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# Uncertainty, pastoral knowledge and early warning: a review of drought management in the drylands, with insights from northern Kenya

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This article explores the recent history of early warning systems in Kenya, determining key features of the entangled political, technical and conceptual processes that prefigure contemporary drought management there. In doing so, it draws out wider implications regarding drought and anticipatory action across Africa's drylands, considering the friction between the dynamics of disaster risk management that structure formal early warning systems and those that shape pastoralist engagements with the volatile and uncertain worlds they inhabit. Surveying recent literature on pastoralism's unique relationship with uncertainty, and associated forms of networked, relational resilience, it reflects on some of the inherent limitations of current approaches to "local knowledge" in the humanitarian sphere. In doing so, it emphasises the need for new, creative approaches to early warning and anticipatory action, which are not merely established via the external synthesis of data but are rather oriented around local pastoralist drought preparation and mitigation strategies and comprise enough flexibility to adapt to a fast-shifting terrain of challenges and possibilities.

KEYWORDS

**early warning, risk management, anticipatory action, drylands, drought**

## Introduction: anticipatory action in the drylands

Drought has long been a characteristic feature of Africa's drylands. Pastoralists, whose modes of production are oriented towards making a success of volatile conditions, prepare for and manage such times of extreme scarcity in a variety of ways, drawing on diverse social networks, skills and forms of information to strategically navigate a rapidly shifting terrain of constraints and possibilities. Their capacity to do so is nevertheless often greatly hindered by a number of converging unfavourable circumstances. Disasters themselves, ranging from droughts to disease outbreaks, floods, conflicts and locust invasions, are occurring with increasing regularity and intensity across Africa's arid lands, in many cases

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as a result of climate change (Braimoh et al., 2018; IPCC, 2019).[1] These disasters compound each other [as described by Levine et al. (2023)], but are also experienced by means of a range of other longstanding fundamental challenges resulting from historical marginalisation, negative perceptions or narratives and restrictive policies (Markakis, 2004; Oxfam, 2008; Derbyshire, 2020). Across multiple pastoral regions, such challenges have been oriented around livestock marketing, land rights, access to basic state services, infrastructure, education and health (see, for example, Pavanello, 2009; Roba, 2018).

Within this context, early warning systems and networks have, for several decades, played a fundamental role stimulating and shaping interventions in the drylands (see Weingärtner and Wilkinson, 2019; Levine et al., 2020). These systems integrate forecasting, hazard monitoring, disaster risk assessment and preparedness activities to enable timely action in advance of crisis across multiple sectors. Indeed, more widely, Pelling et al. (2020) have pointed to the substantial global impact such systems have had in preparing for and mitigating flood events, noting that the number of people killed or harmed by floods has reduced since the 1980s despite an increase in the occurrence of flood events themselves (see also UNISDR, 2019). Such a success story, though, is far less discernible within the context of drought management, certainly in eastern Africa—the focus of this article—where the last decade has seen a series of pronounced and protracted droughts, which in many instances have led to famine like conditions and crisis levels of hunger (Hillier and Dempsey, 2012; Farr et al., 2022). Despite timely warnings, pastoralist livelihoods have routinely been undermined. Assistance, often in the form of "anticipatory action"—a term referring to actions taken before a crisis in order to mitigate its worst effects –, has been minimal, often ineffective and broadly out of sync with local strategies and needs (see, for example, Mohamed et al., 2023). It is also worth noting that this term remains a relatively open-ended and ambiguous one, applied in different contexts to different forms of activity and assistance, including by some to the locally-led actions of populations affected by disasters. This article does not explore either early warning or anticipatory action from this perspective, seeking instead to interrogate the development of these modalities specifically within humanitarian settings and interventions.

To do this in appropriate detail, the article explores the recent history of early warning systems in one country—Kenya—, determining key features of the entangled political, technical and conceptual processes that prefigure contemporary drought management there, reaching back to inaugural early warning projects established in Turkana County in the far north (see Figure 1). In doing so, it establishes a discrete case study from which wider implications may be drawn regarding drought and anticipatory action across Africa's drylands today, interrogating the friction between the dynamics of disaster risk management that structure formal early warning systems and those that shape pastoralist engagements with the volatile and uncertain worlds they inhabit. Grasping the contours of this dissonance engenders fundamental questions about the scope of anticipatory action today, the assumptions upon which it relies and the enduring ambiguity between short-term humanitarian relief and long-term "resilience building" of which it is emblematic.

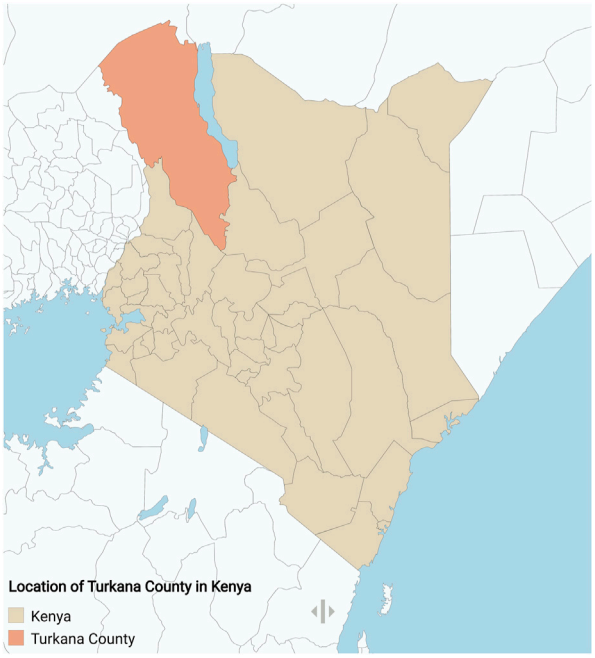


FIGURE 1
Map showing the location of Turkana County in Kenya's far northwest.

Unravelling the history of drought management in Kenya also sheds new light on the changing ways in which negative narratives about pastoralism, and indeed the northern rangelands themselves, have continued to dominate policy and decision-making, despite seismic paradigmatic shifts and, more recently, concerted efforts at multiple levels to identify and challenge such narratives (see Odhiambo, 2014; Semplici and Campbell, 2023). As we explore in the following section, Kenya's first early warning capacities were established in the 1980s shortly after, and to an extent by means of, a fundamental shift in understandings of drylands ecologies and pastoral production systems, through which colonial-era views of pastoral irrationality, over-accumulation and environmental destruction came to be comprehensively overturned (see

1 A large proportion of disasters are triggered by hydrometeorological hazards manifested in the El Niño southern oscillation (ENSO), whose frequency has increased in eastern Africa in recent years (for a detailed discussion see Park et al., 2020).

Hardin, 1968; Brown, 1971; Lamprey, 1983). In place of these older views, which, in general, corroborated a perspective of pastoral systems as "equilibrial" in nature, a picture of rangelands at "disequilibrium" was proffered, with evidence from across Africa demonstrating a socio-ecological situation in which volatility and instability were defining characteristics (see Ellis et al., 1987; Ellis and Swift, 1988).[2] Where older views had implied rigidity and vulnerability to change, the characterisation of drylands pastoralism as 'non-equilibrial' emphasised its flexibility, open-endedness and dynamism.

Alongside this change in thinking *vis-à-vis* pastoralism, drought early warning also rose to prominence in Kenya amidst a wider attentiveness to the political and economic contexts of famine [largely influenced by Sen (1980) and Sen (1981)]. New perspectives emerging in the early 1980s construed famine not merely as an inevitable outcome of drought or indeed as a result of livelihoods that were envisaged to be unsustainable, but rather as the result of long-term marginalisation and state neglect. Such perspectives (put into practice over the course of several years by means of a series of externally funded drought management projects) came later to be grounded in a wider set of political objectives that gained momentum in Kenya toward the end of the 20th century. These were oriented around a general dissatisfaction with the centralisation of power and decision making in Kenya's national government, and culminated not only in the establishment of the National Drought Management Authority (NDMA) but also in seismic constitutional reform and the devolution of power to local governments following a referendum in 2010 (Elmi and Birch, 2013).

This context of long-term political change, and the diverse narratives, ideas and institutional trajectories it has comprised, provides an effective framework within which to assess some of the features and dynamics of the early warning systems shaping interventions in eastern Africa's (and particularly Kenya's) drylands today. While these systems arguably harbour immense value and promise for pastoralist futures, the well apprehended disconnect they continue to comprise between data analysis and local experience (as outlined by Hall, 2007), and indeed their associated dislocation of decision making from the contexts in which such decisions matter (despite, in Kenya, their emergence amidst a protracted movement to devolve power to local contexts) are causes for concern. As we set out further on, a significant barrier obstructing the integration of local pastoralist strategies, needs and methods arises not from a lack of will, but rather from limitations in prevalent conceptualisations of the nature, boundaries and dynamics of "local knowledge." We argue that contemporary early warning systems and associated protocols and programmes have much to gain from embracing a more comprehensive understanding of this knowledge and the creative ways in which it is used in the contemporary world to manage volatile and uncertain contexts.

The potential impact of this shift is perhaps particularly discernible when one considers the longstanding predominance of what Lind et al. (2020: 1) recently referred to as "decentralised decision-making" in drylands societies, and the tendency for "many voices [to] count in deciding on land and resource uses" in these areas. The undermining of this characteristic decentralisation (which is arguably an essential means of managing high levels of volatility and spatio-temporal variability) is feasibly a significant factor limiting the effectiveness of drought management today, both in Kenya and more widely, regardless of technological advancements. Whilst droughts have been accurately forecast, anticipatory actions formulated in situation rooms via the external synthesis of diverse datasets (both quantitative and qualitative) have failed to meet local needs and have failed to account for, or address, the complex and constantly shifting mosaic of causal factors leading to phenomena such as food insecurity and acute malnutrition (see, for example, Burns et al., 2022; Levine et al., 2023). In the following section, we trace the emergence of early warning and drought management in northern Kenya, exploring their development from the 1980s to the present through multiple projects and political shifts.

## Drought management and early warning: origins and development in Kenya

The move to institutionalise drought management in eastern Africa and to establish systems that aim to stymie the evolution of catastrophic scenarios is ill conceived merely as emerging from various technological advancements associated with weather monitoring. In Kenya, the ascendance of early warning systems in the 1980s was in large part influenced by a prevalent dissatisfaction across multiple spheres with the forms of political exclusion and "under development" that recurrently allowed drought to develop into famine. In this sense, whilst formal early warning systems in their present format might generally be conceptualised as existing in, or at least being managed from, locations external to various drought afflicted areas, their initial emergence was very much associated with an acute, localised attention to the relationship between various forms of marginalisation and famine.

This is significant when one considers some of the contemporary social and political implications of Kenya's existing early warning systems. However, it is also significant in terms of forming a more general picture of the longer-term political processes in which drought management has been implicated in Kenya. Kenya's earliest drought management system emerged in Turkana, in the far northwest, in the second half of the 1980s during the final stages of the Turkana Rehabilitation Project (TRP), which had been established to deal with the impacts of a severe and

2 The term equilibrium, as discussed here, is not to be confused with the same term deployed in economics to articulate a balance in economic forces. In this article, the term is generally discussed in relation to ecosystems, referencing literature from Human Ecology.

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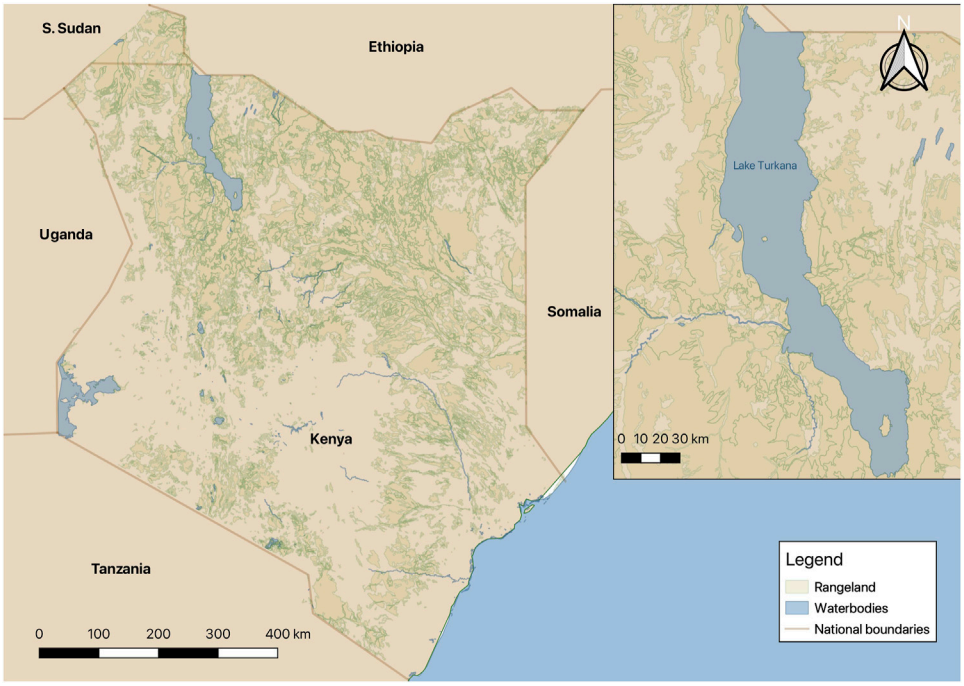


FIGURE 2
Map of Kenya showing rangelands and waterbodies, with a close-up of Lake Turkana (which lies to the east of Turkana County).

protracted drought (for an overview, see Derbyshire et al., 2024; see also Figure 2). This drought had caused catastrophic livestock losses (Hogg, 1982; McCabe, 2004), leaving thousands in an extremely precarious situation. The TRP constituted an international response funded via the European Economic Community (ECC) and the governments of the Netherlands and Norway. It instituted a diverse range of activities to deal with the crisis, from planting new woody species to a food-for-work programme, which saw destitute herders encouraged into riverside farming.

In the ensuing decades, the TRP, and indeed the wider world of humanitarian assistance in which it was situated, came to be critiqued at length (i.e., Hogg, 1982; Adams, 1986; Adams and Anderson, 1988; Derbyshire, 2020). For the most part, such criticisms have emphasised the negative characterisation of drylands pastoralism that shaped interventions throughout much of the 20th century and the general conceptual association of "development" with a shift away from pastoralist practices.[3] And yet, as much as the TRP was shaped by the various negative narratives that prefigured it, it was also a seedbed for significant, mutually entangled conceptual and programmatic shifts which would ultimately culminate in a robust (and indeed ongoing) set of challenges to these narratives.

The first of these shifts emerged from new scientific investigations of the volatile ecology of African drylands, and the place of pastoral livelihoods within them. Several leading proponents of "the new paradigm"—a view of drylands pastoralism as fundamentally "disequilibrial" in nature—were closely implicated in development and humanitarian responses to Turkana's challenges in the late 1970s and early 1980s. As noted in the introduction, this new paradigm dramatically contradicted previously prevalent views concerning the irrationality of pastoral livestock ownership, wealth accumulation and environmental destruction, which were central to the above-mentioned assumptions that development must entail the adoption of alternative livelihoods in such regions. Scoones (2018) notes that both Jeremy Swift and Andrew Warren (champions of the disequilibrium view) wrote important papers for the 1977 UN Conference on Desertification (UNCOD), which was held in Nairobi, at which Kenya's country position paper explicitly blamed "improper livestock and range management" for the perceived processes of desertification exacerbating drought (Republic of Kenya, 1984: 5). Whilst these papers seem not to have had a

3 It is important to note that in many contexts such deeply rooted narratives and negative stereotypes have not been shed. Alene et al. (2021: 1159), for example, have described the enduring power of such narratives in shaping the "sedentary metaphysics of the Ethiopian state," which continues to envision nomadic pastoralism as a barrier to modernity and development. Within Kenya, Odhiambo (2014) has set out in detail the ways in which narratives about the irrationality and unsustainability of pastoralism reaching back to the colonial era are influential in policy contexts. This point is discussed further on.

significant immediate impact, the work of both researchers, and a wider network of their colleagues, went on to radically transform understandings of key development and humanitarian challenges in drylands contexts in the ensuing years (see Dyson-Hudson and McCabe, 1983; Ellis et al., 1987; McCabe, 1987; Ellis and Swift, 1988; Warren, 1995; McCabe, 2004; Warren, 2005). Much important foundational research was undertaken in Turkana during this time, including through discrete projects funded via various organisations involved in the wider humanitarian and development effort of which the TRP was a part (see, for example, Ellis et al., 1987). The drought experienced in Turkana in the early 1980s was, in this respect, a force that galvanised not only donor finance and humanitarian support, but also academic attention. It seems reasonable to assume that, alongside the general scientific merit of the research, this attention was at least partly provoked by a combination of the extremity of the situation at hand and a growing dissatisfaction with the responses it was eliciting.

The second shift stemming from the TRP—the development of practical drought early warning capacities and processes (which we describe below)—emerged alongside this research. In this sense, it is difficult to conceive of the two as being conceptually unrelated. A 1985 report commissioned by Oxfam, and produced by Jeremy Swift, outlined the basic principles behind these new approaches (i.e., principles that had emerged from interventions in Turkana in the early 1980s). A much later report revisiting this period highlights the importance of the work of Amartya Sen (i.e., 1980, 1981) during their development and also references the work of de Waal (1987), which, although not published until the late 1980s, focused on the roughly contemporaneous Darfur famine of 1984-85 (NDMA, 2013). The centrality of such literature further emphasises the recognition that emerged during the TRP of the political and economic dimensions of drought, and the need for this environmental phenomenon to be dealt with via robust institutions rather than short term projects.

Amidst this attentiveness to the political and economic contexts of famine, new infrastructural and institutional capacities that emerged during the TRP came to play critical roles facilitating initial experimentation with early warning (NDMA, 2013: 6–9). Indeed, it was via healthcare infrastructure established during the initial drought of the early 1980s that regular mid-upper arm circumference (MUAC) measurements first came to be deployed as an indicator of declining conditions. Alongside these measurements (taken at various newly established clinics) enrolment in school feeding programmes and aerial livestock surveys were also utilised as measurements to determine overall conditions *vis-à-vis* drought. It is important to note that many of the ideas and terms that emerged during the implementation of these monitoring activities have remained central to early warning systems across Africa in the ensuing decades. These include the notion of drought warning stages, the idea of a drought contingency plan and the term "pastoral terms of trade," which explicitly frames and addresses drought as an economic issue (Swift, 1985; NDMA, 2013).[4]

In the years following the TRP, a series of major projects came to develop and refine the methods it had propagated (see Table 1). Protocols developed by Swift came to be implemented by a newly formed Turkana Drought Contingency Planning Unit (TDCPU), which was initially funded by the Norwegian government alongside wider TRP activities. In the late eighties, the Drought Monitoring Project (DMP) emerged and expanded drought management in northern Kenya via partnerships with a wide range of other NGOs and new monitoring/assistance programmes in several other arid districts, including, for example, the World Bank funded Emergency Drought Recovery Project. The DMP was then complimented and ultimately superseded by the Drought Preparedness Intervention and Recovery Programme (DPIRP), which lay the groundwork for the Arid Lands Resource Management Project (ALRMP) to emerge in the late 1990s. The ALRMP expanded drought monitoring activities even further, initially to eleven districts and then to twenty-eight by the early 2000s. It was the ALRMP—in many respects a culmination of 20 years of experimentation and refinement—that would ultimately provide the framework for the establishment of Kenya's National Drought Management Authority, bequeathing both its data and its methods. Broadly speaking, the NDMA envisages the criteria for an effective drought response to comprise both a general reduction in the impact of a drought and a safeguarding of any gains that have been made in relation to drought resilience.

However, closely intertwined with this antecedent project history reaching back to the TRP was an equally important political process, which saw northern Kenya's recurring experience of catastrophic drought gradually pulled further and further into the political sphere, and which ultimately culminated not only in the establishment of the NDMA but also, at roughly the same time, Kenya's adoption of a new constitution and the devolution of power from national to local governments.[5] Indeed, in their report discussing the work of the Ministry of State for Development of Northern Kenya and other Arid Lands (which was formed in April 2008 and which itself was instrumental in gazetting the NDMA), Elmi and Birch (2013: 3) highlight how a number of different conditions coalesced at this time in favour of change,

4 It is also significant to note that the 2013 NDMA report, which was produced following a workshop attended by practitioners central to the TRP, notes the experiment that took place in the early 1980s of doubling food relief rations to many areas, which was aimed at enabling people to barter excess food. This is further evidence of an interpretation of famine as an economic and political failure, and of a drive to account for its complexity.

5 It is noteworthy and revealing to consider how long the problem of drought took to fully enter the political domain in Kenya, considering the vivid accounts of drought and famine that appear in the earliest colonial accounts (for examples see Osborne 2014).

TABLE 1 Key drought management projects and organisations in Kenya in the years leading up to the establishment of the National Drought Management Authority.

| Project/Organisation | Funder | Year of establishment |
|---|---|---|
| Turkana Rehabilitation Project | European Economic Community; governments of the Netherlands and Norway | 1980 |
| Turkana Drought Contingency Planning Unit | Norwegian government | 1985 |
| Drought Monitoring project | The Netherlands government | 1989 |
| Drought Preparedness Intervention and Recovery Programme | The Netherlands government | 1995 |
| Emergency Drought Recovery Project | The World Bank; UNICEF | 1993 |
| Arid Lands Resource Management Project | The World Bank; UNDP | 1996 |
| National Drought Management Authority | Kenyan government | 2011 |

including "a history of pastoral civil society activism and struggle which was gradually infiltrating competitive politics, the ongoing search for a new constitution, [and] the emergence of a discourse around resilience following the 2008–2011 drought." In other words, drought, historical marginalisation and civic dissatisfaction (particularly regarding access to public services) were part and parcel of the same movement towards politicising the recurring problem of hunger and identifying long-term, institutional solutions to it (see also Ngigi and Busolo, 2019).

There is thus a general sense in which Kenya's institutionalisation of drought management (particularly through the establishment of the NDMA) and its commitment to ending drought emergencies (Republic of Kenya, 2015) might be seen as components within a broadly progressive process of political change that has served to ground fundamental development challenges within political discourse rather than leaving them purely to apolitical, technocratic management via a host of international (and largely project based) agencies and organisations (cf. Ferguson, 1994a; Ferguson, 1994b; Ferguson, 2006). A key force within this process has been the Pastoral Parliamentary Group, a legislative advocacy group open to members of parliament in Kenya and oriented towards lobbying on behalf of pastoral areas (for an overview see Wario, 2004; Livingstone, 2005).[6]

On the other side of the coin, it has been pointed out that despite this gradual shift in impetus, certain restrictive narratives and assumptions have remained deeply influential within the processes shaping both development and humanitarian activities in the drylands of Kenya. For example, shortly after the establishment of the NDMA, Odhiambo (2014: 52) noted how "climate change feeds an age-old narrative about ASALs—that which views [them]. . . as degraded and blames pastoral land use for the degradation." More recently, Semplici and Campbell (2023: 6) have highlighted how "the same goal of transforming herders into something else has been reiterated since colonial days, time and again," albeit nowadays in new forms and guises. Below, we consider the broader context through which these persistent narratives continue to percolate, exploring the structure of contemporary early warning systems in eastern Africa and the ways in which anticipatory action has been shaped both by a series of substantive technological advancements and by a renewed sense of international urgency toward the drylands in light of climate change. We outline how various features of decision making, planning and practice seem to run contra to the above outlined conceptual history of early warning systems, and their connection, at least in Kenya, with the emergence of new paradigms framing the drylands not as places of irrationality and destruction but of dynamic, community led resilience worthy of attention and support.

## Contemporary early warning systems in eastern Africa

Over the course of the last two decades or so, anticipatory action has garnered increasing attention across multiple sectors. Whilst early warning systems themselves emerged out of a long-term familiarity with recurring and broadly predictable shocks, and indeed were made possible by steadily growing capacities across many contexts and regions to respond to these more effectively, mounting interest in anticipatory action can perhaps be understood as the convergence of two more recent trends within existing early warning systems. The first of these is the advancement of various scientific methods and forms of data analysis, including remote sensing and meteorological forecasting. The second is the growing demand for more

6 More widely, pastoral parliamentary groups have also played a significant role over recent decades in Uganda and Ethiopia. The latter of which countries has a Pastoral Affairs Standing Committee, founded in 2002, to represent the interests of Ethiopia's pastoralists (though it is important to be sceptical when assessing the effectiveness of such groups, see, for example, Morton 2005; Pavanello, 2009).

effective assistance for drought and flood affected populations in the face of climate change. This combination of technological advancement and climate-change related obligation (backed up with donor investment) was recently emphasised in an FAO report on social protection and anticipatory action, which noted that "as the quality of climate risk information and scientific forecasting has continued to improve, the imperative to act in advance of an imminent shock in order to protect people, assets and livelihoods has also gained notable attention and increasing investment." (FAO, 2023: 1).[7]

In eastern Africa, the institutional and political history outlined above has culminated not only in national agencies such as the NDMA, but also a much wider array of advanced, formal early warning systems and information networks used in varying ways to trigger anticipatory actions, including the Intergovernmental Authority on Development's Climate Prediction and Applications Centre (ICPAC) in Nairobi, USAID's Famine Early Warning Systems Network (FEWS NET) and the FAO's Food Security and Nutrition Analysis Unit in Somalia (FSNAU), among others. It is important to note that the kinds of actions implemented following the predictions made by these systems, and indeed the scales at which such actions are undertaken, are extremely diverse. They include everything from direct assistance via cash transfers or food distribution to heightened surveillance, investment in preparedness, resource redirection and information dissemination.

Nevertheless, despite the clear advances in forecasting accuracy, specificity and dissemination that these systems represent, recent years have seen numerous cases of inaction or ineffective action, despite multiple warnings. For example, following a widespread and devastating drought in 2011, during which an estimated 50,000–100,000 people died, Hillier and Dempsey (2012) outlined how early warning systems had generally performed well in the run up to the crisis and attributed widespread inaction to a systematic failure in timely programme implementation. More recently, Farr et al. (2022) have emphasised how almost half a million people across Somalia and Ethiopia were, in 2022, facing famine like conditions, whilst in Kenya 3.5 million were facing crisis levels of hunger. They argued that "a large step forward over the past decade has been that it is now accepted that anticipatory action is more cost-effective than late-stage humanitarian response, but this still has not translated to sufficient action at scale; the agreements have not translated into political will" (Farr et al., 2022: 12). In a similar vein, exploring the impact of the Sendai Framework in drought management across North Africa and the Middle East, Jedd et al. (2021) have recently outlined how whilst the language of proactive risk management has diffused through many countries at the national level, drought management continues to be dominated for the most part by crisis interventions.

Such renewed emphasis on the political and economic dimensions of hunger seems to echo the shift in thinking that helped stimulate the initial emergence of Kenya's first early warning system during the TRP (as discussed above, i.e., Sen, 1980 and Sen, 1981). However, it is not the only lens through which recent ineffectiveness has been viewed. A broad interest is also discernible across the humanitarian sphere in local knowledge and "indigenous forecasting." Calls to better incorporate these things largely envisage doing so as a means of better embedding various scientifically informed anticipatory actions and programmes within community forecasting techniques and early warning practices, or, as the Sendai framework puts it (in the context of understanding disaster risk), it is important to "ensure the use of traditional, indigenous and local knowledge and practices, as appropriate, to compliment scientific knowledge in disaster risk assessment and the development and implementation of policies, strategies, plans and programmes of specific sectors" (UNISDR, 2015: 15).

Regardless of the restrictive assumptions about the nature, boundaries and dynamics of 'local knowledge' which seem to underly this attentiveness, and which we discuss in detail below, there are perhaps deeper, largely unarticulated insecurities across the world of disaster risk management that it reflects. In particular, it is arguably the case that improved scientific forecasting and rangeland monitoring capacities have served, at least in part, to centralise decision making and to tether it (and anticipatory actions themselves) to highly technical forms of data analysis, which serve to exclude local actors and institutions (as emphasised by Baudoin et al., 2014; Hall, 2007; cf. Catley et al., 2013: 21–22). In other words, the present era of somewhat technocratic management seems, in many respects, redolent of humanitarian and development intervention in the decades leading up to and culminating in the TRP (i.e., the 1960s–1980s)—a time before assumptions about pastoralism, and the drylands, had been comprehensively challenged, when the passivity of local practices and institutions was taken for granted and when interventions were oriented towards averting not only short term shocks but also much longer-term social and environmental crises, themselves imagined as inevitable outcomes of irrational and destructive livelihoods (Derbyshire et al., 2024). As we noted above, these decision-making dynamics are situated within a context that is still profoundly conditioned by older imaginaries and narratives. Indeed, Semplici and Campbell (2023) correlate a recent re-awakening of international attention in African drylands, and the associated

7 To a large extent, the growth and development of anticipatory action has also taken place in relation to commitments made in the 2005 Hyogo Framework (UNISDR, 2007), and more recently the 2015 Sendai Framework for Disaster Risk Reduction (UNISDR, 2015; cf. Braimoh et al., 2018). The International Decade for Natural Disaster Reduction (1990–2000) was also a noteworthy galvanising force (Baudoin et al., 2014), as was the World Humanitarian Summit of 2016, which stimulated renewed attention on creating a nexus of development and humanitarian assistance *vis-à-vis* livelihood protection (Levine et al., 2020).

framework of "resilience building," with stability-oriented interventions (ranging from new largescale irrigation schemes to various forms of commercialisation and mechanisation) that are often starkly divergent from the forms of flexibility and mobility that have long been critical to pastoralists (see also Krätli, 2015).[8] More widely, restrictive phenomena including resource privatisation and poor infrastructural planning have been shown in many contexts to still be degrading rangelands and pastoral institutions on a substantive scale (e.g., Flintan et al., 2011; Lind et al., 2016; Birch, 2018).

In taking stock of these issues, questions emerge as to the commensurability of anticipatory action (as an element of formal early warning systems and as it is currently generally formulated) with the existing dynamics of drought management in pastoral contexts in the drylands, at the community level. Certain core features of existing early warning systems—particularly the centralised, technical nature of decision making—not only seem to render them inaccessible and distant to local actors but also mean that they are broadly out of sync with pastoralist drought mitigation strategies themselves (including various moral economy practices, which we discuss in the following section). This latter point articulates with a perhaps much starker division in outlooks between the two spheres of action *vis-à-vis* uncertainty. Whilst early warning systems are established on calculative control and the reduction of uncertainty to risk and thus "lack flexibility and the ability to experiment, improvise and fail" (Caravani et al., 2021: 6), it is well understood that pastoralists tend to understand and manage uncertainty in a drastically different manner. A rich and extremely well-evidenced body of literature spanning multiple contexts in Africa's drylands shows how pastoral livelihoods and economies tend to be oriented toward embracing and working with uncertainty, not buffering against it (for example, Scoones, 2023; Farinella and Nori, 2020; Lind et al., 2020). Pastoralists make the most of the characteristic variability of the lands they occupy and indeed are actively productive by means of it (Krätli, 2015).

In doing so, their responses to worsening conditions tend not to be mechanistic and linear like the actions implemented by various programmes and organisations following "action triggers," but are rather deliberative and distributed, often involving a high level of flexibility, an openness to multiple different possible outcomes, an attentiveness to diverse forms of knowledge, a utilisation of expansive networks built on diverse social and economic relationships and an ability to dynamically foster reliability by means of these networks via the triangulation of different skills and information (Scoones, 2023).

This difference in orientation, whilst fundamental, is arguably not emblematic of a conceptual divergence so complete as to render the two approaches mutually exclusive. On one level, envisaging either of them as a monolith is clearly inaccurate. Drylands pastoralism takes on diverse forms and socio-economic and political arrangements even in broadly ecologically similar regions. Likewise, anticipatory action, as we emphasised in the introduction, is a fairly ambiguous modality shaping programmes and decisions across multiple sectors, from government services to humanitarian and development agencies. It comprises a broad range of possible actions, from direct assistance to heightened surveillance, and from investment in preparedness to resource redirection or information dissemination (Weingärtner and Wilkinson, 2019). Moreover, and perhaps more importantly, the concept of "looking ahead, planning ahead and responding proactively as early as is justified before a crisis develops" (Levine et al., 2020: 14) is, on a basic level, undoubtedly central in both worlds.

In this sense, the point that recent ineffectiveness in the run up to drought in eastern Africa is associated not with the accuracy or clarity of warnings but rather with the dynamics of implementation itself harbours complex implications. On one level, there is a widely articulated need for broad systemic improvements at both national and regional levels to overcome barriers (both political and financial) to effective early action (see Mwangi et al., 2022). The Inter-Governmental Authority on Development's (IGAD) recent regional strategy for disaster risk management highlights both inadequate financial and human resources and a lack of political support as key challenges in eastern Africa and the Greater Horn over the coming decade (IGAD, 2021). Similarly, Farr et al. (2023: 12) argue for anticipatory action to be paired with "investment in development, resilience and accountability, as well as longstanding commitments to support local and national response capacity and quality financing—including flexibility, predictability and multi-year cycles." In Kenya, these recent calls echo the emphasis originally placed on the inflexibility of government systems and the enduring lack of drought contingency finance in the Common Programme Framework for Ending Drought Emergencies (Republic of Kenya, 2015: 122), itself an initiative that emerged through the same long-term political reconfiguration that underlay both devolution and the establishment of the NDMA.[9]

On another level though, in apprehending the mechanistic and control-oriented character of early warning systems,

8 Over recent years, Kenya's government has refocused attention on irrigation schemes coupled with various technological advancements as a "silver bullet" for longstanding development issues, despite recurrent catastrophic failure in this sphere. Particularly emblematic of this renewed interest are the newly established National Irrigation Authority and the Galana-Kulalu "mega project," as discussed by Müller-Mahn et al. (2021).

9 Here it is important to note that ineffectiveness during recent droughts in eastern Africa should not necessarily be associated with restrictive or "anti-pastoralist" policies across the African continent. There are numerous examples, particularly over the past 20 years or so, of protocols, initiatives and policies that support drylands pastoralism, including the IGAD Transhumance Protocol, the N'Djema and Noukchott declarations of 2013 and the West African "pastoral codes."

including anticipatory action triggers, one is presented with a different perspective on their hitherto limited effectiveness in the drylands. Rather than better coordination between large organisations, or enhanced efficiency in implementation of pre-determined actions, a need is clearly discernible to better account for and centre existing preparation and mitigation strategies amongst affected communities. We noted earlier how this need is widely acknowledged across the humanitarian sphere (and not only in relation to pastoral contexts in the drylands), nevertheless, ongoing efforts to fulfil it would appear to be limited by the continuing propensity for actions and wider protocols to be formulated entirely via the external synthesis of meteorological, agricultural, hydrological and socio-economic data (Baudoin et al., 2014). In this sense, some of the most substantial obstacles between formal early warning capacity and local impact in pastoral areas are less to do with the political and financial dimensions of drought management (though these are, of course, important) and more to do with the assumptions underlying planning and practice. As we outline below, insights from a wide range of case studies exploring pastoralist knowledge in the context of prevalent instability highlight the need to develop new approaches to the delivery of assistance during worsening conditions.

## Anticipatory action, uncertainty and pastoral knowledge

Since paradigmatic shifts in the 1980s, the dynamic spatial and temporal complexity of pastoral production systems (rather than their assumed passivity and simplicity) have been taken for granted in discussions across multiple academic spheres. We noted above how these theoretical developments were implicated in wider cross-disciplinary and cross sectoral shifts (including, in Kenya, the emergence of preliminary early warning capacities) that served for the first time to position drought in eastern Africa as primarily an economic and political concern. We have also explored how, following these combined shifts, early warning systems in eastern Africa have experienced substantial institutional growth, attention and investment whilst nevertheless regularly failing to stimulate timely and effective anticipatory actions. Largely in response to these failures, a diverse literature on local or "indigenous" forecasting and "participatory early warning" has emphasised the misguidedness of eschewing existing local capacities for predicting, preparing for and managing drought-stimulated crises and the need to return affected populations to the centre of decision making (for example, Speranza et al., 2010; Iticha and Husen, 2019). As Baudoin et al. (2014: 4) put it, the current era requires "an approach that is less science-driven in favour of placing vulnerable communities at the core of early warning systems."

Nevertheless, given the complexity and heterogeneity of pastoral economies, one key challenge of centring such knowledge has proven to be discerning it in the first place. What we mean by this is that, despite extensive evidence to the contrary, drylands pastoralism itself arguably continues to be implicitly envisaged in many humanitarian and development contexts as founded on stable, immutable knowledge repertoires passed down from one generation to another rather than dynamic learning, improvisation and creativity. Whilst the notion of "valuing variability" has reached a wide range of governance and policy making circles in the decades following the 1980s (see Krätli, 2015), the legacies of older models—particularly in the form of various narratives that envisage the drylands as unproductive and pastoralists as inefficient—thus continue to restrict thinking about what pastoral knowledge is, how it is accumulated and deployed in the contemporary world and how early warning systems might better support it. As part of this, patterns of pastoral mobility and economic specialisation are also still often tacitly conceptualised as spatially and temporally constant in nature, and thus deeply susceptible to erosion, rather than as fluid and open-ended across seasons and in relation to a wide array of continually changing socio-economic and political factors (as discussed in relation to long-term environmental and economic change by Davies, 2015; cf. Roe, 2020; Maru, 2023).

Pelling et al. (2020: 129) suggest that the question of 'how expert analysis interacts with other knowledge traditions in developing more integrated understandings' is currently a central dilemma facing disaster studies. In the world of early warning, the process of identifying solutions to this dilemma is arguably often stunted by the common invocation of various unnuanced binaries—i.e., traditional/scientific, formal/informal, indigenous/expert, and so on –, which serve, for the most part, to arbitrarily delimit forms of information and analysis, thus obscuring possibilities for new connections, meanings and forms of relation (cf. Hastrup, 2016; Moore, 2011: 9). In this sense, fully discarding the influence of old narratives and assumptions *vis-à-vis* pastoralist knowledge in the context of anticipatory action perhaps requires less focus on unchanging mechanisms and customary institutions that are envisaged to be somehow socially or culturally "nested" (such as "coping mechanisms," for example) and more focus on normative culturally bound positions (cf. Crane, 2010). This is perhaps more easily said than done, particularly when policy making circles continue, in many contexts, to be shaped not only by donor preferences but also by the dynamics of risk in settled farm settings.

Indeed, it is worth emphasising here that in the context of arable farming—an agricultural production system that, unlike extensive grazing, is not specifically geared towards exploiting asymmetric nutritional distribution—early warning systems have, in general, been both accurate and specific enough to achieve a high impact across many regions. Both Australia

and the United States, for example, have longstanding and widely appreciated drought early warning systems, which are impactful across multiple scales of farming (see Kuwayama et al., 2018; Kogan et al., 2019). In Ethiopia, an early warning system using data from the Early Warning Response Directorate in combination with the Livelihoods, Early Assessment and Protection (LEAP) tool has proven to be able to estimate the number of farmers who will need food assistance during the two main cropping seasons, on the basis of crop, rainfall and water requirement data (Van Grinkel and Biradar, 2021). This system has focused on projected crop yield reduction to determine the scale and scope of humanitarian assistance required. It is argued to have resulted in a rapidly scaled up provision of resources and a reduction in humanitarian response time by three-quarters (Drechsler and Soer, 2016). Meanwhile, Ewbank et al. (2019) have recently demonstrated how advice, forecasts and warnings generated by early warning systems have resulted in direct community-led action both before and during the agricultural season across Nicaragua and Ethiopia. A result comparable to the claim by Akwango et al. (2017) that in agro-pastoral areas of Karamoja, northern Uganda (where 87% of the households involved in the study were engaged in farming), drought early warning systems reduced the threat of food insecurity by nearly 24% and improved household nutrition by 34% (based on the household dietary diversity score).

Such successes, whilst no doubt worthy of appreciation, are often envisaged as evidence for the potential value of early warning systems that function in the same way in extensive grazing settings, even though food production, and thus the dynamics of drought risk, are substantively different in such settings. The shortcomings engendered by this ubiquity of approaches is no doubt exacerbated by what Caravani et al. (2021) have recently highlighted as a restrictive, control-oriented risk framing, which is cemented into mainstream institutional and policy approaches across the spheres of social assistance, humanitarian relief and disaster response via various professional, bureaucratic and institutional biases including tight assurance and accountability protocols (Scoones, 2021; Johnson et al., 2023). Again, this is a framing that is closely related to donor preferences and expectations, rendering various programmes and projects minimally answerable to the populations they are established to support.

To Scoones (2023), the notion of taking pastoralist knowledge and practice seriously constitutes a substantive challenge to conventional development thinking. As we noted above, building on a trajectory of investigation reaching back to "disequilibrium" thinking, his research has set out multiple case studies exploring the ways in which pastoralists deal with the characteristic uncertainty of the worlds around them. These contrast with the often centralised, linear and control-oriented dynamics of early warning systems to the extent that "participation" alone would seem not to be sufficient. A key theme arising from this work has been that of relational resilience and networked, moral economy practices, which themselves are not reducible to the sorts of mechanisms and institutions often sought out for inclusion or integration by early warning protocols but are rather "highly differentiated and always changing" (Scoones, 2023: 11; cf. Scott, 1976).

A moral economy, according to Mohamed (2023: 81) "enshrines reciprocity, redistribution, social insurance, and the formation of identities that are essential in helping people survive and thrive, including under uncertain conditions." The knowledge that makes this possible is not centralised but rather distributed across society; neither is it reducible to a catalogue of actions implemented in a designated set routine. Instead, it is best conceptualised as a habitual orientation toward the world, active across multiple spatial and temporal scales, and geared towards creating forms of reliability by means of instability. Case studies from across eastern Africa highlight the centrality of moral economy practices throughout the drylands, showing that whilst pastorals deal with uncertainties in diverse ways (as we emphasise below), social relations are always central (see, for example, Iyer, 2016). Specifically in northern Kenya, the work of Mohamed (2023) has documented a variety of redistributive, resource pooling strategies deployed by pastoralists in Isiolo County to weather difficult economic and environmental conditions. Derbyshire et al. (2024) have discussed the livestock centred moral economy in Turkana, its significance in rural areas and its recursive constitution of critical social institutions, including rites of passage and marriage. Meanwhile, Roba (2018) has highlighted the networked and relational nature of livestock markets in Marsabit South, the complex social ties connecting producers, processors, transporters, traders and retailers, and the need to support these with access to better information (see also Roba et al., 2017).

The question of how to centre and support such moral economies in worsening conditions is complicated, particularly when humanitarian assistance mechanisms and protocols tend to comprise limited scope for flexibility. Nevertheless, a particularly useful concept in this endeavour has been forwarded by Roe (2020), who proposes that pastoralist systems might be conceptualised as infrastructure, and pastoralists themselves as "reliability professionals"—operators who recognise patterns, formulate contingency scenarios and transform both of these into the reliable provision of a globally significant critical service, even amidst turbulence (for further case studies exploring this idea see Roe et al., 1998; Konaka, 2021; Tasker and Scoones, 2022; Mohamed et al., 2023). Caravani et al. (2021) have set out a number of policy implications stemming from this nascent literature, emphasising the need to recognise and incorporate the skills, practices and capabilities of networks of professionals in pastoralist contexts and in so doing to develop new forms of flexibility (including in financing mechanisms) in organisations seeking to provide assistance.

Nevertheless, one potential risk in advocating for such an incorporation too simplistically is inadvertently framing pastoral knowledge in terms that are too ubiquitous, and thus inducing a different kind of essentialisation that not only does little to help address the problem of centralisation in decision making exhibited by contemporary early warning systems (which we discussed above), but also fails to provide answers to the general challenge of creating more contextually specific forms of assistance ahead of and during crises in the drylands. Afterall, whilst pastoralist knowledge and skill are clearly characterizable via a set of overarching principles and similarities (which themselves stem from a similar fundamental economic orientation), differences in the ways in which pastoralists pursue their livelihoods and accumulate knowledge by means of them are nevertheless substantial and of critical importance to the question of drought-related assistance. Within the Wodaabe community in West Africa, for example, specialised local knowledge allows herders to analyse livestock health through the quality of milk, or to align migration cycles with the spatially variable vegetative cycle of grass (see Krätli and Schareika, 2010). To communities in Turkana in northern Kenya, on the other hand, pastoralist livelihoods are nowadays less oriented towards annual grasses and cyclical migration (indeed grass grazing species such as cattle are kept far less often due to broad ecological changes) and depend more on knowledge of key drought-time trees and bushes, whose fruit may be processed to feed vulnerable stock, and indeed people, during harsh conditions (Derbyshire, 2020). Of course, such specific instances are part of much larger and more complex knowledge repertoires, enfolded within social orientations toward variability and uncertainty that are no doubt similar in multiple ways, but the particular forms of assistance or information each one might require from an early warning system are nevertheless distinct.

In this sense, it is clearly important in a general sense that a conceptualisation of pastoral knowledge as dynamic, and thus deployed in a creative and agile manner to manage multiple forms and scales of crisis, and indeed to strategically capitalise on a shifting array of possibilities in the process of doing so, becomes more widely influential in the sphere of anticipatory action, particularly with regard to direct assistance (if only for the sake of allowing more valuable forms of assistance to be formulated). However, it is also important that such a shift in thinking does not result in new forms of oversimplification that work to reduce the relevance of humanitarian programmes in new ways. In the same vein, the idea of 'integrating' pastoralist knowledge, as is advocated in a variety of development contexts nowadays, poses a variety of complicated risks, themselves associated with the inevitable abridgement and misappropriation that results from seeking to rigidly define something as complicated as knowledge for the sake of its incorporation into a wider system or structure. Perhaps most prominent among these are the risks of inadvertently stripping agency or custodianship from pastoralist communities themselves or aiding the commodification and instrumentalization of pastoralist knowledge (as a form of "indigenous knowledge") by external agencies.

Instead of integration, then, understanding and support would appear to be more appropriate foci for advocacy. A clearer understanding, in the development and humanitarian spheres, of how pastoralists manage drought in general harbours the promise of more carefully tailored programmes and systems that pro-actively support the particular dynamics of drought management in discrete socio-economic contexts at the community level, and for interventions to be designed and selected not only in relation to forecasts (and thus the external synthesis of various data) but also in relation to specific existing practices, networks and patterns of collaborative support. As we have outlined above, a key step in achieving this is expanding perceptions of pastoralist knowledge (and thus scope for supporting it), and moving beyond notions of discrete mechanistic, socio-culturally embedded responses. Equally, given the fluid ways in which pastoralists tend to manage uncertainty, determining and investing in the capacities of 'high reliability professionals' in pastoral areas requires equally flexible and dynamic forms of financing at the local level–that is to say, forms of support that can shift quickly, both in scope and in structure, in line with an ever-changing horizon of local constraints and possibilities.

## Conclusion

Since the declaration of the International Decade of Disaster Risk Reduction (1990-2000), disaster response has transformed on a global scale, shedding its old reactive paradigm to embrace one of risk reduction and preparation (Coetzee and Van Niekerk, 2018).[10] The aid sector has reprioritised, galvanising funding and expertise around a range of technological advancements that offer a radically different approach to age-old recurring problems. Drought, which has long dominated the imaginaries shaping understandings of Africa's drylands (places that were, until very recently, explicitly construed as ungovernable and uncontrollable) has come to be rethought. What does this mean for the conceptions of pastoralism itself that have, for so long, been figuratively entangled with this environmental phenomenon? Such negative characterisations—pastoralism's irrationality, its orientation toward meagre survival despite sub-optimal conditions (rather than success) and its general stability (rather than dynamism)—seem still to linger in the humanitarian sector, closing off possibilities for effective support.

10 This decade was first proclaimed in 1987, when the United National General Assembly adopted resolution 42/169 (see Smith, 2002).

To Scoones (2023: 2), such lingering characterisations culminate in a sphere that, whilst perhaps well intentioned, is still ultimately oriented toward the "disciplining restrictions of stabilising control, whereby the unruly is closed down and rendered governable."

When conceptualised outside of these negative and limiting portrayals, drylands pastoralism might be seen to consist of traits that pose new and important questions of formal disaster management on a global scale. Perhaps most fundamentally, its non-linearity as a socio-ecological system, and the temporal and spatial complexity of its engagements with multiple forms of disaster and ensuing crisis underline the inadequacy of interventions into the drylands that are based solely on predictive control and oriented toward a return to "normal" or "stable" conditions (conditions that have never predominated in such environments). In order to answer these questions, it seems clear that anticipatory action and early warning systems more widely must take care to temper donor enthusiasm for forecasting accuracy and mechanistic action triggers, for despite unquestionable technical advancements in these areas the sector at large remains fallible to the traps of old views, methodologies and practices (see Krätli et al., 2015). It is important to remember that the idea of reducing certain perceived risks in a complex adaptive system is neither straightforward nor without risk itself. Indeed, multiple case studies from around the world describe instances where changes made to particular variables have, following short-term or immediate improvement, ultimately cascaded into deleterious disturbances at other spatial and temporal scales (i.e., Lebel et al., 2010; Davies et al., 2023). In many pastoral regions, the spectre of food aid dependence (and thus food insecurity) via a complex process of political and institutional destabilisation is a prominent example of such unintended disturbance.

To Ramalingam (2013), whose work *Aid on the Edge of Chaos* explores the current and potential impact of complexity theory on the aid system, there is a clear need for aid to embrace complexity, rather than seeking to close it down or buffer against it. Significant correlations can be apprehended between this broad point and the ideas that have emerged more recently from research into pastoralism's unique relationship with uncertainty. Both call for a more "systemic, adaptive, networked, dynamic approach" (Ramalingam, 2013: 361), rather than one that seeks to institute new forms of fragile stability and predictability. For this to be possible in the sphere of anticipatory action, early warning systems must find new ways of bridging the widening gap between data analysis and local experience—its role must be envisaged less as an exogenous push and more as an endogenous catalyst or source. It may be that this entails the consideration within early warning systems of drought indicators that are specific to particular places, and formulated in a participatory manner, perhaps in a way similar to the development of "bottom up" indicators for measuring peace and conflict in various African countries described by Firchow and Ginty (2017). Alternatively, it may entail collaborative and participatory planning through models such as the Ward Development Planning model recently outlined by Bedelian et al. (2023) and currently implemented in five counties across Kenya.

Either way, tracing the trajectories of political, institutional, conceptual and processual change that have converged in Kenya's recent history of drought management, as this article has done, it is clear that belief in such a shift has been, and remains, a guiding principle serving to blend multiple forces of momentum, across multiple sectors and interests. As new scales of urgency and donor support stimulate renewed interest in the world's drylands, it is critical that such histories of iterative progress, and concurrent processes of localisation (in both decision making and management) are not engulfed or undermined. Having said this, in advocating for such contextual specificity, it is also important to remember that anticipatory action itself is ill construed merely as, or even primarily as, various pilot programmes or forms of direct assistance [as was recently emphasised by Levine et al. (2020)]. As an aid modality it encompasses an extremely broad and indeed still open-ended array of preparedness actions. In this regard, the challenge of not only catering to heterogeneous socio-economic contexts but also determining pathways toward engaging with and taking root amidst the specific dynamics shaping these individual contexts is open to creative solutions. For this challenge to be met—and for anticipatory action to gain real purchase and offer support amidst local strategies of drought preparation and mitigation (rather than taking place externally to them)—implicit assumptions about the boundaries that divide different forms of knowledge must be shed.

## Author contributions

SD undertook the literature review and wider stakeholder engagement, synthesised key findings and led the writing of the manuscript. RB assisted in the writing of the manuscript. TM reviewed literature and assisted in the writing of the manuscript. GR assisted in the writing of the manuscript. All authors contributed to the article and approved the submitted version.

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## Conflict of interest

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