Applying Resilience Thinking to Questions of Policy for Pastoralist Systems: Lessons from the Gabra of Northern Kenya

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2010. *Human Ecology,* 38:335-350.

Stable link for this paper: http://dx.doi.org/10.1007/s10745-010-9327-1

Abstract The aim of this paper is to explore the relevance of a systematic application of resilience thinking to questions of pastoralist policy, a task that requires taking the concept of resilience beyond the level of a metaphor and operationalizing it. One approach to accomplishing this is the components-relationships-innovation-continuity framework (Cumming et al. 2005), which, in this paper, we apply to analysis of the social-ecological system of the Gabra people in north-central Kenya. While some types of indicators, such as those monitored by humanitarian information systems, can help to identify when the resilience of a system has been eroded, indicators of the components, relationships, and sources of innovation and continuity help o make clear the dynamics of how resilience is being lost. In the case of the Gabra, our analysis suggests that there is a need to envision a third alternative—a stability domain that is distinct both from traditional pastoralism whose viability has been undermined and from the perversely resilient poverty trap that is coming to dominate. While this kind of conclusion may not be new, a resilience-based analysis helps to uncover specific details regarding what such a third alternative might entail and what kinds of policy levers might help to make it possible.

Keywords Gabra · Pastoralists · Policy · Resilience · Thresholds

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Introduction

Policy and development programming aimed at pastoralists and the lands in which they live have often been based on misconceptions about the nature of both pastoralism and the non-equilibrium environments in which pastoralists live (Ellis and Swift 1988; Scoones 1995; Behnke and Abel 1996b; Ingo et al. 1996). Furthermore, numerous researchers have argued that mobile pastoralism represents a response to the variability of rainfall and pasture resources in drylands which is both ecologically and economically rational (e.g., Behnke et al. 1993; Scoones 1995; Niamir-Fuller 1998). While a deeper understanding of the nature of pastoralist livelihoods and production systems is gradually seeping into policy and programming (Davies 2008), there are still many unanswered questions about appropriate policy directions.

One issue is whether traditional pastoralism is still viable, or whether a radically different livelihood system is needed, as it may no longer be feasible to restore sustainable pastoralist systems. Devereux and Scoones (2007) and Sandford (2007), respectively, argue the two sides of this debate. Other researchers delve more into the nuances in this debate. For example, Fernandez-Gimenez and Le Febre (2006) caution against concluding that reduced mobility necessarily implies the end of pastoralist systems. Another issue relates to adaptation to climate change. Some commentators see pastoralist systems as weakened and fragile systems on the verge of collapse, whereas others argue that pastoralists are the *most* capable of adapting to climate change (Nori and Davies 2007).

Policymakers and development programmers also have the problem of making sense of the complexity of pastoralist systems, and obtaining appropriate information on which to base policy. They lack frameworks that can help them to understand pastoralist systems and plan for them in a systematic way. Some relevant information

sources are available, for example, from drought monitoring and famine early warning systems. However, these kinds of humanitarian information systems (HISs) are limited in scope (Maxwell and Watkins 2003). Humanitarian information systems have had a number of problems: they often focus narrowly on one set of variables while ignoring others, measure hazards and impacts without providing insights into the chain of causation, give insufficient attention to causal factors, and provide their warnings too late (Buchanan-Smith and Davies 1995; Dilley and Boudreau 2001; Maxwell and Watkins 2003). More to the point, HISs tend to be designed for specific purposes, such as providing government and non-governmental relief agencies with some level of early warning that a crisis in imminent, and tend to be very focused; they are not designed for dealing with the dynamics and complexity of social-ecological systems (Berkes et al. 2003). They provide only limited help to policymakers and development programmers regarding the questions of what to do for pastoralists, especially in terms of long-term development.

Resilience thinking is particularly relevant to the study of pastoralist systems and has the potential to help fill this gap. For example, it addresses threshold effects and related indicators, which are of particular concern for pastoralist systems. Thresholds can be addressed through the systematic monitoring of key ecosystem variables and through the development of indicators of gradual change and early warning signals (Chapin et al. 2009). Here we apply resilience thinking to the analysis of a pastoralist social-ecological system, using a framework that provides a foundation for developing such resilience-based indicators. The aim of the paper is to consider the relevance of a systematic application of resilience thinking to questions of pastoralist policy. In doing so, we explore the potential value of resilience thinking to the development of an analytical framework—a framework which allows for an understanding of pastoralist systems and their resilience *before* the occurrence of threshold effects that catastrophically demonstrate system vulnerability.

Resilience Thinking, Thresholds, and Pastoralist Policy

Resilience is the capacity of a social-ecological system "to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes" (Gunderson and Holling 2002; Walker et al. 2004; Resilience Alliance 2009). This capacity can also be conceived of "as the ability of the system to maintain its identity in the face of internal change and external shocks and disturbances" (Cumming et al. 2005:976). Among the concepts that are central to resilience thinking is the notion that neither the ecological system nor the social system can be adequately understood without understanding the linkages between the two, and that the two function together as an integrated *social-ecological system* (Berkes and Folke 1998; Folke 2006).

Resilience depends both on elements within the system that provide continuity and memory (biological memory and social memory), and elements that bring novelty and change. Resilience thinking is based, in part, on the assumption that social-ecological systems are seldom, if ever, stable. Rather, social-ecological systems tend to have multiple equilibrium states or stability domains (Gunderson and Holling 2002). Graphically, this can be shown as in Fig. 1. In this heuristic, the ball represents the system, valleys represent stability domains and arrows represent disturbance. Resilience, then, corresponds to the amount of disturbance needed to push the ball over the edge of one valley into another (Gunderson 2000). Scholarship based on this perspective therefore tends to focus on dynamics within social-ecological systems and on the capacity of these systems to tolerate disturbance.

The resilience perspective brings attention to threshold effects in complex systems. One or more controlling variables in a system can fluctuate within a certain range without producing profound effects on the system as a whole. Basins of attraction are created by interactions among these variables and feedbacks among them. However, change in certain threshold-bearing variables, or groups of such variables, beyond a certain point can produce a regime shift, a shift from one basin of attraction to another with interactions reorganizing around this new basin (Walker and Meyers 2004). In Fig. 1, the threshold corresponds to the highest point between the two valleys. Alternatively, one can conceive of thresholds for various elements of the system, such that a shift to another stability domain may not occur until several system elements have passed their thresholds (Cumming et al. 2005).

These features of the resilience perspective make it an ideal starting point for studying that all-important imperative for pastoralist societies—the capacity to withstand

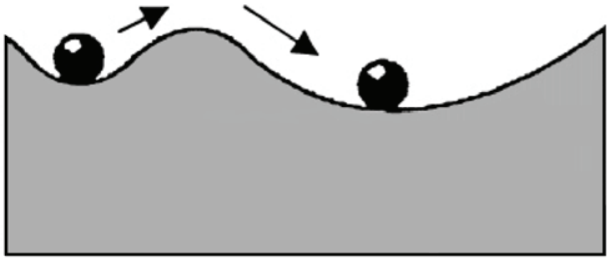

Fig. 1 Stability domains. The *ball* represents the system, *valleys* represent stability domains, and *arrows* represent disturbances. Resilience is the amount of disturbance needed to push the ball over the edge of one valley into another and corresponds to the width of the valleys. Adapted from Gunderson (2000).

shocks and stresses. For example, in dryland pastoralist societies climate influences institutions, land use practices, and day-to-day lives, and human practices in turn have important impacts on the biophysical environment, an example of a coupled social-ecological system. Constantly changing range conditions and livestock numbers, and great uncertainty and variability in climate, are related to flexibility of livelihood and decision-making systems. Thus, dryland pastoralist systems require an analysis that puts dynamics front and centre. The resilience perspective provides some of the conceptual tools that are needed for such an analysis—tools for making sense of social-ecological linkages and change in complex social-ecological systems (Berkes et al. 2003).

While resilience thinking has been applied to some rangeland ecosystems (Carpenter et al. 2001; Walker and Abel 2002), the resilience literature has not yet given much attention to pastoralism and particularly to the social elements of pastoralist *social*-ecological systems. The scholarship that sees pastoralism in terms of non-equilibrium systems and that draws on the "new rangeland ecology" (Behnke et al. 1993; Scoones 1995, 2004) is certainly compatible with a resilience-based approach but tends not to draw on the resilience literature. One analysis that is based directly on resilience thinking is an overview of Sahelian pastoralism by Niamir-Fuller (1998) who suggests that a number of practices and mechanisms contribute to resilience in pastoralist systems, including seasonal migration of herds (macro-mobility) and rotation of grazing areas (micro-mobility). These various mechanisms, such as mobility, flexibility, use of reserve pastures, reciprocity among herders, and nested rights, work in synergy with each other. A strategy that contributes to resilience is management of key resource sites, such as drought reserve pastures. This strategy depends on several mechanisms: mobility, diversity of pasture classifications and movement patterns, and local enforcement. It serves as a drought adaptation strategy because it “banks” rarely used marginal pastures for emergency use in drought years. The interdependent nature of these mechanisms can also be seen when one or more of them are undermined. For example, a reduction in dispersion (across space and of the resources that a particular pastoralist group normally uses) can result in reduction in mobility, fewer incentives for monitoring, and loss of drought-adapted strategies such as group herding (Niamir-Fuller 1998).

Although resilience thinking provides concepts that can help in understanding and describing the dynamics of social-ecological systems, resilience itself cannot be measured directly, except after a disturbance has triggered a threshold effect. An alternative to measuring resilience directly is to measure attributes of systems that are related to resilience, that is, surrogates of resilience (Bennett et al. 2005; Carpenter et al. 2005). One approach is to focus on the identity of the system in question—the elements that make the system what it is—and to measure these (Cumming et al. 2005). These elements are grouped into four categories: the components of the systems, the relationships between the components, sources of innovation, and sources of continuity. *Components* are the "pieces of the system", the human and non-human actors; *relationships* are the ways the components interact and fit together; *innovation* refers to the elements of the system that generate change or novelty; and *continuity* refers to elements of the system that embody memory and enable the system to maintain itself as a cohesive entity.

The idea of this framework is that, over time, many aspects of a system may change, but the essential system functions and attributes that characterize the system must be maintained if the system is to be considered resilient. Cumming *et al.* (2005) offer the example of a ranching system. Replacing sheep with goats could be seen as an innovation that entails some reorganization, but no loss of system identity. On the other hand, loss of livestock or ranchers from the system, or of a harvesting relationship between them, would represent a loss of identity. This approach also helps clarify the distinction between what is considered the system itself and the drivers impacting the system (Cumming et al. 2005). Drivers can be defined as any factor, natural or human-induced, that directly or indirectly causes a change in a social-ecological system. Delineating system identity in this way provides a framework for developing an analytical description of a social-ecological system and its resilience.

Study Area and Research Methods

Field research was conducted among Gabra pastoralists in north-central Kenya, primarily in Chalbi District, which is extremely dry and has no permanent rivers. Throughout most of the area, precipitation is under 300 mm. per year and is highly variable, with the coefficient of variation ranging from 30% to 50% (National Environment Management Authority 2006). In the past two decades many Gabra have established homes in permanent settlements, but a significant percentage are still nomadic, and livestock is still the foundation of the Gabra economy. A household's livestock mix is typically diverse, based on camels but also including sheep, goats, donkeys and sometimes cattle (Ganya et al. 2004). Movement of herds and households is a key part of survival in this arid region, and institutions such as those governing the use of shallow wells reflect the need for flexibility and access by a mobile population (Robinson 2009a). Even those households which have established a permanent residence still rely primarily on livestock for their survival, and send some household

members and their livestock long distances in search of water and pasture.

The research was conducted at various places throughout Gabraland, with in-depth research being conducted in three sub-case localities, each of which included a permanent settlement, various nomadic camps around, and the camp of one of the traditional Yaa councils representing one of the Gabra's phratries[1]. The three settlements were Balesa, Kalacha, and Hurri Hills. At the community-level, 114 semi-structured interviews were conducted with respondents throughout Gabraland. One particular sub-set of semi-structured interviews conducted at the community level focused on livelihoods. Individuals from 21 households from the three sub-case localities were interviewed regarding household livelihoods, shocks, stresses and other factors influencing the livelihood, and strategies for coping and recovery. We refer to these henceforth as the "shocks and stresses interviews". These interviews represented 11 households located in permanent settlements and ten in nomadic camps. The research also included participant observation with Gabra herders, and interviews with key informants working for NGOs and government agencies.

Various methods were used in group activities and community meetings, including diagramming techniques such as are common in Participatory Rural Appraisal. One visual method that was particularly important was the influence diagram, a diagram that portrays ideas, beliefs and attitudes, particularly regarding causality (Gitau 2004). Each of the two influence diagrams discussed here was created by a small group of men in order to analyze key features of the social-ecological system, particularly in relation to the need to protect livelihoods and rebuild herds after losses. In both cases, the diagram was done on the ground using stones, sticks and other physical objects to represent various causal factors, and then was copied onto paper. And in both cases, not all factors that participants were willing to discuss were put into the diagram, largely due to time limitations, but the most of the most important factors are represented. The figures below are "cleaned up" versions of those diagrams, but accurately represent the nodes and connections produced in the original diagrams by the focus groups. More details on the methods are described in Robinson (2009b).

Gabra Livelihoods and Key Factors Influencing Them

Livelihoods, and Shocks and Stresses

The importance of livestock to Gabra livelihoods cannot be overstated. There were no respondents in the “shocks and stresses” interviews who did not own livestock, even those few who either had wage employment or who owned a shop in town. Discounting relief food, 16 of the 21 respondents, including six living in permanent settlements and all ten living in nomadic camps, said that livestock was the *only* source of their livelihood. Only two of 21 households had a household member or other family member with wage employment providing cash income to the family. Four households were engaged in some kind of trade, either petty trade or a small shop. Livestock, as well as being the main source of livelihood, was also the primary form of savings, and those respondents who relied only on livestock for their livelihoods also relied solely on livestock as their principal form of savings.

The two shocks and stresses that were most commonly mentioned were drought and livestock theft. Essentially, everyone who owns livestock was affected by recurring droughts, which, according to the vast majority of respondents, are becoming increasingly severe. The 2005-2006 drought left many people without a single animal. Livestock theft occurs between rival ethnic communities; large-scale livestock theft between groups of Gabra is unheard of. A third drain on livelihoods was livestock disease, but this was mentioned by only six respondents and only two complained of it being a serious problem.

One stress that was mentioned by most respondents was the depletion of pastures around permanent settlements. Among Gabra elders who were interviewed, two principal causes were cited: over-concentration of livestock/overgrazing, and the general decline in rainfall. The poor state of pastures around permanent settlements, most of which are situated at the site of permanent water, affects all pastoralists, not only those people who have settled. During the dry season and droughts, people and their herds congregate around reliable water sources. But as forage becomes less and less available in these areas, the dry season and droughts become more and more stressful. As one elder of Yaa Sharbana said, "These days … where there is water there is settlement and there is no pasture, and where there is pasture there is no water."

Preparation, Coping, Recovery and Adaptation

The Gabra are accustomed to fluctuations in the size of their herds. Although they have traditions and practices that help protect against loss, death of livestock on a large scale is not unheard of. The most infamous example of livestock loss in Gabra history occurred in 1889 when rinderpest decimated cattle herds (Robinson 1985). But such occurrences are not confined to distant history: during the drought of 2005-2006, great numbers of animal carcasses marked the long trails between permanent water and the remaining dry pastures. The percentage of animals lost varied from place to place, and while precise figures are

[1] The Gabra have five phratries each made up of between nine and nineteen clans.

not available it is known that many households lost their entire herds. To the Gabra, droughts are seen as acts of God; even livestock theft is seen as part of the normal course of life. However, the vast majority of respondents reported that in recent years, both have become more frequent and more severe.

The central strategy for dealing with these shocks and stresses, simply stated, is to maximize herd size when rainfall is good, minimize losses during droughts, and rebuild herds after losses. Based on the shocks and stresses interviews, other community-level interviews, and influence diagrams with elders, the mechanisms and tactics for dealing with shocks and stresses that emerged as most important are summarized in Table 1. They are broadly consistent with coping and recovery strategies that have been identified by other researchers who have studied the Gabra and other pastoralist groups in northern Kenya (e.g., Torry 1973; Robinson 1985; McPeak and Barrett 2001; Olukoye et al. 2001; Kassam and Ganya 2004; McPeak 2005; Robinson 2009a). In the table, these mechanisms and tactics have been classified according to their primary function in relation to shocks and stresses: preparation for, coping with, recovery from, and adaptation to shocks and stresses. While all of the mechanisms and tactics identified in Table 1 can be seen as adaptations, many of these are well-established; the *adaptation* column in Table 1 refers to *new* adaptations—the introduction of new elements into the social-ecological system in recent years.

The central strategy of Gabra pastoralists (maximizing herd size when rainfall is good, minimizing loss during droughts, and rebuilding after loss) is pursued via three main tactics: mobility, herd splitting, and animal care. Mobility takes many forms, and there are numerous terms in the local language denoting particular types of herd movement. Herd splitting involves not only dividing the milk herd from the *foora* or dry herd, but also, if the livestock holdings are large enough, breaking the herd into separate units, usually based on livestock species, so that each can be taken to the best locations for that species. Herd splitting also helps to ensure that not all of a family's "eggs are in one basket". Those who have been able to spread their livestock to various locations are less likely to suffer devastating losses from droughts or raids. Both mobility and herd splitting are undertaken to serve the primary livelihood strategy: when times are good, move animals to places that best serve their growth and reproduction (preparation); during droughts, moving animals to where they have the best chance of survival (coping); and after droughts or other shocks or stresses, try to rebuild the herd as quickly as possible (recovery). "Taking care of one's animals" is the third tactic of this strategy—taking necessary steps to ensure animal nutrition and health and thus maximize reproduction and milk production, and minimize losses.

As shown in Table 1, other mechanisms and tactics that come into play once a drought hits (coping) include slaughtering and selling livestock, and, in recent droughts, emergency water tankering. Livestock that are slaughtered can be eaten directly by members of the household and the entire nomadic camp, or can be sold in the towns. It should be noted though that the livestock market in Gabra towns is not well integrated with larger livestock markets in Marsabit (the nearest population centre and market town) and nationwide. Furthermore, for most respondents, selling animals is not something that is done regularly. In

Table 1 Mechanisms and tactics for dealing with shocks and stresses among the Gabra

Mechanism/Tactic	Actor	Primary Function			
		Preparation for shocks & stresses	Coping with shocks & stresses	Recovery from shocks & stresses	Adaptation to shocks & stresses
Mobility	HHs	XX	XX	XX	
Taking care of one's animals	HHs	XX	XX	XX	
Herd splitting	HHs	X	X		
Selling and slaughtering livestock	HHs	x	XX		
Emergency water tankering	NGOs, government		XX		
Traditional stock sharing and restocking mechanisms	Inter-HH, lineage/clan			XX	
NGO/relief agency restocking programs	NGOs			X	
Development of new water points, improvements to existing water points	NGOs				XX
Diversifying livelihoods	HHs				x

HH = household, Actor = primary actor executing this mechanism or tactic, x = practised by or important to very few households, X = practised by or important to *many* households, XX = practised by or important to *most* households.

"normal" times most people only sell livestock in small numbers for cash to buy basic supplies. The option of selling and slaughtering animals always has to be balanced against the imperative of maximizing herd size. Only a few respondents sold livestock in large numbers as a way of avoiding drought-induced losses. Instead, most admitted that they wait too long until the drought is in full force and the market already glutted.

Mechanisms and tactics for recovery all revolve around rebuilding herds. In addition to mobility and animal care, other important tactics include stock sharing, restocking and reciprocity. As well as distributing risk and strengthening social bonds, stock sharing helps people to start rebuilding their herds. Traditional stock sharing, like mobility, takes many forms, both as loans and gifts. Another source for rebuilding herds has been restocking programs carried out by the Red Cross and NGOs. The scope of these restocking programs is relatively small, but can nevertheless be important to those who have lost all their livestock.

New adaptations in this system are as yet quite limited, and fall into two categories: diversification of livelihoods, and the development of new locations for, and new types of, water points. Those who are able to diversify their livelihoods do so by engaging in paid employment and petty commerce in permanent settlements, or in horticulture. Opportunities for the latter are quite limited: there is some gardening in the vicinity of the spring in Kalacha, but the mineral content of the water is high and salinization likely. Some people farm in Hurri Hills where precipitation is greater but soils are poor. Nevertheless, as alluded to above, such diversification characterizes few households—most people still earn their livelihood only from livestock. The other new element, led by NGOs, is the creation of new, strategically-located water points that open up under-used pastures. The aim is to take the pressure off the permanent water points and the pastures around them.

Influence Diagrams

One research technique that was particularly useful to understand Gabra livelihoods *as a system*, was to create influence diagrams in focus group sessions. The starting point for these diagrams was the question, "What are the factors that affect herd size and influence how you are able to rebuild your herds?" Essentially, influence diagrams attempt to show the most important causal factors at play in the issue being addressed. These factors are represented as positive and negative feedback, indicated by (+) and (-) symbols, respectively. No attempt was made to weight causal factors on the diagram itself, but the degree of importance of various factors is discussed below.

In producing Fig. 2a, elders of an nomadic camp that, at the time of the research, was situated near the town of Kalacha identified five main factors directly impacting on whether, and to what extent, someone is able to rebuild their herd: conducting raids, taking good care of animals, receiving animals as gifts and loans from family and well-wishers, livestock diseases, and the condition of pastures. Livestock disease, as a factor that inhibits the rebuilding of herds, is shown with a (-) symbol; the other four, as factors that help rebuild herds, are shown with (+) symbols.

According to the participants, rainfall is by far the major factor influencing the availability of pasture growth. The most critical negative influence therefore is drought. Following these nodes in the diagram, drought results in a reduction in rainfall, which in turn means less available pasture, which results in death of livestock and herd owners being unable to increase the size of their herds. A secondary factor influencing pasture, and thereby reproduction and growth of herds, is mobility. When herds can be moved without restriction, they can be taken to the best pastures, preventing overgrazing, and pastures therefore are not exhausted.

With respect to "raiding to replace livestock", none of the participants claimed to engage in this practice, nor did we ask directly if any of them did. What they said was that some Gabra do raid neighbouring groups to steal livestock and that it is part of how some people rebuild their herds. However, raiding also has a negative effect, leading to revenge attacks, general insecurity, and loss of livestock for other Gabra. Most critical is the loss of loading camels because it means a loss of mobility. Because loss of mobility results in potential overgrazing in places where people have settled, the implication is that livestock theft by neighbouring groups, and indirectly the Gabra's own raiding of these groups, contributes to degradation of pasture resources, at least around the permanent water sources where people have settled. The role of water points was also mentioned during the discussion but was not explicitly included in the diagram.

A discussion with a group of nomadic elders of Yaa Sharbana, the council of the Sharbana phratry, produced a similar diagram (Fig. 2b). The main determinants influencing the growth of herds were identified as pasture and water. There is also negative feedback as herd sizes grow, with increasing herd size resulting in pastures and non-permanent water sources being exhausted more quickly, leading to decreased herd viability and putting a brake on further herd growth. Nevertheless, the primary negative impact on pasture and water sources was said to be drought, and not grazing by growing herds. A set of factors that has improved water availability has been the combination of increasing levels of education and the work of NGOs, leading to improvements such as subsurface dams (known in Kenya as sand dams), wellhead protection and the construction of rainwater harvesting tanks. In Balesa, for example, as a result of subsurface dams slowing down runoff, groundwater is replenished and

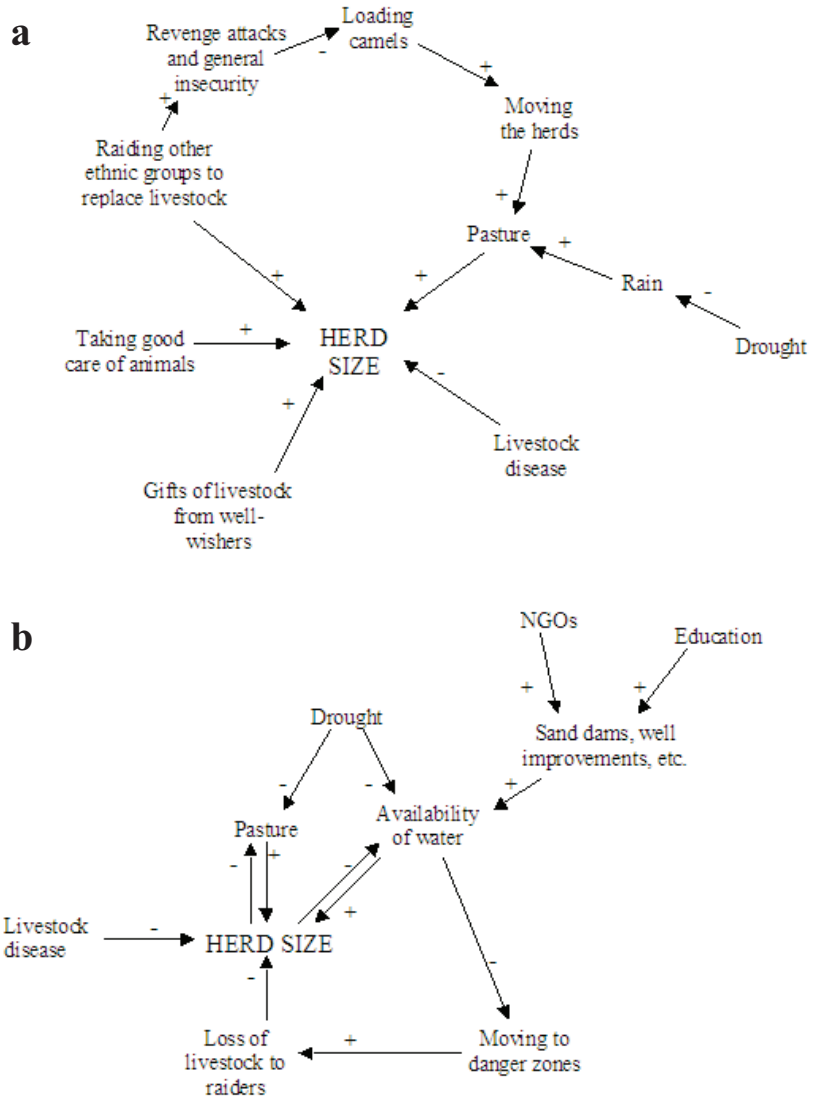

Fig. 2 Influence diagrams created by groups of Gabra elders. **a** Diagram created at Kuni Gorrai Olla, a nomadic camp which at the time of the research was located near the town of Kalacha. **b** Diagram created at Yaa Sharbana, the camp of the traditional Yaa council of the Sharbana phratry. Respondents were asked, "What are the factors that affect herd size and influence how you are able to rebuild your herds?" Causal factors are shown as positive and negative effects. Contributory factors are shown with a (+) symbol and inhibitory factors are shown with a (-) symbol.

wells in the area remain productive for much longer than they used to. The availability of water also helps in an indirect way by reducing the need to move to distant pastures where the chances of being raided and having livestock stolen are higher.

Analysis: System Identity, Thresholds and Visualizing the System

System Identity

The next step in the analytical description of the social-ecological system was to describe system identity, using the categories suggested by Cumming and *et al.* (2005): components, relationships, sources of innovation and sources of continuity. Some of these are explicit in the features of the social-ecological system described above, having been mentioned in interviews and focus group discussions; others have to be deduced. These do not represent all variables that may impact the system. Rather, they are those elements of the system which, if removed, would result in a qualitatively different system. For example, there are a number of modern institutions such as government-appointed chiefs and elected councillors who can influence decisions but without whom the Gabra social-ecological system would still be the Gabra social-ecological system. For example, there is probably no single grass or forb species that makes the system what it is; on the other hand, one could not imagine the Gabra social-ecological system without pastures, and so the general category of pastures can be considered one of the defining components of the system. Cattle, sheep and goats

are lumped together because none of these species is in itself crucial to system identity. Each type of animal has important characteristics and, from the herder's point of view, strengths and weaknesses, but if any one of those species were to be greatly reduced, the system would not necessarily lose its identity. The same cannot be said of camels: camels are key to Gabra livelihoods and way of life (the importance of camels is discussed further below).

The elements that do and do not belong in a list of system elements derives, in part from a researcher's subjective decision as to the type of system that one wishes to study and describe (Cumming et al. 2005). In this case we took livelihoods as a starting point, and the complex system that we describe as the system that supports livelihoods. However, the list of system elements is also derived from the nature of the system and the relationships among its variables. The defining elements of a social-ecological system are such that, if removed, they would have cascading effects on the rest of the variables in the system. Table 2 is a list of the key elements distinguishing the identity of the Gabra social-ecological system. A few of the elements are discussed and explained briefly here.

A few of the *components* of the system have already been mentioned: camels, other livestock (cattle, sheep and goats), and pastures. Others include water points, households, and the traditional institutions of the Yaa and jalaab. Among the important *relationships* characterizing the system are those created between individuals and households for reciprocal exchange of animals (stock friendships) and traditional restocking mechanisms. Another social relationship is local markets. In the Gabra social-ecological system, the selling of livestock plays only a minor function in converting livestock into other forms of capital as a way of avoiding drought-induced losses. However, the small-scale selling of animals is the primary way in which most households meet their non-livestock consumption needs. Among the biophysical relationships are pasture regeneration processes. Two other relationships identified in Table 2—herd mobility and rules governing commons—together embody a critical relationship between the social and the ecological, and between livestock and pastures.

Herd mobility, in turn, influences one of the *sources of continuity* for this system—seed dispersal—which itself is connected to pasture regeneration processes. Among the *sources of innovation* are overlap and flexibility in decision-making authority and territorial boundaries that are flexible and imprecise. In the past when the Gabra have been faced with major shocks and stresses, such as in the late 1800s, one of the key factors in their adaptability has been the flexibility of their institutions (Robinson 1985). This kind of flexibility manifests itself in a number of ways, including territorial boundaries. As noted by Haro et al. (2005), flexibility of nomadic movement functions without any strong emphasis in the culture on territorial boundaries. To the extent that these boundaries even exist, they tend to be flexible over time (Kassam and Ganya 2004). Furthermore, the Gabra, like other ethnic groups in the area, have a nested decision-making structure that lacks very rigid and clear lines of authority (Haro et al. 2005). The fuzziness and flexibility of boundaries and decision-making authority seem to be key sources of innovation in the social-ecological system.

Thresholds For Livestock, Mobility And Grazing Patterns

Cumming and co-authors (2005) suggest focusing on the elements of system identity in order to overcome the difficulty of operationalizing the concept of resilience and empirically measuring it. Rather than attempting to measure the width and depth of stability domains, for example, one can determine thresholds for the components, relationships, and sources of innovation and continuity that characterize the system. These key variables are important for their interactions with other elements of the system. Beyond certain thresholds their relationships with other elements of system change, leading to cascading effects, and reorganization into a potentially very different system.

In this section we discuss a small set of the various system elements identified above and consider how to conceive of thresholds relating to these. The discussion below quantifies a few of the thresholds, but there is a lack of quantitative data for several key variables. However, some inferences can still be deduced from the qualitative analysis of components, relationships, and sources of innovation and memory. These variables and their thresholds may be seen as factors worthy of attention for the Gabra social-ecological system or other dryland pastoralist system because of implications for resilience loss. Some examples of system elements, thresholds and relevant drivers are shown in Table 3.

One critical threshold at the household level relates to herd size. Below a certain number of animals, a herd cannot produce sufficient milk, meat and blood to sustain the household. When a single household loses livestock, stock friendships and traditional restocking mechanisms help to return the household to a minimum level. Restocking programs carried out by NGOs and relief agencies have also afforded modest assistance to many households by providing a few animals. But if a large number of households drop below the threshold, the capacity of either traditional or modern restocking mechanisms to return these households to subsistence levels can be overwhelmed. As one abba olla ("father of the camp") put it, "These days Gabra hardly have any animals. So how can we share?" When this happens, these households are ejected from the pastoralist economy, at least temporarily. The number of camels is particularly important. Without a

Table 2 The Gabra Social-Ecological System—Elements of System Identity Based on Framework from Cumming *et al*. 2005)

System Element	Explanation
Components	
Households	The primary economic unit for the Gabra is the household, the ibidda.
Phratry councils (Yaa) and traditional judges (jalaab)	The Gabra have five Yaa councils, one for each phratry. The jalaab is a particular category of elder who serves as a judge and as a representative of the Yaa among the people.
Camels	Camels are listed separately from the other livestock species because of the important and unique functions that they serve as transport animals and for maintaining mobility
Cattle, sheep and goats	
Water points	
Pastures	
Relationships	
Traditional meetings (korra)	Korra are meetings that are held as and when needed at various levels of social organization.
Lineage/clan (miilo/balbala) relationships	Wells are, in a sense, owned by clans. In addition it is through these relationships that much of the social capital is organized, and much of the traditional restocking that takes place is within lineages.
Stock friendships, restocking mechanisms	This category of relationships overlaps with previous, as some, but not all, stock friendships and traditional forms restocking takes place along clan and lineage lines.
Local markets	In the Gabra social-ecological system, the selling of livestock plays only a minor function in converting livestock into other forms of capital as a way of avoiding drought-induced losses. However, the small-scale selling of animals is the primary way that most households meet their non-livestock consumption needs.
Commons rules for accessing pasture and especially water	
Groundwater recharge processes	
Pasture regeneration processes	
Herd mobility	Herd mobility, as well as being an important livelihood activity, embodies a critical relationship between livestock and pastures
Innovation	
Diversity and flexibility of livestock species mix	The livestock that Gabra keep is diverse, including camels, sheep, goats, cattle and donkeys. This diversity of livestock is part of their regular coping strategies and is related to the varying amounts of time that different animals can go without water. Furthermore, different livestock species have differing grazing habits, differing needs for water, and differing levels of tolerance to various stresses. Thus having a mix of species helps the Gabra to respond to and cope with a highly unpredictable climate (Torry 1973; Ganya et al. 2004).
Fuzziness of decision-making authority	The fuzziness and flexibility of boundaries and decision-making authority seems to be a key source of flexibility and innovation in the social-ecological system.
Boundaries that are fuzzy and flexible	
Biodiversity embedded in sacred sites and patchy landscape pattern	The Gabra recognize over 100 sacred sites. Sacred sites, together with a patchy landscape pattern provide for a degree of biodiversity.
Continuity	
Oral history	With the aid of the Gabra's elaborate calendar, many of the oldest men have a good knowledge of Gabra history, and there are also particular elders who specialize in history.
Sacred sites	Genetic memory is maintained in part through the existence of sacred sites, where the cutting of trees and other uses of flora are restricted.
Seed dispersal via livestock mobility	The dispersal of seeds by livestock is an important factor in the maintenance of pasture.

The social-ecological system is described according to four types of elements that comprise its identity. *Components* are the pieces of the system, the human and non-human actors. *Relationships* are the ways that the components interact and fit together. *Innovation* refers to the elements of the system that generate change or novelty. *Continuity* refers to the elements of the system that embody memory and enable the system to maintain itself as a cohesive entity (Cumming *et al*. 2005).

minimum number of loading camels, the household is forced to locate itself near a water point, rather than locate itself near good pasture and use the camels to bring water. And without a minimum number of loading camels, it is no longer possible to transfer the entire household to new locations as pastures are depleted. The typical result is to move to one of the permanent settlements and to rely, at least partially, on relief food. With the household livestock

Table 3 Selected Elements of the Gabra Social-Ecological System with Examples of Thresholds and Drivers

Selected Elements of the Gabra Social-ecological system	Examples of Thresholds	Examples of Drivers that may Impact the Element
Components		
Cattle, sheep and goats	No. of cattle, sheep and goats/household	Conflict/livestock theft, restocking programs
Camels	No. of camels/household	
Relationships		
Herd mobility	TLUs based in the rainy season within some defined radius from permanent water	Conflict, restocking programs, sedenterization
Pasture regeneration processes	Level of regrowth of plant species a, b and c within some defined radius from permanent water	Sedenterization, climate change
Commons institutions governing access to water	Water points: ratio of no. operated as commons to no. operated as private property	The Water Act 2002, NGO water projects Creation of new institutions
	Extent to which institutions are able to limit access to wells	
Innovation		
Biodiversity embedded in sacred sites and patchy landscape pattern	α diversity of plant species in sacred sites	Climate change, conflict
Continuity		
Sacred sites	Sq. kilometres of land respected as a sacred site.	Conflict

confined to inferior pastures, reproduction and milk production are both hampered and household finds itself in a poverty trap. According to respondents, the minimum number of loading camels that a household needs is about three; if counting females and colts as well, about seven camels in total. As a result of drought and/or livestock theft, many Gabra households have already dropped below this threshold and have settled in towns or in camps for internally displaced persons.

Herd size, therefore, is related to another element of system identity: herd mobility. If too many people lose mobility and settle in one place but are still trying to make a living from livestock, then all of the other factors influenced by herd mobility are in turn affected. Pastures around the settlement or water point are overgrazed, and eventually regeneration is compromised. Because settlements are mostly located near reliable water in the midst of dry season grazing areas, nomadic households are in turn affected as they find that their dry season destinations are already overgrazed. The dry season and especially droughts, becomes more stressful for all, as the pastures surrounding permanent water points are never given time to recover. Therefore, a threshold measure for herd mobility might focus on the number of livestock that do not move away from permanent water in the rainy season, as would normally occur in traditional practice.

An associated relationship variable is pasture regeneration, which is most critical in the vicinity of permanent water points. The threshold here could be conceived of in terms of the regrowth of a few key plant species within walking distance of the water point. Given that different livestock species prefer different plant species and are able to move varying distances, thresholds might be set for a number of key plant species most important for each livestock species.

These variables are closely linked to each other, and the thresholds that bear on these interconnections are important. For example, if household herd size falls below a minimum threshold, mobility is in turn affected, along with pasture regeneration around permanent water. When these variables fluctuate within their thresholds, the system as a whole continues to function and to respond well to shocks and disturbance. However, when conditions change such that internal and/or external drivers increasingly push these variables beyond their thresholds, a cascade of changing relationships can result in a complete reorganization of the system around a different stability domain. In the next section, we discuss our approach to developing a holistic understanding these elements that make up the Gabra system, and discuss some drivers that are pushing that system towards a new configuration.

Visualizing the System and Envisioning Alternatives

Identifying the components, relationships, sources of innovation and sources of continuity of the social-ecological system is essentially an analytical process for deconstructing the system. To gain a holistic understanding of the system, another step is needed—one that focuses specifically on dynamics. For example, the dominant cycle in the Gabra social-ecological system is the cycle that is dictated by droughts. Here we describe two simplified and idealized versions of that cycle: a version that shows the "traditional", resilient pastoral system that can withstand

droughts and loss of animals to theft, and a contemporary version in which various recent developments such as growth in human population and escalating conflict have undermined coping mechanisms and created a poverty trap. In the traditional version of the cycle, livestock numbers wax and wane following years of good and poor rainfall. Droughts, and to a lesser extent raids by enemy groups, result in livestock being lost, but this is followed by a period of herd growth. Households that do fall below a minimum threshold for herd size can hope for traditional forms of restocking and stock sharing to lift them back up above that threshold again, and thus the system is characterized by a self-correcting negative feedback loop (Fig. 3a).

Fig. 3b shows an alternative, present-day situation in which a number of the thresholds discussed above have been crossed, and a large number of households have fallen below a minimum threshold of herd size, thus allowing a vicious circle to take hold. Without a sufficient number of camels, households lose mobility and are unable to seek out the best pastures. As a result, livestock nutrition suffers, reproduction is hampered and the household is vulnerable to future droughts. People are forced to settle around permanent water, meaning that nearby pastures are not rested. The poor state of pastures around the water point hampers herd growth, even for those who are still mobile. This situation entails a self-reinforcing positive feedback loop that propels the system across thresholds and into a new configuration characterized by destitution and environmental degradation.

Expressed in terms of the components-relationships-innovation-continuity framework, this vicious circle represents a weakening of several elements, comprising the identity of the system. Stock sharing is reduced as fewer households have livestock to spare; as the abba olla mentioned above said, one cannot share what one does not have. Pasture regeneration near water points is hampered and herd sizes do not rebound. The system is caught in "perverse resilience". That is to say, the system may have moved into an alternative stability domain from which it will not easily be dislodged. These two figures, representing two possible states, are simplified and obviously omit many details. But they illustrate the implications of some of the thresholds discussed above, such as thresholds for herd size, herd mobility, and pasture regeneration.

In comparing two alternative states, one is faced with having to make value judgments. The question of whether

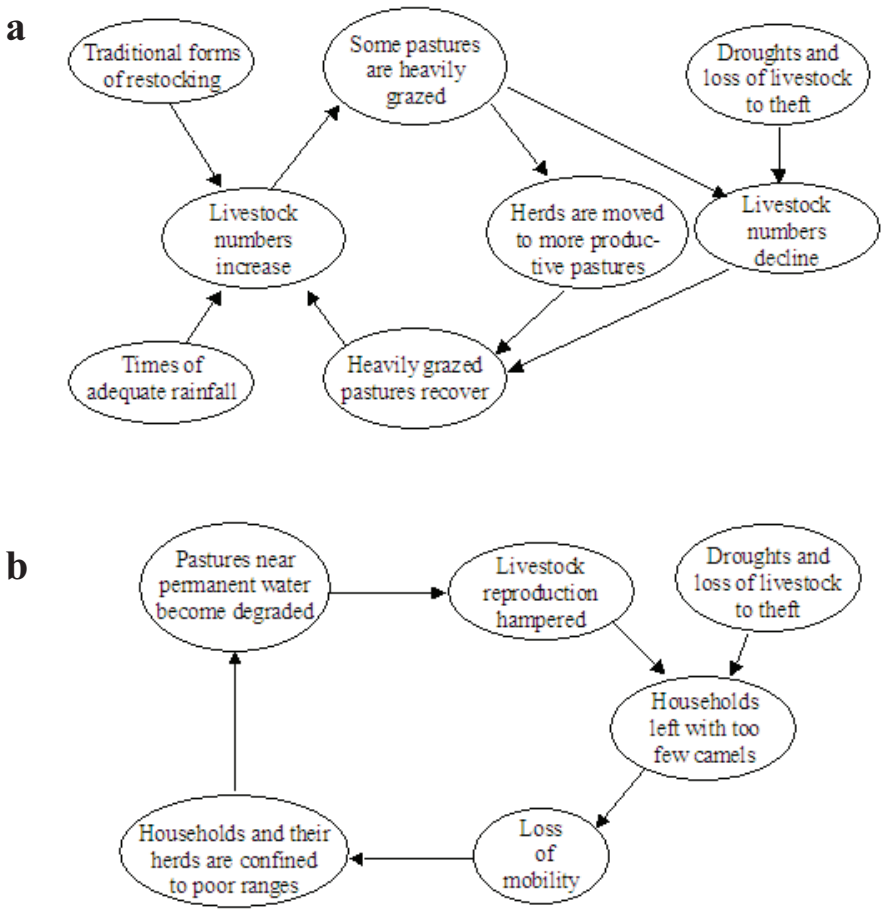

Fig. 3 Alternative cycles in the Gabra social-ecological system. **a** Cyclical changes in traditional, resilient mobile pastoralism. **b** A present-day alternative—loss of mobility creates a poverty trap. **a** shows livestock numbers waxing and waning, with mobility being a key factor that allows herds to be rebuilt. **b** describes what occurs when livestock (especially camel) numbers have been decimated and mobility has been lost. The two diagrams portray self-reinforcing sets of dynamics that contribute to the resilience of two alternate states.

a cycle is a vicious circle or a virtuous circle is subjective. In this example, it is not difficult to declare the cycle represented by Fig. 3b as undesirable. But does this mean that the other option is desirable? The system described in Fig. 3a, although resilient to drought and able to re-establish households that have lost livestock, is a system that is maintained through periodic large-scale deaths of livestock. It is likely that at times in the past, such as during the crisis period of the late 1800s, a significant number of human deaths also occurred (Robinson 1985). As long as the number of livestock that disappear from the system because of any one drought never becomes *too* many, the system can continue. However, the death of large numbers of livestock with each drought also means that a significant amount of capital is regularly destroyed. Converted instead into other forms, this capital could have been invested in improving people's lives. The system described in Fig. 3a has proved, through many generations, to be resilient. But whether it is desirable depends upon value judgements and comparison to other possible states.

This way of depicting aspects of system dynamics can also offer clues as to possible future trajectories for the system. In the real world, these two idealized cycles are not necessarily mutually exclusive states but can co-exist to varying degrees in various places around Gabraland. For example, although many people have suffered devastating herd loses and have been forced to move to permanent settlements (Fig. 3b), this does not mean that traditional restocking mechanisms have disappeared. Indeed, many Gabra affirmed that these traditions are still strong, and many people spoke of how they have been beneficiaries or benefactors in the sharing of livestock. While both of the figures accurately describe some of the dynamics within the Gabra social-ecological system, one can ask which of the two is currently dominant. This research suggests that over time it is the latter, the vicious circle represented Fig. 3b, that is becoming increasingly dominant.

Given the increase in human population that has occurred over the past forty years (Ganya et al. 2004), the increasing severity of droughts (according to Gabra elders), and the general drying trend (Kenya Meteorological Department 2007), the "traditional" social-ecological system, characterized in Fig. 3a is probably no longer resilient. The drivers of change relate directly to elements that make up the social-ecological system, as identified in Table 2: the increase in human population means that the number of households has increased, while severe droughts and the general drying trend directly impacting water points, groundwater recharge processes and pasture regeneration processes. These drivers, furthermore, have been pushing key variables beyond their threshold points, some of which were identified in Table 3. For example, the great increase in the number of households requires either a corresponding increase in livestock population or else a decrease in the number of livestock per household. The former results in pasture regeneration processes around permanent water sources being affected as these pastures are not allowed to rest, and the latter jeopardizes the ability of households to survive through a drought. In fact, from our observations, both are happening.

The tension between the two alternative stable states—traditional mobile pastoralism and the vicious circle described in Fig. 3b—can be summarized visually in the form of a stability domain diagram (Fig. 4) in which Fig. 3a and b correspond to the two valleys "A" and "B", respectively. The trends just discussed result in traditional mobile pastoralism becoming less resilient (valley "A" in Fig. 4) and the poverty trap relatively more resilient (valley "B" in Fig. 4).

Discussion and Policy Implications

One way in which resilience thinking is potentially useful for policymaking and programming is by providing a framework for developing a systematic assessment of a social-ecological system. Part of this assessment might take the form of describing the elements of the identity of the system in question—its components, relationships, sources of innovation and sources of continuity—and determining thresholds for each of these elements. For

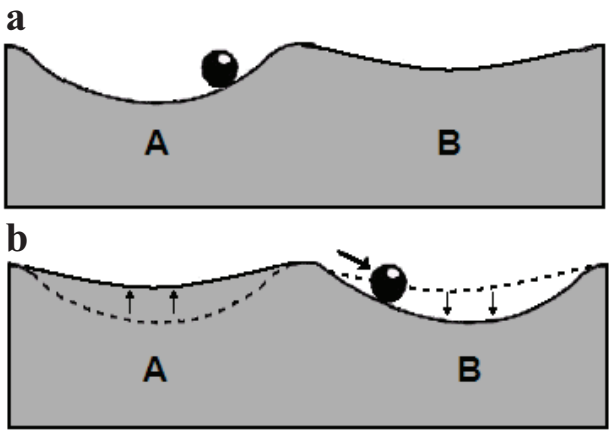

Fig.4 Two stability domains for the Gabra social-ecological system. **a** shows two possible states for the Gabra social-ecological system: traditional mobile pastoralism (A), and a poverty trap in which drought, theft and other shocks and stresses have left more people destitute than restocking mechanisms can cope with (B). **b** represents the notion that traditional pastoralism is becoming less and less viable, and the poverty trap more and more difficult to escape. The vertical arrows represent forces such as demographics and climate change that are undermining the resilience of traditional pastoralism. The *heavy arrow* represents a particular shock such as a drought that pushes the system from one state to another.

some system elements, it could be difficult to devise measurable thresholds for which data collection would not be too onerous, and one may ask whether it would be worth the effort. Without doing any of the above analysis, one could arrive at straightforward indicators that in some way provide an assessment of the current state of pastoralist livelihoods in northern Kenya. For instance, some of the types of data that the Famine Early Warning Systems Network relies on—such as changes in food and livestock prices (Famine Early Warning System 2000; Maxwell and Watkins 2003)—indicate effects of shocks and stresses working through a social-ecological system, but do not describe *how* the effects occurred. Are many households now relying on relief food because traditional restocking mechanisms failed, because entire herds of livestock have been stolen, because pastures are degraded, or because of some combination of these factors? Are livestock prices falling because livestock owners fear losing their animals to starvation, or because consumers are afraid of Rift Valley Fever (as happened in Kenya in 2007)? Indicators such as animal birth rates, market prices for livestock, household milk consumption, or the proportion of households relying on relief food do not answer these questions in themselves, because unless they are understood in relation to other variables in the social-ecological system they are only indicators of aggregate effects produced by the system, not of dynamics *within* the system.

The approach of describing system identity proposed by Cumming *et al.* (2005), on the other hand, does promise to provide an analytical description of what is happening within the system and why. Identifying and periodically measuring the components, relationships, and sources of innovation and continuity that distinguish the system, in relation to thresholds, should also contribute to an understanding of the ongoing evolution of the system and help measure changes in the resilience of that system over time.

The relevance of resilience thinking to policymaking and development programming for pastoralists can also be seen in applying the idea of stability domains. Traditional mobile pastoralism (valley "A" in Fig. 4) is becoming less and less tenable, and the alternative that currently dominates (valley "B") is clearly undesirable. However, policies that only push the system back towards valley "A" without addressing its limited resilience under current circumstances are insufficient, and merely perpetuate crises. But are these two alternative states the only two possibilities? It is becoming increasingly important to envision an alternative system—one that is resilient, that provides livelihoods, and that meets some other desirable criteria. The literature on resilience is replete with social-ecological system examples that move between alternate states (e.g., Berkes et al. 2003). The literature also suggests that in some cases, it would be desirable to transform the system into a completely new alternative (Walker et al. 2004). However, such transformations can have high social and environmental costs, as well as potential benefits. In the present case, we are not recommending a complete transformation but a third alternative state that is designed to maintain the benefits of the traditional system while mitigating some of the problems. The idea is sketched in Fig. 5.

This is not to condemn mobile pastoralism—far from it. A viable alternative would almost certainly bear many similarities to traditional pastoralism. For example, for the kinds of highly variable climates in which nomadic pastoralists live, a system in which livestock numbers do not fluctuate is not desirable, and perhaps not even feasible (Sandford and Scoones 2006). The alternative, therefore, would be a system in which livestock numbers go up and down, but with a reduction of the human suffering and loss of capital that drought-induced livestock deaths currently entail. One possible way to achieve this is through an increase in offtake and conversion of livestock to other forms of capital.

System identity elements provide some insights regarding the nature of the envisioned alternative. Stakeholders wishing to push the system towards an alternative could adopt a strategy of selecting system elements that they could try to enhance: for example, local markets, herd mobility, and water points located in drought reserve pastures. Improving local markets, for instance, could help to remove livestock from the system in times of drought while preserving the capital that they represent. This, in turn, might help to lower the threshold for household herd size. Currently, larger herds represent a buffer against drought, but if a household could be assured of being able to sell their animals at a reasonable price in times of drought, the need for the buffer would be reduced.

However, the alternative system will probably also require the introduction of *new* elements into the system. For example, new livelihood activities could help to absorb some of the human population and also provide objects for investment other than livestock. This too could help to lower the threshold for household herd size insofar as some of the household's livelihood would come from other

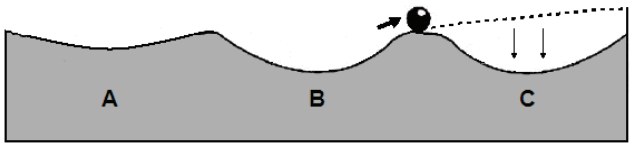

Fig. 5: Envisioning and Creating a Third Stability Domain
If the perverse resilience represented by valley "B" is becoming more resilient and traditional pastoralism represented by valley "A" less so, then one option for stakeholders will be to try to envision and create a third alternative (C). The arrows represent deliberate action taken by policymakers and other stakeholders to create this alternative.

sources. Diversification of livelihoods could also help to strengthen markets if significant numbers of households begin to satisfy their needs for meat and milk through purchases rather than by raising their own animals. Careful attention would have to be given to how such activities might affect other elements of the system. For example, promoting horticulture on land around permanent water sources could have negative consequences for pastoralists. A key to creating this alternative system would be to establish new relationships among variables such that the vicious circle described in Fig. 3b no longer exists or is at least mitigated.

The matter of how to create an alternative stability domain, and whether to do so is even desirable, can be informed by researchers and by insights from resilience thinking. But definitive answers to these questions for any particular social-ecological system would require further research, far-reaching stakeholder consultation, and real world action. These questions are of great relevance to current policy debates on pastoralists and pastoralism. One of these debates is being promoted by the Future Agricultures Consortium[2]. The pessimistic side of the debate argues that in most of the Greater Horn of Africa there are now too many pastoralists, which, combined with a natural resource base that is not increasing in productivity, means that not enough livestock can be kept to sustain a viable pastoral system (Sandford 2007). According to this argument, the best that can be hoped for is for is a significant reduction in the number of people dependent on pastoral livelihoods.

Reacting against this kind of thinking, Devereux and Scoones (2007) argue that a focus on any optimal minimum livestock:human ratio is misguided, in part because most pastoralists have other livelihood sources, and so there can be no standard minimum ratio. Instead, they argue, policy should focus on strengthening local market linkages and fostering diversification, while also supporting and maintaining traditional livelihoods and the resources that these livelihoods rely upon. The two sides of the debate share the view that livelihood diversification is needed, but a key difference lies in how and to what extent traditional pastoralism should be supported in the meantime. Devereux and Scoones advise extreme caution regarding irrigated agriculture, insofar as it threatens to convert productive riparian grazing areas to agriculture and thereby "encouraging even greater collapse" (2007: 4). The issue is whether traditional pastoralism is worth supporting while the hoped-for diversification takes place, or whether all efforts should be put towards creating new livelihoods and getting as many people out of the pastoral economy as quickly as possible, a system transformation in the sense described by Walker and coauthors (2004).

The policy choice depends upon whether and how a viable alternative to the vicious circle depicted in Fig. 3b above can be created. Since not all dryland pastoralist systems are alike, the answer will vary from case. For instance, on the whole, our observations suggest that Gabra livelihoods are almost certainly less diversified than Maasai livelihoods. In addition, for the Gabra the issue of grazing lands lost to irrigated agriculture is not as severe as has been described for many other pastoralist systems (e.g., Kloos 1982; Tadesse and Peden 2005; Mwangi 2006). It is these kinds of details that will determine, on a case-by-case basis, how existing pastoralist systems might be supported, or in what new direction they might be pushed, as well as the kinds of policy and programming levers that might be helpful. These are the kinds of details that the sort of analysis in this paper can help to uncover.

In conclusion, the systematic application of resilience thinking to questions of pastoralist policy is relevant. *Resilience*, however, is an abstract concept referring to an emergent property of a complex system that is not directly observable. Therefore, the task is to operationalize *resilience* and taking it beyond the level of a metaphor. The components-relationships-innovation-continuity framework (Cumming *et al*. 2005) is one approach to accomplish this. It allows the policymaker to develop an analytical description of a pastoralist social-ecological system and its identity. Such a framework can help in understanding the dynamics of complex social-ecological systems, in part by identifying the elements of a system for which threshold effects are important.

One could infer, from the types of indicators that HISs typically monitor, that resilience of the Gabra pastoralist system has been eroded. For instance, increasing numbers of Gabra are relying on food aid in permanent settlements. Indicators/surrogates based on resilience thinking, however, can help to make clear the dynamics of *how* resilience is being lost. Elements of the Gabra system that we have identified (and their respective indicators) include camels (number of camels per household), other types of livestock (number of animals per household), and pasture regeneration processes (level of regrowth of certain plant species within some defined radius from permanent water). What makes these kinds of indicators different is that the variables they measure are integrally linked to each other and create the basin of attraction that defines the system. The approach also highlights the need for stakeholders to envision alternative "stability domains"—alternative systems that would probably bear similarities to traditional pastoralism but that would also involve novel elements such as new livelihood sources. Assessing alternatives in terms of stability domains can help to shed light on policy choices related to supporting traditional pastoralism versus

[2] The Future Agricultures Consortium (www.future-agricultures.org) is a partnership between research-based organisations in Africa and the UK that promotes stakeholder-led policy dialogues.

encouraging alternative livelihoods. Our aim has not been to resolve any of these policy debates, but rather to demonstrate the relevance of resilience thinking to questions of pastoralist policy. One contribution that resilience thinking can make to policymaking is in terms of clarifying information needs, and identifying appropriate indicators and warning signals.

Acknowledgements The research on which this paper was based was financially supported through doctoral fellowships to Robinson from the Social Sciences and Humanities Research Council of Canada (SSHRC) and the International Development Research Centre (IDRC), supplemented by an IDRC project grant to Berkes and the Canada Research Chairs program (http://www.chairs.gc.ca). The research also benefitted from in-kind support from the Pastoralist Integrated Support Programme and the International Livestock Research Institute. We would also like to thank the participants and respondents in this research: Kenyan pastoralists and a great many people who are working on their behalf.

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