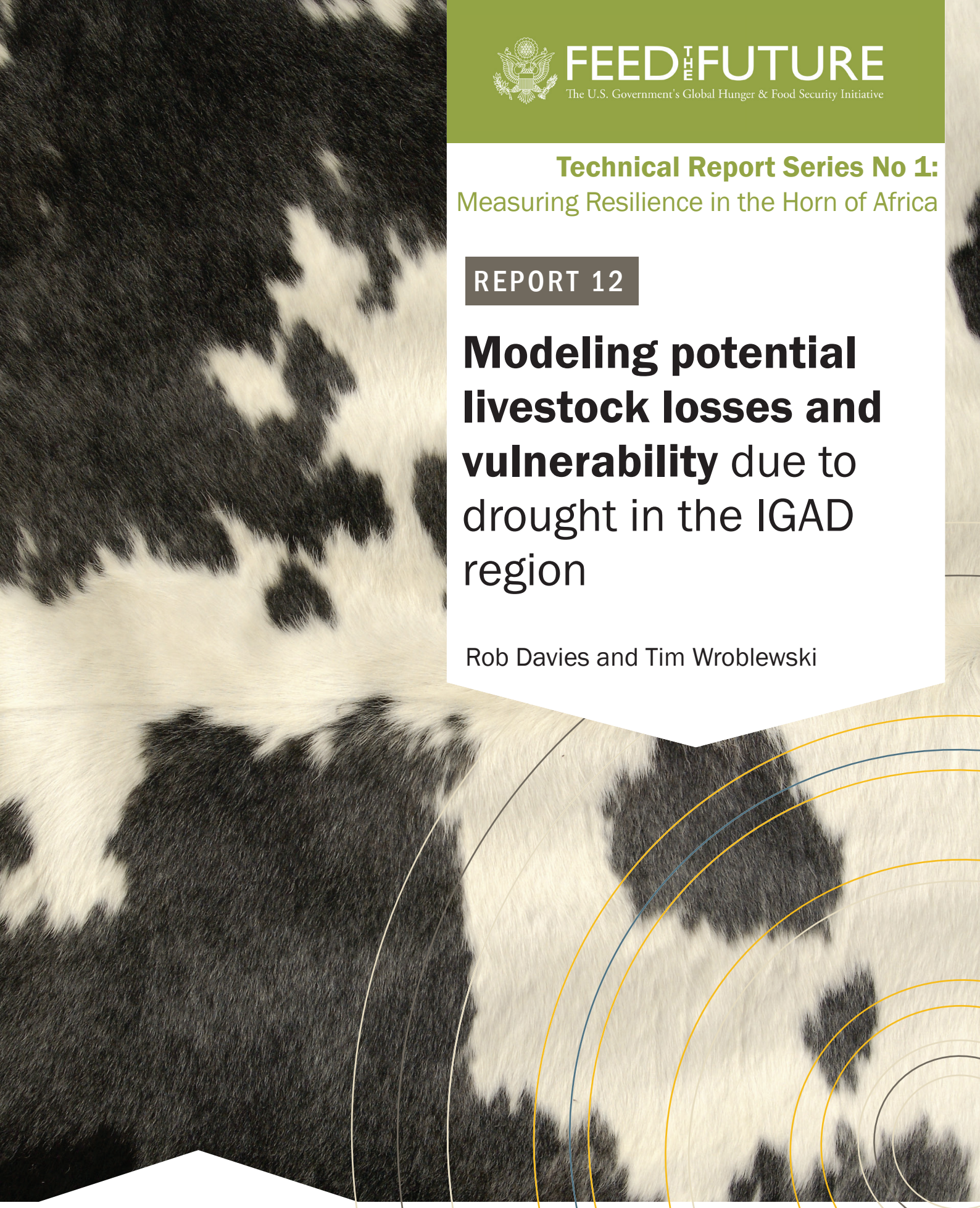

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Technical Report Series No 1:
Measuring Resilience in the Horn of Africa

REPORT 12

Modeling potential livestock losses and vulnerability due to drought in the IGAD region

Rob Davies and Tim Wroblewski

technical consortium
Building Resilience in the Horn of Africa
CGIAR

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

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Contributors: Rob Davies[a] and Tim Wroblewski[a]

Edited by: Sabrina Chesterman[b] and Katie Downie[b]

[a] *habitat INFO,* [b] *Technical Consortium*

This report is prepared by experts for the Technical Consortium for Building Resilience in the Horn of Africa. For more information on the Technical Consortium contact Dr. Katie Downie - k.downie@cgiar.org.

Disclaimer: The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

Design and layout: Jodie Watt Media

Citation: Davies, R. and Wroblewski, T. 2014. Modeling potential livestock losses and vulnerability due to drought in the IGAD region. Report prepared by the Technical Consortium, a project of the CGIAR. Technical Report Series No 1: Measuring Resilience in the Horn of Africa. Nairobi, Kenya: International Livestock Research Institute (ILRI).

Acronyms

ALRMP	Arid Lands Resource Management Project
ASALs	Arid and semi-arid lands
ENSO	El Niño Southern Oscillation
HoA	Horn of Africa
IGAD	Intergovernmental Authority on Development
IWMI	International Water Management Institute
NDMA	National Drought Management Authority
NGO	non-governmental organization
TAMSAT	Tropical applications of meteorology using satellite data and ground-based observations
TC	Technical Consortium for Building Resilience in the Horn of Africa

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1 Introduction

The Technical Consortium for Building Resilience in the Horn of Africa (TC) is a project of the CGIAR, which was formed in 2011 following the effects of the 2011-2012 drought. The main aim of the Technical Consortium initially was to provide financial and technical support to the Intergovernmental Authority on Development (IGAD) and its member states (Djibouti, Ethiopia, Kenya, Somalia, South Sudan, Sudan and Uganda) to formulate regional and national investment programmes for the long-term development of ASALs and to follow this with technical support, with particular focus on monitoring and evaluation and the targeting of investments within these plans. These investment plans became the Country Programme Papers (CPPs) for drylands projects for the Member States and the Regional Programming Framework (now the IGAD Drought Disaster Resilience Sustainability Initiative (IDDRSI)), which focused on investment plans to address regional issues for IGAD.

The focus of the TC's work at present is to collaborate with different partners, specifically including the governments in the region as their plans develop, to provide tools for measuring the impact of investments on enhanced resilience and to develop decision support tools for better targeting and prioritization of investments or projects. These tools will not only be useful for monitoring the impact of interventions within the national drylands investment plans and provide evidence for rational decision-making and prioritization, but will be applicable for donors, developments, NGOs and civil society when measuring or targeting their projects.

It has been noted that there is a gap between the strategies that decision makers use to allocate policy-related investments for ASALs and the analytical techniques that researchers use to model the conditions of ASALs and assess the impact of related interventions. To help bridge this gap, the TC has been working to develop and apply approaches to support evidence-based decision-making and investment prioritization to enhance resilient development trajectories in Horn of Africa (HoA). The result will be a toolbox of methodologies and application processes that facilitate the capacities of the IGAD member states to identify the investments with greatest potential for the highest impact to build resilience to shocks and stressors, in particular to drought, in the HoA.

The toolbox will be tailored to elucidate the implications of more focused interventions, for a more specific sub-population of interest, as those details are specified by IGAD or the member states. It will also be able to test how well investments perform under different conditions (climatic and otherwise) and over varied time horizons.

The toolbox will be of use to multiple audiences, but the primary focus for application will be to provide tools for the Government of Kenya (GoK) National

Drought Management Authority (NDMA), to assist with decision analysis and prioritization for investment proposed in the Kenya Ending Drought Emergencies Common Programme Framework (EDE CPF) drylands investment plan. It is also assumed, however, that the conceptual analysis and knowledge gained in the provision of tools to the GoK NDMA will also be of use to other clients such as NGOs, donors and development partners to assist with their decision making processes and that these tools will also have potential for replication in the remaining IGAD member states.

Context

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The Horn of Africa is predominantly comprised of arid or semi-arid lands, and is a naturally drought-prone region. With increasing pastoral or agro-pastoral land use, the environment and pastoral communities in this region are progressively susceptible to severe drought. In particular, heavy stocking of the land and consequent overgrazing will extend existing droughts, while denuded vegetation is the primary cause of further desertification and an increase in future droughts. This imbalance of livestock requirements and pasture availability results in livestock mortalities and food security issues.

It is therefore imperative that such pastoral communities be resilient to an environmental shock such as severe drought, in order to sustain food security in terms of livestock (where resilience applies to the conditions that affect the impact of the shock and the ability of a community to timely recover following the shock). Measuring the resilience to drought of pastoral communities within the Horn of Africa is therefore key to ameliorate or avert further livestock losses in this region, and to support the much-needed paradigm shift from relief to region- and community-specific development.

Two components of the drought module have been developed to complement the existing spatial tool[1]. Module A (general drought risk) identifies areas in need of help across multiple sectors throughout the whole region using medium to long-term data on drought exposure risk. Module B (pastoral livestock risk) highlights pastoral and agro-pastoral localities where farmers and dependents may be at risk of significant livestock mortalities in the short-term.

[1] For more information, please consult *Report 13: Spatial analysis for investment targeting - Pilot Tool*, Technical Consortium Report Series 1, 2014.

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Module A: **General drought risk**

In Phase 1 of the pilot spatial tool generic shocks are considered which may occur anywhere in the IGAD region – taking into account that many shocks (especially economic and social shocks) have a broad geographic focus. However, the tool has been designed to accommodate and produce likelihood of occurrence maps for shocks which occur in specific areas. At the same time, weightings can be adjusted in response to feedback and a full sensitivity analysis, to assess their influence.

General drought risk is calculated using a new drought exposure layer based on longer-term datasets (using information gathered in recent decades). It is envisioned that this will be useful to potential investors considering a variety of sectors, such as water management, early warning information systems and conflict reduction. The spatial tool outputs a map and spread sheet that both indicate the average risk of drought on an administrative district basis.

'The likelihood of drought occurring' layer is displayed in the map and excel outputs of the spatial tool and uses the following indicators and weightings:

- drought (people affected) * 1;
- standardised precipitation index * 1;
- inter-annual rainfall variation (IWMI) * 1;
- inter-annual rainfall c.v. (TAMSAT) * 1;
- seasonality * 1;
- model mortalities c.v. * 1.

The latter two variables are outputs from the livestock – rainfall interaction model and they tend to highlight localities strongly influenced by ENSO phenomena.[2]

In the outputs of the general drought resilience spatial tool, there is also a new 'Susceptibility to drought' layer. This is based largely on the previous susceptibility/impact layer (environmental sensitivity, representing those areas that would feel the immediate impact of a drought), but is slightly modified in order to ensure indicators are not used throughout the analysis more than once.

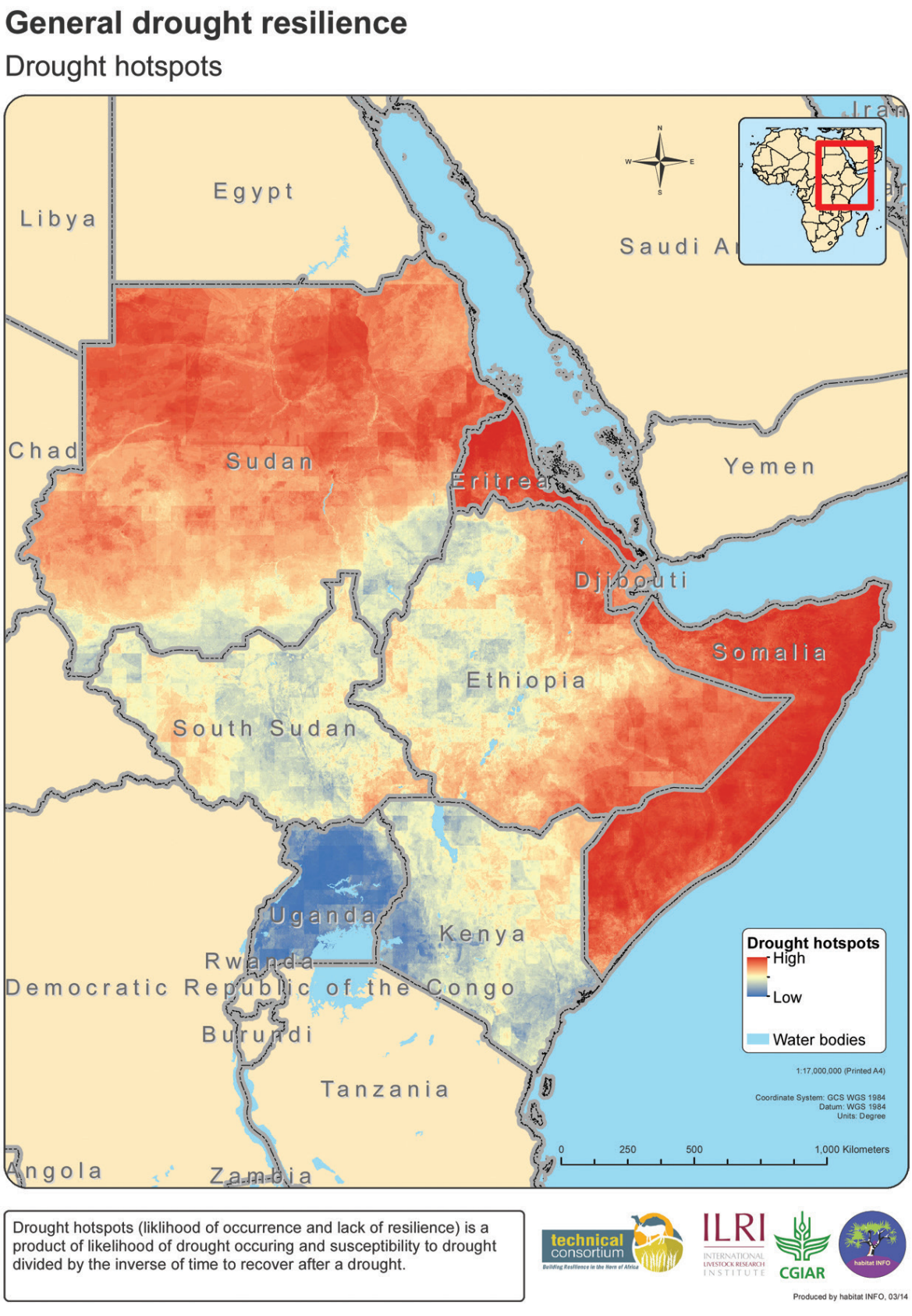
In Drought Module A, however, the focus is to assist with targetting locations where the need to build resilience to drought is the greatest. The previous formula for general resilience and calculate the lack of resilience is therefore inverted as follows:

$$\frac{\text{likelihood of drought occuring} \times \text{susceptibility to drought}}{\text{adaptive capacity (inverse of time to recover after a drought)}}$$

[2] For more information, please consult *Report 13: Spatial analysis for investment targeting - Pilot Tool*, Technical Consortium Report Series 1, 2014.

The formula helps identify 'drought hotspots'; where the likelihood of occurrence and susceptibility to drought is high and the potential for recovery is low. This layer is represented in Figure 1 below.

Figure 1: Drought Hotspots



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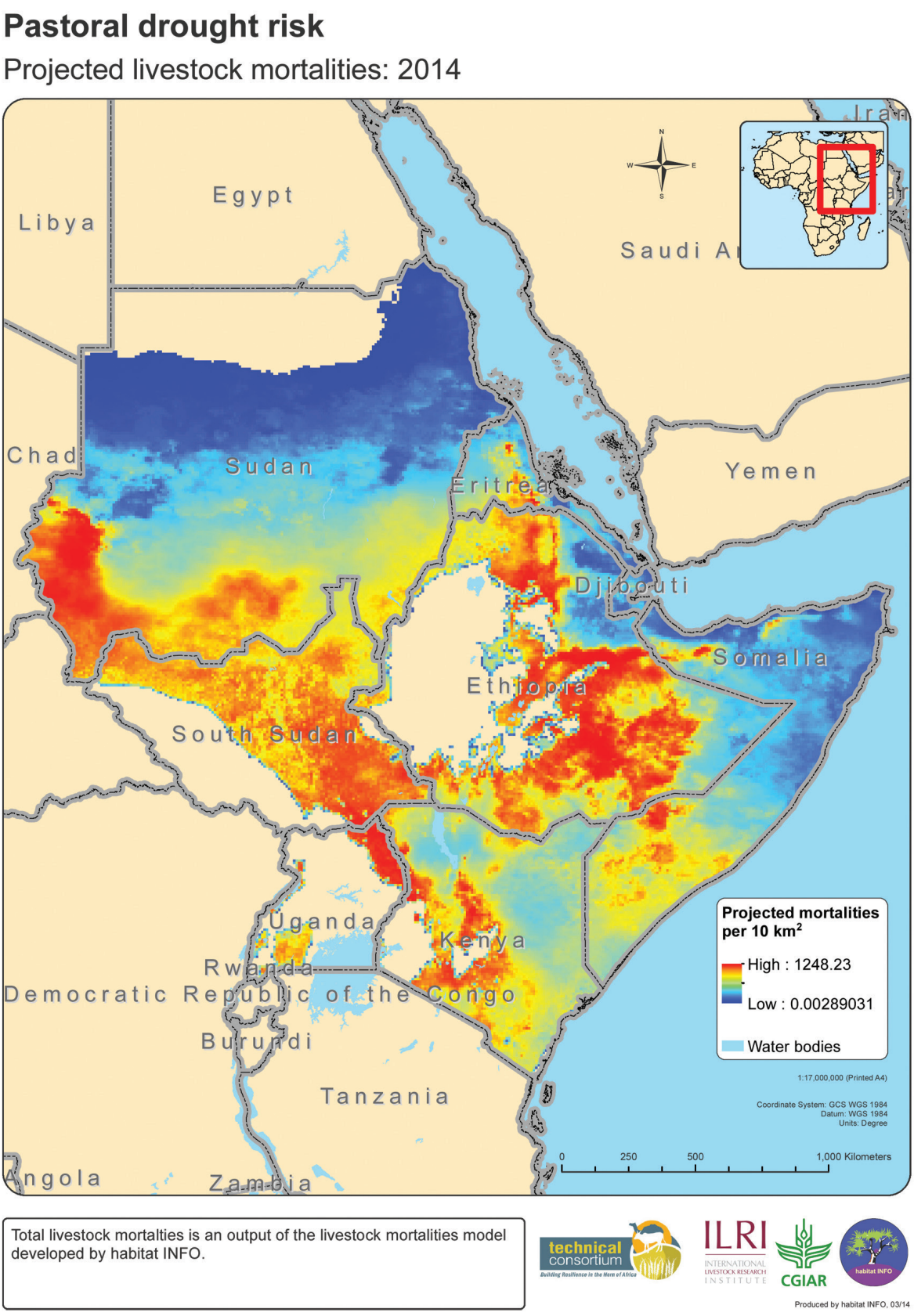
Module B:
Pastoral drought risk

‘Module B: Pastoral drought risk’ is based on short-term rainfall estimates and a model of livestock population dynamics at high geographic resolution, and is confined to the pastoral and agro-pastoral land use regions. This module assists with assessing the targeting of investments such as the promotion of stock movement and reduction, would yield greatest gains towards enhancing resilience.

The risk of drought layer is based on the projected livestock mortalities in the current year (2014)[3]. This layer is represented in Figure 2 on the following page.

[3] For more information, please consult *Report 13: Spatial analysis for investment targeting - Pilot Tool*, Technical Consortium Report Series 1, 2014.

Figure 2: Pastoral drought risk (projected livestock mortalities: 2014)



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Annex 1:
Data composite modifications

The following modified environmental sensitivity composite indicators are used in the different drought module versions to avoid repeat inclusions.

Environmental 2: Land use composite layer

Existing composite indicator	For general drought risk (Module A)	For pastoral drought risk (Module B)
Explanation needed. It includes the following indicators: ■ deforestation ■ slope ■ rangeland use ■ classification of land use/cover	This composite collates best available data pertaining to land use impact. It includes the following indicators and weightings: ■ forest loss *1; ■ slope *1; ■ ALRMP mortality rate (Kenya) *1; ■ soil degradation *1; ■ habitat transformation *3; ■ tsetse fly occurrence *2; ■ livestock mobility *1	This composite collates best available data pertaining to land use impact. It includes the following indicators and weightings: ■ forest loss *1; ■ slope *1; ■ model mortalities c.v. *2; ■ model livestock excess 2014 *3; ■ ALRMP mortality rate (Kenya) *1; ■ soil degradation *1; ■ habitat transformation *3; ■ tsetse fly occurrence *2; ■ livestock mobility *1

Environmental 5: Climate composite layer

Existing composite indicator	For general drought risk (Module A)
Explanation needed. It includes the following indicators: ■ rainfall data from remote sensing ■ ENSO index ■ productivity	This composite collates best available data pertaining to climate. The following layers are combined with the following weightings: ■ rainfall * 1; ■ length growing period * 1; ■ net primary productivity * 1; ■ wind speed * 1; ■ maximum temperature extremes * 1; ■ minimum temperature extremes * 1; ■ incidence of fire * 1; ■ evapotranspiration * 1

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technical consortium

Building Resilience in the Horn of Africa

The Technical Consortium for Building Resilience in the Horn of Africa provides technical support to IGAD and member states in the Horn of Africa on evidence-based planning and regional and national investment programs, for the long-term resilience of communities living in arid and semi-arid lands. It harnesses CGIAR research and other knowledge on interventions in order to inform sustainable development in the Horn of Africa. www.technicalconsortium.org