Development process resilience and sustainable development: Insights from the Drylands of Eastern Africa

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Abstract

Recently, the development and humanitarian relief communities have directed their attention to building resilience to droughts and other shocks and stresses. Using *resilience* as a framework for planning investments in disaster risk reduction and development activities faces a number of challenges. Development implies that people are actively changing, which poses the question of whether such changes are adaptations or transformations, or whether this is a subjective or academic distinction. The lack of clarity presents a challenge for monitoring resilience-building investments, yet such investments require indicators of impact. In this paper we argue that resilience of the system *per se* is not the primary goal of development and may sometimes be an impediment. We propose an alternative approach to conceptualizing resilience that more accurately reflects the concerns of the humanitarian relief and development communities, which is based on monitoring resilience of the development process, rather than resilience of a given system.

Keywords

Pastoralism, Process Resilience, Social Resilience, Transformation, Dryland, Arid

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Introduction: resilience in the current discourse on dryland development

The drylands of eastern Africa are frequently subject to drought. In the past decade the region has reportedly experienced an increase in drought-related humanitarian crises[1] and this contributes to the growing interest amongst humanitarian agencies and development partners in the concept of resilience. The recurrence and increasing impact of drought is raising doubts about the viability of pastoralism amongst some actors in the region, whilst other actors see the alternatives to pastoralism as less resilient, despite their popularity with some development actors (Headey et al., 2012).

In 2010-2011, drought in the Horn of Africa affected over 13.5 million people and led to creation of the Drought Disaster and Sustainability Initiative (IDDRSI) of the Intergovernmental Agency on Development. Through IDRISSI countries are developing investment plans following a Common Architecture for Resilience. International donors have pledged over USD1.2billion to the initiative and a Global Alliance for Action for Drought Resilience and Growth has been established by development partners to coordinate support to resilience building in the region[2].

It is evident that resilience may be understood in a number of different ways and can mean different things to different actors: for example resilience can be applied to an ecosystem, a household, a community or a national economy. There are particular questions of scale, since it cannot safely be assumed that resilience of individuals adds up to resilience of a community (Norris et al., 2008) or that resilience of communities adds up to resilience of the wider society (Carpenter et al., 2001). Neither can it be assumed that strengthening resilience in one community does not have a negative impact on the resilience of another community, or that resilience to one event is necessarily compatible with resilience to other events (Cifdaloz et al., 2010; Walker et al., 2006).

For all its popularity, important questions remain over how to measure resilience, particularly in relation to social systems, and how to address possible risks associated with resilience. There is also inadequate attention to the role that shocks such as drought play in driving social transformation and the long term implications (positive as well as negative) of such transformation. Institutions that are attempting engage in resilience programming have operational definitions to guide their work but these are generally limited by inadequate understanding of resilience as an emergent property of a system; hence they rely on groups of indicators without really engaging in what is different about resilience. Assumptions that are made in resilience work have not been adequately scrutinized, including the assumption that social and ecological systems function similarly and therefore display similar resilience attributes.

[1] http://hornofafricadevelopment.org/docs/USAID-Resilience-Paper.pdf

[2] http://www.disasterriskreduction.net/fileadmin/user_upload/drought/docs/REGLAP_Information_brief_on_IGAD_led%20_IDDRSI.pdf

This paper examines the relationship between resilience and sustainable development in developing country contexts. We identify challenges in defining system function, basins of attraction and thresholds for social systems, all of which present obstacles to monitoring resilience. We also identify a challenge in differentiating between adaptation and transformation and suggest that social system resilience *per se* is not the principle goal of development. Rather, transformation of social systems may sometimes be either an explicit goal, or an accepted side-effect of development. Sustainable development, in other words, implies managed transformation. We argue that if our overall goal is sustainable development, the aim of monitoring should be to track the resilience of the development process and the implications of perturbations to development. Using examples from pastoral development in eastern Africa we illustrate the types of indicators that could be informative in understanding resilience as a property of sustainable development processes.

System resilience

While there are various strands of research and theory informing current discussions of resilience in the relief and development communities, scholarship that focuses on resilience as a property of complex social-ecological systems is the most developed, although difficult to apply in practice. The concept of *resilience* in this school of thought evolved first in the field of ecology as a way of understanding how ecosystems respond to disturbance. As the role of human influence on the environment has become better acknowledged, the notion of interdependent social-ecological systems became popular (Berkes and Folke, 1998). Social-ecological resilience has been defined as "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (Walker et al., 2004, p. 5). Social-ecological systems are complex and dynamic and they consist of a diversity of components and sub-systems that interact and continuously evolve and adapt according to their interactions. Resilience is an emergent property of such systems, one that is not reducible to the discrete components of the system (Carpenter et al., 2005; Gunderson, 2000). The way such complex systems respond to disturbance can be unpredictable as they undergo changes that may be rapid or slow, gradual or episodic, depending on the nature of the stimulus and the state of the system (Folke, 2006; Gunderson and Holling, 2002).

This continuous process of change poses a challenge for defining the system “function, structure, identity, and feedbacks”. The term “basins of attraction” has been used to describe the quasi-equilibrium in which a system tends to remain despite being moved around within the basin by constant disturbances (Walker et al., 2004). When a disturbance is great enough, a social-ecological system can be pushed from one basin of attraction to another. Moving across such a threshold, or tipping point, requires a fundamental change in the system to a new state, or ‘regime’ (Walker and Salt, 2006), with a new system configuration. New regimes may be resilient but they are not necessarily desirable, and they may sometimes represent a form of “maladaptation”: for example poverty traps (Barrett and Swallow, 2006) or bush-encroached rangelands (Angassa and Oba, 2008). The challenge of system definition is compounded by the subjective nature not only of determining which basin of attraction is preferable to another, but also of determining which functions, structures and feedbacks are relevant in determining just what that system is (Cumming et al., 2005).

The nature of resilience as an *emergent* property poses another challenge: that of measuring resilience. It may be that the only sure way to identify the threshold of a basin of attraction is to cross it (Carpenter, 2003). For these reasons, when attempting to assess and measure social-ecological resilience it may be more

appropriate to think in terms of "surrogates" rather than direct "indicators" (Carpenter et al., 2005). Attempts to operationalize *resilience*, moreover, have tended to use contextual case study methodologies rather than development of standard indicators/surrogates: e.g. the components-relationships-innovation-continuity framework (Cumming et al., 2005; Robinson and Berkes, 2010), and the assessment framework for practitioners published by the Resilience Alliance (Resilience Alliance, 2010).

Distinguishing social and ecological resilience

The use of the term *social-ecological resilience* has arisen because ecological and social systems do not evolve in isolation: the concept of resilience must encompass the dynamic relationship between the two. Human sustainable development depends on ecosystems for the services they provide: for example provision of food and water or regulation of climate. However, human action (often in the name of development) changes these ecosystems and can undermine their capacity to support life. Specialization of human activities can lead to loss of biodiversity for example, which in turn weakens the long term resilience of the ecosystems on which those activities depend (Brock et al., 2001; Holling, 1986), and agricultural production is one of the prime examples of this. On the other hand, human activities can also help to maintain resilience of social-ecological systems. In pastoral systems for example, human management of livestock herds shapes the productive environment by mimicking seasonal grazing patterns of natural herbivores; in this way, management contributes to the functionality and resilience of semi-arid grasslands (Holling, 1986).

The linkages between the social and the ecological are so profound and pervasive that they should be understood as a coupled social-ecological system rather than as two discrete entities—this principal has been central in resilience thinking. Yet, the social science aspect of resilience thinking has not been systematically developed (Berkes and Folke, 1998; Davidson, 2010). Despite the integral relationship between social and ecological systems, it does not follow that the concept of *resilience*, as it was developed in the field of ecology, necessarily applies to resilience of social systems (Adger, 2000). For instance, resilience models do not account well for the impacts of individual agency, power and institutional arrangements in society but instead make assumptions about consensus that are not well supported with evidence (Hatt, 2013).

The notions of *function* and *regime* and the concept of thresholds and tipping points also present particular challenges when it comes to understanding resilience of social systems. Social systems are not simply the outcomes of structural variables, but are driven by conscious choices, both individual and collective. Human beings exercise agency in a number of ways: for example, they can postpone the effects of an ecological disruption, either delaying its impact or displacing the impact to an alternative location. They use imagination and creativity to influence their development pathways. Humans can anticipate events, for example using technology to foresee disturbances, they can anticipate risks and can take steps to deal with them and they have the capacity for collective action. Human agency is not equally distributed and there are highly disproportional effects of power and privilege. Privilege influences not only the distribution of resources but can result in an absolute decline and can also weaken the capacity of other agents to respond to danger signals (Davidson, 2010).

A key component of resilience in complex systems is the capacity for self-organization without system-level intent: interactions among components feeding back to produce macroscopic system properties and patterns which in turn influence the interactions that produced them (Levin, 1998; Walker et al., 2002). A market is an example of self-organization in a social system—the individuals involved may be completely

unaware of the overall system, or even if they are aware of it may be doing nothing, whether individually or collectively, to deliberately influence it. However, human beings do respond and adapt to stressors and changes and engage in intentional actions including, at times, collective action aimed at influencing the social and ecological systems within which they operate

One recent approach which attempts to account for the role of human agency in resilience has been to integrate insights from two strands of literature—one on resilience in social-ecological systems and the other on the psychology of development and mental health—to conceptualize what constitutes not social-ecological system resilience but *community* resilience (Berkes and Ross, 2013). Another approach is to distinguish resilience from adaptability and transformability, the latter being described as pertaining to the capacity of social components in a system to manage resilience (adaptability) and to create fundamentally new system configurations (transformability) (Gunderson et al., 2006). Approaches to "adaptive co-management" emphasize learning from experience to respond to feedbacks and to govern these transformations (Plummer and Armitage, 2007).

Social-ecological systems, if they are resilient, adapt continuously to retain their basic function within a given regime. However, there is lack of consensus in the literature as to whether resilient systems are those which adapt and remain fundamentally the same (Walker et al., 2004) or whether resilience also includes the capacity for transformation when systems cross thresholds into a new configuration (Folke et al., 2010). The most common usage of *resilience* appears to be the former: "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner" (UNISDR, 2012). Others consider adaptation to be distinct from resilience and related more to the collective effort to reduce exposure to or impact of disturbances (Davidson, 2010). Transformation, by contrast, has been described as "the capacity to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable" (Walker et al., 2004, p. 5).

Transformation does not necessarily imply a negative social outcome. Where a system exists in an undesirable state, "managing resilience" implies helping the system to transform. Managing system resilience requires capabilities not only for enhancing desirable resilience, but also for reducing the undesirable in order "to preserve the flow of economic, social and environmental benefits to society as a whole" (Walker et al., 2010, p. 15). Since the field of development tends to assume that societies should constantly improve, the concept of 'bouncing forward' – transforming into a qualitative better state – has been put forward (Lebel et al., 2006). However, the process of transformation can be inequitable and unpredictable and will have winners and losers: the process is inherently political. For instance, many African governments consider pastoralism to be an undesirable system and have taken measures to transform it and turn mobile pastoralists into sedentary livestock keepers or crop farmers (Davies et al., 2010; Niamir-Fuller, 1999).

System resilience and sustainable development

With the development community devoting resources to building the resilience of dryland communities to drought and other shocks and stresses, the frequently repeated question – "resilience of what, to what?" (Carpenter et al., 2001) – again calls for answer. Simplifying the problem by focusing on a narrow system and its response to a very specific event – for example resilience of community X to drought – incurs a number of risks: it tells us nothing about progress towards higher level development goals, or about the impact of local

resilience on other communities or on the society at large, and it assumes that short-term resilience is compatible with long term resilience. It also runs the risk of causing unanticipated feedbacks. It is important to monitor the possibility that resilience programming could be harmful if by strengthening short-term resilience to a specific event it contributes to a loss of flexibility in social systems (Berkes et al., 2003). As resource management becomes more efficient in meeting short-term goals and controlling variability, so institutions and technologies may become more rigid and less responsive to environmental feedback. There are numerous examples of the aggressive extension of 'green revolution' practices to the drylands – practices such as monocultures of high yielding crop varieties – that have made ecosystems and people more vulnerable to external shocks such as droughts or pests (Holling, 1986).

Moreover, measuring resilience of social systems is fraught with difficulties. It may not be practical to define a 'function' or regime of a social system when in reality the system is subject to human intentionality and is constantly evolving and adjusting to multiple stimuli. As a result, social systems may not have identifiable thresholds beyond which point they can be definitively stated to have changed regime. Determining when the resilience of a social-ecological system is or is not desirable involves value judgments and is inherently political (i.e. involves human agency).

More importantly however, if development is a process of transformation then a desirable social system may be one that is better described as malleable rather than resilient. Transformation in social systems has been described as being "the equivalent of societal collapse: the whole-scale breakdown of multiple institutions characterizing a social system" (Davidson, 2010, p. 1145), yet system transformation has also been described as the evolution of structures and processes and renewal of the system that allows for continuous development, (Smit and Wandel, 2006) or the reorganization of a system for a more desirable state (Walker et al., 2004). Resilience of a social system, therefore, may be desirable in certain circumstances and undesirable in others.

Nor is system resilience necessarily the primary objective of development and many examples can be found of societies transforming in the pursuit of development. Both the emergency relief and the development communities are interested in characteristics that can be summarized by common human development indicators: the development community is interested in improving those indicators over the long term, and the relief community is interested in maintaining those indicators over the short term in the face of droughts and other disasters. Achieving this will sometimes require resilient systems but will sometimes require transformation of those systems.

Development process resilience

We therefore propose that it is necessary to differentiate between resilience of a given system and resilience of the development process. We assume that development process resilience is the goal of communities and their development partners, even though there may not be consensus on development goals. Resilience of social systems, or social-ecological systems, on the other hand, can be undesirable if it impedes development. In this paper, therefore, we use the term "development process resilience" to imply continued progress towards self-defined sustainable development outcomes for human welfare. We suggest that focusing on the resilience of the development process will also help to overcome some of the difficulties inherent in measuring and monitoring the resilience of social-ecological *systems*. While it is recognized that "process resilience" will often benefit from social-ecological system resilience and that social stability may be one explicit development goal of community members, we suggest that rather than monitor resilience of

social or social-ecological systems *per se*, what is important is to measure progress toward development goals and the attributes of the system that confer resilience on that development process.

Figure 1 illustrates a stylized view of resilience of the development process. Scenario A depicts multiple disturbances leading to a volatile development process, but with an average development trajectory that is not altered. In Scenario B development progress is slowed down by a disturbance but the rate of progress returns to pre-impact levels thereafter. In Scenario C a disturbance permanently slows down the rate of development, whilst Scenario D depicts a decline in development as the result of a disturbance. Monitoring progress towards development goals allows us to track performance of social systems and could inform us about their capacity for transformation. It also allows for comparison between communities and across levels and scales and allows a more nuanced assessment of resilience – inferred for example from the relative rate and steadiness of progress towards certain development goals rather than a simpler binomial resilient versus non-resilient.

Figure 1: Comparative Resilience of Sustainable Development: impacts on the rate of development

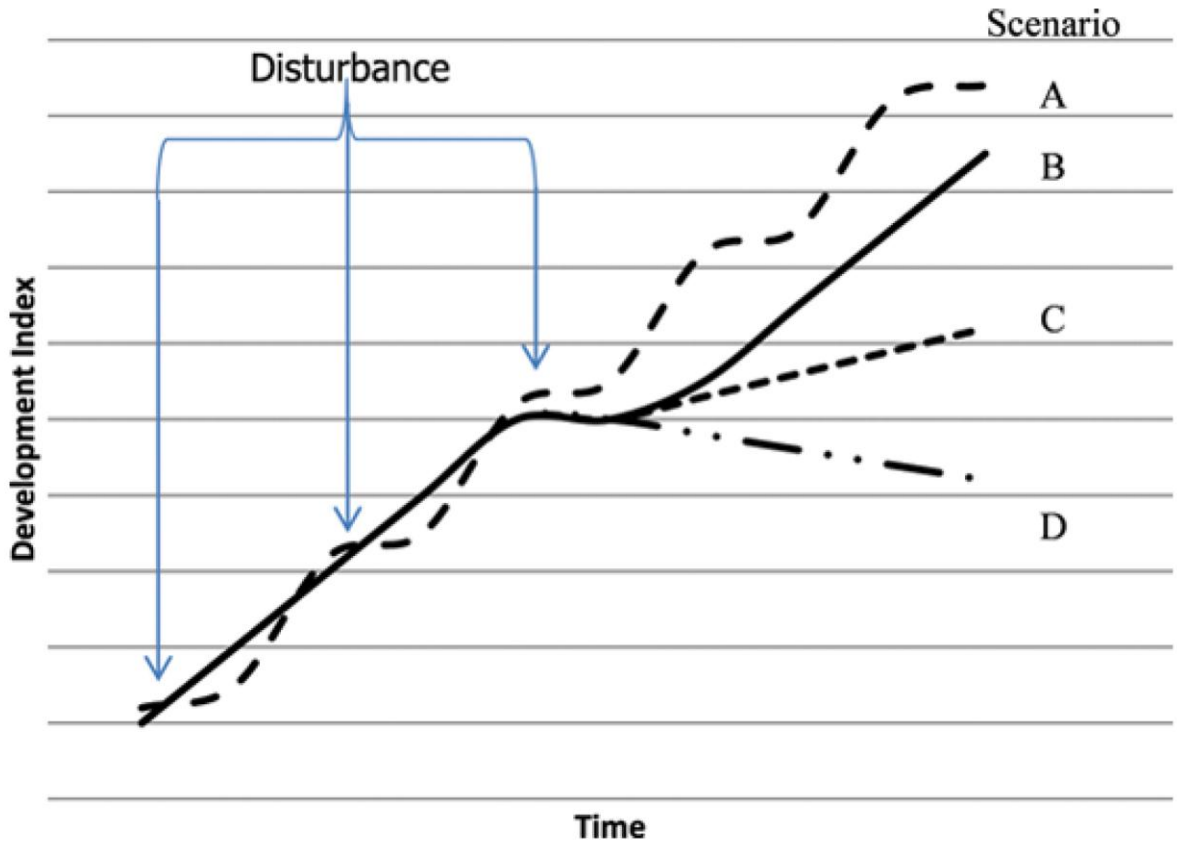

Figure 1. Comparative resilience of sustainable development: impacts on the rate of development. Scenario A: multiple disturbances lead to volatile development progress. Scenario B: a disturbance slows down development, but progress recovers to pre-impact rate. Scenario C: a disturbance permanently slows down the rate of development. Scenario D: a disturbance leads to development decline.

Options for measuring development process resilience

The selection of indicators of development process resilience will inevitably be dictated by costs, but will also be influenced by the scale of analysis. Household level analysis will give more precise insight to resilience at a micro-scale but this will not be adequately informative about resilience of development at the national level. According to one OECD resource, development may be thought of as an "increase in well-being across the members of a society between two points in time" (United Nations, 2008, p. 2), with a strong emphasis on economic growth (GDP). This definition is narrower than some measures, although it captures a wide variety of assets that contribute to market production, including financial, produced, natural, human and social capital. However, the OECD also recognizes broader interpretations of development that encompass, for example, human rights (United Nations, 2008).

National data sets, such as GDP figures, can be used to identify macro trends and observe correlation with particular influences, but will be less sensitive to localized performance and changes. There are a number of different development indices or indicators that can be monitored, and the choice may be influenced by the definition of development, level of detail sought and the scale of analysis (e.g. whether national, community or household level). Members of a community may have a diversity of development goals and this should also be considered when developing indicators and methodologies.

The Human Development Index (HDI) provides a broader measurement of development than GDP, based on life expectancy, education and income (UNDP, 1990). The HDI is routinely used by the United Nations to monitor development, and in many countries can be disaggregated to the sub-national level, allowing comparison of national performance with that at district level, or comparison between districts. School enrolment rates for example may be informative in identifying negative outcomes from influences such as drought and would lend themself to quite localized analysis, for example at the level of individual schools and communities. The advantage of using multiple indicators is that the data will give a more comprehensive view of resilience, which would better reflect the trade-offs inherent in household-level decision-making: for example, to withdraw children from school to boost the labor force, or to change marketing practices in order to maintain children in school.

However sustainability of development is not captured by the HDI which presents a limitation for monitoring long-term resilience of development. There is no standard approach in common use for monitoring sustainable development although there are numerous approaches that have been used at national level in different countries (Hass et al., 2002). The Millennium Development Goals (MDGs) provide one framework for measuring development reflecting the three dimensions of sustainability: economic, social and environmental (United Nations, 2012). The MDGs are arranged in seven categories (leaving aside Goal 8: Global Partnerships), with a number of sub-goals, that provide greater definition in each area and which can provide the basis of a monitoring tool:

1. Poverty and hunger;
2. Primary education;
3. Gender equality;
4. Child mortality rates;
5. Maternal health;
6. Levels of HIV/AIDS, malaria, and other diseases;
7. Environmental sustainability.

MDG indicators vary from country to country but national statistical offices are mandated to track progress in implementation of Poverty Reduction Strategies (PRSPSs) which are intended to be aligned with the MDGs. However, dryland regions are often poorly represented in national data sets and monitoring of the key indicators for these regions is anticipated to be weak in most countries. Moreover, there appears to be limited systematic monitoring against MDG indicators at the sub-national level.

Indicators of development, and therefore of process resilience, are likely to differ between national (and possibly district) level monitoring and monitoring at the community scale. Community indicators could be identified through a more participatory approach and would be expected to give a much more precise view of the resilience of development at a localized scale. Household-level analysis is routinely conducted by humanitarian organizations for example and this provides a potentially rich source of data for tracking development progress over time. Other definitions of development may also be used to guide monitoring, such as human freedom (Sen, 2000) which might be tracked through a tool like the Democracy Index, as compiled by the Economist Intelligence Unit.

Measuring Development Process Resilience of east African Pastoralists

To illustrate our proposition we draw on experiences of pastoralist development from eastern Africa. Pastoralism has sometimes been defined in terms of its adaptability, and pastoral communities employ elaborate risk management strategies, seeking reliability through their management practices in a highly uncertain environment (Roe et al., 1998). Sustainable pastoralist development should—although often does not—emphasize the centrality of adaptive capacities. Pastoralists in eastern Africa have developed many ways of managing risk which have been widely researched in an attempt to understand the rationale and customs of pastoral management. Pastoralists' adaptations to dryland ecology include herd (and sometimes household) mobility, protection of distinct seasonal resource zones, maximizing stock numbers during productive periods, diversifying livestock species, herd splitting, pooling resources, diversifying incomes and labor migration (Scoones, 1994).

Although traditional pastoralist capacities to manage risk may have been strong in the past, in many cases they appear to have been weakened (Davies et al., 2010). Pastoral systems may be losing their adaptability and becoming less resilient, or perhaps transforming to less desirable states. Development policies and investments can contribute to loss of resilience by undermining adaptive strategies and capacities (Angassa and Oba, 2008). For example, engagement in markets may contribute to some elements of resilience of the development process, but it can also expose producers to new risks whilst weakening internal exchanges that underpin traditional insurance mechanisms (Davies and Bennett, 2007).

Pastoralists seek stable livelihood outcomes (including food security) within a highly variable and dynamic biophysical environment and one that is also often highly socio-politically uncertain (Roe et al., 1998). Process resilience may therefore be measureable in terms of improvements in these livelihood outcomes in a context of patchy and ephemeral grazing and water resources combined with unpredictable disturbances such as drought, insecurity, land expropriation, global economic downturns, and volatile markets. However, resilience for pastoralists also has to be differentiated from the continuation of the practice of extensive livestock husbandry by all people in the system: the pastoral system itself encompasses people who do not keep livestock, but who play an important role in the resilience of the overall system (Homewood, 2008). Desirable pastoral resilience, therefore, is not necessarily the persistence of a particular form of pastoralism (i.e. the system) or of particular cultural traits of pastoral societies.

Based on the literature referenced in this article, a number of indicators of resilient pastoralist development can be identified, as listed below. As the list illustrates, suitable indicators could be informative of both development process resilience as an outcome as well as of the determinants of sustainable development outcomes: for example, good governance is both a means and an end of development. It may be informative to investigate this distinction further.

Categories of indicators of resilient pastoralist development might include:

1. Income and income diversity
2. Asset and asset diversity (including, but not restricted to, livestock herds)
3. Rangeland ecosystem health
4. Security
5. Equity
6. Local governance
7. Resource rights (including land, water, forests)
8. Market access and transaction costs
9. Urban growth and integration

Some of these types of indicators might be similar or even identical to indicators used to assess system resilience: for example, resilience of rangeland ecosystems may be very consistent with sustainable development. However, some other characteristics in this list – local governance and equity, for example – can be expected contribute to the transformation of the social system rather than its resilience. In the following sections we elaborate on three selected indicators to examine how each relates to development process resilience and to resilience of social-ecological systems.

Rangeland ecosystem health

To use rangeland condition as an indicator of development process resilience has implications for how we interpret degradation, since changes to the ecological regime may sometimes be consistent with development that is both sustainable and resilient. It is possible to envision significant transformations of rangeland social-ecological systems that are coherent with sustainable development of pastoralism, such as replacement of riparian vegetation with irrigated fodder production. In addition to the subjective nature of degradation, dryland ecosystems exist in a state of non-equilibrium, which has presented challenges for monitoring rangeland ecosystem health: the dynamic nature of vegetation cover and diversity make them unreliable indicators on their own (Behnke et al., 1993). To assess whether the development process is resilient therefore requires indicators of ecosystem function in the rangelands and monitoring of on-going changes. Recommended indicators of rangeland ecosystem function include soil and site stability, hydrologic function and biotic integrity (e.g. long term trends in composition of grasses versus shrubs) (Pyke et al., 2002).

Measuring rangeland ecosystem health as an indicator of development process resilience inevitably will include some indicators that are also pertinent for measuring resilience of social-ecological systems. We anticipate a close relationship between rangeland social-ecological system resilience and pastoralist development process resilience, but whereas we assume the latter to be always desirable, we cannot confidently say the same about the former: we do not make a judgement on the relative value of different configurations of the ecosystem. We propose that a declining trend in ecosystem services is unsustainable and therefore inconsistent with development process resilience. However, we consider there to be a range of possible configurations of the social-ecological system that may be consistent with resilient development.

Assessing this range of options would be highly informative of the most efficient development strategies and the trade-offs between alternatives. Drivers of change in rangeland ecosystem services can also be monitored to identify positive and negative feedbacks between development and resilience, such as the risks associated with land fragmentation and grazing mismanagement or the benefits of rangeland rehabilitation.

Local governance

The UNDP's 2002 Human Development Report, in a thorough review of the connection between good governance and development, argued that although the causal relationships are by no means straightforward, democracy and good governance are essential for improvements in human development (UNDP, 2002). This relationship is relevant not only for development over the long term, but also for coping with disasters in the short-term: as Nobel laureate Amartya Sen (Sen, 1997) has noted, famines do not occur in democratic countries. We therefore assume that there are features of governance which universally contribute to the resilience of the development process and which transcend idiosyncratic institutions or particular system configurations. Essentially, these are characteristics that are typically referred to as elements of "good governance": elements such as accountability, transparency, and voice.

Institutions and other elements of governance are also central to the resilience of social-ecological systems (Folke et al., 2005) and pastoralist systems are a case in point: clan councils (Robinson and Berkes, 2010), institutions around water and pasture commons (Niamir-Fuller, 1998; Robinson, 2009), and traditional meetings institutionalized in pastoralist cultures (Robinson et al., 2010) have all been cited as integral elements of pastoralist systems. The undermining or disappearance of such institutions from pastoralist systems has knock-on effects that can result in complete system reconfigurations. Assessing the contribution of governance to system resilience is context specific, based on an understanding of particular institutions and the nature of their relationships to other elements of their social-ecological system. It is therefore important to decouple general features of good governance—such as transparency or accountability—from the persistence of particular institutions. The former are always positive whilst the latter may be positive or negative depending on context. Also note that in cases where system transformation is desired, good governance is essential (Olsson et al., 2006).

Assets and asset diversity

Traditionally, indicators of development have focused heavily on income and production, and more recently on the ownership of or access to a broader set of assets, including natural, human, financial, physical and social capital. However, resilience of the development process is determined additionally by the feedback between types of assets owned and used: for example, the detrimental impact of livestock numbers on rangeland ecosystem health. Whilst development process resilience may require a growing total asset wealth, it cannot be assumed that growth in assets automatically lead to development process resilience. Indeed, for assets to grow indefinitely would almost certainly require a complete transformation of the pastoral social-ecological system: from one dominated by the livestock economy to one dominated by other economic sectors. In assessing development process resilience, the viability of individual households to remain as pastoralists is not the primary concern: maintaining a certain household herd endowment cannot be assumed to be always positive for sustainable development. Rather, the concern is with the aggregate value of household assets—livestock, cash savings, farm equipment, and so on—as these can all contribute to the household's ability to buffer against shocks and stresses and to reinvest.

This implies an important difference between asset indicators of development process resilience and social-ecological system resilience. For the latter, livestock numbers are key: the resilience of a pastoralist *system* demands that most households have a certain minimum number of livestock in order for them to continue earning a livelihood from livestock and maintain viable herds (Lybbert et al., 2004). An assessment of resilience in a pastoralist social-ecological system would therefore use livestock assets per household as an indicator. However, in traditional pastoralist systems, severe droughts function as a mechanism that prevents livestock numbers from growing to the point that they cause environmental degradation. Relief programs that directly or indirectly prevent livestock deaths or that quickly restock pastoralists after drought-related losses may in some cases have the unintended effect of undermining the feedback between livestock assets and rangeland health and may contribute to environmental degradation and an overall decline in the productivity of livestock keeping. For such reasons it has been suggested that a pastoralist system in which livestock numbers do not fluctuate may be neither feasible nor desirable (Sandford and Scoones, 2006). Using livestock per household as an indicator of system resilience, therefore, necessitates finding not only a lower threshold below which households cannot continue to earn a livelihood from pastoralism, but also an upper threshold above which environmental degradation occurs. We suggest that the focus in asset indicators of development process resilience, on the other hand, would consider to totality of household assets.

Conclusion

We have argued that investments in resilience building in eastern Africa are constrained by inadequate understanding of resilience as an emergent property of a system and of the link between resilience and the process of sustainable development. We propose an alternative interpretation of resilience that more closely resembles the goals of these actors and we propose ways to measure this. Some indicators of development process resilience are similar to indicators of social-ecological system resilience, but not all, and the differences may be highly informative about the trade-offs, costs and options of development. While assessments of the resilience of social-ecological systems may be useful, it is not the resilience of social-ecological systems that is the aim of development or even of disaster risk reduction. Moreover, using social-ecological system resilience as a framework for assessment introduces an unnecessary complication in that system resilience is difficult to measure insofar as it is context specific, and is not always desirable. For development to be resilient, sometimes systems need to be transformed.

Further work is required to differentiate indicators that are unequivocally positive from those that are context specific. This differentiation may help benchmark development and also tailor development investments to different contexts. Indicators of process resilience appear likely to have less problem of contextual specificity and we suggest that the ideal indicators are those which are unequivocally positive. Further insight is needed, through empirical research, to differentiate between indicators of resilient development outcomes and indicators of determinants of those outcomes. Those determinants may be intrinsic features of the system and this would be informative of the relationship between social-ecological system resilience and development process resilience.

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