labour. The result is an ‘evolutionary’ process of intensification (Boserup 1965, 1981; Pingali *et al.* 1987; Tiffen and Mortimore 1992), resulting in a move from extensive pastoralism to intensive mixed farming. As intensity of production increases, so the argument goes, the costs of production decrease, especially those that relate to transportation of inputs. In addition, in an integrated agropastoral system the transaction costs of negotiating contract herding or manure–crop residue exchanges disappear (Toulmin 1992b; Bayer and Waters-Bayer this book).

Despite the appealing logic of arguments in favour of livestock–crop integration on-farm, there are a number of pitfalls (Gass and Sumberg 1993). Although certain efficiencies may increase at the level of the farm unit, there are a range of inefficiencies at the broader geographical scale that arise through integration, particularly in the semi-arid zone. The production efficiency of individual animals may decrease in settled farming areas as compared to transhumant pastoral settings. For instance, Wilson and Clarke (1976) report the higher production indexes of migratory livestock in western Sudan. Other research, however, is more equivocal. Wilson (1982) found no significant differences between transhumant and agropastoral livestock in Mali, while van Raay and de Leeuw (1974) found settled livestock to be more productive in northern Nigeria because of their preferential access to prime grazing. However, generalizations are difficult to make, as there are highly efficient mixed farming systems found in the dry areas of southern Africa (Scoones 1992a; Abel 1993), where there has been a long tradition of integration.

In some settings, such as in the West African Sahel, the comparative advantages of the agricultural and pastoral areas may be lost through integration. If pastoral livestock are increasingly incorporated into agropastoral areas, and transhumant movement tracking the production vagaries of the dry rangelands is abandoned in favour of more ‘efficient’ settled production systems in more equilibrium environments, then the opportunity for exploiting large areas of dry range will be lost. Under conditions of

land pressure, to encourage the abandonment of the dry rangelands may be an inefficient solution. On top of this, the loss of pastoral livelihoods will result in additional costs as people migrate to the towns in search of casual employment or are driven to destitution. In terms of wider social welfare, in any country with a pastoral population, this can hardly be regarded as an efficient solution.

Mixed farming increases feed diversity and decreases variability in feed production. Mixed farming systems usually increase the diversity of feed available to animals compared with access to range resources alone. Crop residues, feed concentrates, agro-industrial by-products, as well as graze and browse in rangelands and between fields, offer a wide diversity of alternative feed. The variability of primary production in dry rangelands is high primarily due to rainfall variability.³ Coefficients of variations of crop residue production in comparable areas are lower (although coefficients of variations of grain production are higher). This implies that in most semi-arid areas it is easier to track a variable environment with access to crop residues, as crop residues act to dampen some of the variability of production seen in the rangelands (Sandford 1988; Bayer and Waters-Bayer this book).

Some argue that the feed diversity and reduced variability of fodder production found in mixed agropastoral systems offer greater fodder security, making tracking variable environments more efficient in mixed agropastoral systems. However, while mixed farming systems offer a diversity of feed sources, this is also true for many pastoral systems. Flexible movement over extensive rangelands means that a great variety of grass and tree associations can be exploited, making good use of the varied phenology, production dynamics and forage quality of the different sources. In addition, pastoralists almost invariably have some access to crop residues and other agricultural by-products. Catch cropping by pastoralists often results in more fodder than grain. In addition, grazing arrangements between pastoralists and agriculturalists have long been a route for pastoralists to gain access to farm resources (Powell and Waters-Bayer 1985; Toulmin 1992b; Powell and Williams 1993). Pastoralists also purchase feed concentrates and other supplements to complement range resources and facilitate tracking.

Account must also be taken of scale. Production variations may be very high between seasons or years if a restricted single farm area is considered. However, if the scale is increased production variability decreases sub-

³ Data from the southern rangelands of Ethiopia shows the coefficients of variation of grass biomass production to range between 19 and 59 per cent (short rains) and 25–47 per cent (long rains) (Bille 1982; Cossins and Upton 1988; Coppock, 1994). In Zimbabwe the primary production coefficients of variation depended on soil type and degree of bush cover; they were 59 per cent in Tuli where rainfall CV was 47 per cent and 27 per cent at Matopos where rainfall CV was 38 per cent. The highest variability of grass production over 17 years was found in thornveld, clay soil areas which had been cleared (Dye and Spear 1982; Noy-Meir and Walker 1986). In Mali, coefficients of variation ranged from 86 per cent in the northern part of the Gourma to 64 per cent in the south over the period 1984–1990 (de Leeuw *et al.* 1993).

stantially, especially if the biomass variability of different parts of the larger area is uncorrelated. This is what happens in an extensive range setting, where animals can be moved between different sites with different levels of production at any given time. This flexibility is often not feasible for a mixed farmer and the high local level variability must be coped with on a reduced scale. Landscape form will also affect the ability of livestock to respond to spatial and temporal variability. In highly dissected landscapes, such as in southern Zimbabwe, where habitat heterogeneity is high and key resource patches are plentiful, livestock may be herded in relatively restricted areas and within an agropastoral setting, except in extreme droughts when long distance movement may be required (Scoones 1992b, 1994). By contrast, in more uniform landscapes, such as the Kalahari sands areas of Botswana, more extensive pastoral production systems are required, involving frequent movement between agricultural areas and cattle posts (White 1992).

Mixed farming offers opportunities for stratification of production systems. Advocates of production system stratification argue that in order to exploit the comparative advantages of different ecological zones, it makes sense to stratify the production system, with different components of the livestock production process occurring in different areas. For instance, the dry areas of the Sahel have a comparative advantage for breeding animals. The low disease incidence, the high quality feed and the skills of pastoral producers suggest that an efficient breeding operation can be sustained in such areas. However, the dynamic ecological conditions are not conducive for efficient fattening operations. Such operations, it is argued, are more efficiently carried out in more equilibrium environments, where fodder and water supplies are guaranteed. Such areas are found in the mixed farming areas of the sub-humid savannas, with greater access to input supplies (feed concentrates, agro-industrial by-products, etc.) and output markets, which in the case of West Africa are further south on the coast (Staatz 1979; Jahnke 1982; Holtzman and Kulibaba, this book).

Again, the simple logic of the argument is highly appealing. But, as before, there are complications made more pertinent by our consideration of tracking strategies. Stratification is a poor mechanism for tracking. The logic assumes that the comparative advantage is static over time. Clearly this is not the case. Rainfall variations in the 'breeding zone' will mean a highly variable supply of young animals. In periods of drought, such animals may be in poor condition and receive low prices, thus increasing the incentives for pastoralists to hold on to them for sale at a higher price. Equally, during periods of good rainfall the 'breeding zone' may be quite a good 'fattening zone' too. In such periods where plentiful fodder exists, pastoralists will be unlikely to pass on animals that have a real potential for locally added value. Thus because of the dynamic variability of the pastoral areas, static notions of stratification are largely unworkable. However, local forms of stratification do exist. For instance, in the Sahel some farmers are diversifying into livestock rearing (e.g. *mouton de case*) as a risk minimization strategy.

Tracking ecosystem variability is potentially an efficient solution for dry areas. The complementarities with agricultural areas are obviously a necessary component of the future of pastoral areas. However, arguments for mixed farming must be tempered by considerations of what efficiency means in a dynamic ecological context.

Livestock movement

Movement of animals in response to spatial and temporal variation in resource availability is perhaps the most classic of all the tracking strategies (Swallow 1994). Movement allows herders to track fodder across the landscape, making use of patchy grass production caused by uneven rainfall or variations in landscape topography. Rather than manipulating herd numbers in response to climatic variability, as would a rancher operating in an enclosed area, pastoralists move and so shift their resource endowments (Behnke 1994). Efficient tracking requires movement over different scales depending on the temporal and spatial pattern of primary production variability. For illustration, let us contrast two different areas. The first is in a highly dynamic ecological setting where primary production varies enormously between years, where a dramatic fall in fodder availability is common and where similar conditions apply over wide areas. The second case is in a more equilibrium setting where primary production variability is lower, extreme droughts are rarer and the diversity of fodder sources within a relatively small area is higher. In the first case, it is clear that access to large grazing territories are required. But as production variability decreases, the scale of grazing territory required to sustain an effective tracking strategy also decreases. However, even in the second case, the occasional extremely dry year occurs and large scale movement may be necessary.⁴

In addition to the scale of movement, the regularity of movement will differ between the two cases. Under uncertain environmental conditions, movement over long distances must be a regular occurrence, as for transhumant pastoralism (Bremen and de Wit 1983). In the second case, more typical of agropastoral settings, movement is more irregular. Exploitation of local level variability (local key resources, browse, crop residues) is sufficient in most years, and only occasional movements over longer distances are needed under conditions of extreme drought (Scoones 1992b).

Flexible and responsive movement requires institutional arrangements that ensure occasional access and that can resolve disputes and develop contingency plans for movement (Swift; Sylla this book). In cases where large scale movement is highly irregular, organizational and administrative arrangements are not geared up to facilitate movement. Very often large costs are imposed on livestock-owning people by regulations that restrict movement. Most administrative arrangements (movement permits, veterinary regulations, etc.) assume a stable environment where move-

⁴ A similar contrast can be made between the mono-modal rainfall setting of the Sahel, typified by north-south movements, and the bi-modal rainfall situation of east Africa, where relatively localized and more erratic movements are common.

ment is discouraged. However, under more dynamic ecological conditions, movement becomes increasingly central and such administrative structures impose a major cost on the production system (Scoones 1992b).⁵ When movement to particular sites occurs on a regular basis, negotiation of trekking routes and access to seasonal grazing must occur more frequently. Under such conditions institutional and administrative arrangements evolve that explicitly deal with ensuring movement and resolving conflicts.

Increasingly, arrangements that facilitate transhumance are no longer viable as key grazing land has been removed from pastoral use and put under the plough, or expropriated for conservation purposes. For instance, the Kenyan Maasai have lost over 1000 square miles of grazing over the past century as the Laikipia plateau, the Ngong hills, the Mara plains, the Amboseli swamp and the Mau forest area were removed from their control by other interests (agriculturalists, settler farmers, national parks) (Little 1987). This pattern continues today in Maasailand (Kituyi 1990), as well as many other pastoral areas (Galaty and Johnson 1990). Conflicts between agriculturalists and pastoralists have increased, particularly over 'key resource' sites, areas which are important for both agriculture and live-stock production. Under such conditions, tracking through movement becomes increasingly difficult.

Physiological tracking by low-input animals

Adaptations of animal physiology may offset expected mortality levels during drought and increase recovery rates afterwards. Indigenous zebu cattle have energy sparing mechanisms that act as an adaptation to undernutrition and water deprivation (Finch and King 1979; King 1983; Nicholson 1987). Trials show that increasing the walking distance and decreasing the watering frequency, as might happen in a period of drought, did not result in any significant loss of weight in African zebu (Finch and King 1979). Fasting metabolic rate decreased by around 30 per cent, especially in the first 30 days of undernutrition and this led to decreased water requirements (Western and Finch 1986).

Adjustments to low feed intake are also observed among calves. Studies of Borana cattle in Ethiopia show that reduction in milk supply to the calf (through human consumption or reduced cow production due to poor nutrition in drought) does not affect the longer term target weight of calves, despite reducing calf growth rates in the short term (Coppock 1992). Recovery following drought is equally rapid. When food is available again there is a rapid response in metabolic rate levels and, with an increased plane of nutrition, conception rates greatly increase amongst mature female zebus.

Shifts in metabolic rate have two important implications. First, there are

⁵ Clearly, there will be occasions when movement restrictions to limit the spread of contagious diseases and the imposition of quarantine regulations are warranted. However, in the design of veterinary regulations and associated administrative arrangements, the trade-off between veterinary control and mobility must be taken into account.

apparently no extra weight losses imposed by longer foraging treks and reduced water availability during periods of undernutrition in drought. Therefore indigenous animals are physiologically adapted to mobility and flexible responses to uncertain fodder and water availability. Second, due to reductions in fasting metabolism, more animals can be sustained on a given amount of available fodder during periods of drought than would be possible if there was no physiological tracking of the environment. In other words, forage needs in drought may be reduced by as much as 30 per cent through shifts in metabolic rate. This will likely result in significant reductions in drought-induced mortality among zebu cattle (Western and Finch 1986).

Healthy animals are best able to track environmental fluctuations. Animals with high parasite loads, for instance, are less resilient to stress. For this reason, veterinary interventions during drought periods (e.g. anti-helminth drug campaigns) may increase tracking ability of pastoral herds and flocks. Such interventions could usefully be complemented by support for indigenous systems of veterinary care, such as the feeding of browse fodder with anti-helminthic properties.

Pastoralists' own breeding strategies emphasize breeding for survival. Breeding occurs under conditions of stress, with selection pressures which encourage certain traits. This is unlike most conventional animal breeding where selection for milk or meat occurs under high-input conditions (Bayer 1989). It is not surprising that the introduction of so-called 'improved' breeds into areas with highly variable and sometimes very low feed availability have been disastrous. Breeding for physiological tracking and low-input conditions remains a challenge to be taken up by animal scientists.

Marketing

Livestock sales levels in pastoral areas are often correlated with rainfall. In periods of drought, pastoralists tend to sell more and in wetter periods, pastoralists tend to accumulate their herd capital. For instance in Swaziland, 25 per cent of the variation in annual cattle herd offtake rates was attributable to rainfall variation, 40 per cent to price changes and 35 per cent remained unexplained in an analysis of sales patterns from small-scale herds between 1950 and 1976 (Doran *et al.* 1979). Similar correlations between sales rates and rainfall levels are found in Zimbabwe between the 1920s and mid-1980s (Scoones 1990). The supply of livestock also depends on the structure of herds. In many pastoral areas, commercialization of livestock production is constrained by herd size (Behnke 1987) and herd composition (Dyson-Hudson and McCabe 1983). Livestock marketing in uncertain environments therefore must be responsive to highly variable levels of supply, both between years and between seasons.

High variability in throughput is experienced by parastatal marketing authorities and private traders alike. For instance in Kenya, the Livestock Marketing Division experienced an interannual coefficient of variation of purchases of 51 per cent between 1960 and 1978. Private traders equally

had high variability in purchase levels ($CV = 36$ per cent) over the same period (White and Meadows 1980).

The uncertainty of animal supply from pastoral areas is compounded by the high transaction costs involved in the marketing process. Because of the long distances between production areas and urban markets, transport costs are high. Equally, because of poor market infrastructure (holding grounds, storage facilities, etc.), the costs of marketing for the producer may be high.

Efficient tracking responses require getting animals to markets rapidly before prices collapse during drought. The availability of private traders' truck transport may increase flexibility and speed of response, but costs may be high if there is limited competition in the transport business. Most studies show that trekking is a more efficient option for large stock, especially where trek route facilities already exist (Staatz 1979; Sandford 1983; Holtzman and Kulibaba this book). Private or public investment may assist in offsetting some of these costs. For instance, government road schemes in pastoral areas may increase marketing opportunities. Private investment in transport (such as trucks), butcheries or small-scale meat and milk processing may increase the variety of marketing options in pastoral areas.

Most public investment in meat marketing in pastoral areas has failed. Large abattoirs or freezing plants often lie idle. The high overhead costs of maintaining large facilities working at low capacity for long periods means that most parastatal meat marketing systems have collapsed (Sandford 1983; Bekure and McDonald 1985; Holtzman and Kulibaba this book). But in some areas, parastatal marketing authorities have persisted. Political pressures have meant that parastatals such as the Botswana Meat Commission or the Zimbabwe Cold Storage Commission have been allowed to continue operating at a loss, on the assumption that they are fulfilling a useful rural development role and should not be considered only on commercial criteria. In drought periods such parastatals operate buying schemes in order to provide a last resort selling option for herd owners (Hubbard and Morrison 1985; Rodriguez 1986).

The mix of public and private investment in marketing systems needed to encourage tracking responses by pastoralists will vary from place to place. In general, governments bear high overhead costs and are constrained by bureaucratic procedures, while private operators are more flexible. This suggests that public investments are best directed to broader infrastructural support (roads, trekking facilities, etc.), while private investment is likely to be most responsive to particular local market conditions.

Constraints to efficient tracking

The previous sections have outlined different ways pastoralists can track a highly variable environment. It is clear that a combination of these strategies can allow a highly efficient pastoral land use strategy making optimal use of variable fodder supplies for maximum return over time. However,

there are clearly constraints to efficient tracking strategies. These include the following.

Labour and skills. Tracking often involves high levels of skilled labour input. For instance, flexible and responsive movement (especially complex herd splitting and phased movement of different animal types) requires skilled herding labour. Similarly, fine-tuned fodder management through drought periods also requires knowledge about animal physiology, experience of different responses to different feed combinations and labour for fodder collection and selective feeding. Again such labour and skills may be difficult to find in some pastoral areas, due to the out-migration of male pastoralists in search of alternative employment opportunities. Very often available labour is unskilled and with limited experience. This reduces the efficacy of many of the tracking strategies discussed above.

Ownership and commitments. Today, an increasing proportion of pastoral herds are owned by absentee herd owners (Little 1985a,b, 1987; Thébaud 1993). They may be government officials, rich agriculturalists or urban businessmen with little knowledge of the complexities of pastoral production in dry, dynamic ecosystems. Hired herd managers do not own the animals themselves, and so have less incentive to invest in fine-tuned tracking management. The consequence is often a different set of objectives and a lower level of productivity in absentee owners' herds compared to those of resident pastoralists (Sutter 1987; White 1990). Absentee herd owners may be able to bear this cost as they have interests in other income earning activities outside the pastoral sector. However, this inefficiency in tracking imposed by the nature of ownership and the lower commitment to pastoral production is an opportunity cost, as the same herds could be yielding a higher return under different ownership and with greater care.

Access to land. Perhaps the greatest constraint to efficient tracking is limited access to land, particularly to key dry season grazing resources. This constraint is being felt by nearly all pastoral peoples. Securing rights of access to land and water is perhaps the most important challenge for the future of pastoralism. Appropriate resource tenure regimes and associated institutional and administrative arrangements are key to increasing the efficiency of tracking (Lane and Moorehead; Swift; Sylla this book).

Borders, boundaries and conflicts. Efficient tracking very often requires access to large areas. Many pastoral populations straddle national boundaries or are resident in and around national parks or wildlife areas. To track an uncertain environment efficiently often requires access to areas across official borders or boundaries. Despite the ecological logic of flexible movement, this inevitably causes problems for state administrators who are obliged to defend the sanctity of lines marked on national maps. In some cases borders and boundaries remain notional and pastoralists can move uninhibited. Elsewhere, strong-arm tactics are employed when, for political or other reasons, it is deemed necessary to expel pastoralists from national parks or when a 'security threat' requires the state to prevent 'insurgent' pastoralists from crossing a national border (Hogg 1992; Homewood 1993). Local boundaries, within larger territories, are also

the site for contests over access rights, particularly where key resource sites are limiting (Scoones and Cousins 1994). Appropriate forms of governance and legal measures are required at both international, national and local levels to facilitate mobility and improve tracking efficiency.

Information. Efficient tracking requires good information. Ideally this information should include predictions about future patterns of resource availability. At the minimum effective tracking requires the ability to respond to current conditions, with regular up dates, so flexible responses can continue. Pastoralists traditionally use complex weather forecasting techniques and networks of communication between different well sites, oases and outposts to be able to respond flexibly to variability. Such systems have proved very efficient under the conditions of poor electronic communication and low infrastructural development in most pastoral areas. Attempts to develop early warning systems using satellite technology, while technically feasible, have not been effective in the management of pastoral areas (Buchanan-Smith *et al.* 1992; Toulmin this book).

A number of issues combine to make satellite monitoring a poor solution to increasing tracking efficiency in most pastoral settings in Africa. First, flows of information from centralized satellite imagery processing facilities to pastoral areas are slow and inefficient. Second, the information, or more particularly the holder of the information (the local district administrator or animal development officer who is often not a herder or from a herding group), is often not trusted and most pastoralists are unprepared to risk their herds' survival and so their livelihoods on information from such a source. Third, the form of the information supplied may not be what the pastoralist needs. For instance, the scale of resolution of most fodder availability maps is so coarse that its utility for fine-tuned management remains limited. Although it is feasible to gain high resolution, high quality information, the processing costs and information overload implications are excessive. As a result, pastoralists tend to prefer information that is generated by them, rather than information generated by satellites and scientists. Finally, the costs of implementing (and sustaining the recurrent costs) of such a system are beyond the means of most national governments in Africa. While satellite images and image processing are becoming progressively cheaper, the administrative and bureaucratic costs of disseminating information remain high.⁶ It is difficult to escape the conclusion that the use of such techniques is often driven by a need to find a use for the technology.

Service provision. The provision of services in pastoral areas can both constrain and support efficient tracking. Constraints arise when services are

⁶ In Australia satellite technologies are used to good effect as a tool for range planning and management. The large size of ranch properties, the dispersed nature of the ranching community and the easy access to computer and telecommunication systems means that, in the Australian case, satellite, remote sensing systems provide an appropriate technological solution (Foran and Stafford-Smith 1991; Stafford-Smith and Pickup 1993). There is therefore nothing fundamentally wrong with the use of satellite systems, it is just that they are inappropriate for most African cases. However, in the future, localized satellite systems may be developed that are appropriate for pastoral settings in Africa.

provided in a way which either limits the ability to move flexibly or withdraws labour from herding and livestock management activities. Although approaches to mobile service delivery (schools, clinics, veterinary care) have been devised and in some instances implemented (Antenneh 1985; de Haan and Bekure 1991; Iles and Young 1991; Umali *et al.* 1992; Young 1992), conventional state service provision has concentrated on the provision of services assuming a sedentary life-style or identical transhumant routes each year.

When tracking fails

Efficient tracking may not always work. There are many barriers and there will continue to be. The experience of pastoral areas in the past two decades has not been a happy one. Conflict is increasing, very often involving bloodshed; levels of destitution are rising, with increasing numbers of people being forced to leave the pastoral sector with little prospect of a return; and major food deficits sometimes leading to famine continue to haunt dry Africa. The costs of this situation, particularly locally, but also internationally, are high, and escalating.

When effective tracking fails, other options are necessary. Safety nets that can help maintain livelihoods and avoid conflicts are critical components. Without such social security measures, the opportunities for a return to pastoral livelihoods and the efficient exploitation of a variable and hostile environment are lost, for some maybe forever.

Providing safety nets. Social welfare interventions may act to avoid destitution among pastoralists, reducing the ratchet effect of poverty. If livelihoods can be sustained through external intervention during periods of crisis, such as drought, there may be a greater chance of a return to a pastoral way of life following the crisis. The opportunity costs of doing nothing are potentially very high. Previous drought periods have seen pastoral populations driven to migrate to urban areas, often ending up in settlement camps with few prospects for the future. The social costs of such outcomes are high not only for the destitute pastoralists, but also for host communities and agencies obliged to intervene.

Strategic drought interventions. Welfare and development support can be strategically timed to offset the high costs of drought on pastoral livelihoods. Such interventions include:

- Livestock price interventions to avoid mass sales;
- Food aid or cash/food-for-work to avoid the necessity of further asset disposal or famine;
- Livestock aid (fodder imports, anti-helminth control, etc.) to avoid excessive livestock mortalities.

These interventions are best implemented at a local level as part of a drought contingency plan where pre-planned actions are designed and actions implemented in relation to various 'warning' signals based on an understanding of pastoral livelihoods (cf. Buchanan-Smith 1992 for Turkana, Kenya; Davies 1992 for Mali). Too often drought interventions

have arisen through relief, resulting often in aid dependency and the loss of indigenous coping mechanisms, rather than long-term development responses. They have often been haphazard and uncoordinated, arriving too late and implemented in a poorly thought-out manner without analysis of the longer-term implications. In dryland environments 'crisis' events are, after all, 'normal'. Although unpredictable, they are certainly expected. Integrating relief with longer-term development activities is thus an important challenge.

Alternative livelihoods. Flexible exit and re-entry into the livestock sector are rare. The loss of a pastoralist's herd and flock during a drought may be permanent. Indigenous systems of stock redistribution (sharing, loaning, herding and stock associate relationships, raiding, etc.) are increasingly rare (Toulmin 1992b). Small-scale restocking operations initiated by NGOs and other development agencies (Oxby 1989; Toulmin this book) have had some success, but little impact overall. Wider interventions are required that allow opportunistic livelihood strategies that stretch beyond the pastoral sector. Providing alternative livelihood options during drought, which allow pastoralists some alternative to destitution, may provide a greater chance for re-entry into the livestock sector at a later date. Public works, cash-for-work schemes, assisted migration, pastoral reserve areas in high potential zones and provision of local income-earning alternatives may represent legitimate public investment priorities in pastoral areas (Teklu *et al.* 1991; Maxwell 1992; Webb *et al.* 1992).

Flexible resource tenure arrangements for variable environments

The conventional typology of resource tenure suggests a set of mutually exclusive property regimes. In the context of the pastoral development debate, the most common of these are private, communal and state property regimes.⁷ Yet in pastoral areas, because of the extent of spatial heterogeneity and temporal variability in resources, different resource tenure systems co-exist and overlap. Different types of property regime may be more or less appropriate at different times and places. Empirical data from pastoral areas show no neat division between property regimes, but rather a complex set of overlapping rights that are continuously contested and renegotiated. These rights may shift over time and shift from place to place.

In uncertain environments the value of resources changes sharply over both space and time. This is why we see dynamic resource tenure systems in pastoral areas, with different levels of rent extracted from a resource, depending on where the resource is and the prevailing environmental conditions at the time. When rent extraction potential rises, the incentives increase to invest in managing that resource and exclude others, if at all possible. According to property rights theory, when the benefits derived

⁷ One other non-property regime is open access settings where no rights, rules and regulations exist over use. Most areas that are seen as 'open access' are in fact state property, as the state very often holds the residual legal rights over pastoral land.

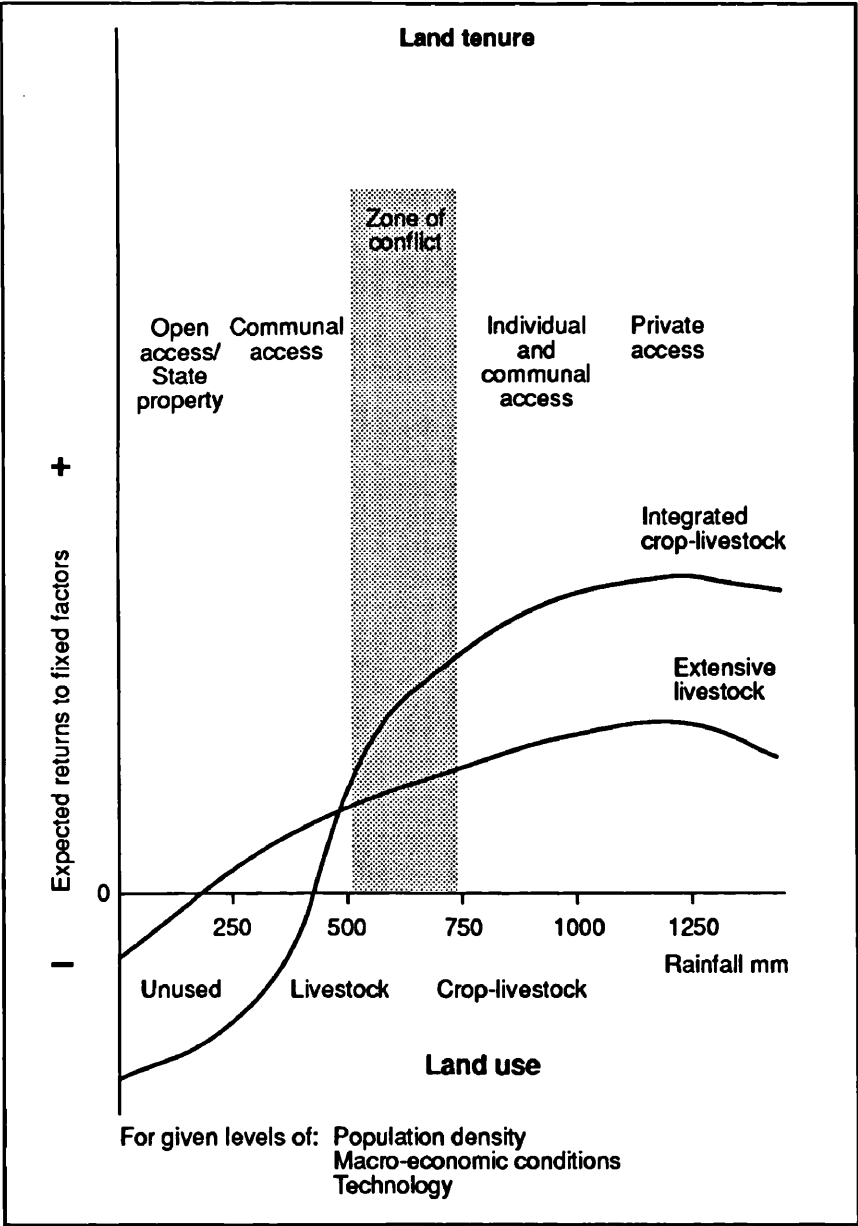


Figure 1 *The Swallow model* (Swallow, Woburn workshop)

from controlling access to the resource (as an individual or group) exceed the transaction costs of defending the resource from others and managing it, then we can expect a greater chance of more exclusive forms of property regime to emerge (Demsetz 1967; Behnke 1991, 1994; Bromley 1992; Lane and Moorehead this book). Put simply, if it pays to keep others out, then people will do so if they can. Whether such exclusive forms of tenure turn out to be private or communal will depend on particular circumstances. Local politics, social organization, assurance mechanisms and history (among many other things) may influence the emergence of new tenure settings in different ways in different places.

Expected forms of tenure can be expected to change along an environmental gradient, from drier zones where resources are generally of low value per unit area and environmental variability is high, to more humid zones where resources are of higher value per unit area and the environment tends to be more stable (Figure 1). A number of predictions follow from the property rights argument outlined above. In drier zones, more flexible forms of land tenure can be expected, involving few (co-ordinated access) or no property rights (open access). In wetter areas more exclusive forms of tenure can be expected (private property, exclusive communal tenure). In the semi-arid areas between, a more confused situation arises, with a greater range of options and a greater potential for conflict. With few exceptions, this is exactly what we see in practice (Lane and Moorehead this book).

Although the simple property rights model appears robust, there are a number of other important dimensions. The tenure situation described in Figure 1 is far from being static and must consider first, the implications of dynamic variability at a particular site; second, the implications of spatial heterogeneity; third, the implications of longer-term changes in land use across environmental gradients; and finally the social, political and historical context in each setting. These issues are examined below.

Interannual variability in resource productivity

In dryland areas fodder production varies enormously and unpredictably, as does its scarcity value. In dry years (or during the dry season) forage is at a premium, as livestock compete for the limited available fodder. In such situations the curve described in Figure 1 shifts upwards. Conversely, in seasons of relative plenty, the curve shifts downwards. As the demand-supply situation changes, so does the resource value and consequently the incentives to engage in defending resource rights. In other words, the type of resource tenure and organizational arrangements will depend on how good the season has been.

For instance, in the Darfur area of Sudan an increasing number of grazing land enclosures were seen during the dry years of the mid to late 1980s. Such areas provided restricted access grazing to particularly powerful kin groups of settled farmers in the El Fasher region. Simple thorn fences were used to exclude others, including migrant herders (Behnke 1985b; Curtis and Scoones 1990).

Spatial variability in resource value

Environmental variability also has a spatial dimension. The value of different resources within the pastoral landscape at any point along the curve described in Figure 1 is not the same. Usually a variety of patches of different quality (in terms of fodder production or forage quality) make up a heterogeneous fodder resource base. Small, high-value key resources (e.g. drainage lines or sinks, river banks, water points, salt-licks, strategic fodder reserves such as trees, etc.) may be highly contested areas, particularly in periods of drought, and are thus often areas where more exclusive forms of tenure emerge. This pattern is observed in western Sudan in wadi areas (Behnke 1985b), in Zimbabwe in *dambos* (valley bottom sites) (Cousins 1992; Scoones and Cousins 1994) and around boreholes and other water points (White 1992 for Botswana; Thébaud 1993 for Burkina Faso; Guèye 1993 for Senegal). In these cases, it has become worthwhile to exclude others, either because of drought, or because of increased population pressure or because of competition for a high-value resource.

Access to key resources is often central to the survival of the whole pastoral production system, because without access to such areas, livestock cannot survive dry periods. Removal of relatively small patches (through encroachment by agriculturalists or expropriation by state farms or other interests) can be highly damaging, inflicting major costs on the pastoral sector (Lane and Scoones 1993). It is for this reason that we see much of the conflict around resource use associated with such areas. This is particularly the case in the semi-arid zone, where such resources are especially valuable, since resource pressures are at their most intense with the competition between agricultural and pastoral uses of land. In many areas these pressures are increasing, resulting in greater contests for key resources, greater shifts in resource tenure and greater opportunities for conflict between land users.

In many pastoral areas a hierarchy of different tenure systems is seen within the same landscape: some areas are uncontested (effectively open access), other areas are managed communally according to locally negotiated rules (co-ordinated access, common property) and other areas are used exclusively (effectively private).⁸

Secular changes in resource pressure

A number of longer-term trends significantly affect the simple relationship described in Figure 1. Although the debate on global climatic change still rages, there appear to have been changes in some pastoral areas in Africa which have received progressively less rainfall with increased variability between years (Downing 1982; Hulme 1992). Substantial shifts in land use have occurred in the Sahelian region over the period from 1973 to 1988 when a decline in rainfall of 20–30 per cent was observed (Farmer 1986;

⁸ There are important differences between the *de facto* and *de jure* situation in many pastoral areas. For instance some areas may be effectively open access although they are nominally state property. Similarly 'privatised' areas may not be strictly so because of a poorly functioning land market.

IUCN 1989). In particular, as the rainfall isohyets moved south, so did the pastoral herds. This brought them into increasing conflict with settled agriculturalists (Bayer and Waters-Bayer this book).

Such changes may be combined with shifts in resource value brought about by changes in resource pressure. Increasing human populations in most parts of Africa have resulted in greater competition for available resources. As populations have increased, new forms of resource management and tenure have arisen. The expansion of arable farming into grazing areas has meant that livestock management has had to adapt. Fodder intake is maintained by the increased use of crop residues with high nutrient content, the use of arable fallows rich in legumes, the establishment of fodder trees and the practice of 'pastoral gardening', where careful grazing between fields and along field boundaries makes maximum use of available fodder (Bayer and Waters-Bayer this book; Thébaud 1993). Adaptation to increased resource pressure requires new arrangements. These may involve negotiations between farming and pastoral groups or access restrictions during the cultivation season within agropastoral communities so that mixed crop-livestock farming can continue successfully. Whatever the case, increased resource pressure inevitably means heightened opportunities for conflict and an increasing need for negotiation and arbitration procedures.

Flexible tenure regimes

Overlapping claims to resources, shifting assertions of rights and continuous contestation and negotiation of access rules dominate tenurial arrangements in uncertain environments. The solution is not to impose particular tenure types on a variable setting; whether these are uniquely communal or private they are unlikely to work. Instead, the need for flexible tenure arrangements must be recognized. This is problematic for two reasons. First, flexible arrangements, by their very nature, are difficult to codify in law, and second, because of this lack of codification, tenurial rights are difficult to defend through formal legal processes (Swift this book). This is why effective pastoral institutions are important. In the past, stable social groupings, based on kin, clan and tribal networks, were able to deal with these uncertainties. Today, this is less the case and new institutions to manage environmental variability and flexible tenure regimes are required.

Two aspects of variability require attention. First, where variability is unpredictable, then no form of prescriptive legal (or other) arrangement is of much use, except in terms of broad principles. Customary tenure systems operate shared, overlapping forms of tenure rights in such settings as maintaining strict boundaries is usually untenable. However in highly variable environments the need for conflict mediation will be fairly constant (Behnke 1994). In such cases, a form of conflict resolution *process* can be specified in law and attached to formal institutions. Such a procedural framework would have to be designed to deal with a range of unpredictable contingencies, but would offer a flexible mechanism for

dealing with disputes (Vedeld 1993). This avoids the need to transform customary land rights into formal law.

Second, when variation is more predictable, as in the case of identifiable key resources, or when longer-term trends are evident, such as expansion of arable areas into pasture lands, then more-formalized measures may be taken to secure access rights and specify tenurial regulations. In such situations, policy-makers must decide on the relative social, economic and other costs of different options (e.g. between the use of a particular area for agriculture or grazing) and examine these trade-offs in the broadest sense. Clearly this represents a policy decision ultimately determined by political processes; processes in which pastoralists are usually at a major disadvantage. Resolution of such issues must therefore rely on an increased policy leverage and lobbying power afforded by more effective pastoral organizations (see below).

In all cases, the development of flexible tenure regimes will require the consideration of a variety of trade-offs. These affect rights and responsibilities, access to resources and the form of user group (see Box 2).

Institutional development for variable environments

Most management and policy prescriptions are not attuned to flexible responses and variable environments; instead they assume equilibrium and predictability. Each of the previous sections on planning, tracking and resource tenure draw the same conclusions with regard to institutional

Box 2 Trade-offs central to negotiating tenure arrangements

Rights

Communal vs. private rights
Historical vs. current rights
Ownership vs. stewardship vs. usufruct rights
Permanent vs. temporary rights
Negotiable vs. fixed rights
Restricted vs. unconditional rights
Primary vs. secondary/tertiary rights

Access

Access to all resources vs. selected resource access
Free vs. paid access
Seasonal access vs. year-round occupation

User Groups

Exclusivity vs. inclusivity
Inheritable membership vs. non-inheritable
Homogeneity vs. heterogeneity of resource users

development. In highly variable environments it is essential to develop solutions at the local level and not attempt to impose institutional and organizational⁹ blueprints from above. In order to deal with complexity and variability in a flexible and adaptive manner, local institutions must be strong.

This section pursues this issue with a discussion of institutional development in variable environments. Two major themes run through this discussion, both of which are central to institutional and organizational arrangements for responding to the high variability and uncertainty typically found in dryland Africa. The first theme is the need for an effective hierarchy of institutional responsibility for resource management, that stretches from the local to the national and sometimes beyond. It is not simply a choice between 'bottom-up' and 'top-down' approaches as some of the populist rhetoric would have it. Since environmental variability occurs over different spatial scales, with events occurring with different frequencies, different types of institution will be appropriate for dealing with resource management and pastoral development issues at each level. Because of the uncertain and episodic nature of environmental variability, centralized and bureaucratic state institutions are generally poorly equipped for dealing with local level management issues. Centralized bureaucracies tend to aggregate, standardize and prescribe, rather than differentiate, fine-tune and adapt. It is in these latter qualities that local institutions have a comparative advantage.

Nevertheless, wider-scale institutions have important roles to fulfil. Providing a broad and enabling legal framework which offers principles and guidelines for resolving issues through local level processes is one key area. Governmental institutions may be important in resolving disputes or negotiating between parties, acting as a broker and arbitrator. Credibility, transparency, accountability and impartiality are necessary attributes currently lacking amongst government structures in many pastoral areas. Equally governments and large donor projects are best able to provide certain services in pastoral areas (roads, marketing infrastructure, basic health-care facilities, etc.).

The second theme concerns issues of conflict negotiation, mediation and arbitration. If institutional responses are to be flexible, there are always going to be points of contest where different parties disagree. The previous section's discussion of flexible tenure systems has already highlighted this. Effective tenure systems that allow mobility and flexible response to contingent events must be firmly rooted in institutional arrangements that allow for the negotiation of resource access and resolution of conflicts. The focus on flexibility and mobility switches attention from 'ideal' tenure types that may be prescribed (private, communal, etc.) to dealing with overlapping rights with greater or lesser exclusivity. As resource rights vary in space and time and between different groups of people, this requires

⁹ An institution is a complex of norms and behaviours that persist over time by serving some socially valued purpose, while an organization is a structure of recognized and accepted roles (Uphoff 1986: 8-9).

a shift of focus to conflict resolution mechanisms and institutional approaches for dealing with these. A number of principles for institutional development in highly variable, unpredictable environments can be drawn from the discussion.

Subsidiarity. The principle of subsidiarity can be a guiding concept in thinking about institutional development and administration in pastoral areas (Swift this book). Subsidiarity implies that power and responsibility should be devolved to the lowest institutional level consistent with the provision of services and maintaining accountability. In practice this implies a shift in responsibilities away from attempts at extensive state provision in pastoral areas to decentralized, local control. Rather than the state attempting to provide legal frameworks down to the lowest level, the state would offer a broad framework and require local groups to negotiate access rights and resource management agreements among themselves, while maintaining certain responsibilities for adjudication and arbitration. Similarly in the area of service provision, state support for veterinary health care or range management would be limited to basic infrastructural support with other elements being locally managed (Swift this book).¹⁰

Building bridges between customary systems and formal law. Another principle that emerges is the need to build bridges between customary systems (both *de jure* and *de facto*) and formal law. Formal legal systems, frequently anachronistic inheritances from the colonial era, often run counter to customary arrangements. The result is major conflict between state-led intervention and pastoral populations, particularly surrounding access to land. If this is to be resolved, investment in building bridges between the two systems will be enormously important (Swift this book). Without this, emerging pastoral organizations at the local level will find it very difficult to operate, especially when such local level organizations come into conflict with the state.

Pastoral institution building must recognize diverse interests. Building pastoral institutions is not an easy task. Too often an idealized notion of 'community' is imposed on pastoral societies. In fact, pastoral groups are highly differentiated, and increasingly so. There are often a wide range of diverse interests within groups, including women, men, richer herd owners, poorer people, those who are temporary migrants, absentee herd owners and so on. Some groups are more visible and vocal than others. Each group may have different options for responding to environmental uncertainty, and therefore require different things from a pastoral organization. For instance, large herd owners may be able to split herds and carry out complex forms of transhumance, while poorer herders may be unable to

¹⁰ The debate on decentralization and subsidiarity does not derive solely from the need to respond flexibly to variable environments. However, the ecological argument provides another angle to the argument for increased attention to local level management issues derived from debates about participatory development (Chambers 1993; Scoones and Thompson 1994), state-civil society relations and democratization (Clark 1991) and the retreat of state service provision under liberalization and structural adjustment (Mosely 1991; Mosely and Weeks 1993; Woodward 1993).

respond through mobility and may need 'safety net' support in order to avoid losing their animals in a drought. The differentiated nature of pastoral society requires a slow and patient institution building process, and a recognition of different types of groups appropriate for different tasks. For instance, permanent pastoral organizations may be formed around regular and common tasks or needs that are widely felt, while *ad hoc* organizations may be more appropriate for dealing with episodic events (e.g. negotiating resource access during drought) or with sectoral interests (e.g. product processing carried out by women) (Sylla this book).

Conflicts should be addressed explicitly, not ignored. Conflicting interests are an inevitable consequence of dealing with complex resource management and development issues involving a diverse range of highly differentiated actors. Visible and expressed conflicts can be tackled through an early initiation of 'round-table' discussions and consultation with different actors to explore conflicting interests, the establishment of procedural legal frameworks for resolving conflicts when they arise and formalized institutional settings for conflict negotiation, arbitration and resolution.

Pastoral organizations should start small and help forge collective interests. The experience of pastoral institution building in all parts of Africa suggests that starting small and forging collective action around sets of common interests (e.g. marketing, health care) is the most likely route to successful organizational development. Attempting to deal with complex issues at the start, such as range management or resource tenure, usually results in failure (Sylla this book). It is best to start small, working from existing organizational arrangements and build up from there (Esman and Uphoff 1984).

Lobbying for pastoral interests at national and international levels is an important role for pastoral organizations. A variety of changes in policy for pastoral areas are required if the practical implications of the new thinking in range ecology are to be realized on the ground. Such policy changes (e.g. in respect of resource rights) will not come easily. Pastoral groups are politically marginalized in most African countries and access to the political decision-making process is limited. However federations of smaller pastoral associations may be able to make pastoral interests heard at a national level through lobbying and advocacy, exploring the definition of rights through the legal system and through links and alliances in international arenas. The experience of forming such federations is so far limited, but there is a growing experience in Central African Republic, Mauritania, Burkina Faso and Senegal (de Haan 1991; Vedeld 1993; Zeidane 1993). Successes in other areas, such as associations of wildlife producing districts in Zimbabwe (Zimbabwe Trust 1991) or farmer organizations in many parts of the world (Uphoff 1992b; Bebbington 1991) suggest that the shift from the local level to political change at the national level is probably the only effective route to long-term policy change.

Extension support needs to shift from technical provision to institution building. Conventional extension at the local level has concentrated on technical advice on range management and animal health. While this is still needed, there is perhaps a more pressing need, that most fieldworkers (both

state and NGO) are ill-equipped to supply—support to institutional development. Skills required of ‘institutional organizers’ (cf. Uphoff 1992a,b) as organizational facilitators, development catalysts, brokers of information and conflict mediators are not part of the ‘normal professionalism’ of most rural development workers (Korten 1980; Chambers 1993). Investment in retraining for such challenges is a key task for the future.

New roles for different actors: projects, programmes and investments in the pastoral sector

Pastoral development is plagued by an ‘equilibrium of low expectations’ (Uphoff 1992b: 359). What are the conditions of breaking away from this, making things happen and exploring possibilities, rather than accepting the probability of failure?

Rural development ‘successes’ appear to rely on a good fit between the needs of beneficiaries, the organizational competence for decision-making and implementation at the local level and the programme’s outputs and requirements (Korten 1980). Achieving such a fit must be high on the agenda of programmes in pastoral areas. This requires that attention be paid to the context and the relationship between the project and the supposed beneficiaries. In addition, attention needs to be paid to the building of local capacity to diagnose and solve problems through institutions that are able to sustain activities (Korten 1980; Chambers 1983; Uphoff 1992a).

Researchers, planners and administrators must interact closely if learning is to be encouraged. An action-oriented implementation, monitoring and assessment approach is central to adaptive management. This must be done in close contact with people on the ground, preferably with most tasks being carried out by them. Uncertainty, error and conflict must also be embraced in a learning process approach. Optimal intervention may be very limited where resource productivity is low, as in most dry rangelands. The costs of planning, administration and management must therefore be kept low, avoiding the tendencies for over-collection of data, excessive precision and zealous intrusion from outside (Behnke 1994).

Donors and other development agencies are increasingly adopting the rhetoric of participation and flexible, open-ended planning approaches. However, the establishment of effective adaptive management in practice is more elusive than the rhetoric suggests. There remain fundamental contradictions between declared purpose and actual procedures due to the reluctance to abandon rigid planning frames, commitments to strict procedures, the need to disburse money according to target deadlines and the desire to see quick returns from capital investment, rather than long-term returns from human capacity building. As a result very few large development agencies can legitimately claim to have effectively evolved an adaptive planning approach.

This is an important lesson in itself. Maybe large development agencies are structurally incapable of being flexible and able to learn adaptively.

They do, nevertheless, have an important role to play through taking the lead in policy analysis and institutional development at a national level, funding of capital development projects and supporting intermediary organizations working with local groups. Large development bureaucracies in pastoral areas should probably concentrate on simple, capital investments (roads, marketing facilities, basic infrastructure), while state agencies provide a certain number of regulatory, assurance functions (provision of legal frameworks, adjudication of disputes, securing of land access rights, etc.). Pastoral institutions, perhaps supported by intermediary NGOs, are better suited to carry out local level adaptive planning and management, although they may need support for policy-level initiatives (Hogg 1992). Intermediary organizations (federations of pastoral groups or other NGOs) may then act to channel funds and provide support for local level action (Pretty and Chambers 1993; Wellard and Copestake 1993; Farrington and Bebbington 1994). Some principles for project or programme design in pastoral areas are outlined in Box 3.

Conclusion: new directions in pastoral development in Africa

The new thinking in range ecology suggests a redirection of investment in the pastoral sector. The large livestock projects initiated in Africa

Box 3 Some principles for project and programme design in uncertain environments

- Long time frames are needed for iterative planning with the involvement of pastoralists. Successful planning and intervention may take 15 years or more.
- Start small and build up, focusing on institutional capacity at a local level.
- Resist unrealistic disbursement targets.
- Projects are learning experiments: change course if necessary. Do not get stuck with out-dated or irrelevant project plans.
- Learn from experience, especially occasional episodic events. Monitoring and evaluation mechanisms need to be geared to the rhythm of learning in variable environments.
- Institutional and organizational flexibility are important to allow responses to unexpected events. Bureaucratic project structures and procedures will stifle innovation.
- A diversity of different organizations may be appropriate to tackle complex challenges found in pastoral areas. Pastoral organizations, service NGOs, producers' federations and government all may have roles. Do not get stuck with one organizational model.
- Local level development will be affected by macro-level policy. Tackling these wider issues through support to legal cases, policy advocacy and lobbying is directly relevant to local level pastoral development.

Table 2 Comparison between the 'old' and the 'new' thinking about pastoral development

Area	'Old' thinking	'New' thinking
Objectives	Focus on commodity production: livestock development	Focus on livelihoods: pastoral development
Range management	Open range improvement (legumes, fodder trees, rotations) Paddocking and restrictive movement: fences	Focus on key resources: improvement, rehabilitation, creation Mobility and flexibility: no fences
Planning	Blueprint development planning	Flexible, adaptive planning, with local involvement and a recognition of uncertainty
Drought	'Normal' year development and drought relief separated Focus on production issues in 'normal' years	Drought 'proofing' and safety net provision integrated Focus on tracking: de/restocking, supplementary feeding, etc.
Tenure	Fixed tenure regimes: privatization (or exclusive communal) Conflict issues largely ignored	Flexible tenure: complex mix of overlapping and integrated regimes Focus on conflict negotiation, mediation and arbitration
Institutions and administration	Service delivery package through centralized extension services Extension worker for technical delivery	Pastoral organizations for local management issues Extension workers as institutional organizers

during the 1970s and whose offspring are still highly influential both among national planners and donors were characterized by several elements (Sandford 1983; this book). These included: boreholes and water points, veterinary support, technical range management, ranches, abattoirs and market infrastructure. How would this suite of investments change if the implications of the new thinking in range ecology were taken seriously?

Table 2 offers a summary of some of the issues highlighted by chapters in this book, contrasting 'old' with 'new' thinking. Obviously such simple contrasts over-simplify; very often the 'new' is not so new and the 'old' is quite rare. The aim is, however to capture the essence of the debate, rather than the detailed nuances, and to stimulate some reflection on the practical implications for development projects, programmes and investments.

Seven major shifts in pastoral development strategies are suggested by this analysis (see also Sandford this book). These are:

- In highly dynamic, non-equilibrium environments land degradation is not the major issue it was once assumed. Therefore boreholes and water points should continue to be a priority in areas where water is a limiting factor. The cost of bare 'sacrifice' zones immediately surrounding each borehole is usually far outweighed by the benefits of more efficient fodder use and higher livestock populations (Hanan *et al.* 1991). However, very high densities of boreholes in arid environments may ultimately result in a decreased resilience of the system as the patchy nature of the environment is destroyed. Changes in resource access following borehole investment also remains a concern (cf. White 1992 for the Botswana case).
- Maintaining the size and health of animal populations through investment in veterinary care also remains a priority. High populations do not necessarily impose long-term environmental damage, and healthy animals are able to track environmental variations more effectively. Conventional veterinary support, through vaccination campaigns, needs to be complemented by decentralized animal health services and the indigenous knowledge of herders themselves.
- Conventional range management in dry areas is of limited value. Technical support should be focused on particular niches where productivity increases are most likely. Investment in the improvement or creation of key resource patches, for instance, deserves attention from technical experts. Breeding programmes using exotic breeds should be abandoned in favour of improving the physiological tracking capacity of indigenous breeds.
- So-called 'traditional' pastoral systems have higher returns than ranches under comparable conditions (see Table 1). The ranch model for livestock development in dryland Africa therefore should be abandoned in favour of support for existing systems.
- To make systems more flexible, pastoral institutions will have to be particularly strong. Greater emphasis needs to be paid to institutional capacity building. 'Institutional organizers' working with local pastoral associations provide opportunities for supporting the development of local institutions. This will require major retraining of field-based extension staff.
- Investment in marketing and infrastructure still has a role. The need to secure livelihoods through cash sales of animals remains an imperative in pastoral areas. Good access to market facilities and information permits more effective tracking. Investments should focus on improving tracking abilities in order to sustain pastoral economies, rather than simply focusing on red meat production. Instead of investment in large abattoirs or freezing facilities, investment in basic infrastructure, including roads, will remain important in pastoral areas.
- Policy analysis and reform need much greater attention. Instead of simply focusing on boosting meat production from pastoral areas, policies are

needed to ensure the economic viability of pastoral communities and their contribution to the national economy. This means examining policy options that allow flexible planning and development, enhanced capacity for tracking, secure but flexible resource tenure systems and the development of effective and strong pastoral organizations at both local and national levels.