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ASSESSING DROUGHT DISPLACEMENT RISK FOR KENYAN, ETHIOPIAN AND SOMALI PASTORALISTS

TECHNICAL PAPER

Norwegian Refugee Council (NRC)
Internal Displacement Monitoring Centre (IDMC)
Justin Ginnetti and Travis Franck
26 April 2014

DISASTERS
CLIMATE CHANGE AND
DISPLACEMENT

EVIDENCE FOR ACTION

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THE NANSEN INITIATIVE
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ACKNOWLEDGEMENTS

This technical paper was written by Justin Ginnetti (Senior Advisor, Research Methodologies and Evidence, Internal Displacement Monitoring Centre) and Travis Franck (Program Director, Climate Interactive).

IDMC is grateful to the following people who have helped develop the model, provided data or contributed to the development of this report by offeringr insights and comments on drafts: Dina Ionesco, Mireille Mugisha, David Musombi, Nuno Nunes, Patrice Quesada and Fatma Said (International Organization for Migration); Tom Awuor, Negist Biru, Gideon Galu, Abdirizak Nur and Yakob Mudesir Seid and Laura Harrison (Famine Early Warning Systems Network (FEWS NET)); Sharon Ndlovu (Common Market for Eastern and Southern Africa (COMESA)); Carol Njuki (Intergovermental Authority on Development (IGAD)); Adan Bika, S. J. Muchina Munyua and Ameha Sebsibe (IGAD Centre for Pastoral Areas and Livestock Development (ICPALD)); Edmund Barrow and Jonathan Davies (the International Union for Conservation of Nature (IUCN)); Polly Erickson and Andrew Mude (International Livestock Research Institute (ILRI)); Ezekiel Ngure and Daniel Schensul (United Nations Population Fund (UNFPA)); François Gemenne (Sciences-Po, Paris); Achiba Gargule (Regional Learning and Advocacy Project for Vulnerable Dryland Communities (REGLAP)); Prof. Richard Odingo and Prof. John Oucho University of Nairobi; Dan Maxwell and Dawit Abebe Shiferaw (Tufts University's Feinstein International Center); Richard Choularton (World Food Programme (WFP); Paul Opio (United Nations Food and Agricultural Organization (FAO)); Stephanie McCauley, Elizabeth Sawin, Lori Siegel, Charles Jones, Jack Homer (Climate Interactive); Nina Birkeland, Saeed Hersi, Prafulla Mishra, Tine Ramstad, Qurat Sadozai, Nina Schrepfer and Rolf Vestvik (Norwegian Refugee Council); and Alexandra Bilak, Sebastián Abuja, Martina Caterina, Kate Halff, Nuur Mohamud Sheekh and Michelle Yonetani (IDMC).

The authors would particularly like to thank the pastoralists who took the time to speak with us and our IDMC colleagues.

Thanks to Tim Morris for editorial assistance.

Published by the Internal Displacement Monitoring Centre
Norwegian Refugee Council
Chemin de Balexert 7-9
CH-1219 Châtelaine (Geneva)
Switzerland

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This publication was printed on paper from sustainably managed forests.

A PROJECT COMMITTEE FUNDED BY THE EUROPEAN UNION

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of the Internal Displacement Monitoring Centre and should in no way be taken to reflect the views of the EU.

The European Union is made up of 27 Member States who have decided to gradually link together their know-how, resources and destinies. Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms. The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders.

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ACRONYMS

ASAL	Arid and Semi-Arid Lands
CCA	Climate Change Adaptation
CRED	Centre for Research on the Epidemiology of Disasters
DiDD	Disaster-induced Displacement Database (of IDMC)
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EM-DAT	Emergency Events Database (of CRED)
ENSO	El Niño Southern Oscillation
FAO	Food and Agricultural Organization of the United Nations
FEWS NET	Famine Early Warning System Network
GAR	Global Assessment Report
GPID	Guiding Principles on Internal Displacement
HFA	Hyogo Framework for Action
IDMC	Internal Displacement Monitoring Centre
IDP	Internally Displaced Person
IGAD	Intergovernmental Authority on Development
ILRI	International Livestock Research Institute
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
KRCS	Kenya Red Cross Society
NDMA	National Drought Management Authority (of Kenya)
TLU	Tropical Livestock Units
UNEP	United Nations Environmental Programme
UNHCR	Office of the United Nations High Commissioner for Refugees
UNISDR	United Nations International Strategy for Disaster Reduction
WMO	World Meteorological Organization

PREFACE

This technical paper represents an initial attempt to assess patterns of internal and cross-border displacement related to droughts in selected countries of the Horn of Africa, specifically the border regions of Kenya, Ethiopia and Somalia. It presents findings from the third of five planned analyses[1] which correspond with the regional consultations of the Nansen Initiative, a state-led process that brings together representatives from governments, international organisations, civil society, think tanks and other key actors to develop a protection agenda for people displaced across state borders by disasters and the effects of climate change.[2]

The primary intended audience for this paper are those in national and regional governments responsible for reducing and managing disaster risks – drought in particular – and for protecting the rights of internally displaced persons (IDPs). Given that displacement risk is largely influenced by human decisions, final outputs of the process discussed in this paper could potentially inform development decisions and reduce or avoid the risk of displacement. Humanitarian actors may also use this analysis to inform preparedness planning for disaster-induced displacement. For example, the paper could help determine evacuation centre capacity, temporary shelter needs or funding needed for activities to reduce displacement risk in particular countries.

Findings from the five regional analyses will inform a consolidated report on the risk of disaster-induced displacement. Also, drawing on IDMC's *Global Estimates*[3] and other relevant data on previously reported disaster-induced displacement, this report will provide evidence-based estimates and scenarios concerning the likelihood of future displacement – and start the discussion about how it can be mitigated.

The first two regional analyses, focusing on Central America and the Pacific, were based on probabilistic risk modelling, a methodology that has been widely used to assess the likelihood of disaster-related economic losses and fatalities particularly in relation to rapid-onset hazards such as earthquakes, storms, floods, tsunamis and landslides. The methodology used in the analysis described in this report is based upon a system dynamics model, which is well suited to address the indirect chain of causality and resulting delay between the onset of a meteorological drought and its impacts on the natural and human systems; the numerous factors and variables involved in these processes; and the complex interplay, including feedback, among these hundreds of factors.

The aim of each regional analysis is to provide the best possible estimates of displacement risk given the available data. In this spirit of continuous improvement, IDMC invites relevant experts and interested readers to comment on and contribute to this innovative area of work.

1 The five regions are Central America, the Pacific, the Horn of Africa, Southeast Asia and South Asia. Technical papers focusing on Central America and the Caribbean (http://goo.gl/vo01pw) and on Pacific countries and territories (http://goo.gl/kYfPaFt) were published in 2013.

2 For more information, see http://www.nanseninitiative.org

3 IDMC, 2013. Global Estimates 2012: People displaced by disasters

EXECUTIVE SUMMARY

A new way of thinking

This study reflects emerging awareness of the need to see disasters as primarily social, rather than natural, phenomena. Individuals and societies can act and take decisions to reduce the likelihood of a disasters occurring or, at the very least, to reduce their impacts and the levels of loss and damage associated with them. Disasters are thus no longer being perceived as 'acts of God' but instead as something over which humans exert influence.

This reconceptualisation of disasters signifies a shift from a retrospective, post-disaster approach to an anticipatory way of thinking about and confronting disasters. This conceptual development dates from the UN International Decade of Natural Disaster Reduction in the 1990s and is reflected in the 2005 Hyogo Framework for Action (HFA), a ten-year plan endorsed by the United Nations General Assembly which aims to reduce the risk of disasters globally. One important outcome of the HFA process is awareness that without ability to measure disaster risk it is not possible to know if it has been reduced.

In the context of disasters, displacement includes all forced or obliged population movements resulting from the immediate threat of, or actual, disaster situation regardless of length of time displaced, distance moved from place of origin and subsequent patterns of movement, including back to place of origin or re-settlement elsewhere. Based upon existing information and notwithstanding some notable exceptions, the vast majority of people displaced by disasters are assumed to remain within their own country rather than to cross internationally recognised borders to find refuge.

Displacement is a disaster impact that is largely determined by the underlying vulnerability of people to shocks or stresses that compel them to leave their homes and livelihoods just to survive. The number of people displaced is, of course, related to the magnitude and frequency of extreme hazard events or processes. The most significant risk factors are those that leave exposed and vulnerable communities without the means to be resilient in the face of such hazards.

Informed by this anticipatory way of thinking about disasters, the approach used in this study departs from most existing analyses by examining the myriad climatic, natural and human factors that lead to a displacement outcome. Thus, while the efforts of many governments and other actors continue to emphasise post-disaster and post-displacement response and recovery the following analysis is based on a holistic, systemic conceptualisation of displacement that attempts to provide entry points for humanitarian and protection actors while at the same time presenting information aimed at those responsible for policies around drought risk reduction and risk management and rural development.

Preliminary results and findings

IDMC and Climate Interactive have developed the Pastoralist Livelihood and Displacement Simulator, a new interactive tool for exploring displacement of pastoralists in relation to droughts and human-related factors. The simulator has not yet been field tested. Therefore, the results of our analysis should be considered as 'initial findings' rather than definitive 'conclusions'. Having said that, the available data has allowed us to draw some initial insights based on the scenarios we explored with the simulator.

Key Findings:

- The Pastoralist Livelihood and Displacement Simulator has demonstrated potential to produce estimates of drought-induced displacement comparable with available empirical evidence.
- System dynamics models can help account for the large number of climatic, environmental and human factors that directly or indirectly influence displacement.
- Drought-induced displacement is shaped by numerous human-related factors (such as the amount of grazing land, pastoralists' ability to access it, herd sizes and composition, livestock marketing strategies, remittance flows, market prices and the scale and type of humanitarian interventions).
- The impacts of these changes are not immediately apparent, meaning that displacement occurs well after the onset of drought.
- People can be displaced by drought even when the actual rainfall is close the historical average.
- If two droughts occur in relatively quick succession then more pastoralists are displaced during the second drought than if the first had not occurred.
- Increases in exposure to drought are related to high fertility rates and growth of the pastoralist population in recent decades.
- State plans to convert rangelands to arable land risk reducing pasture and impacting pastoralist displacement trends.
- Paucity of historical and current data on the number of pastoralists and the sizes of their herds complicates understanding of past and future displacement trends in the Horn of Africa.
- Many reports on drought impacts in the region appear anecdotal.
- UNHCR statistics in Somalia give a general sense of the scale of displacement of pastoralists but data collection protocols only permit respondents to report one 'cause' of their flight, thus risking obscuring the multi-causal dimensions of displacement.

1. INTRODUCTION

To understand disasters we must not only know about the types of hazards that might affect people, but also the different levels of vulnerability of different groups of people. This vulnerability is determined by social systems and power, not by natural forces. Vulnerability needs to be understood in the context of political and economic systems that operate on national and even international scales, influencing the health, income, building safety, location of work and home of groups of people.[4]

This technical paper analyses the phenomena of drought-induced displacement of pastoralists in parts of northern Kenya, southern Ethiopia and southern Somalia (Figure 1.1). It theorises about the complex chain of causality that begins with precipitation deficiency and leads to displacement. It represents these chains in a formal quantitative (system dynamics) computer simulation to produce estimates of drought-induced displacement that can be compared to empirical evidence.

Figure 1.1: Areas of Ethiopia, Kenya and Somalia included in this study (Source: IDMC)

4 Wisner, B., Blaikie, P., Cannon, T. and Davis, I. 2003. *At Risk* (2nd ed.), p.7. London: Routledge.

The system dynamics model incorporates available historical data related to each variable in the model, from precipitation through to markets and pastoralist income. It can be used to:

- simulate the impacts of droughts and floods on pasture quality/productivity and livestock health
- measure their knock-on effects on pastoralist livelihoods
- compare the simulated results of the scale and the patterns of internal and cross-border displacement to historical evidence
- build the understanding of those leading humanitarian response and inform their actions prior to forecasted droughts or floods
- explore possible futures, including future climate change scenarios or humanitarian and development interventions, showing the potential impacts on pastoralist income, food security, displacement and resilience.

This study is primarily intended for those in national and regional government responsible for reducing and managing disaster risks, particularly drought risk, or protecting the rights of internally displaced persons (IDPs). In addition, it is intended to inform the multi-lateral consultations of the Nansen Initiative,[5] a state-led process that focuses on cross-border displacement related to disasters and climate change. Given that drought-related displacement is largely influenced by human decisions – not simply lack of precipitation – the study may also be useful for informing development investment decisions that could reduce or avoid the risk of displacement. Humanitarian actors may also be interested in the findings as a means of informing preparedness planning for disaster-induced displacement.

The approach used in this paper is based upon the understanding that population mobility (internal displacement but also phenomena such as rural-rural and rural-urban migration, short-term/seasonal migration, and disaster-related displacement) of pastoralists is affected by multiple causes. Hazards may erode livelihoods, often over time, and the resulting displacement or migration is subsequently attributed to the loss of livelihood rather than the hazard.[6] Therefore, in order to assess the indirect impact of the hazard on population movements, one must account for the multiple factors that influence livelihoods, including people's perceptions and expectations related to their livelihoods.

In the context of pastoralism, this process of drought-induced displacement is influenced by numerous human-related factors that influence the amount of land for grazing and pastoralists' ability to access it, as well as herd sizes and herd composition, livestock marketing strategies, remittance flows, market prices and the scale and type of humanitarian interventions.

The effects of changes in many of these factors take time to manifest themselves. Thus displacement occurs after a delay with respect to the onset of the drought. Often, delay can follow delay, as one factor, say pasture quality, slowly changes, influencing another slowly changing factor, such as livestock health. Furthermore, within the pastoralist livelihood system there are instances of feedback: larger herds can generate more income, which can be used to acquire more animals. This feedback loop works in the opposite direction in times of drought when livestock die or when pastoralists are forced to sell off productive assets. If a herd is decimated during a drought, either due to mortality or stress sales of livestock, it takes longer to repopulate the herd to its pre-drought size by breeding the few remaining or surviving animals. Both delays and feedbacks are understood, in a variety of systems, to create counterintuitive behaviours that tend to confound the prognoses of decision makers.[7]

IDMC research has found that at least 80 per cent of the world's disaster-driven displacement in the past five years has been triggered by rapid-onset hydro-meteorological events.[8] The estimation methodology used in IDMC's *Global Estimates* was not well suited to assessing drought-induced displacement because of the complex, multi-causal and often delayed impact of droughts on displacement outcomes. Were these estimates to include drought-induced displacement, the amount related to hydro-meteorological hazards would be even higher.

While the Horn of Africa is prone to coastal and riparian flooding,[9] the most significant hazard in this region (and other regions in Africa) is drought. Thus, it became important for IDMC to identify a means of estimating drought-induced displacement. After the Horn of Africa's major drought disaster of 2010-2011 finding a way to estimate drought-induced displacement became a priority.

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5 See http://www.nanseninitiative.org

6 Chappell, L., 2011. *Drivers of migration in household surveys.* Commissioned as part of the UK Government's Foresight Project, Migration and Global Environmental Change. Government Office for Science, UK, London.

7 Sterman. J.D., 2006. Learning from Evidence in a Complex World. *American Journal of Public Health,* 96, pp.505-514.

8 IDMC, 2013. *Global Estimates 2012,* p.6.

9 Though not the focus of this study, flood-induced displacement is also included in the system dynamics model. Floods can temporarily reduce the amount of area available for grazing or constrict pastoralist mobility if rivers cannot be forded to access rangelands on the other side.

1.1 THE RELEVANCE OF PASTORALISM

Pastoralism is the livelihood of the majority of people living in the drylands of northern Kenya, southern Ethiopia and southern and central Somalia.[10] There are approximately 20 million pastoralists in the Horn of Africa, mainly living in arid and semi-arid areas of Kenya, Somalia, Ethiopia and Uganda, where agriculture and other livelihoods are not viable options.

Pastoralism relies highly on livestock for economic and social purposes in "environments with dynamic, non-equilibrium ecologies."[11] This means that the number of animals – and, in turn, pastoralists – is constantly changing due to fluctuations in rainfall and access to fodder and water. As such, pastoralism requires strategic mobility to secure access to grazing or water sources in arid and semi-arid lands.[12]

The pastoralist does not exist either individually or in a homogenous group.[13] The lonely herder wandering in the wilderness to find pasture and water for animals is a romanticised picture of the harsh living and survival conditions of pastoralists. Rather, pastoralists exist as individuals in communities that are often tribally affiliated, with partly different histories, different languages, social and cultural values and ties, distinct struggles for power. They may have diverse species of livestock, with different degrees of mobility and follow different mobility routes. They may be more or less diversified and commercialised and with different levels of access to resources and markets as well as different views of themselves and their future.[14]

Due to the presence of rangelands and tribal access agreements, some pastoralists live near the borders of Ethiopia, Kenya, Somalia, Sudan and Uganda, crossing frontiers as part of routine pastoral movements. This is true, for example, of Borana and Somali pastoralists who move between Ethiopia, Kenya and Somalia. They thus represent a group at high risk of being displaced across a border by drought, making them a population of relevance to the Nansen Initiative.

1.2 PASTORALISM, MOBILITY AND DISPLACEMENT

Drought-related displacement of pastoralists may seem like a paradox given that pastoralists are inherently mobile. Indeed, a conventional notion of a pastoralist is a nomad who 'follows the rains' to find fodder and water, especially when there is a drought. It can be difficult to distinguish among voluntary nomadic movements, less voluntary migration and displacement, particularly in the context of drought. These represent different points along a continuum of human movements "with a particularly grey area in the middle, where elements of choice and coercion mingle."[15] To help clarify this issue, IDMC has produced a study conceptualising pastoralists' displacement, to which the present paper forms a companion piece.[16] A study undertaken by IDMC with the support of the Kenyan Red Cross Society (KRCS) characterises three forms of mobility in relation to pastoralists, summarised below:

The IDMC conceptual study helps demonstrate that nomadic pastoralists can and do become displaced as a result of droughts. The process of displacement results from pastoral livelihoods reaching a critical threshold below which pastoralism is not sustainable. In this paper, and in the simulation model described here the threshold is a minimum amount of livestock necessary to support a household. When the herd size falls below this critical threshold, pastoralism ceases to be viable and pastoralists become displaced – either spatially or *sur place*.[17]

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10 See Famine Early Warning Systems Network (FEWS NET), 2010. Livelihood Zoning "Plus" Activity in Kenya http://goo.gl/IGFj3w; FEWS NET, 2010. Ethiopia – Livelihood Zones. Addis Ababa: Famine Early Warning Systems Network; Randall, S. 2008, "African Pastoralist Demography". In *Ecology of African Pastoralist Societies* (K. Homewood, ed.). Oxford: James Currey; Athens: Ohio University Press; Pretoria: Unisa Press; A. Catley, J. Lind and I. Scoones (eds.), 2013. *Pastoralism and Development in Africa: Dynamic Change at the Margins*. London and New York: Routledge.

11 Scoones, I., 1994. *Living with Uncertainty: New Directions in Pastoral Development in Africa,* p.2. London: Intermediate Technology Publications/Practical Action. http://www.ids.ac.uk/files/dmfile/livingwithuncertainty.pdf

12 African Union, 2010, Policy Framework for Pastoralism in Africa, http://goo.gl/z8USyx See also IDMC/International Security Institute (ISS), 2012, *Kenya's Neglected IDPs: displacement and vulnerability of pastoralist communities in northern Kenya,* p.2. http://goo.gl/pN0qgB

13 McPeak stated that "[P]astoralists are too often treated as a homogenous aggregation of people and places. Our analyses reveal striking heterogeneity," quoted in Stephen Devereux and Karen Tibbo, 2013, "Social Protection for Pastoralists", in *Pastoralism and Development in Africa: Dynamic Change at the Margins* [A. Catley, J. Lind and I. Scoones (eds.)], p.218. London and New York: Routledge.

14 On adaptable livelihoods, see Gufu Oba, 2013. "The sustainability of pastoral production". In A. Catley, J. Lind and I. Scoones (eds.)], op. cit. p. 34ff.

15 Kälin, W. and Schrepfer, N., 2012. *Protecting People Crossing Borders in the Context of Climate Change, Normative Gaps and Possible Approaches,* UNHCR Legal and Protection Policy Research Series, p. 62. Geneva. http://www.refworld.org/docid/4f38a9422.html

16 Schrepfer, N. and Caterina, M., 2014. *On the Margin: Kenya's Pastoralists. From displacement to solutions, a conceptual study of the internal displacement of pastoralists.* Geneva: IDMC. http://goo.gl/OfXvHl

17 *Ibid.*

GLOSSARY OF KEY TERMS

Climate change is a change in the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external pressures, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.[18]

Disaster is "a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources."[19] Disasters result from a combination of risk factors: the exposure of people and critical assets to single or multiple hazards, together with existing conditions of vulnerability, including insufficient capacity or measures to reduce or cope with potential negative consequences.

Disaster risk is normally expressed as the probability of an outcome (e.g., the loss of life, injury or destroyed or damaged capital stock) resulting from a disaster during a given period of time. In this study, the disaster outcome in question is displacement. Disaster risk is considered to be a function of **hazard**, **exposure** and **vulnerability**.

The United Nations' *Guiding Principles on Internal Displacement* observe that **displacement** may occur as a result of, or in order to avoid the effects of, disasters.[20] Displacement includes all forced movements regardless of length of time displaced, distance moved from place of origin and subsequent patterns of movement, including back to place of origin or re-settlement elsewhere. This definition also encompasses anticipatory evacuations. People are considered displaced when they have been forced to leave their homes or places of residence and the possibility of return is not permissible, feasible or cannot be reasonably required of them. Voluntary migration is at the other end of the spectrum of population mobility. 'Voluntary' does not necessarily imply complete freedom of choice, but merely that "voluntariness exists where space to choose between realistic options still exists."[21]

There are three general types of **drought**:

- Meteorological drought refers to a precipitation deficit over a period of time
- Agricultural drought occurs when soil moisture is insufficient to support crops, pastures and rangeland species.
- Hydrological drought occurs when below-average water levels in lakes, reservoirs, rivers, streams and groundwater, impact non-agricultural activities such as tourism, other forms of recreation, urban water consumption, energy production and ecosystem conservation.[22]

Exposure refers to the location and number of people, critical infrastructure, homes and other assets in hazard-prone areas.

'Natural' hazards are events or conditions originating in the natural environment that may affect people and critical assets located in exposed areas. The nature of these hazards is often strongly influenced by human actions, including urban development, deforestation, dam-building, release of flood waters and high carbon emissions that contribute to long-term changes in the global climate. Thus, their causes are often less than 'natural'.

Pastoralism describes a livelihood based primarily (but not exclusively) upon the production, sale and consumption of livestock and livestock products such as meat, milk and other dairy products and hides.

Tropical livestock units (TLU) represent a metric used for quantifying a wide range of different livestock types and sizes in a standardised manner. Due to the fact that species vary in size and basal metabolic rate from region to region (and even within regions), there are several ratios used to convert camels, cattle, sheep and goats to TLU.[23] **'Shoats'** refers to sheep and/or goats because they typically are equivalent to the same number of TLU.

Vulnerability is the degree of susceptibility of people and assets to suffer damage and loss due to inadequate building design and construction, lack of maintenance, unsafe and precarious living conditions and lack of access to emergency services.[24]

18 Adapted from Intergovernmental Panel on Climate Change (IPCC), 2012. Managing the Risks of Extreme Events and disasters to Advance Climate Change Adaptation, Special Report of the Intergovernmental Panel on Climate Change, Cambridge: Cambridge University Press, p.557. http://ipcc-wg2.gov/SREX

19 UN Office for Disaster Risk Reduction. 2009. *UNISDR Terminology on Disaster Risk Reduction.* p.9. Geneva: http://goo.gl/gY0wcK

20 United Nations, 1998. *Guiding Principles on Internal Displacement.* Geneva: http://goo.gl/2XbUHC

21 Kälin, W. 2013. "Changing climates, moving people: Distinguishing voluntary and forced movements of people". In *Changing climate, moving people: Framing migration, displacement and planned relocation,* pp.38-43 [Warner, K., Afifi, T.,Kälin, W., Leckie, S., Ferris,B., Martin, S. and Wrathall, D. (eds.)]. Bonn, Germany: United Nations University Institute for Environment and Human Security (UNU-EHS). http://goo.gl/yDAKca

22 Wilhite, D.A. and Buchanan-Smith, M., 2005. "Drought as hazard: Understanding the natural and social context". In *Drought and water crises: Science, technology, and management issues* [D.A. Wilhite (ed.). Volume 86. Books in Soils, Plants, and the Environment Series. Boca Raton, USA: Taylor & Francis.

23 Livestock, Environment and Development (LEAD) Initiative, 1999. *Livestock and Environment Toolbox.* Food and Agriculture Organisation of the United Nations. http://goo.gl/hjVBV3

24 UNISDR, 2013. Glossary of Key Terms. In *Global Assessment Report on Disaster Risk Reduction 2013 From Shared Risk to Shared Value: the Business Case for Disaster Risk Reduction.* http://goo.gl/GFYwj

Type of movement	Characteristics
Nomadic movement	the strategic mobility of people and/or livestock
	pursued primarily for livelihood purposes and is a matter of choice
	do not stop at internationally recognized state borders
Migration as adaptation	steered by the need to adapt to external circumstances (e.g., climatic hazards or other negative impacts on pastoralists) while trying to maintain a pastoral lifestyle
	still considered 'voluntary' but different from nomadic movements due to the increased pressures on pastoralists
	characterized by movements that traverse or utilize lands belonging to other pastoral communities, farmers or other private owners
	protected by the constitutional and human right to freedom of movement, as long as it remains within state borders
Displacement	may represent a secondary movement after pastoralists have first moved as a means of adapting to a changing environment
	can be a precursor to cross-border displacement
	occurs when traditional forms of rangeland management are insufficient
	characterized by the collapse of mutual support and assistance structures within and among pastoralist communities
	can lead to structural impoverishment ('poverty traps')

Table 1: Types of pastoralist movements (Source: Schrepfer and Caterina, 2014)

1.3 LIVELIHOODS AS A LENS FOR UNDERSTANDING POPULATION MOBILITY

The conceptualisation of displacement in this paper is consistent with, and builds upon, a wide body of research that uses the idea of livelihoods to frame population mobility.[25] This approach is especially relevant for understanding displacement and migration in the context of droughts and other relatively slow-onset environmental changes. This holistic framing was illustrated in the Foresight report (Figure 1.2), which explains how environmental factors impact upon different aspects of people's livelihoods, ultimately influencing migration and other mobility patterns. Implicit in this framing of displacement is the concept of multicausality: population mobility is seldom, if ever, the result of only one cause.

Multicausality is a particularly relevant concept in the context of drought-related displacement of pastoralists. In addition to the lack of precipitation that constitutes a drought hazard, displacement is also influenced by the initial size and composition of one's herd, as well as one's ability to access to water points, grazing land, veterinary services, livestock markets, cash and credit. Several studies have shown that the social and economic factors are more influential than environmental factors,[26] or any one specific climatic event,[27] and by the time people are displaced or forced to migrate, they are more likely to identify economic or social factors as the primary cause of their movement.[28] One study has even questioned if there is sufficient evidence to substantiate the claim that climatic and environmental changes influence population mobility and the livelihood factors upon which mobility decisions depend.[29]

One advantage of this livelihoods-based approach is that it allows one to view pastoralist nomadism, migration as adaptation and displacement in the context of broader socio-economic, cultural and technical trends:

Modernism has brought about internal tensions into the pastoralist social system. And while it is not a choice to become a pastoralist, opting out of the system is one, espe-

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25 Chappell, *op. cit.;* Tacoli, C. 2011. "The Links Between Environmental Change and Migration: a Livelihoods Approach". CR2. Foresight Project, Migration and Global Environmental Change. London, UK: The Government Office for Science. http://goo.gl/xop0xG; Stafford Smith, M., Bastin, G., and Chewings, V. 2011. "Environmental and Non-environmental Drivers of Migration from Global Drylands". DR6. Foresight Project, Migration and Global Environmental Change. London, UK: The Government Office for Science. http://goo.gl/G2AE6p.

26 Chappell, *op. cit.;* Tacoli, *op. cit.;* Stafford Smith, *op. cit.*

27 Henry, S. et al., 2004, "Descriptive Analysis of the Individual Migratory Pathways According to Environmental Typologies," *Population and Environment* 25:5 (May): 397–422.

28 Chappell, *op. cit.*

29 Lilleør, H.B. and Van den Broeck, K. 2011. "Economic Drivers of Migration and Climate Change in LDCs." *Migration and Global Environmental Change – Review of Drivers of Migration* 21, Supplement 1 (December): S70–S81. doi:10.1016/j.gloenvcha.2011.09.002. http://goo.gl/LVITiG.

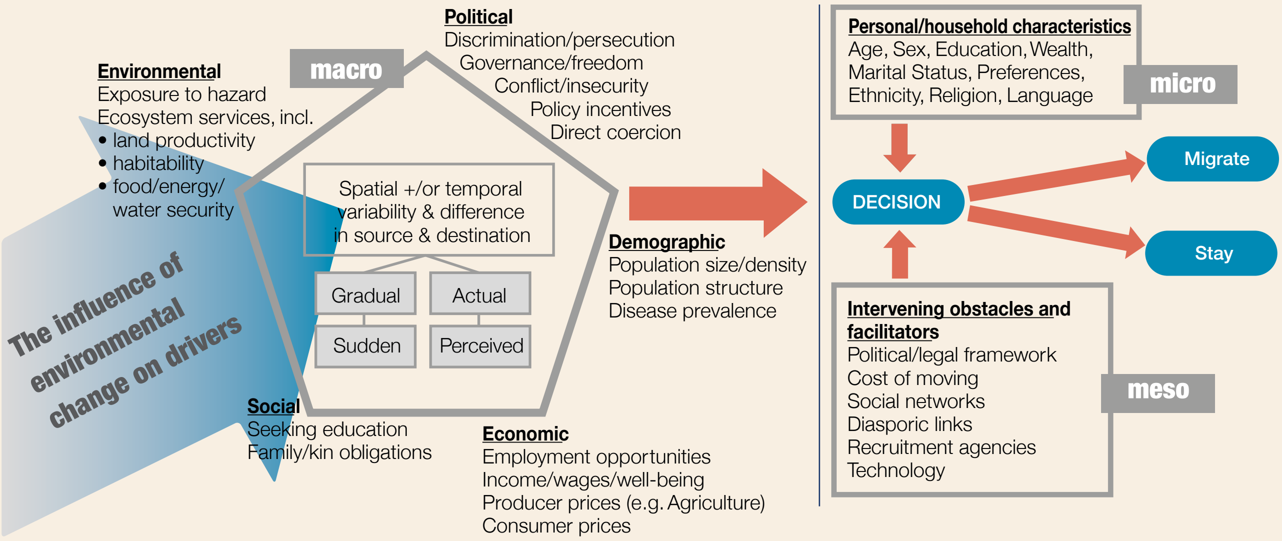

Figure 1.2: Livelihoods-based understanding of population mobility (Source: Foresight, 2011)

cially for the young pastoralist generation that had access to education. While some see this development as a threat to the future of pastoralism, others see this as a means to diversify [pastoralist livelihoods by] strengthen trading and marketing ties to towns, or through remittances access additional resources. This explains pastoralists' peculiar relationship to urban centers: On the one hand, towns are representative of poverty where pastoralist communities drop off their poor, on the other hand towns offer commercial markets as well as education opportunities.[30]

To capture these dimensions of mobility in the system dynamics model we have incorporated broad mobility trends, such as urbanisation, while focusing on the shorter-term dynamics related to drought-induced displacement. As mentioned above, it is not possible to completely isolate short- and long-term phenomena: for example, pastoralists displaced in relation to droughts may eventually move to an urban centre or pursue another type of livelihood.

1.4 DISPLACEMENT AND CONFLICT

The role of conflict in displacing pastoralists is not addressed in this present study. However others have found that pastoralists in Kenya, Ethiopia and Somalia have been displaced by one or more of the following:

- the legacy of colonialism; • violence and conflict;
- cattle raiding; • human rights violations;
- border politics; • small-arms proliferation;
- activities of militaries and militant groups;
- the effects of the conflict in Somalia.[31]

Ethnic conflicts have been found to increase the risk of political instability, which has affected herd mobility, and the threat of armed conflict (real or perceived). Displaced pastoralists have been separated from their resource base when mobile pastoralists force pastoralists to settle near sources of security.[32] In Sudan, conflicts have also interrupted normal and adaptive pastoralist movements, blocking access to grazing reserves and increasing the risk of conflicts between pastoralists and settled farmers.[33]

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30 *Ibid., p.11.*

31 Sheekh, N.M., Atta-Asamoah, A. and Sharamo, R.D., 2012. *Kenya's Neglected IDPs: Internal displacement and vulnerability of pastoralist communities in northern Kenya.* Nairobi: Institute for Security Studies (ISS). http://www.issafrica.org/uploads/8Oct12.pdf

32 Oba, G., 2011. *Mobility and the sustainability of the pastoral production system in Africa: Perspectives from contrasting paradigms.* Paper presented at the International Conference on the Future of Pastoralism, 21 – 23 March 2011, Tufts University, Medford, MA, USA.

33 Young, H., Suleiman, H., Behnke, R., and Cormack, Z., Adam, A.E.H., Ahmed, S.M., and Abdelnabi, H.M., 2013. *Pastoralism in Practice: Monitoring Livestock Mobility in Contemporary Sudan.* Nairobi: United Nations Environment Programme; http://goo.gl/BWlezc; and Krätli, S., El Dirani, O.H., and Young, H., 2013. *Standing Wealth: Pastoralist Livestock Production and Local Livelihoods in Sudan.* Nairobi: United Nations Environment Programme. http://goo.gl/9N8spl

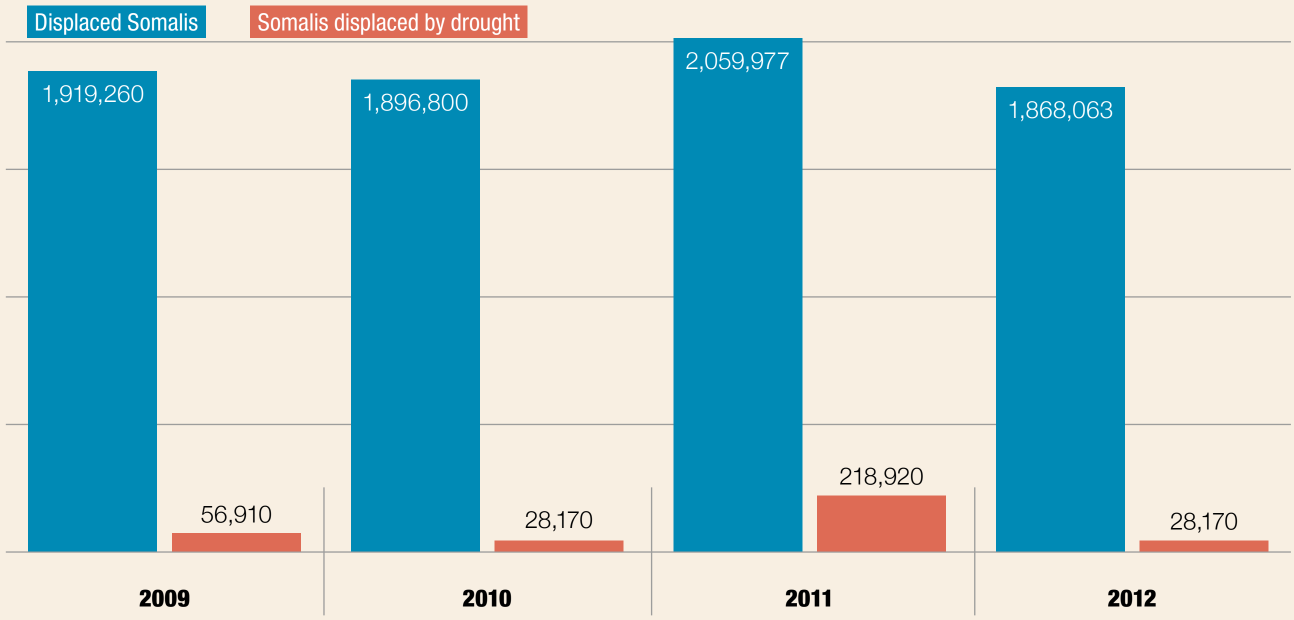

Figure 1.3: Number of Somalis displaced annually 2009-2012 (Source: UNHCR)

The decision to omit these effects from the model was deliberate, motivated by our primary focus on the more 'direct' effects of droughts – to assess whether we can address this gap in IDMC's global monitoring of disaster-related displacement. We also decided that we could add conflict effects to the model at a later date once the drought-specific elements of the model had been independently peer reviewed.

This omission of conflict is significant: during the period analysed in this study, millions of Somalis were displaced internally or fled to neighbouring countries during the 2010-2011 drought, but only a tiny fraction of these displaced people identified drought as the primary cause of their displacement (Figure 1.3).[34]

Pasture and water conflicts have long been part of the socio-cultural pattern of the pastoral communities in the arid and semi-arid lands (ASAL) of the Horn. There are many types of conflict that manifest themselves during droughts. Some are more closely related to drought than others, but each can have an impact on pastoralists' displacement.

1.4.1 Conflict related to shared land and water

Communal land ownership tenure systems grant pastoralists equal rights to exploit resources,[35] but in practice the use of grazing areas is regulated between and within tribes. Thus, drought-related migration in search of pasture and water by one tribe into areas that belong to others often causes conflict between pastoralists – or between pastoralists and settled farmers.[36] The conversion of quality grazing land to semi-private crop production undermines traditional systems of herd mobility because the converted land is often land that had previously been set aside for dry season grazing.[37]

Pastoralists' adaptive migration during droughts also involves movement across or (temporary) use of agricultural or other land. Its more intensive utilisation can result in conflicts, often with an ethnic dimension, over sharing of land and water.[38]

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34 Official UNHCR statistics can give a broad sense of the scale of displacement, but because their data collection protocols only permit respondents to report one 'cause' of their flight, these figures obscure the multi-causal dimensions of displacement.

35 FAO, 2002. *Land Tenure and Rural Development,* p.7. ftp://ftp.fao.org/docrep/fao/005/y4307E/y4307E00.pdf

36 Kaimba, G.K., Njehia, B.K. and Guliye, A.Y., 2011. Effects of cattle rustling and household characteristics on migration decisions and herd size amongst pastoralists in Baringo District, Kenya. *Pastoralism: Research, Policy and Practice* 1:18. http://www.pastoralismjournal.com/content/1/1/18; and Krätli et al., *op. cit.*

37 Oba, *op. cit.*

38 Schrepfer and Caterina, *op. cit.*

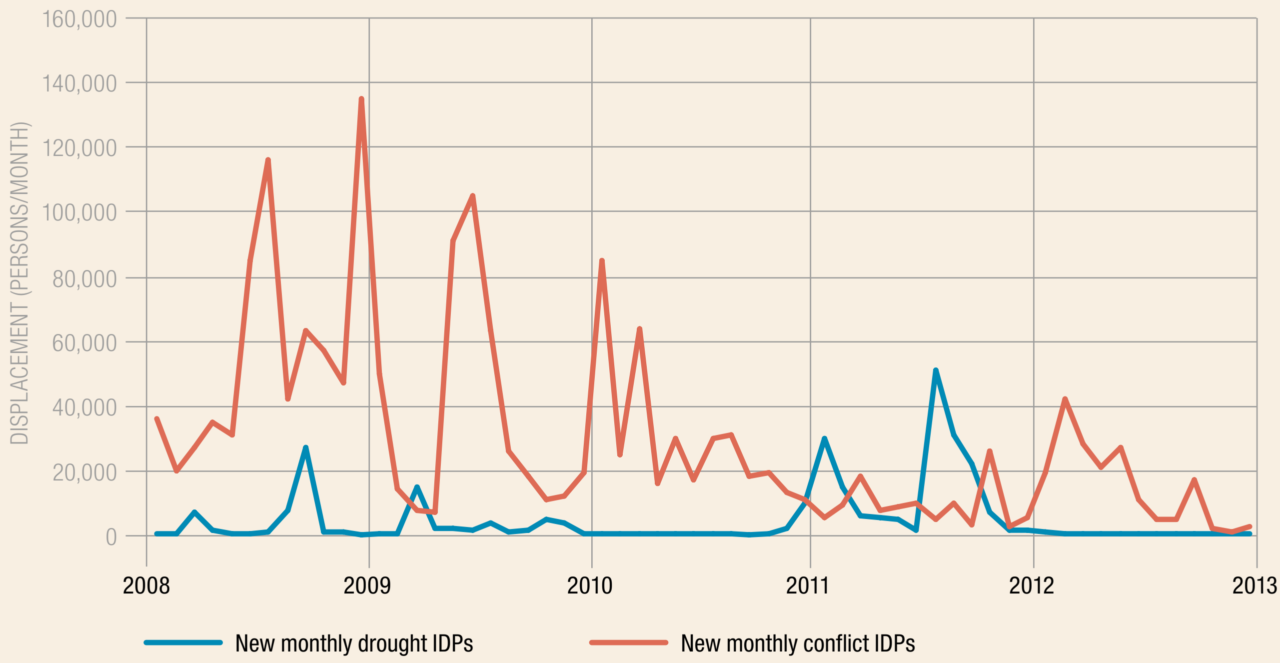

Figure 1.4: Reported monthly displacement in Somalia due to conflict and drought. (Source: UNHCR)

1.4.2 Raids, cattle rustling and small arms proliferation

Raids and livestock rustling entail the forceful acquisition of livestock, usually cattle. This form of theft is a regular feature among pastoralists in the ASALs and is particularly prevalent during droughts when it serves as a means of restocking decimated herds.[39] The proliferation of small arms and commercialisation of cattle rustling has led to more large-scale violent cattle raiding between neighbouring pastoral communities.[40] In response, pastoral communities often arm themselves for protection against hostile groups. The threats caused by the increasing numbers of human deaths and livestock losses due to cattle rusting and other organised raids can influence pastoralists' mobility and/or migratory decisions as well as herd size. This can, in turn, undermine their asset base and livelihood robustness.[41] For example, armed conflicts – and the fear of them – leave large grazing areas unused, which accelerates overcrowding and overgrazing problems in relatively secure areas.[42]

1.4.3 Cross-border incursions and armed conflict

Pastoralists inhabiting borderlands are also susceptible to cross-border incursions. Kenya's foreign policy decisions have also shaped conflict patterns. For example, Kenya's military incursions in Somalia have suppressed livestock marketing.[43] As demonstrated in Figure 1.4, the armed conflict in Somalia directly influences patterns of internal and cross-border displacement. Additionally, displacement of pastoralists is also indirectly influenced by the conflict due to its impacts on access to grazing areas, livestock marketing and human and animal mortality.[44]

39 Kaimba *et. al., op. cit.;* Barrett, C. B., Bellemare, M.F. and Osterloh, S.M., 2004. *Household-Level Livestock Marketing Behavior Among Northern Kenyan and Southern Ethiopian Pastoralists.* http://goo.gl/PrVvrD

40 Hendrickson, D., Armon, J. and Mearns, R., 1996. Livestock raiding among the pastoral Turkana of Kenya: Redistribution, predation and the links to famine. *Institute of Development Studies Bulletin* 27:3.

41 Kaimba *et al., op. cit.*

42 Regional Livelihoods Advocacy Project (REGLAP), 2010. *Pastoralism demographics, settlement and service provision in the Horn and East Africa.* Oxfam GB and Humanitarian Policy Group, Overseas Development Institute. http://goo.gl/LOiPnc

43 Schrepfer and Caterina, *op. cit.*

44 Sheekh *et al., op cit.*

2. MODELLING DROUGHT-INDUCED DISPLACEMENT WITHIN THE HORN OF AFRICA

In order to account for the complex factors that influence drought-related displacement, IDMC and Climate Interactive, a U.S.-based NGO with expertise building system dynamics models to support policy and decision-making, have developed the Pastoralist Livelihood and Displacement Simulator. The simulator incorporates the best available data from climate, environmental and social sciences and incorporates it into an interactive system dynamics model that reveals impacts of diverse natural and human factors on the livelihood and displacement of pastoralists.

Geographically, the Pastoralist Livelihood and Displacement Simulator encompasses Garissa, Mandera, Marsabit and Wajir districts of Kenya, the Borena and Liben zones in Ethiopia as well as the Bay and Gedo regions of southern Somalia. Temporally, it spans the 50-year period from 1990 to 2040.

IDMC and Climate Interactive developed the simulator to improve understanding of the how drought combined with other factors to influenced the livelihood and displacement of pastoralists. The simulator works in real time so that policy-makers, humanitarians and pastoralists themselves can use it to identify high-leverage points to prevent, mitigate and respond to the impacts of droughts. The tool allows people to test how effective policies and interventions would have been had they been implemented in the context of past droughts; and it also allows them to explore different future scenarios to see the impacts of the policies, interventions and potential changes in climate.

2.1 'NATURAL' DISASTERS?

The standard nomenclature for calculating disaster risk is as a convolution[45] of hazard, exposure and vulnerability.

Risk = Hazard X Exposure X Vulnerability

Figure 2.1: Commonly used elements and equation for disaster risk. The exact relationship is defined differently in varying models.

This conceptualisation of disaster risk signifies a shift from a retrospective (i.e., post-disaster) approach to an anticipatory way of thinking about and confronting disasters. This conceptual development and focus on risk dates from the UN International Decade of Natural Disaster Reduction in the 1990s – the precursor to the current UN International Strategy for Disaster Reduction (UNISDR) – to the adoption in 2005 of the *Hyogo Framework for Action* (HFA) which aims by 2015 to achieve "the substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and countries."[46]

An important outcome of the HFA process is awareness that without the ability to measure, it is not possible to know if disaster risk has been reduced. Measuring disaster risk (especially the risk of economic losses) is the core business of insurance and reinsurance companies. The HFA has made it a public responsibility, and one that includes more than just economic losses. UNISDR has consolidated much information and research on disaster risks in its biennial Global Assessment Reports (GARs), making economic risk information more transparent and raising awareness of disaster mortality risk. We are augmenting this with new tools and methodologies that enable governments and others to more effectively assess, reduce and manage disaster displacement risk.

Disaster displacement risk has been poorly understood and neglected, particularly in light of the fact that disaster-induced displacement has been increasing and is likely to continue to do so. As noted in IDMC's *Global Estimates 2012,* the trend is driven by three factors:

- population growth and increased concentration of people and economic activities in hazard-prone areas such as coastlines and river deltas are increasing the number of number of people exposed to natural hazards
- improvements in life-saving early warning systems and evacuation planning means that more people are expected to survive disasters even as their homes are destroyed
- climate change may increase the frequency and/or severity of some hazards (hydro-meteorological hazards account for 83 per cent of all disaster-induced displacements observed during the last five years).[47]

As with mortality and economic loss risks, it is beyond the ability of any government to eliminate disaster risks entirely. It is thus important to know which displacement risks can be reduced so that resources can be allocated most effectively.

The factors that shape pastoralists' vulnerability to droughts play a significant role in displacement outcomes. Vulnerability levels are generally considered to be slowly declining on a global level, although not at a sufficient pace to keep increases in exposure in check. In the Horn of Africa, the increases in exposure to drought are related to high fertility rates, meaning that the pastoralist population has grown since the 1970s and 1980s (Figure 2.3). When looked at from the local level, this may not be the case as vulnerability levels vary widely: some pastoralists may be forced to sell their productive assets, perhaps an effective short-term coping strategy, but one that can result in long-term vulnerability and poverty traps.[48]

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45 By convolution we here mean that each variable in the equation in Figure 2.2 may be expressed by a function (rather than say, a constant value). The relationship between each of these in turn may be expressed by another function obtained by integration that explains their relationship.

46 United Nations International Strategy for Disaster Reduction (UNISDR), 2005. *Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters.* Geneva. http://www.unisdr.org/we/inform/publications/1037. The HFA was endorsed by UN General Assembly Resolution A/RES/60/195 following the 2005 World Disaster Reduction Conference and adopted by 168 countries. A post-2015 agreement is currently being prepared for adoption at the Third UN Conference on Disaster Risk Reduction scheduled to take place in Sendai, Japan in 2015.

47 Internal Displacement Monitoring Centre and Norwegian Refugee Council, 2013. *Global Estimates 2012: People displaced by disasters.* http://internal-displacement.org/publications/global-estimates-2012

48 McPeak, John G., and Christopher B. Barrett. 2001. "Differential Risk Exposure and Stochastic Poverty Traps Among East African Pastoralists." *American Journal of Agricultural Economics* 83:3 (August): 674–679. http://www.jstor.org/stable/1245098.

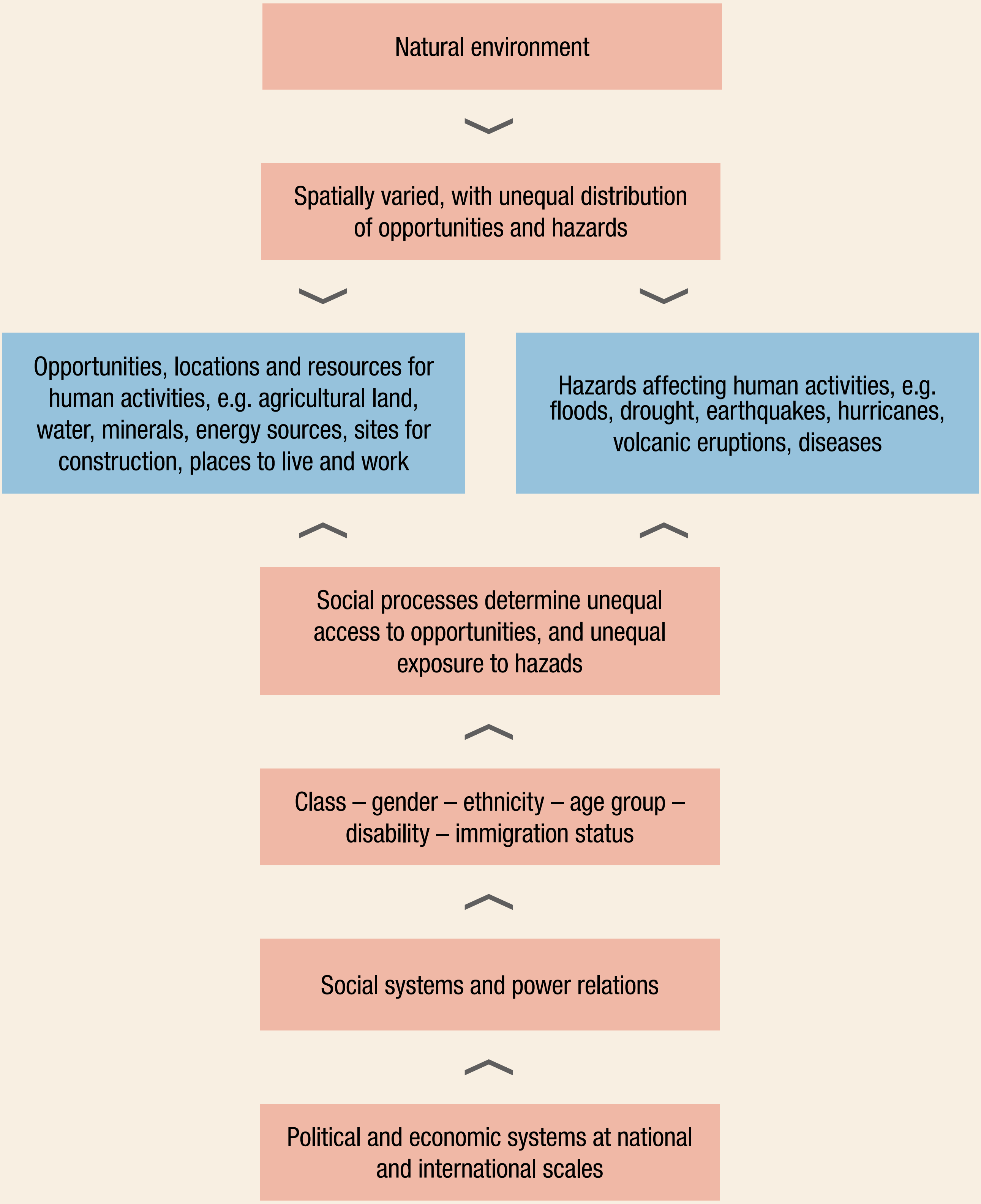

Figure 2.2: Factors and relationships that influence disaster risk (Source: Wisner et al., 2003)

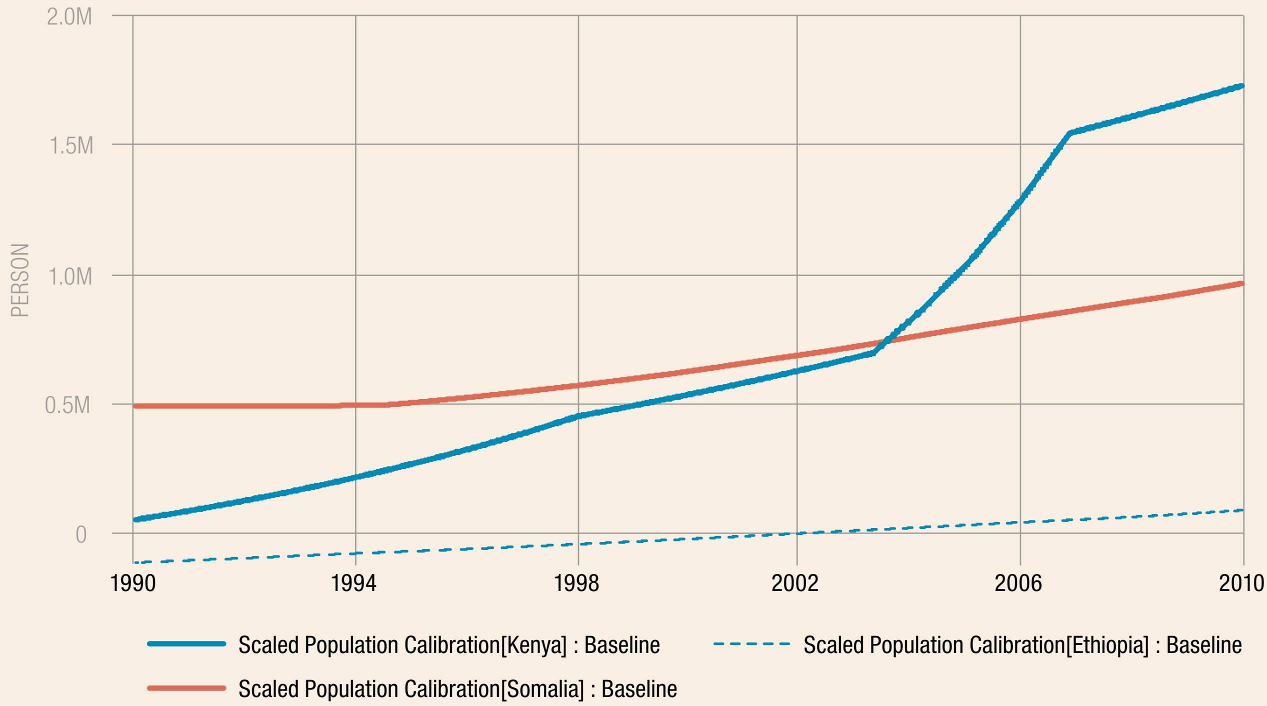

Figure 2.3: Population growth in pastoral areas of Ethiopia, Kenya and Somalia included in the study (Source: Climate Interactive and IDMC)

2.2 UNDERSTANDING DROUGHT-INDUCED DISPLACEMENT WITH A SYSTEM DYNAMICS MODEL

System dynamics is a modelling technique often used to analyse population dynamics and the behaviour of complex systems.[49] After extensive consultation with experts, IDMC concluded that a methodology based on system dynamics modelling represented a scientifically rigorous and useful way to assess and understand displacement associated with droughts or other slow-onset phenomena. A system dynamics-based methodology is able to incorporate the complex interactions between the variables and the feedback loops within the environmental and human systems and would be able to explain how a slow-onset hazard such as a drought could induce a livelihood crisis resulting in displacement.

2.3 STRENGTHS AND WEAKNESSES OF THE SYSTEM DYNAMICS-BASED APPROACH

System dynamics models help take account of the large number of climatic, environmental and human factors that directly or indirectly influence displacement. They also help demonstrate the complex interplay among these variables, often involving feedback loops, and can be useful to help decision makers build a deeper understanding of the relationships between factors. In this way system dynamic models can help people see a more complete picture, and help them discover possibly unconsidered opportunities for change.

System dynamics models also run quickly, on ordinary computers, and so are very useful for quickly testing a range of scenarios, including scenarios about possibly uncertain future conditions (such as climate conditions, population trends, and policy choices).

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49 Agent based modelling is another complementary approach and has been used to assess migration associated with predicted climate change impacts, such as increased wetness or dryness, in Burkina Faso. For further reading on how agent based models have been used, please see: Kniveton, D.R., Smith, C.D. and Black, R., 2012. “Emerging migration flows in a changing climate in dryland Africa.” *Nature Climate Change,* 2, pp.444–447. For more information on the complementarity of agent based and system dynamics modelling, please see: Borshchev, A. and Filippov, A., 2004. “From System dynamics and Discrete Event to Practical Agent Based Modeling: Reasons, Techniques, Tools”. *System dynamics,* 2004; and Rahmandad, H. and Sterman, J., 2008. “Heterogeneity and Network Structure in the Dynamics of Diffusion: Comparing Agent-Based and Differential Equation Models”. *Management Science,* 54:5, pp. 998–1014; and Scholl, H. J., 2001. “Agent-based versus system dynamics modeling: A call for cross study and joint research.” *Proceedings of the 34th Hawaiian International Conference on System Sciences.*

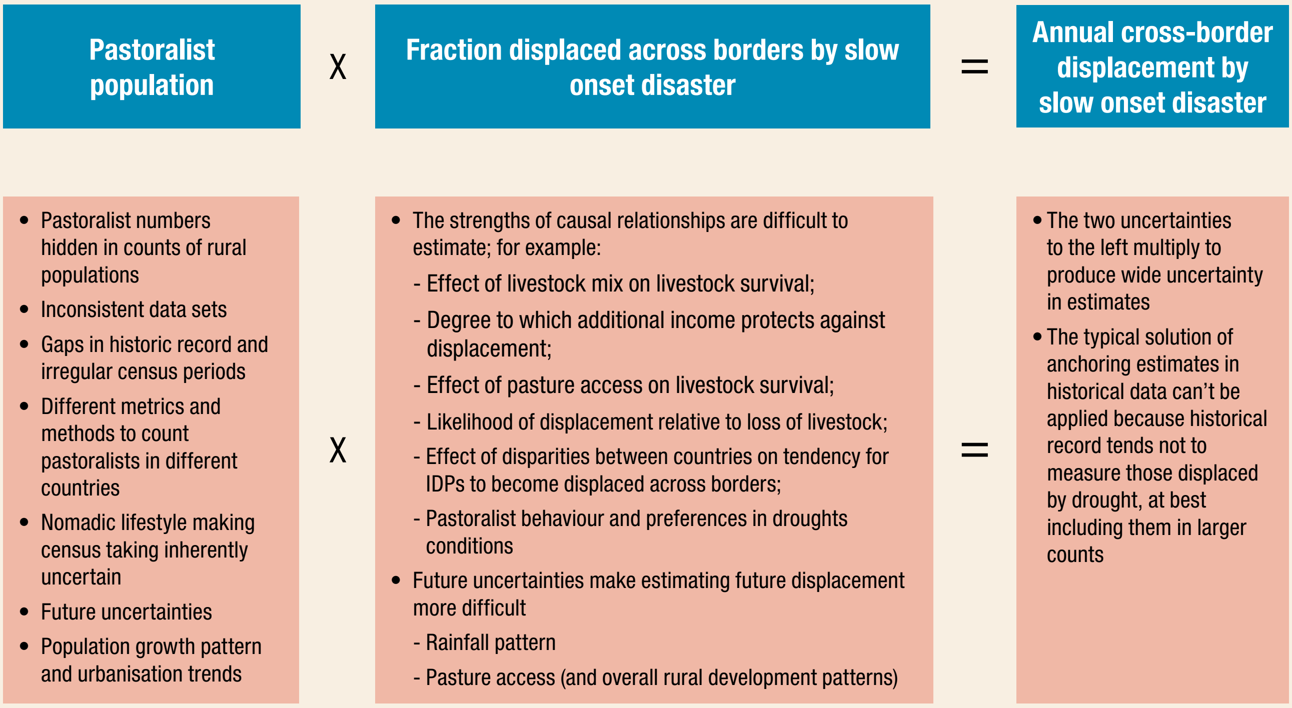

Figure 2.4: Expression of cross-border displacement associated with slow-onset hazards

Compared to a GIS model, system dynamics models are less well equipped to address and visually represent certain spatial dynamics. For example, by focusing on trends over time, we had to sacrifice detailed information on the spatial distribution of impacts. The system dynamics model described here, for example, disaggregates the region into Somalia (Bay and Gedo), Kenya (Garissa, Mandera, Marsabit and Wajir), and Ethiopia (Borena and Liben), but does not attempt to show particular hot spots or safe zones for displacement within those areas.

System dynamics simulations focus more on showing the broad outlines of possible scenarios, rather than offering specific and highly exact predictions (say of future numbers of displaced pastoralists). Given the lack of data related to this phenomenon it is unlikely that other modelling methodologies could produce rigorous exact predictions, but systems dynamics modellers specifically avoid promising such predictions, recognising that the uncertainty of future conditions can make them misleading. These challenges are outlined in detail below.

2.4 USING A SYSTEM DYNAMICS MODEL TO ESTIMATE THE POTENTIAL SCALE OF DISPLACEMENT OF PASTORALISTS

The goal of this research effort was to better understand the system that drives pastoralists to lose their livelihoods and become displaced. The system dynamics methodology used in the research involved a step-by-step inspection of the 'theories of change', the quality of data available, and the gaps in available data. The research process not only leads to a tool that can be used to rapidly develop displacement scenarios, but also a more holistic view the pastoralist displacement landscape.

The holistic view enabled us to illustrate important insights into how pastoralists are displaced and what will affect their livelihoods in the future. The view also means that we have a better understanding of what conclusions we cannot say with certainty. The most common reason we cannot make statements with a high degree of confidence arises from the lack of quality data for the modelled regions. In particular, data collection on pastoralists is harder than for most IDP groups because pastoralists are nomadic. The government, international agency and NGO experts that we consulted confirmed that census data and data on livestock are particularly difficult to obtain.

2.5 "ALL MODELS ARE WRONG": KEY UNCERTAINTIES IN THE PASTORALIST LIVELIHOOD AND DISPLACEMENT SIMULATOR

Governments and organisations coping with displacement in the Horn of Africa – now and in the future – are understandably very interested in estimates of the future potential scale of displacement of pastoralists as a result of slow onset disasters such as drought. Unfortunately, several factors make such estimates highly uncertain. In our work to create the computer simulation described in this report we have encountered those challenges, which means our simulator's estimates of the potential future scale of displacement are also highly uncertain. These challenges are described in more detail below.

Estimates of potential cross-border displacement of pastoralists by slow-onset hazards can be thought of as the multiplication of two estimates. (See Figure 2.4)

Both elements in this equation carry significant uncertainties. How many pastoralists live in the region today, and how many will in the future is difficult to estimate.

2.5.1 Difficulty establishing baseline demographic conditions and trends for populations

There is scarce primary historical data available on pastoralist demographics and that which does exist is of relatively poor quality.[50] "The extent of this data-deficit on a continent-wide scale can be evaluated when we consider that Kenya, probably the country with the best demographic data in sub-Saharan Africa and many nomadic pastoralist populations, excluded the 7 northerly districts (where most Kenyan pastoralists apart from the Maasai live) from all DHS surveys until 2000."[51] In Somalia, the UNDP population estimate of 2005 was the first published since the start of the armed conflict in 1991; more recently, the AfriPop project has been combining satellite imagery analysis with extrapolations from demographic trend data to produce an updated population estimate.[52]

The nomadic way of life of pastoralists and the fact that even in non-drought conditions populations live in remote areas and move across national boundaries, mean that accurate baseline estimates of populations of pastoralists in Somalia, Kenya, and Ethiopia have been difficult to ascertain. It has been difficult, for example, to estimate what fraction of 'rural' population in different countries or provinces are pastoralists. It is similarly difficult to estimate birth and death rates under baseline conditions. Additionally, different provincial and national governments may use different methods and frequencies for collecting demographic data, making it difficult to unite datasets from different parts of the region into a single, internally consistent picture. Historical datasets are also hard to use because administrative boundaries have changed in many of the regions included in this study.

2.5.2 Difficulty establishing baseline data on livestock numbers

Like pastoralists who herd them, the number of livestock in the pastoralist system in the Horn of Africa is highly uncertain. Their mobility makes estimation difficult, and a cultural reluctance to divulge herd size may further obscure the data.[53] Because loss of livestock is a key driver of displacement in the simulation, the incomplete data on historical livestock populations, both under normal and drought conditions, has posed a challenge for the modelling.

2.5.3 Uncertainty about the relative strength of drivers of cross-border displacement

The percentage of people displaced across borders in the past by slow onset disasters in the region has similarly been difficult to estimate.

Via interviews and the general literature on pastoralists we have identified many interconnected drivers of displacement (both internally and across borders) of pastoralists in response to drought. We describe these in more detail in the following sections of this report. While anecdotal evidence supports that these factors (such as herd size, other income and access to pasture) influence the rate of displacement, discerning which factors dominate the process requires validation against historical data (in this case rates of displacement in response to varying levels of drought). In general, such data has been difficult to obtain, as is described in more detail below.

50 Sara Randall, 2008. "African Pastoralist Demography." In Homewood, K. (ed.) *Ecology of African Pastoralist Societies* pp.200–225.

51 *Ibid.,* p.202.

52 Robinson, C., Zimmerman, L., and Checchi, F., 2014, "Internal and External Displacement Among Populations of Southern and Central Somalia Affected by Severe Food Insecurity and Famine During 2010-2012". Washington, DC: FEWS NET. http://goo.gl/fWThsk.

53 Randall (2008) notes that ethnic-minority pastoralists have been reluctant to divulge information about household size and livestock holdings due to a fear that this information could be used to reduce aid and/or increase taxes.

2.5.4 Difficulty estimating the historical scale of displacement of pastoralists

The common way to reduce the amount of uncertainty of estimates produced by simulation models is to use historical data to calibrate the model. Unfortunately, determining the number of pastoralists who have been displaced either internally or across borders in relation to recorded droughts has also been extremely challenging. Most records from IDP and refugee camps do not distinguish pastoralists from farmers, nor do they accurately reflect whether people were forced to flee due to the impacts of a drought or other causes, such as conflict. As a result, one of the typical ways to bolster confidence in estimates produced by computer simulations – comparing model results with historical data – has been difficult. The one published study of displacement in the region in the context of the 2010 – 2011 drought, which focused on cross-border displacement from and internal displacement within Somalia, relied on the same UNHCR data we used to calibrate or simulator.[54] We have not fully ruled out the possibility that governments or international agencies have data sets on pastoralist displacement that could significantly improve our simulation. Finding such data, or preparing now so that it could be collected during possible future periods of high displacement, would be an important contribution to narrowing the uncertainties of our estimates.

2.5.5 Uncertainty regarding future conditions

In addition to uncertainty about baseline trends and the strength of drivers of displacement it is also difficult to 'predict' future conditions in the region. For example, the level of future climate change is unknown, and depends on effects outside the region. The influence of global climate change on local and regional rainfall patterns is also uncertain.

Future population trends, and trends of urbanisation, also add uncertainty. The *Fifth Assessment Report* of the Intergovernmental Panel on Climate Change (IPCC) states that "[m]ajor extreme weather events have in the past led to significant population displacement," and that "changes in the incidence of extreme events will amplify the challenges and risks of such displacement. Many vulnerable groups do not have the resources to be able to migrate to avoid the impacts of floods, storms and droughts."[55] Based on "medium evidence" the IPCC identified a vicious cycle in which the negative impacts of climate change can increase the likelihood of future conflicts and that conflicts, in turn, can increase vulnerability to climate shocks.[56]

Our response to this uncertainty is to instead study future scenarios, or combinations of scenarios. It is important to remember that these scenarios are, in the case of displacement of pastoralists, a layer of uncertainty applied on top of uncertainty about current conditions and the relative strengths of driving factors. Thus uncertainty about the future compounds the already large uncertainty in this system.

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54 Robinson *et al., op. cit.*

55 Adger, W. N., Pulhin, J., Barnett, J., Dabelko, G.D., Hovelsrud, G.K., Levy, M., Oswald Spring, U., and Vogel, C. 2014. "Chapter 12. Human Security." In *Climate Change 2014: Impacts, Adaptation, and Vulnerability IPCC Working Group II Contribution to AR5.* Cambridge and New York, NY: Cambridge University Press, p.2. http://goo.gl/Ijinuu.

56 *Ibid.,* p.3.

3. INITIAL FINDINGS: BUILDING CONFIDENCE IN THE MODEL RESULTS

Because the Pastoralist Livelihood and Displacement Simulator is a relatively new tool and has not yet been field tested, we have categorised the results of our analysis as 'initial findings' rather than 'conclusions'. Given that we had access to precipitation and pasture productivity data, we are confident in the parts of our model that relate to rainfall and pasture productivity. Furthermore, the way rangelands respond to changes in precipitation and the way that animal health and mortality relate to water and fodder availability have been researched and described in academic literature, giving us more confidence in the way the simulator captures these relationships. By contrast, we had relatively little data on human and livestock populations and the weight of factors that influence individual pastoralist decision-making. As a result, we are less confident in the way the simulator reproduces these patterns of behaviour.

3.1 DEFINING AND TESTING CAUSAL RELATIONSHIPS

A key component of the development of the Pastoralist Livelihood and Displacement Simulator was formalising the causal relationships and drivers of pastoralist displacement. From literature review, fieldwork, interviews and data collection, we have constructed a systems view of rainfall, pasture/grazing land, pastoralist economics and displacement (Figure 3.1). Generally speaking, less rainfall because of more droughts causes a decline in pasture productivity. The availability of less fodder in turn increases livestock mortality which shrinks the livestock population. The displacement of pastoralists increases during these periods when herd sizes reach the critical threshold necessary for subsistence, at which point pastoralists are (temporarily) unable to support their livelihoods.

Figure 3.1 represents a high-level view of the key factors of the model, and how they can be influenced by natural and human factors. Each of these factors itself represents a smaller system whose behavior is influenced by many factors. The Pastoralist Livelihood and Displacement Simulator captures the dynamics of these 'subsystems' and the way that they interact to influence livelihoods and the behaviour of the variable of primary interest: the displacement of pastoralists.

In order to build a model with all of these elements, we looked for data to define the following important relationships in the pastoralist system:

1. between rainfall and displacement
2. between rainfall and livestock population
3. between livestock/livelihood and displacement.

While we found data and reports shedding light on all three relationships, only the first two have high quality data underlying them at this point in our research. In particular, the strength and shape of the relationship between livestock and displacement involves the social norms and preferences of pastoralists (Figures 3.2 – 3.4). Figure 3.2 illustrates how herd size influences livelihoods and displacement: when a pastoralist's livestock holdings increase, household income goes up and food security improves and pastoralism continues to be a viable option. However, when a drought decimates a herd, it reduces pastoralist incomes, creates food insecurity and undermines the sustainability of pastoralism; as mentioned above, when the herd reaches the threshold at which point pastoralism is no longer viable in terms of income and food security, pastoralists become displaced.

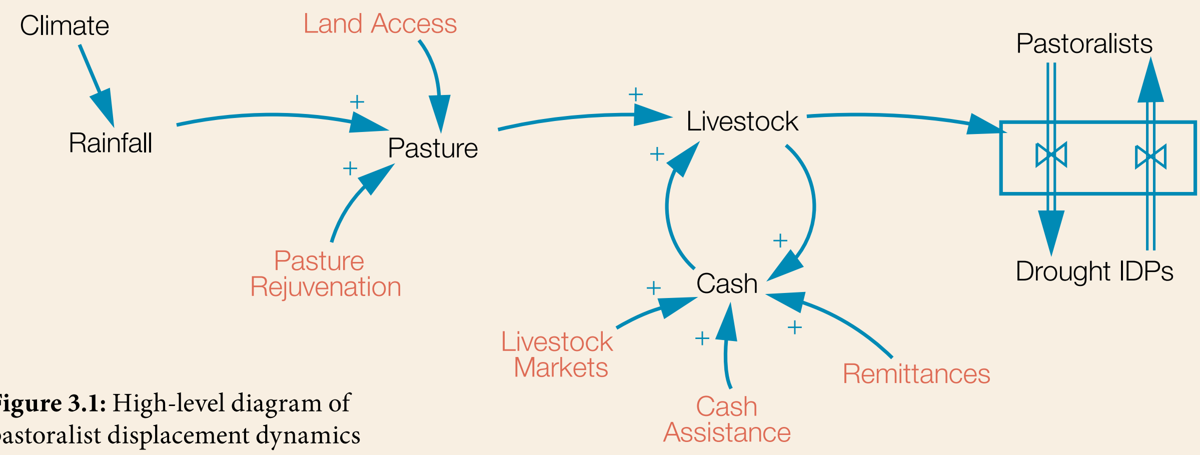

Figure 3.1: High-level diagram of pastoralist displacement dynamics

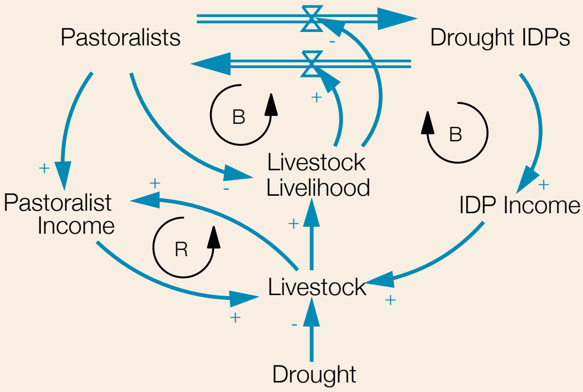

Figure 3.2: Detail of the displacement dynamics

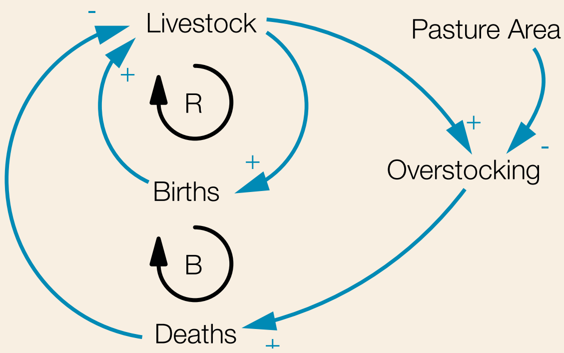

Figure 3.3: Natural livestock dynamics

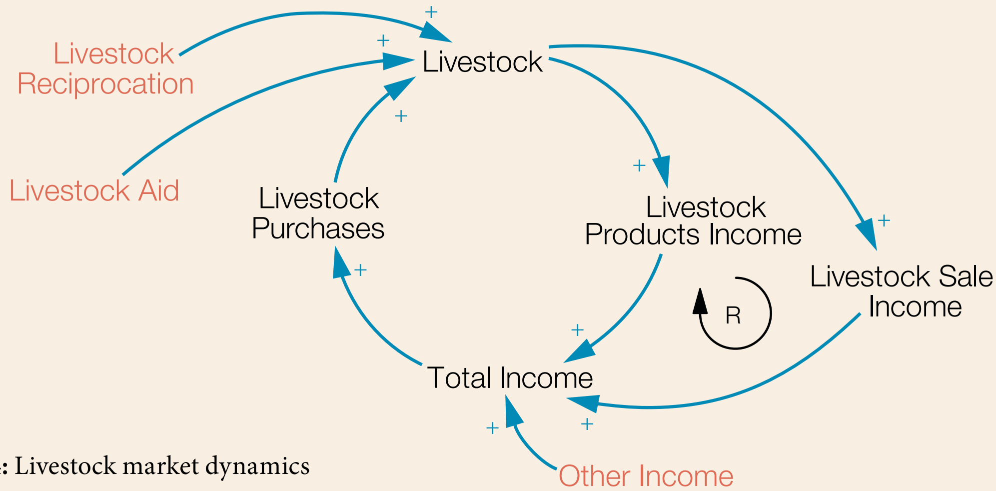

Figure 3.4: Livestock market dynamics

Key variables | Causal relationship, + causation | Causal relationship, - causation

Policies/interventions | Reinforcing feedback loop | Balancing feedback loop

Flows between pastoralists and IDPs

Figure 3.3 reveals how rain-fed grazing lands are in a state of dynamic (rather than static) equilibrium: as livestock produce more livestock they may eventually approach and even surpass the carrying capacity of accessible pasture areas at that point in time. When this occurs, pastoralists must sell their animals to reduce the pressure on their grazing areas. If they don't the herd will shrink naturally as livestock mortality increases and live births decrease.

Likewise, Figure 3.4 illustrates how having some livestock helps pastoralists increase their herd size in two ways. First, the more animals one has the faster the herd will growth via the birth of new livestock. Second, as the size of one's herd grows and income from the sale of milk and other livestock products increases, one will have more cash with which to purchase still more animals. Due to the same factors, rebuilding the herd becomes increasingly difficult and time consuming once the size of one's herd falls below the subsistence threshold. At this point, interventions like food assistance and access to credit or breed stock can facilitate the rebuilding one's herd.

We have found case studies that qualitatively capture various parts of these norms and preferences, but we have not yet found rigorous quantitative surveys and analysis.

Using the data that we did find on the first two relationships, we were able to build confidence in the model. In particular, the model is able to produce patterns that that resemble to the trends seen in data from the region.

3.1.1 Relationship between rainfall and livestock population

To test whether the model generates realistic declines in livestock numbers in response to drought, and with realistic timing, it would be ideal to turn to datasets on livestock population. Unfortunately, we have found such data difficult to uncover. Humanitarian assessments during droughts often report the impact of the drought on livestock populations. They are difficult to interpret because it is hard to discern which populations they are talking about (i.e., pastoralists, agro-pastoralist or everybody), the geographic scale of the livestock decline and time frame over which the decline occurred. Some reports say the 1995 drought caused a 70–80 per cent decline in livestock populations in the Horn of Africa without specifying where within the region the decline took place or the base year against which it was measured. Although better data about the impact of drought on livestock populations has been hard to uncover we find, within the limits of existing data, that the model generates realistic livestock declines in response to historical rainfall patterns.

We collected a variety of anecdotal evidence about the impact of drought on livestock populations (Table 2). We compared the model's livestock population results to the collected historical field reports. We found the model output fits well for some historical droughts (for example in the early 2000s) but less well for others (Figure 3.5). The simulated livestock population of north-eastern Kenya didn't decline as much as reports described during the mid–1990s drought. One reason for the discrepancy could be that the drought was more extreme elsewhere in the Horn and the report of a 29 per cent decline of cattle was for stated for the entire Horn, not just Kenya where declines could have been less severe). The next two reports stated livestock declines in "Kenya", though not necessarily Garissa, Mandera, Marsabit or Wajir. The model output for the had a good fit to the historical data we found for the 2001 drought – the modelled livestock population declined by the reported 30 per cent (of the assumed pre-drought peak). The model behaviour in the mid–2000s drought is reasonable, although the modelled livestock population declined less than was reported in the historical evidence we found.

3.1.2 Relationship between rainfall and displacement

Figure 3.6 compares actual monthly rainfall in southern Somalia with the national monthly displacement[57] in Somalia due to 'drought', as reported by the UN Refugee Agency (UNHCR). The mean average rainfall of southern Somalia is also plotted so it is easy to compare when rainfall is above or below normal.

Examining the data, there are three main insights:

- Displacement is delayed relative to reductions in rainfall. Displacement does not occur immediately when the rains fail but, instead, the flow of IDPs increases after a delay of several months

- Displacement can occur even if rainfall is close to the mean rainfall. People can be displaced by drought even when the actual rainfall is close the historical average (e.g., the first part of 2009)

- The flow of newly displaced persons, declaring 'drought' as their reason for displacement, declines quickly when the rains come. People stop becoming displaced because of drought when the rains provide the water needed for their livelihoods. Importantly, this doesn't necessarily mean that total number of drought-displaced IDPs declines – instead it means that there are no new drought-displaced IDPs requiring assistance.

57 http://goo.gl/poQvng

Drought Year(s)	Location	Drought Impact
1991 – 1992	Northern Kenya	70% loss of livestock
1991 – 1993	Ethiopia (Borana Plateau)	42% loss of cattle
1995 – 1997	Greater Horn of Africa	29% loss of cattle; 25% loss of sheep and goats ('shoats')
1995 – 1997	Southern Ethiopia	78% loss of cattle; 83% loss of shoats
1998 – 1999	Ethiopia (Borana Plateau)	62% loss of cattle
1999 – 2001	Kenya	30% loss of cattle; 30% loss of shoats; 18% loss of camel
2002	Ethiopia (Afar and Somali)	40% loss of cattle: 10-15% loss of shoats
2004 – 2006	Kenya	70% loss of livestock in some pastoral communities
2005	Kenya (Mandera and Marsabit)	30-40% loss of cattle and shoats; 10-15% loss of camels
12/2005 – 3/2006	Kenya	40% of cattle, 27% of sheep, 17% of goats, killed 40 people
2010 (May)	Somalia	70-80% livestock lost

Table 2: Collected anecdotal reports of drought impacts on livestock

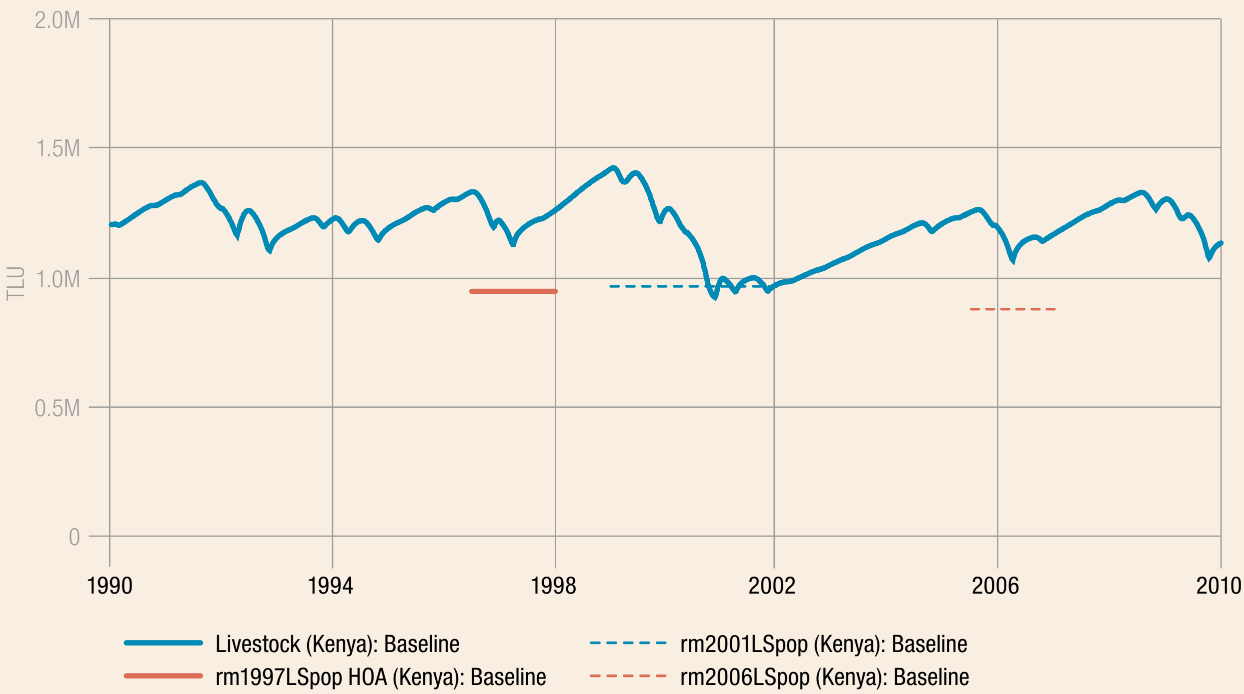

Figure 3.5: Simulated livestock population in Kenya compared to historical, anecdotal drought impacts

A model of drought displacement should be able to reproduce similar behaviour to Figure 3.6 for a similar pattern of rainfall. Figures 3.7 and 3.8 show the model results when the model is driven by historical rainfall in the two bordering regions of the model: southern Somalia and north-eastern Kenya. The simulated behaviour reproduces the patterns seen in the historical data:

- displacement is delayed and typical occurs several months after an expected rainy season
- displacement can occur when rainfall is close to the historical mean
- displacement flow drops significantly and quickly when a new rainy season begins.

While the model results for Somalia (Figure 3.7) replicate the pattern of behaviour seen in the historical data (Figure 3.6), the model output doesn't exactly match the UNHCR displacement data for several reasons. The UNHCR data is for all of Somalia and all Somalis, not just pastoralists in southern Somalia, whereas the model is specific for pastoralists. This explains why the scale of displacement is higher in the UNHCR data as compared to the simulated output. Additionally UNHCR data doesn't disaggregate pastoralists from agriculturalists who might be more strongly affected by drought than pastoralists because they aren't able to move their crops to 'greener pastures'. If agriculturists are more sensitive to drought than pastoralists there could be some displacement episodes in the UNHCR dataset that are not seen in the pastoralist-specific model output.

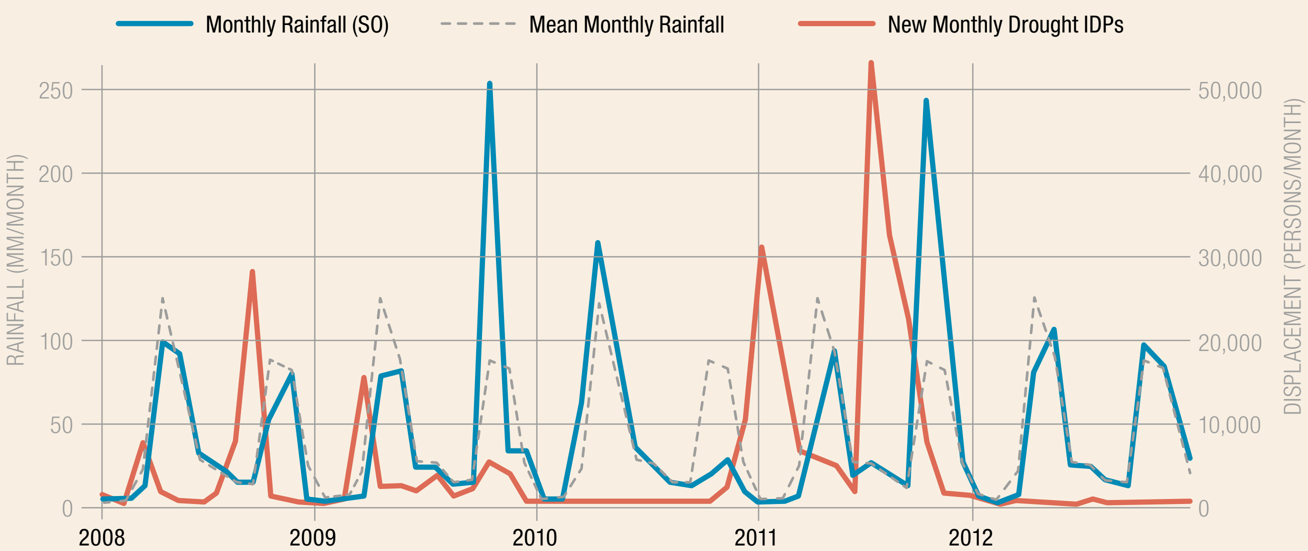

Figure 3.6: Comparison of rainfall and reported monthly drought IDPs.

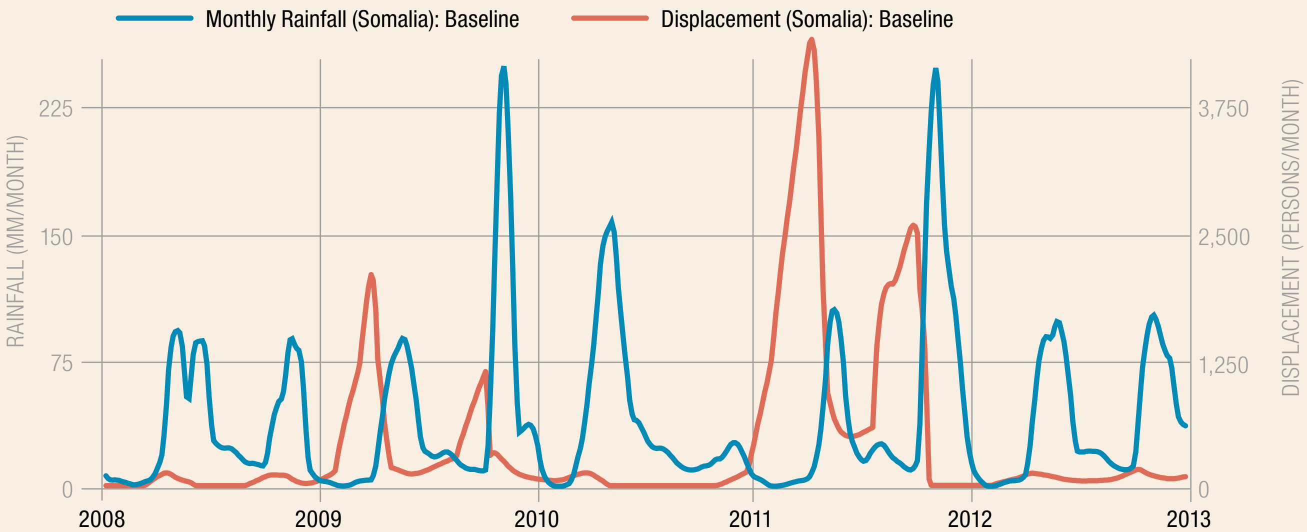

Figure 3.7: Historical monthly rainfall compared with simulated drought displacement in Somalia

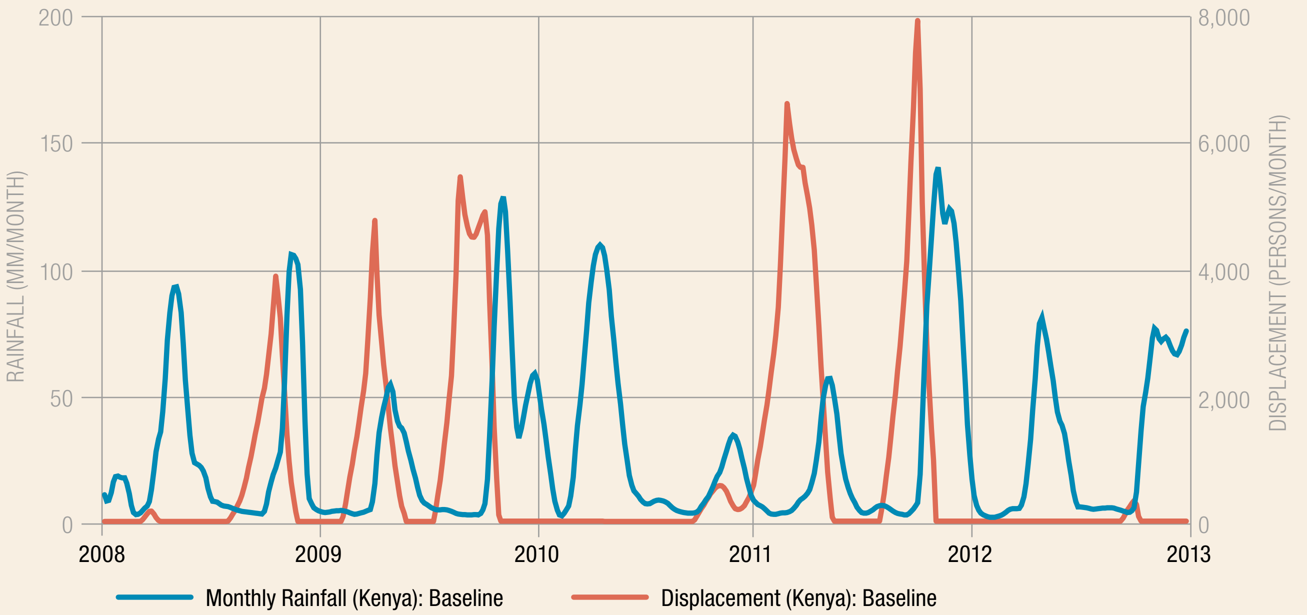

Figure 3.8: Historical monthly rainfall compared with simulated drought displacement in Kenya

3.2 PROJECTIONS WITH HIGH DEGREE OF CONFIDENCE

Given the strengths and weaknesses of the data in the Horn of Africa, it is hard to project exact levels of future pastoral displacement. However, a formal system dynamics model allows us to analyse the system, evaluate the data uncertainties and draw out some conclusions. These particularly concern the factors which seem to have stronger versus weaker impacts on vulnerability to drought induced displacement and which future conditions might produce a pastoralist system most vulnerable to drought induced displacement.

We developed a suite of scenarios (Table 3) to discuss future conditions for pastoralists. These highlight some areas of data uncertainty, but also areas of policy uncertainty that decision makers could address.

3.2.1 #1: Population growth will influence magnitude of displacement

In the system dynamics simulation, growth of pastoralist populations is a significant factor affecting the magnitude of future displacement. Our modelling has estimated pastoralist population by integrating official census data with academic demographic research. To project into the future, we use birth and death rates that are in the middle of literature estimates for pastoralists. Additionally, we have an 'urbanisation rate' that approximates the trend of pastoralists who choose to seek an alternative, non-livestock, means for their livelihoods.[58]

Figures 3.9 and 3.10 show four different scenarios of population growth and the resulting displacement. The difference between the two figures is that Figure 3.9 illustrates the displacement in terms of the total number of pastoralists who would be displaced and Figure 3.10 expresses the displacement as a percentage of the pastoralist population. The baseline scenario uses the default birth and death rates of the model. Population Growth Zero depicts a scenario of zero population growth from levels in 1990. This scenario shows how population growth could already be having an impact on the scale of displacement observed in past droughts.

58 In the baseline scenario, the crude birth rate for pastoralists is 38 persons/thousand/year, the crude death rate is 12 persons/thousand/year and the 'crude urbanisation rate' is five persons/thousand/year.

Scenario name	Description
Baseline	The default set of parameters of the model.
Population Growth Zero	No population growth. Population is held constant at the initial 1990 levels.
Population Growth Higher	The birth rates and death rates are both adjusted to have lower total population. Birth rates are 10% lower; death rates are 10% higher.
Drought Twice as Likely	The probability of drought is doubled for each region.
Land 10	Restrict available pasture land by 10% in 2015.
Land 20	Restrict available pasture land by 20% in 2015.
Land 30	Restrict available pasture land by 30% in 2015.
Combined	Combines Land 30, Population Growth Higher, and Drought Twice as Likely into a single scenario.
Higher Grazing Efficiency	Increases the livestock grazing efficiency from the default 65% to 80%.
Higher Grazing Efficiency, Double Drought	Combines Higher Grazing Efficiency and Drought Twice as Likely into a single scenario.
Drought Tolerant Livestock	Approximates a more drought tolerant herd by reducing the daily food requirements from the default 10 kg/TLU/day to 8 kg/TLU/day.
Drought Tolerant Livestock, Double Drought	Combines Drought Tolerant Livestock and Drought Twice as Likely into a single scenario.

Table 3: Summary of model scenarios used in this report

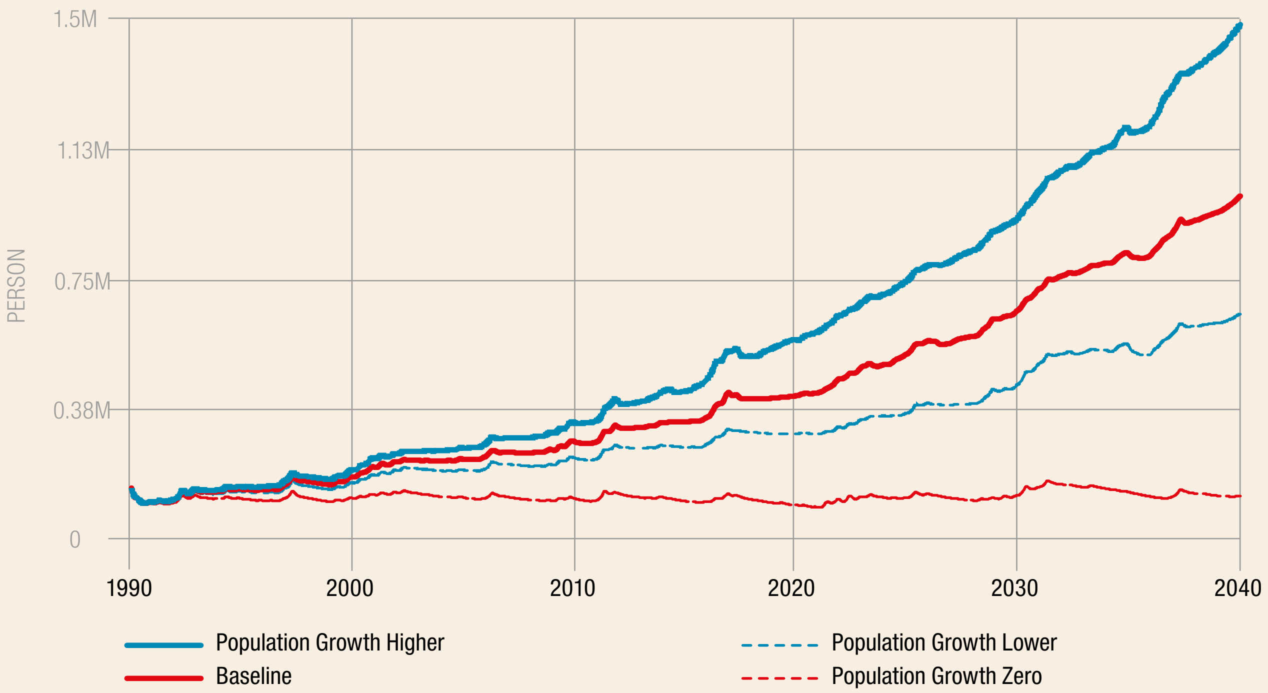

Figure 3.9: Model simulation: Total number of pastoralists displaced in relation to droughts

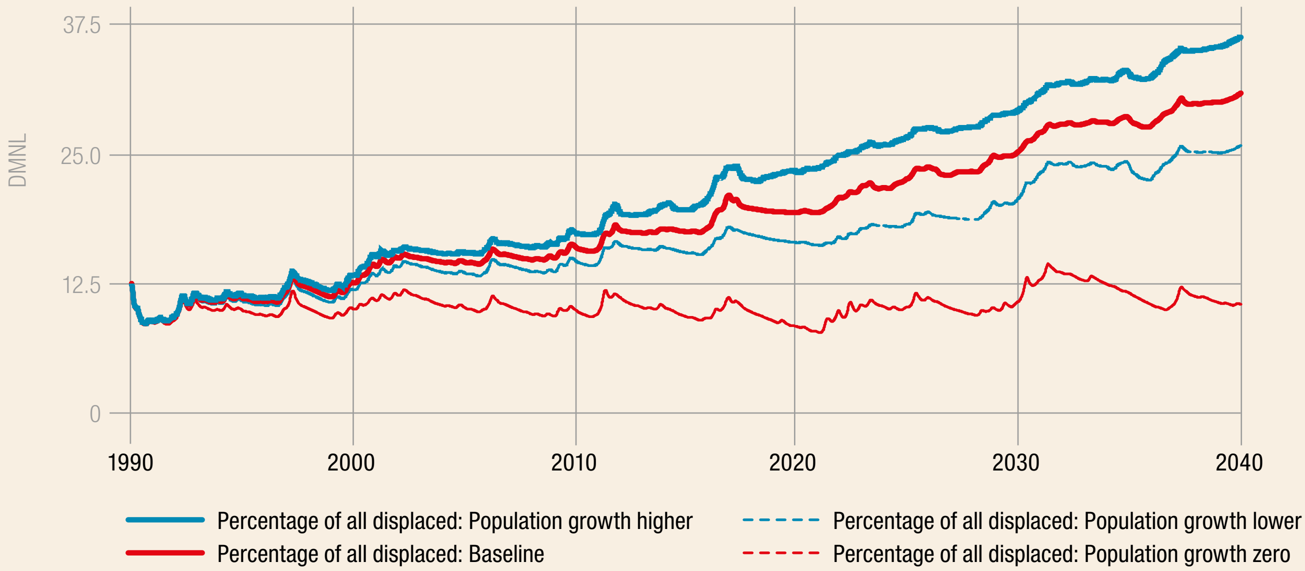

Figure 3.10: Model simulation: Percentage of the total pastoralist population displaced in relation to droughts

The remaining two scenarios were designed to illustrate a potential range of future population growth. Population Growth Higher adjusted the default birth and death rates such that both cause higher than Baseline growth. Birth rates were increased by ten per cent and death rates were decreased by ten per cent. Opposite adjustments were used to construct the Population Growth Lower scenario.

In all of the scenarios (except for Population Growth Zero) the percentage of pastoralists that would become displaced steadily increased through the model's 2040 time horizon, with the probability of drought being held constant (that is with no increasingly extreme climate impacts on rainfall). There has been discussion among experts about the sustainability and viability to pastoralism.[59] While the model doesn't have an explicit

59 See, for example Sandford, S. 2008. *Too Many People, Too Few Livestock: The Crisis Affecting Pastoralists in the Greater Horn of Africa.* Brighton, UK: Future Agricultures, Institute for Development Studies. http://goo.gl/12K8Xw; and Devereux, S., and Scoones, I. 2008. *The Crisis of Pastoralism?* Brighton, UK: Future Agricultures, Institute for Development Studies. http://goo.gl/PoAwKG.

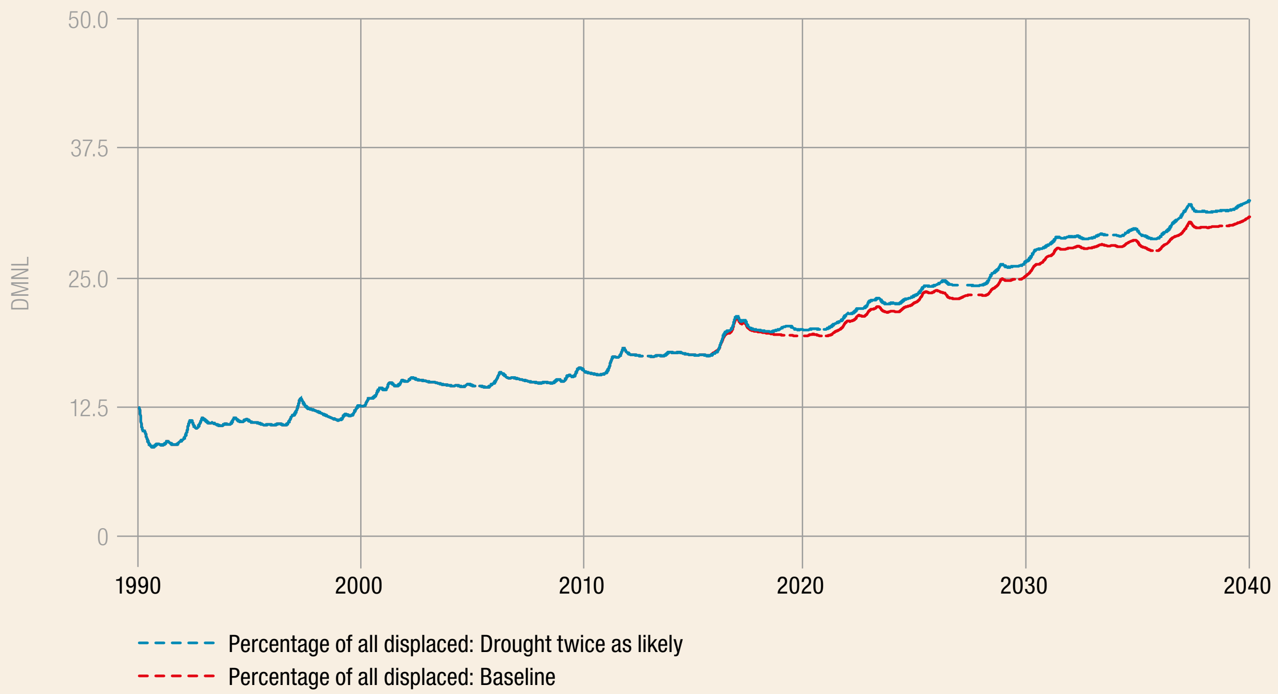

Figure 3.11: Percentage of pastoralists displaced if the with double the probability of drought between the present and 2040

limit or carrying capacity, it does have optimal ratios of people per livestock unit, and livestock per fodder unit, and a growing population pushes these parameters in the model away from their more optimal range.

3.2.2 #2: Drought probability influences displacement

While pastoralist displacement is affected by social changes, government policies and other forces, the frequency and amount of rainfall is fundamental to a viable pastoralist livelihood. To explore the importance of rainfall and droughts in the future, we constructed a scenario that doubled the probability of a drought occurring in a given year. That is, if the annual probability of drought is normally 20 per cent for northern Kenya then it will be 40 per cent in the new scenario. More pastoralist displacement occurs in the Drought Twice as Likely scenario compared to the Baseline scenario (Figure 3.11).

Importantly, Figure 3.11 is only a single scenario of future rainfall. To have a more complete picture of future rainfall scenarios, decisions makers should compare different but equally plausible random rainfall patterns, which the model can generate randomly. One reason for exploring many randomly generated scenarios is that displacement depends on the timing and variations in rainfall. These can vary even when the probability of drought occurrence does not change.

Figure 3.12 illustrates the range of one thousand different rainfall scenarios given the same baseline probability of drought. Even with the same probability of drought – the change of a drought is the same in all scenarios – there are variations in the level of displacement in the region. The variation has to do with the timing any particular drought, and how close any two droughts are together. If two droughts occur in relatively quick succession (e.g., one year apart) then more pastoralists would be displaced during the second drought than if the second drought occurred by itself. The displacement would be higher because the livestock population wouldn't have recovered from the first drought yet, and therefore pastoralists would be more vulnerable at the beginning of the second drought.

Figure 3.13 plots a second set of one thousands rainfall scenarios, each of which has the likelihood of drought occurrence doubled (e.g., same as Drought Twice as Likely). The distribution of pastoralist displacement has shifted upward when compare to the Baseline scenario. These results suggest that, for any given probability of drought it will be the precise timing of droughts and recent history that determines the level of displacement. An important line for future research using our model will be to investigate patterns of rainfall between rainy seasons, exploring whether early action during mild droughts could help build resilience to possible future droughts, for example.

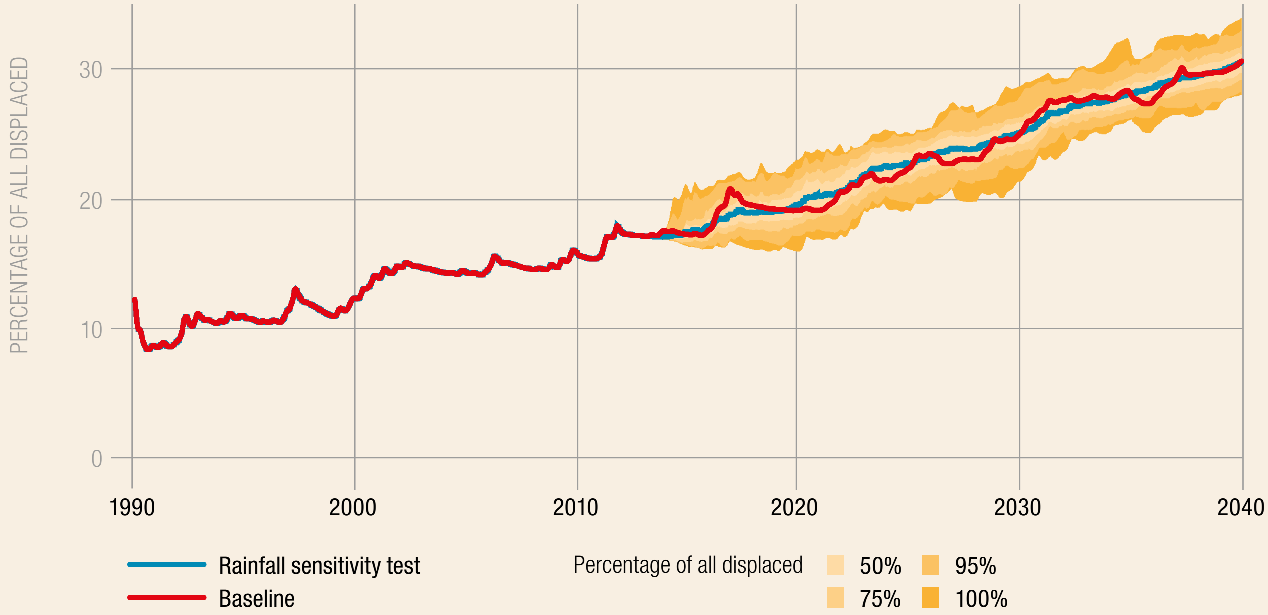

Figure 3.12: Percentage of pastoralist population displaced using Monte Carlo displacement simulation based on 1000 drought scenarios

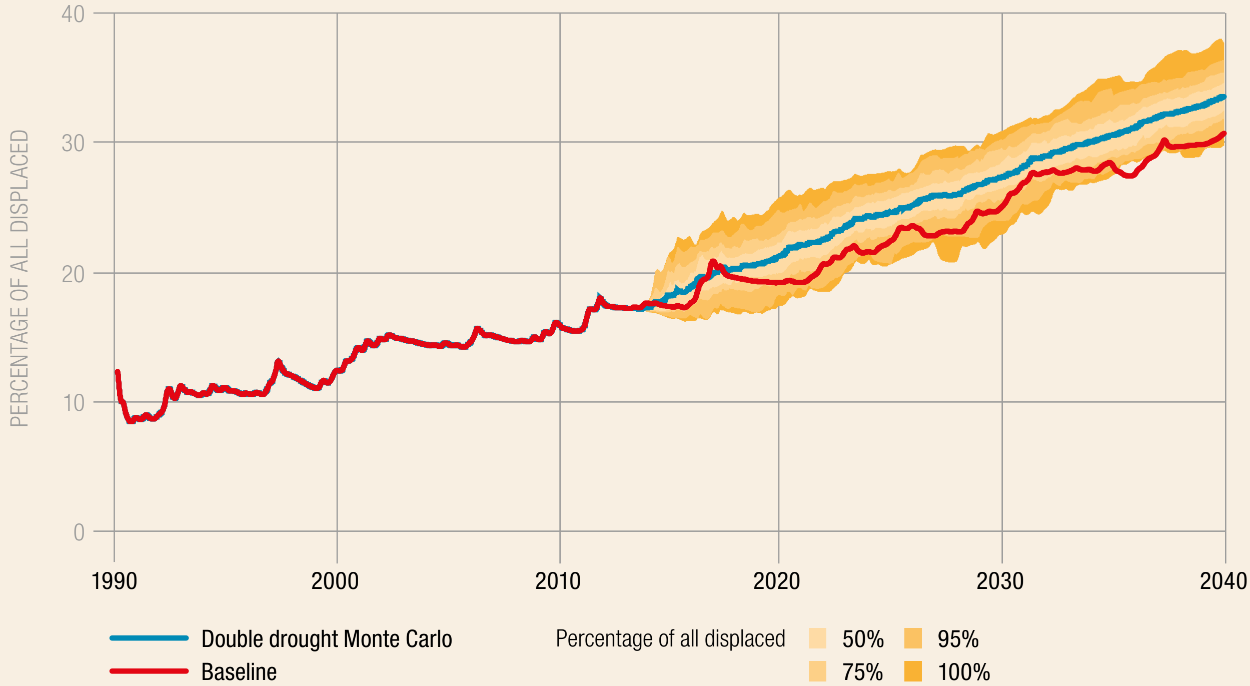

Figure 3.13: Percentage of pastoralist population displaced using Monte Carlo simulation with double the probability of drought

3.2.3 #3: Drought and climate change are not the only drivers of displacement

In places like Somalia that are affected by both conflict and drought, the scale of drought-induced displacement is far below displacement related to conflict (Figure 1.4 above). UNHCR figures reveal that people registering in IDP and refugee camps reported that drought was the primary cause of their displacement in only a few months between 2009 and 2012. Indeed, the peak months of drought-related displacement would register as merely average had they been caused by conflict.

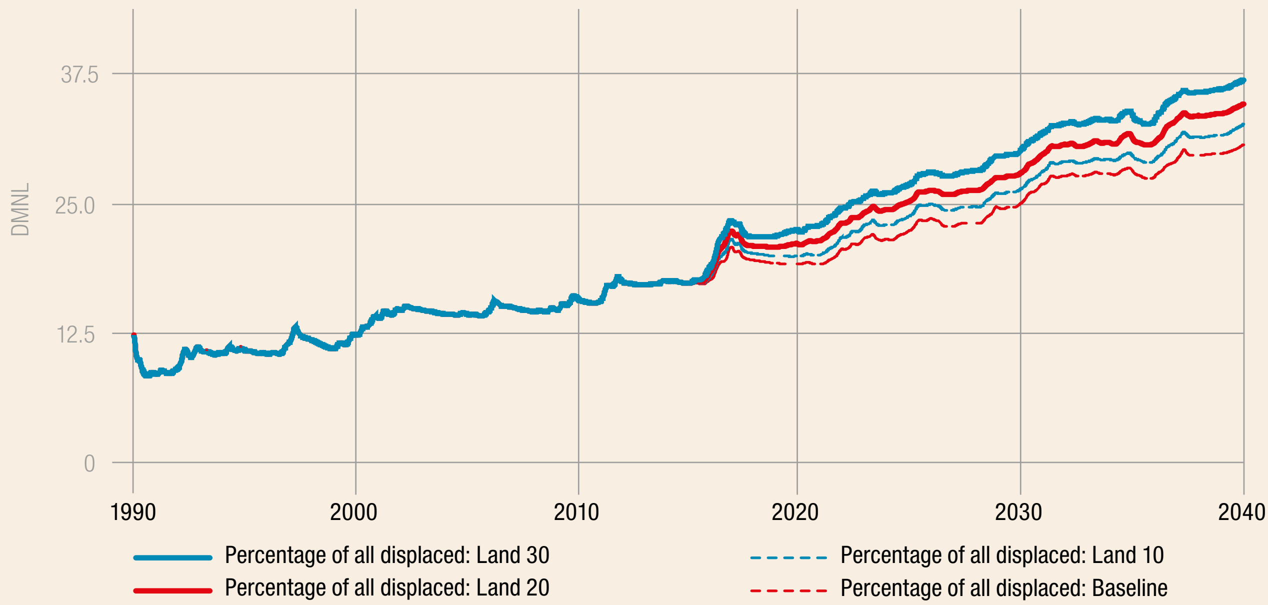

Figure 3.14: Percentage of pastoralist population displaced based on different land access scenarios

3.2.4 #4: Pasture access influences pastoralist vulnerability and displacement patterns

In some regions, there are increasing demands on pastureland resulting in restricted pasture access or pasture completely out of production as it converted to arable land. For example, the Government of Kenya has planned to convert 1.2 million hectares of its arid and semi-arid lands to irrigated agriculture (an objective President Kenyatta reaffirmed shortly after the 2013 election) with possible effects on pastoralists' ability to access traditional grazing lands.[60] Additionally, at times conflict may make areas of pasture inaccessible to some or all pastoralists.

We created three Land scenarios to explore the impact of reductions in accessible pasture area. In the simulation these are not tied to a particular policy or cause of pasture reduction. That is, pasture access reduced in the model the same way if the policy were about national park creation, conversion to cropland or reduction in open access to communal land.

The scenarios separately test how a 10 per cent, a 20 per cent, and a 30 per cent reduction of pasture impacts pastoralist displacement. Figure 3.14 compares these three scenarios with the Baseline scenario, and show that all three pasture reduction scenarios lead to more displacement, with the most extreme reduction scenarios having the largest effect. In the simulation, reduction in pastureland reduces the amount of grass fodder for the livestock. The livestock respond by having higher deaths rates, resulting in a smaller overall herd. Pastoralists are then faced with supporting themselves with fewer livestock, in rainy seasons and during droughts.

While the governments in the region may have little ability to influence future rainfall patterns, these results suggest that the sensitivity with which they handle pastoralist land access issues could influence how vulnerable to drought induced displacement pastoralists communities will be in the future.

3.3 POTENTIAL: ENGAGING DECISION-MAKERS ON POLICY QUESTIONS

The Pastoralist Livelihood and Displacement Simulator has the potential to engage policymakers and other decision-makers by exploring policy options interactively in real time. The model user interface is designed to answer a decision-maker's "what if?" questions.

To illustrate this potential, we have provided three examples of how the model could be used 'on the fly' to examine different policies that may impact pastoralist displacement. The three scenarios are not intended as examples to demonstrate that the model can be used to test individual policies, multiple policies simultaneously, and polices under different climate conditions, rather than to advocate for or draw conclusions about particular policies or combinations of policies.

[60] Patnaik, A. 2014. "Irrigation Scheme Locks Horns with Kenya's Pastoralists." *The Oslo Times.* http://goo.gl/AX2Uqd More recent estimates indicate that this 1.2 million hectare figure overstates the actual potential by more than 33 per cent (. See: Ngotho, A., 2013. "765,000 Hectares in Kenya for Irrigation." *The Star.* December 4. http://goo.gl/vRk40S.

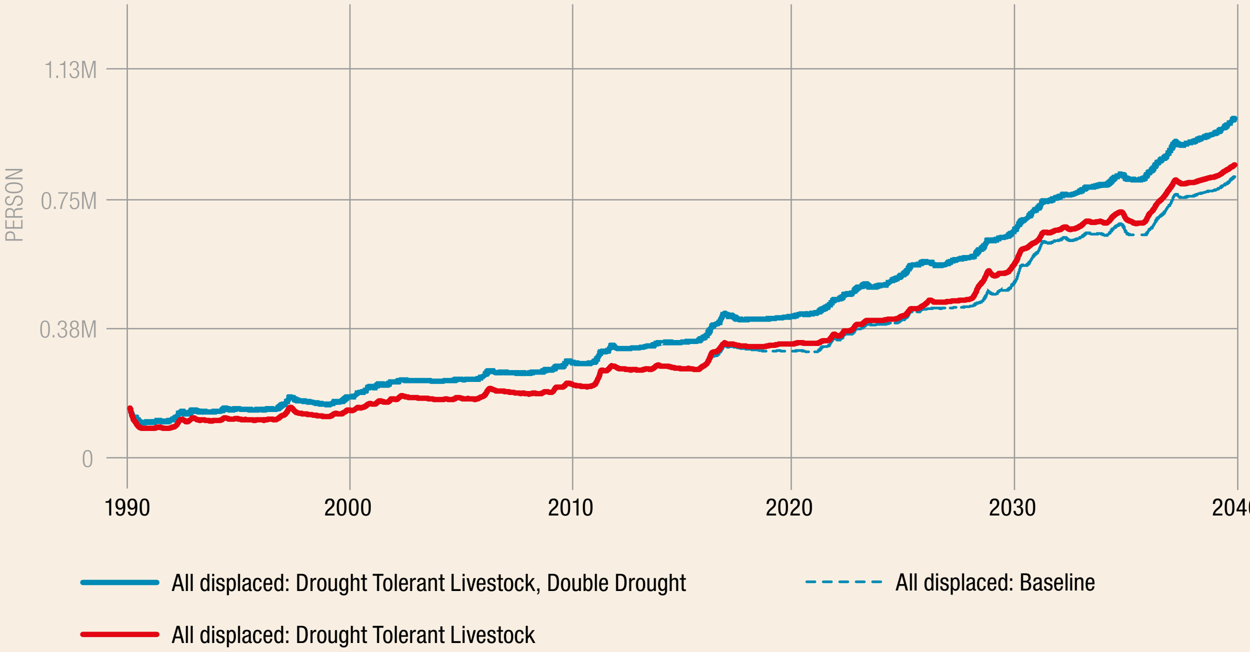

Figure 3.15: Simulating the effectiveness of drought-tolerant livestock and improved access to water points, emergency food and veterinary services

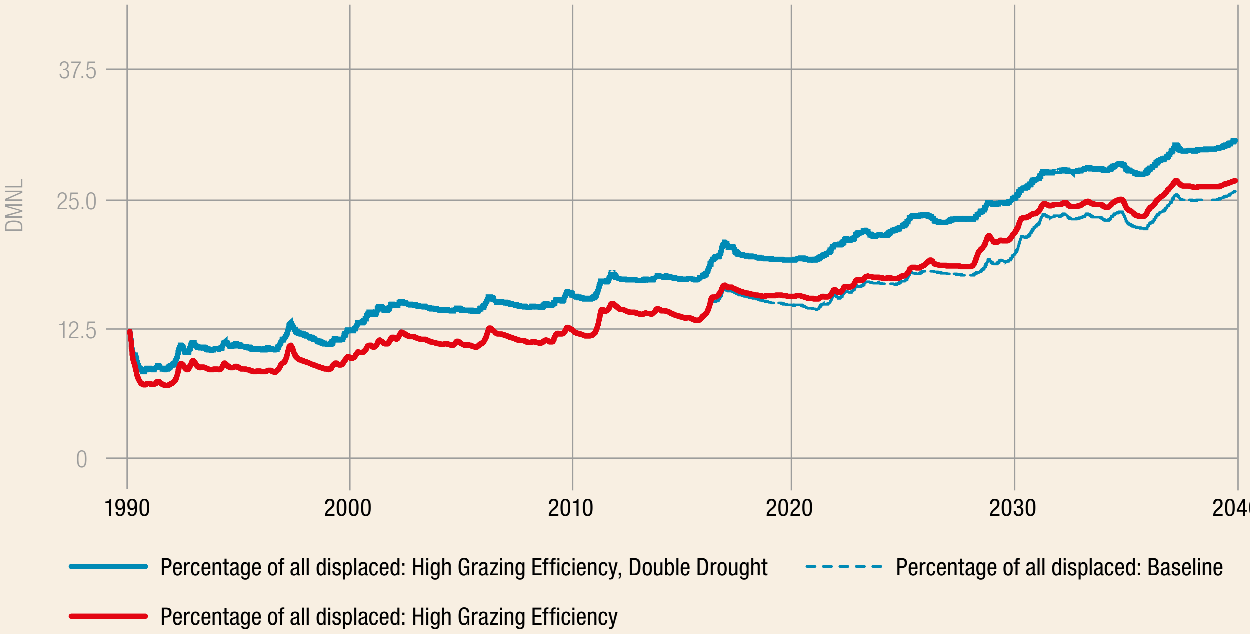

Figure 3.16: Simulating the effectiveness of improved grazing efficiency

3.3.1 Example one: Drought-tolerant herds

One way to enhance resilience to drought is by shifting herd composition away from cattle and toward more drought-tolerant animals, such as camels. An alternative strategy to enhance resilience to drought is to increase access to water points, emergency food stocks and veterinary services. In the simulation users can simulate these interventions by changing a parameter that determines livestock resistance to drought. As shown below, improving the resistance of livestock to droughts reduces displacement. This effect is particularly apparent in a scenario where the probability of drought is higher (Figure 3.15). In this scenario, displacement of pastoralists can be reduced under normal climate conditions and even if the probability of drought were to double.

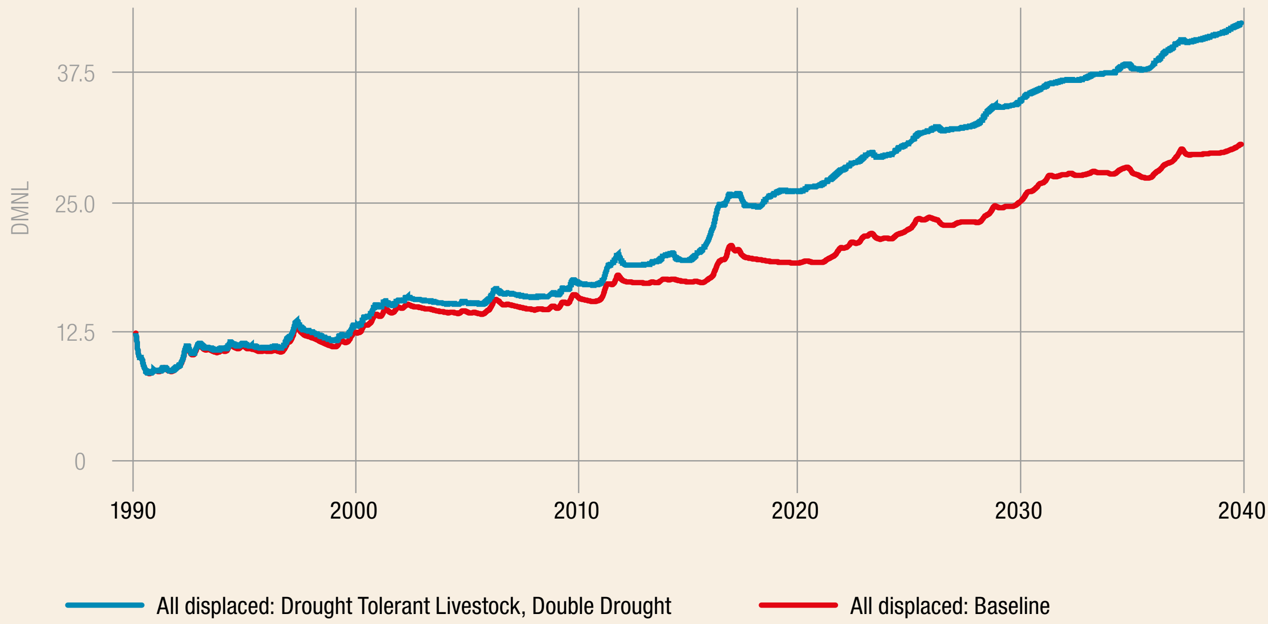

Figure 3.17: Simulation of a 'worst case' situation due to the loss of access to grazing lands, high population growth and more frequent occurrence of droughts.

3.3.2 Example two: Improve grazing efficiency

In 1982, Stephen Sandford estimated that the maximum achievable grazing efficiency is 62 per cent in the case of cattle and 85 per cent for sheep and goats (and, probably, camels).[61] This means that even during difficult times some fodder remains uneaten. Given the subsequent use of remote sensing (satellite imagery) analysis and the possibility of using mobile phones to inform pastoralists where they can find fodder for their livestock, it may be possible to improve upon these figures, for example by letting pastoralists know where fodder is, or is expected to be, available. If grazing efficiency were improved, displacement could be reduced significantly.

In the simulation, when grazing efficiency increases, even in the face of higher probabilities of drought, displacement is reduced (Figure 3.16).

3.3.3 Combined scenario

Another advantage of interactive policy testing is that decision makers can explore combinations of strategies, including strategies that different stakeholders might have control over, so that a mixed group can begin to see the possibilities for working together to address complex problems. Conversely, decision makers can see what might happen if several sectors of the system were to be simultaneously unsuccessful at building resilience, or if factors outside of the stakeholders control were to change in concert. Figure 3.17 shows an example of the sort of Combined Scenario that might be generated in such a setting. This scenario combines a 30 per cent reduction in pasture access, with higher population growth, and a doubling of drought likelihood. Combined, these factors create a scenario with very high rates of drought-induced displacement.

By exploring 'worst case' types of scenarios, like the one described here, policy makers can weigh the impacts of inaction, from which they might be able to begin estimating the value of different alternative outcomes.

3.4 FURTHER WORK TO IMPROVE DROUGHT DISPLACEMENT MODELLING

The development of the Pastoralist Livelihood and Displacement Simulator represents a first step in IDMC's efforts to monitor and analyse drought-related displacement. At present, it is an evidence-based tool for understanding the environmental and human drivers of displacement of pastoralists. There are several ways that the simulator could be improved in the future, especially if it were to be used to inform decision-making and early warning/early action.

As a first step, the modelling process has revealed several data gaps that currently add to the uncertainty of the simulations. More reliable time series data about

61 Sandford, S. 1982. Pastoral strategies and desertification: opportunism and conservatism in dry lands. In Spooner, B. and Mann, H.S. (eds.) *Desertification and Development: Dryland Ecology in Social Perspective.* Academic Press, London.

Application	Current capacity	Requirements for improving capacity
Understanding the impact of drought on pastoralist livelihoods and displacement	Appropriate for analysing the numerous drivers of displacement of pastoralists in order to understand the relative significance of each factor	Additional baseline and time series data needed to build more confidence in the simulator, to improve calibration and weighting of variables
Informing development, drought risk management and climate change adaptation policies	Appropriate for field testing of the model and guiding policy in a general manner	Data collected during field testing phase could be used to make the simulator more accurate, to identify new types of interventions and to revise the structure of the underlying model (as appropriate)
Decision-making for drought preparedness and response operations	Not yet appropriate for use in this capacity or as a early warning/early action tool	More data would be needed to build confidence in the model and increase its precision, and the simulator would likely need to be revised to focus on the very short time frame (e.g., 6 – 18 months)

Table 4: Current and potential applications of the Pastoralist Livelihood and Displacement Simulator

pastoralist and livestock populations are needed to calibrate and build confidence in the simulator. Initiatives such as the AfriPop Project and potentially new sources of data (e.g., from human and livestock vaccination programmes) may help fill some of these gaps.

Furthermore, social phenomenon, like urbanisation, changes in family structure and education patterns, and decisions of when and how to displace are important to understanding trends in future displacement. Determining some of the strengths of these effects may require carefully designed field studies and additional interviews with pastoralists and displaced pastoralists.

With the increased confidence in the model that could be built with access to the types of data described above there is also and extend set of scenarios that could constructively be tested with the simulation. Questions of interest include:

- Closer examination of the impact of the pattern of rainfall – for example clustering of mild droughts, or a strong drought followed by an intermediate drought – and examination of the effectiveness of interventions and policies for different patterns of rainfall

- Expand sensitivity testing, to help determine which factors of the system have the strongest influence on displacement

IDMC and Climate Interactive are eager to build upon existing work in order to make the Pastoralist Livelihoods and Displacement Simulator more useful for national and local decision-makers, humanitarian organisations and pastoralists. Some current and potential applications of the simulator are described below in Table 4. The kinds of data and research that would be needed include:

- more systematically collection of baseline data

- data on historical episodes of displacement, or preparing to monitor displacement in the near future

- social science/field testing to explore the relative weighting of drivers of displacement in different locales

- birth and death rates of different livestock mixes

- demographic modelling of pastoralists and better understanding of urbanization, education and other trends

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DISASTERS
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This is a multi-partner project funded by the European Commission (EC) whose overall aim is to address a legal gap regarding cross-border displacement in the context of disasters. The project brings together the expertise of 3 distinct partners (UNHCR, NRC/IDMC and the Nansen Initiative) seeking to:

1 › **increase the understanding** of States and relevant actors in the international community about displacement related to disasters and climate change;

2 › **equip them to plan for and manage** internal relocations of populations in a protection sensitive manner; and

3 › **provide States and other relevant actors tools and guidance** to protect persons who cross international borders owing to disasters, including those linked to climate change.

iDMC internal displacement monitoring centre

Internal Displacement Monitoring Centre
Norwegian Refugee Council
Chemin de Balexert 7-9
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www.internal-displacement.org

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