The Economics of Early Response and Resilience:
Lessons from Kenya

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TABLE of CONTENTS

Acronyms

ASALs	Arid and semi-arid lands
BCR	Benefit to Cost Ratio
CAP	Consolidated Appeals Process
DFID	Department for International Development
DPP	Disaster Preparedness
DRR	Disaster Risk Reduction
EWS	Early Warning Systems
FEWSNET	Famine Early Warning Systems Network
FTS	Financial Tracking Service
GDP	Gross Domestic Product
GoK	Government of Kenya
HEA	Household Economy Analysis
HERR	Humanitarian Emergency Response Review
KSH	Kenyan Shilling (local currency)
MDGs	Millennium Development Goals
MNKOAL	Ministry of Northern Kenya and Other Arid Lands
MoH	Ministry of Health
MT	Metric Tonne
MTIP	Medium Term Investment Plan
PDNA	Post Disaster Needs Assessment
PSNP	Productive Safety Nets Programme
SRA/LRA	Short and Long Term Rain Needs Assessments
STM	Short Term Mean
USD	United States Dollar
WFP	World Food Programme
WHO	World Health Organization

1 Introduction

The impacts of natural disasters and complex emergencies have been increasing over recent decades, putting the humanitarian system under considerable pressure. The costs of humanitarian crises are also growing – not only do disasters and complex emergencies result in significant economic losses, but they also require mobilization of large amounts of humanitarian aid from the international community.

It is widely held that, broadly speaking, investment in early response and/or building the resilience of communities to cope with risk in disaster prone regions is more cost-effective than the ever-mounting humanitarian response. Yet little solid data exists to support this claim, and there is a clear need for a greater evidence base to support reform.

The UK Government commissioned an independent study to contribute to filling these evidence gaps. This report presents the findings from the country study on Kenya, and sits within a suite of reports within the Economics of Early Response and Resilience (TEERR) Series (Table 1). More detail and data used to build the findings presented here can be found in the Kenya "Country Supporting Document".

1.1 Structure of this Report

This report analyzes available data for Kenya, along with data modelled using the Household Economy Approach (HEA), to compare the cost of three scenarios:

- Late humanitarian response;
- Early annual humanitarian response; and
- Investment in resilience.

The report is structured as follows:

- **Section 2** provides a very brief overview of the country context.
- **Section 3** assesses the comparative costs from a bottom-up perspective – using disaggregated project and sector level estimates to compare the cost of response.
- **Section 4** assesses the comparative costs from a top-down perspective – using aggregate level costs and losses for the country as a whole.
- **Section 5** draws conclusions from the findings.
- **Annex A** contains detailed calculations that support the analysis.

Table 1: Reports in the Economics of Early Response and Resilience (TEERR) Series

Report Title	Report Content
TEERR Synthesis of Findings:	Summarizes the key findings
TEERR Approach and Methodology:	This report includes the introduction to the study objectives, and the detailed methodology as well as limitations to the analysis.
TEERR Country Reports: • Ethiopia • Kenya • Bangladesh • Mozambique • Niger	The country reports contain a very brief introduction, description of the country/study context, the detailed findings from the analysis, and conclusions/recommendations. These draw together the data presented in the country supporting documents (see below) as well as the HEA report, to model outcomes.
TEERR HEA report:	Contains details of the HEA modelling, assumptions and parameters, as well as modelling output.
Country Supporting Documents	Each country is supported by a report that contains country level detail and data.

2 Disasters and Resilience in Kenya

2.1 Humanitarian Crises due to Drought

The Horn of Africa is dominated by arid and semi-arid lands (ASALs). These areas are characterized by low and irregular rainfall as well as periodic droughts. The droughts can vary in intensity, but the region is no stranger to devastating conditions brought on by weather, conflict, government neglect or a combination of each. Between 1900 and 2011, more than 18 famine periods were registered in the region's history.[1] In 1985 a highly destructive drought in the area killed nearly 1 million people and in the last decade major droughts have occurred in 2001, 2003, 2005/06, 2008/09 and 2011. The most recent crisis—the 2011 drought—still affects large segments of the population. North and eastern Kenya is vulnerable, with greater than a 40% annual probability of moderate to severe drought during the rainy season.[2] In Kenya, over 80% of the land mass is defined as arid and semi-arid lands.

Table 2: Historical Comparison of Drought Events in Kenya

Major drought events	GoK[3] and International Humanitarian Aid Received (US$)	Number People Affected[4]
2011	427.4m	3.75m
2009	432.5m	3.79m
2006	197m	2.97m
2003/2004	219.1m	2.23m
1998-2001	287.5m	3.2m

In Kenya, the 1998-2000 drought was estimated to have had economic costs of $2.8 billion.[5] More drastically, the Post Disaster Needs Assessment for the extended 2008-2011 drought estimated the total damage and losses to the Kenyan economy at a staggering $12.1 billion.[6] By comparison, in 2011 Kenya's GDP was $71 billion.

In drought affected areas like the Horn of Africa, aid organizations have come to play a significant role in providing humanitarian response. Food aid comprises the majority of humanitarian aid. While food aid can save lives and fend off famine, it

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[1] http://www.globalhumanitarianassistance.org/wp-content/uploads/2011/07/gha-food-security-horn-africa-july-20111.pdf l

[2] Horn of Africa Natural Probability and Risk Analysis, Bartel and Muller, June 2007.

[3] Government of Kenya

[4] Based on maximum numbers assessed for food aid assistance by government-led Kenya Food Security Steering Group (KFSSG). Data from Ministry of Northern Kenya.

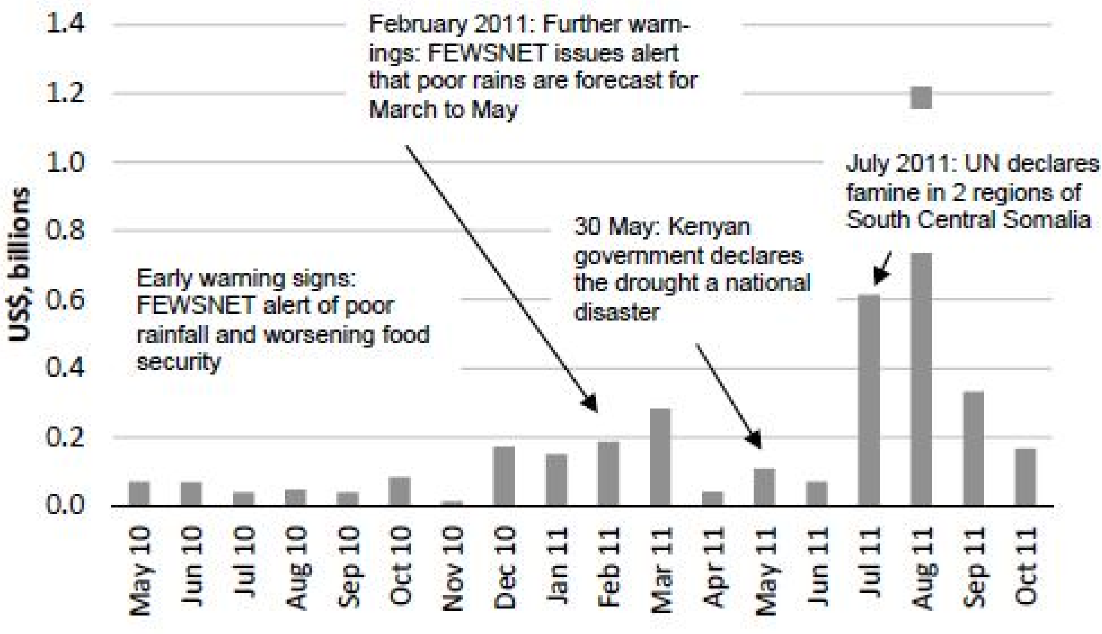
[5] Stockholm Environment Institute (2009). "Economics of Climate Change: Kenya".

[6] Republic of Kenya (2012) "Kenya Post Disaster Needs Assessment (PDNA): 2008-2011 Drought". With technical support from the European Union, United Nations and World Bank.

also arrives with its own set of problems, mainly because it almost always arrives late. During the 2006 drought, despite warnings that came as early as July 2005, substantial interventions did not start until February 2006. Additionally, during the recent 2011 drought, early warnings of poor rainfall were noted as early as May 2010. In February of 2011, the Famine Early Warning Systems Network (FEWSNET) issued a further warning that poor rains were forecasted for March to May. However, as Figure 1 shows, humanitarian funding did not increase significantly until the UN declared a famine in July 2011. At this point, thousands had already suffered.

When humanitarian aid is late, which occurs for a variety of reasons from lack of understanding of the on the ground situation to organizational and administrative delays, it not only directly affects lives but can also disrupt the market. By the time food aid is mobilized and distributed, an affected region may have already passed their time of need. With an influx of outside food sources, local market prices are then skewed. Even when food aid is still needed, the delayed distribution can create problems. For example, in Kenya during the 2011 drought, by the time food supplies were secured for the full caseload of affected people, the short rains had arrived and the saturated road network became impassable. Though humanitarian relief can and does help save lives, long-term initiatives should be implemented to help communities deal with a crisis in real time and to help prevent future crises.

Figure 1: Humanitarian Funding for Ethiopia, Somalia and Kenya, 2010/2011[7]



[7] Save the Children, Oxfam (2012). " A Dangerous Delay: The cost of late response to early warning in the 2011 drought in the Horn of Africa". Data taken from OCHA Financial Tracking Service (FTS)

2.2 Pastoralism

The drylands of the Greater Horn of Africa are inhabited by over 20 million pastoralists, whose livelihood is dependent on movement with livestock.[8] Pastoralism developed out of the need to constantly adapt to the extreme climatic uncertainty and marginal landscapes of the drylands, and has been practiced for centuries. Pastoralists have sophisticated methods to optimize water and land, moving and selling animals to deal with the effects of drought.

Yet, in recent years, the drylands of the Horn have become some of the most vulnerable areas in the world. This is due in part to decades of political and economic marginalisation, which has led to an erosion of the pastoral asset base. These structural forces disrupt migration routes and access to dry season grazing areas, severely curtailing pastoralists' abilities to move animals to different pasture, a key mechanisms for coping with drought. This is particularly true for poorer pastoralists, with smaller herd sizes. Rather than address this marginalisation and reinforce adaptive capacities, there has instead been a focus on providing emergency assistance, which has often been either too late or inappropriate, and which has further undermined sustainable development in these areas.[9]

Pastoralism is the dominant production system in the ASALs, which stretch across the whole of northern Kenya (Turkana, Marsabit, Wajir and Mandera), much of eastern Kenya and the southern rangelands (Laikipia, Narok, Kajiado). The ASALs are home to about 10 million people and approximately 70% of the national livestock herd. In Kenya, pastoralism makes a significant contribution to the economy with livestock production accounting for 50% of agricultural GDP.[10] However, the ASALs have the lowest development indicators and the highest incidence of poverty in the country. Eighteen of the 20 poorest constituencies in Kenya, where 74% - 97% of people live below the poverty line, are in Northern Kenya. The highest rates of poverty are observed among those who are no longer directly involved in pastoralism – as populations grow, rangelands are reduced and both government and private sector investment in the sector remains low so the proportion of the population able to make a viable living on pastoralism is reducing. This trend is exacerbated by recurrent droughts and other shocks leaving many dependent on casual labour, better-off clan members or environmentally destructive activities such as firewood or charcoal sales.

Both arid and semi-arid districts experience chronic food insecurity and in the last

[8] "Disaster Risk Reduction in the Drylands of the Horn of Africa" (2011). REGLAP Newsletter.
[9] Ibid; HPG Briefing note (2006). "Saving Lives through Livelihoods".
[10] Agricultural GDP represents approximately 30% of total GDP.

decade millions have become increasingly reliant on regular food relief. While the economy of the arid districts is dominated by mobile pastoralism, in the better-watered and better-serviced semi-arid areas a more mixed economy prevails, including rain-fed and irrigated agriculture, agro-pastoralism, bio-enterprise and conservation or tourism-related activities.

Pastoralism is adapted to dryland environments, and operates effectively as a livelihoods system in low and highly variable rainfall conditions. On the one hand, pastoralism as a system is growing in some ways, for instance as formal livestock export markets are expanded. However, large sub-populations within pastoral areas i.e. poorer households with few or no animals, are becoming increasingly vulnerable, for a variety of reasons, including:

- Declining sustainability as livestock holdings decrease for the poorer households, and the human population grows.
- Reduced rangelands due to overgrazing and tighter boundary controls and sale and enclosure of lands for a range of uses such as settled agricultural, reserves and conservancy. Wealthier pastoralists with larger herds control more land for commercialized pastoralism.
- Declining livestock and agricultural productivity due to low investment, poor husbandry practices and technologies (despite a growing livestock export trade).
- Environmental degradation and deterioration of natural resources to the point that production may decline below recovery levels.
- Loss of productive assets (livestock/farming/irrigated land) due to drought, floods, disease and livestock theft, particularly for poorer households.
- Breakdown of traditional institutions and social relations as migration patterns change.
- Limited access to markets for selling animals.
- Low socio-economic empowerment of women and youth.
- Geographic isolation in terms of infrastructure, communications and basic services.
- Increasing impoverishment of some communities and more vulnerable households.[11]

In a drought, pastoral households sell animals in order to buy staple cereals. Because everyone is selling, and there are few buyers, prices fall substantially. If the animals have a buyer, this does not necessarily represent a loss to the overall economy, but their low value represents a loss of a key capital asset to the seller household. Further, many animals die from starvation. These pressures predominantly affect poorer households with smaller herd sizes, and can be a common reason for household descent into poverty.

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[11] Ibid.

2.3 Building Resilience for Pastoralists in the Face of Drought

For the purposes of this study, drought responses in Kenya (and much of the Horn) have been broadly categorised into the following (see Table 3 for a more detailed breakdown):

1) **Late humanitarian/emergency relief –** Interventions that address the direct impacts of a crisis or disaster on the target population. Primarily these take place during the crisis itself although may continue after (often as a result of late response).
2) **Early / pre-planned responses** – Interventions undertaken to prepare for, mitigate or reduce the impact of the next anticipated/likely disaster. These may be on-going activities or those which intensify or scale up as a crisis is becoming evident. It assumes appropriate Early Warning systems (EWS) are in place and responded to. Many of these activities overlap with the late humanitarian activities, the key difference being the timing of implementation.
3) **Disaster resilience activities** – This category encompasses a broad range of activities, each should fundamentally increase a community's resilience to disasters. The outcomes produced by these interventions should contribute to reducing the impact of a drought so that external humanitarian relief is reduced, less regularly required or, ideally, eliminated. The interventions listed in the table overleaf are not exhaustive but indicative of the wide range of activities considered 'resilience' building by many (views clearly vary). It should be noted that many 'normal' development activities are included.

Table 1: Categories of Support for Drought Response

Category	Humanitarian/Emergency Relief – when the disaster hits	Early response – anticipating the next disaster	Disaster resilience – Increased ability to withstand repeated disasters
Food / Cash Transfers	• Food aid in response to twice yearly long/short rains assessments and emergency 'flash' appeals. • Emergency ad hoc cash transfers (primarily by NGOs).	• Multi-year, planned food and/or cash transfers assessed using ongoing seasonal / early warning assessments / information. Levels and targeting adjusted/upscaled as needs vary. • Food stores in place in all locations for pre-positioning stocks. • Mechanisms in place to purchase local food products for food aid, especially when surpluses available.	• Multi-year, planned food and/or cash transfers provided for most vulnerable. • Distribution systems privatised and local food commodities used whenever appropriate.
Effective Early Warning / Food Security Information Systems		• Timely, regular information analysed into reports for use by local and national stakeholders to trigger, upscale and downscale activities. • Communities and districts contribute to and receive EW/FSIS data and analysis monthly. Supported to implement drought contingency in plans.	• Timely, regular information analysed into reports for use by local and national stakeholders to plan and organise on-going development and emergency response. • Communities and districts active participation in EW/FSIS data collection and regular use. • Develop and implement local contingency / resilience building plans. On-going community development support.
WASH	• Water tankering, emergency borehole repairs, maintenance, fuel subsidies.	• Water user / management committees and local Water Authorities implement drought contingency plans with reserved funds.	• Implementation of Regional/District water strategies: expansion of water pans, boreholes, shallow wells, bikads etc. • Drip feed irrigation schemes where appropriate. • Ongoing training and capacity building support to District Water Offices/ Water user association.
Nutrition and Health	• Outreach therapeutic and supplementary feeding	• MoH supported to scale up facility-based and outreach therapeutic and supplementary	• MoH supported to scale up high impact nutrition and health interventions to all locations.

Category	Humanitarian/Emergency Relief – when the disaster hits	Early response – anticipating the next disaster	Disaster resilience – Increased ability to withstand repeated disasters
	programmes (OTP/SFP). • Blanket supplementary feeding programmes (BSFPs). • Emergency vaccination campaigns, cholera response etc.	feeding programmes (OTP/SFP). • Early blanket supplementary feeding programmes (BSFPs). • Pre-positioning of medical and nutrition supplies. • Timely vaccination campaigns, cholera response etc	• Trained and equipped community based health care workers able to provide basic preventative and curative health care to remote communities. • Local health committees prioritising and planning local health care. • Comprehensive coverage of facility-based and outreach health and nutrition services (including NIDs), stock out of medical and nutrition supplies.
Livestock	• Fodder distribution and water tankering, slaughter, de-stocking. • Emergency deworming and vaccination campaigns.	• Interventions as per Livestock Emergency Guidelines (LEGs). • Timely facilitation of commercial de-stocking, herd mobility and grazing agreements. • Timely deworming and vaccination campaigns with support of trained cadres of community health workers.	• A comprehensive livestock management strategy in place, including components to support ex-pastoralists who have to move out of the sector. • Ongoing facilitation of livestock market facilities, market information systems and linkages with buyers. • Fodder production and storage systems developed. • Communities facilitated to have on-going herd mobility and grazing agreements. • Support comprehensive coverage of quality vet services and drug supply able to implement regular deworming and vaccination campaigns. • Livestock insurance schemes.
Education	• School feeding programmes • Water tankering to schools and emergency sanitation	• School feeding incorporated into single food / cash pipeline planning. • School / community water and sanitation clubs/ committees implement school drought contingency plans	• Ensure comprehensive access to primary education via traditional and alternative school provision. • Expand provision of boarding schools for pastoralists (for girls and boys), teacher training and vocational and technical colleges.
Infrastructure			• Road construction, electrification, improved communication networks, expanded financial services etc

3 Cost Comparison of Drought Response - Kenya

3.1 Introduction

This analysis approaches the cost comparison from a bottom-up perspective – using disaggregated project and sector level estimates to compare the cost of response.

The HEA and herd dynamics modelling estimates the food aid requirements and animal losses for a high magnitude drought in Wajir Grasslands, assuming a drought in year 1, and calculating losses over 5 years. This analysis is done for the Wajir southern grasslands, in Northern Kenya, with a total population of 367k.

This was modelled for three storylines:

- Storyline A, in which humanitarian aid arrives late;
- Storyline B1, in which early response uses commercial destocking of 50% of adult animals that would have otherwise died[12] ; and
- Storyline B2, in which destocking is combined with additional early response measures, such as supplementary feeding and veterinary services, which are assumed to improve animal condition and hence conception and production. These improvements have been modelled using improvements in rainfall as a proxy determinant for these herd parameter changes, equivalent to approximately 25% increase in annual rainfall compared to the short term mean rainfall amounts.

The destocking Storyline B1 results in similar levels of destocking on a household basis to levels actually seen in previous events, and hence there is confidence around these figures. Storyline B2 attempts to simulate improved animal condition, using improved rainfall characteristics to model the resulting change in production and consumption, and therefore provides an initial indication of potential benefits only.

Table 4 below summarizes the findings for a high magnitude event, defined using the characteristics of the most recent drought (2011). These data are used throughout the analysis below. In the HEA modelling, early response brings some households out of a deficit, and hence the number of beneficiaries declines in each scenario.

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[12] Note that the modelling accounts for adult and immature animal deaths, but only 50% of adults are destocked. This results in a similar level of destocking on a per capita basis to actual evidence, though it is clear that there is not the current capacity to do destocking at this level across either country.

Table 4: Summary of HEA Analysis for Kenya – Wajir Grasslands, high magnitude drought (USD),

Scenario	Number Beneficiaries (Year One)	Food Deficit MT Total (5 years)	a. Costs of Food and Non-Food Aid	b. Value of Excess Animal Deaths	Total Losses (a+b)
A	367,065	158,452	176,079,785	81,304,247	257,384,032
B1	313,039	144,743	88,122,944	61,880,697	150,003,641
B2	287,802	108,762	66,216,865	18,693,483	84,910,348

It should be noted that the aim of the study is to test a methodology for evaluating the *economics* of building resilience, particularly as compared with humanitarian response. Economic analysis is only one facet of the analysis – social, moral, political and institutional factors all have a bearing on prioritization. As a result, ***this study is not trying to provide a list of interventions that should be prioritized for reducing the impact of crises – rather it is providing insight into the economics of various choices, to contribute to a much wider decision-making framework.*** Along similar lines, this study is not looking to evaluate what types of interventions deliver impact at scale – this is dependent on a whole host of factors that are outside the scope of this analysis. Rather, it is attempting to assess the level of impact that could occur if things are done differently, using specific measures as proxies.

3.2 Late Humanitarian Response

<u>Estimating the cost of food and non-food aid:</u>
The WFP estimates a cost of $889 per Metric Tonne (MT) of food aid in Kenya.[13] When this is multiplied by the household deficit, measured in MT of food required in the HEA model, this equates to a total cost of food aid per high magnitude drought in Wajir Grasslands of $141m.

The Kenya Post Disaster Needs Assessment (PDNA)[14] assessed the Kenya drought from 2008-2011 and found that food aid over the four years accounted for 60-80% of the total cost of response. Therefore food aid estimates are inflated by 25% (to be conservative) to reflect the additional cost of non-food aid that is normally provided

[13] The estimated cost of delivering food aid is based on figures from the WFP EMOPS costs for Kenya and Ethiopia, as presented in the 2011 DFID Nairobi paper "Value-for-Money in Humanitarian Aid for Kenya and Somalia." The cost includes purchase, landside transport, storage and handling, and hence is a good representation of the total cost of delivering food aid.

[14] Republic of Kenya (2012) "Kenya Post Disaster Needs Assessment (PDNA): 2008-2011 Drought". With technical support from the European Union, United Nations and World Bank.

in a humanitarian response (e.g. water, nutrition, health, etc). This cost of food aid can therefore be inflated to incorporate non-food aid requirements to a total of $176m for a total beneficiary population of 367k as determined by the HEA modelling. This figure is the total household deficit, measured in food aid, that results over five years as a result of a drought in year one – the effects do not persist only in year one but continue beyond, with the largest impact in year one but residual impacts in subsequent years due to continuing deficits. In order to simplify the analysis, the impacts are summed together and presented in the model in the first year. These costs are solely in relation to a drought in year one, and do not account for the fact that other events are likely to occur in the four subsequent years that could deepen this condition.

The per capita cost of food aid based on HEA data in year one alone is $186. For comparison, on a per capita basis, it is estimated that food aid costs approximately $54 per person per year in Kenya.[15] Inflated to reflect non-food aid costs, this would equate to at least $68 per person per year. The HEA figure is significantly higher because the HEA models costs for a high magnitude event whereas the WFP figures are averaged over a longer time frame characterized by both good and bad drought years. Wajir is also one of the most vulnerable areas and therefore may be representative of the higher end of costs, and this should be considered when interpreting these results.

It is also worth noting that the HEA modelling estimates the total cost of food aid that would be required to fill the food deficit, whereas the World Food Programme (WFP) figures refer to the cost of actual food aid delivered, and hence the findings could reflect a significant gap between need and actual aid supplied. The aim of this analysis is to represent the full economic cost, to the extent possible, and so the HEA figures are used here.

Estimating losses:

The herd dynamic model developed alongside the HEA model estimates the number of animals (camel, cattle, shoats) that would die under a high magnitude drought. These animals are valued using the livestock prices cited in Table 5.

[15] Figure estimated in Kenya report, based on personal communication with WFP. This is cheaper than some other estimates but excludes supplementary WFP programmes such as school feeding, food for assets and supplementary feeding programmes.

Table 5: Estimated Value of Livestock

	Kenya[16]
Camel	$513
Cattle	$323
Shoat (sheep/goat)	$33

Livestock losses using HEA data are estimated at $81m in Wajir Grasslands for a high magnitude drought. This is equivalent to $221 per person, over five years, or $44 per year. By comparison, the PDNA estimates that livestock damage and losses averaged $435 per person for 2008-2011, or approximately $110 per year per person (this is specific to North Eastern Province). The HEA estimate is likely lower than the PDNA estimate because the PDNA losses are calculated for two high magnitude droughts – one in 2009 and one in 2011 (combined into one for the analysis), whereas the HEA assumes a high magnitude drought only once in year one of the modelling. Further, the HEA model shows lower excess deaths for Wajir on average, partly due to a higher mortality rate (i.e. more deaths) in the reference year, in which the gu rains, which are the main rains for pastoralists in northern Kenya, were only 50% of the short term mean rainfall (STM) for 1996-2007.

<u>Total cost of late humanitarian response</u>

The total cost of late humanitarian response is estimated at $257m in a high magnitude drought for a total population of 367k ($176m food aid plus $81m livestock losses). This is assumed to occur every five years in the model.

3.3 Early Humanitarian Response

Under HEA modelling, early response with commercial destocking of 50% of excess adult mortality reduces total costs and losses by 42%, from $257m to $150m. When the cost of destocking is incorporated, early response could save $107 million in a single drought in Wajir Grasslands alone. This represents both the reduced need for food aid and a lower unit cost of food aid (representing a 50% decrease), as well as a reduction in animal losses (representing a 25% decrease).

The estimated cost of delivering food aid under Ethiopia's Productive Safety Nets Programme (PSNP) is used as a proxy for the cost of food aid provided early (assuming that this could be replicated in Kenya), with a value of $487 per MT of food aid (2010/11).[17] The cost of commercial destocking per household is

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[16] National Livestock Information System, Ministry of Livestock Development, Government of Kenya. Based on national average livestock prices from 2004-2010.

[17] DFID (2012). "Ethiopia's productive Safety Net Programme 2010-2014: A value for money assessment". This estimate also includes internal transport, storage and handling costs.

approximately $4.50 per household, or $275k for the affected population (this assumes that commercial traders are introduced to engage in destocking, rather than NGOs or others buying the animals themselves, meaning that costs are lower).[18]

When destocking is combined with improved animal condition, the decrease is much more significant, with total costs and losses decreasing to $85m. When the costs of introducing these early response measures are incorporated, the total savings are anticipated to be $167m in a single event.

When these figures are considered in a single high magnitude drought, the cost of introducing a destocking programme is $275k. Assuming an early response scenario that also results in lower food aid costs as described previously, the total benefit is $107m for a population of 367k. This benefit is a result of both destocking as well as lower aid costs. When the costs of destocking are offset against these benefits, the benefit to cost ratio is 390 : 1. **In other words, for every $1 spent on commercial destocking and early response, $390 of benefits (avoided aid and animal losses) are gained.**

3.4 Resilience

The analysis done for Kenya attempts to cost in detail a range of resilience building measures necessary for pastoralists. The list includes a variety of livestock and WASH interventions, as well as livelihoods diversification and investment in roads, with a total estimate of $137 per capita per year[19]. This is considered an overestimate, as not every household or community will require the full extent of this package of interventions. It should further be noted that education was considered a very important component, but official costs of education investment were exceptionally high and therefore are not included here due to significant uncertainty around these figures.

Other estimates suggest that the cost of food aid provided early could be even lower; for example, see World Bank (2009), "Project Appraisal Document for a Productive Safety Net APL III Project" which cites a cost of $422 per MT (2009 data). A "Cost Benefit Analysis of Africa Risk Capacity Facility" found that the cost could be even lower, citing an example of food aid in Niger where early food aid was 1/3 the cost of late food aid.

[18] The cost of commercial destocking is estimated at $4.5 per person (including overheads and administrative costs), based on a Save the Children programme in Ethiopia. (Save the Children, 2008. " Cost Benefit Analysis of Drought Response Interventions in Pastoral Areas of Ethiopia, Draft Report). This figure is further confirmed by Catley A and Cullis A (2012) who estimate $4.5 per person as well based on a specific project budget.

[19] The figures that support this estimate can be found in Annex D, Table D1; in some cases an average is taken. They can be broken down as follows (per capita, per year): $24 livestock interventions; $25 WASH interventions; $60 livelihood interventions, $11 road interventions; $17 education support costs.

This figure is applied to the total population under the Wajir HEA modelling to arrive at a total proxy cost for building resilience of $50m per year.

Because the effects of resilience interventions do not impact on the population immediately, but rather take time to reduce vulnerability, the aid and losses from Storyline B2 are assumed to persist – with full costs occurring in year 1 (in addition to resilience costs), 50% in year 5, and 25% thereafter (to reflect the fact that there are likely to always be segments of the population in need of aid). Annex C contains sensitivity analysis to vary this assumption – while there is a high degree of confidence that resilience will significantly reduce aid costs, there is very little evidence to suggest how much or how quickly this will reduce, and hence the estimates provided here are purely based on expert opinion.

3.5 Kenya - Cost Comparison of Response

The following table compares the cost of response for each of the storylines, using the HEA data modelled for Wajir grasslands, over the modelled beneficiary population of 367k. Clearly, this analysis could produce different results in other regions, but this gives an indication of the different types of costs incurred.

Table 2: Cost Comparison of Response for Storylines (USD million) – Wajir Grasslands

	Storyline A	**Storyline B1**	**Storyline B2**	**Storyline C**	**Storyline C – with benefits**
Interventions	**Late Hum. Response**	**Destocking**	**Destocking + Improved animal condition**	**Resilience**	**Resilience with benefits**
Aid costs -assumed every fifth year.	$176m	$88m	$66m	Residual risk: Full costs under B2 in year 0, decreased by 50% year 5, 25% carries on every event thereafter	Residual risk: Full costs under B2 in year 0, decreased by 50% year 5, 25% carries on every event thereafter
Losses (animal deaths) – assumed every fifth year.	$81m	$62m	$19m	Residual risk: Full costs under B2 in year 0, decreased by 50% year 5, 25% carries on every event thereafter	Residual risk: Full costs under B2 in year 0, decreased by 50% year 5, 25% carries on every event thereafter
Cost of programme – assumed every fifth year.		$0.28m	$5.8m	$50m annually ($137 per capita for beneficiary population)	$50m annually ($137 per capita for beneficiary population)
Additional Benefits		In addition to a reduction in aid costs and losses, the additional income from destocking can be used for other household needs		**EXTENSIVE:** Additional benefits from MDGs are extensive – increased income through education and ability to access services, reduced morbidity and mortality from health and food security interventions, etc.	Valued at a return of $1.1 for every $1 spent
Total Net Cost over 20 years, discounted at 10%	**$606m**	**$354m**	**$214m**	**$464m**	**($54m)**
Total Net Cost over 10 years, discounted at 10%	**$425m**	**$248m**	**$150m**	**$451m**	**$77m**

The modelling suggests that early response through commercial destocking in Wajir alone would save over $250m in humanitarian aid and animal deaths discounted over a 20-year period (this is for a population of approximately 367k)**.** Under a scenario where interventions are applied to improve animal condition, such as vet services, or supplementary feeding, **the difference could be as much as $392m.** When this is extrapolated to other regions, the total figures would be much higher.

The cost of building resilience is somewhat less than the cost of late humanitarian response over 20 years ($464m and $606m respectively). However, this analysis takes no account of the significant benefits that would arise from resilience interventions – the costs and benefits will depend very much on the different types of interventions that are used.

Sector specific cost benefit analysis of resilience interventions is used below to show how the benefits, when quantified and incorporated into the analysis, significantly offset the costs of resilience. The findings for three sectors – livestock, water and education – offer evidence that the benefits are consistently higher than the costs, ranging from just below breaking even, to $27 of benefit for every $1 spent. The benefits quantified are very tangible – savings that contribute to a household's economy. **If we assume that we only generate $1.1 of benefit, for every $1 spent on resilience measures, a very conservative assumption, the net cost over 20 years is converted to a benefit of $54m,** as compared with aid and losses of $606m in late humanitarian response. The sensitivity analysis contained in Annex A varies this to $2 of benefit for every $1 spent. The model is very sensitive to this change, with net benefits increasing further to $477m.

These factors are combined to model the "value for money" of investing in resilience. The costs of building resilience are offset against the benefits – the reduced aid cost and avoided losses of animals under Storyline B2[20]. A very conservative assumption around the additional benefits that would accrue from investments in resilience that deliver significant health, education and other gains are further incorporated. **When the costs of building resilience are offset against the benefits, the benefit to cost ratio is 2.9 : 1. In other words, for every $1 spent on resilience, $2.9 of benefit (avoided aid and animal losses, development benefits) are gained.** When this is modelled over a 10-year time frame – in other words, within the context of two high magnitude droughts, every $1 spent on resilience generates $2.0 in avoided losses.

[20] It is likely that these avoided losses would be greater if communities are more resilient, but they represent a good proxy value.

3.6 Kenya - Sector-based Cost Benefit Analysis

In order to investigate costs and benefits a bit further, this section presents both the costs and benefits for various interventions that could contribute to building resilience. Three sectors are considered – livestock, water and education.

It should be noted that this does not imply that these interventions will always contribute to building resilience – it is essential that they are implemented in a participatory way, with dedicated resources for maintenance over the longer term to ensure that these measures are implemented well. There are many examples of these types of interventions that do not deliver any benefits because of the way in which they are implemented. Nor does the analysis suggest that there is the capacity, or institutional and governance structures required, to take these to scale currently. Rather, the intention is to show where there is an economic argument to invest further in appropriately designed resilience interventions.

Livestock Interventions

Over the longer term, resilience can be built by ensuring that pastoralists have access to functioning livestock markets, veterinary care, and adequate feed and water. The Kenya report that supports this study estimates the cost per person of a more complete set of long term livestock interventions, including livestock market support, comprehensive vet care via private franchise, livestock insurance and peace building support, at a total cost of approximately $24 per person per year (this is assumed to continue for 10 years, and then decrease by half to $12 per person per year after year 10, as private networks take hold).

The benefits of such a package of measures, under the assumption that they are implemented well and ensuring that the livestock trade is working efficiently, would include avoided costs of aid, and animal losses (these are assumed at 67% in the model, based on HEA model estimates that livestock measures would result in this level of benefit). There would also be numerous unquantifiable benefits, for instance increased sense of security and confidence on the part of pastoralists, as a result of greater control over how they manage their herd.

If not implemented well, some of these measures can result in greater conflict, for example if markets are inappropriately cited, they can result in new tribal interactions. Equally, there are numerous example of livestock market infrastructure being installed without the appropriate management systems or commercial buyers in place and hence a waste of money.

Table 3: Benefits and Costs of Livestock Resilience Measures - Kenya

	Package of Livestock Resilience Measures
Assumed population (HEA beneficiaries)	367k
Cost for total population	\$8.8m each year (reducing to \$4.4m in year 10)
Benefits	67% of aid and excess mortality in a high magnitude drought is avoided per Storyline B2
Benefit to Cost Ratio (BCR) (20 years, 10% discount)	**5.5 : 1**

A full package of livestock interventions that build resilience would result in \$5.5 of benefit for every \$1 spent. This analysis only considers benefits that accrue in a high magnitude event, whereas clearly access to functioning livestock markets and effective animal health can reap significant benefits in non-drought times as well.

Water Interventions

A key requirement for communities in the face of drought is access to water. Humanitarian response largely involves the use of trucks to deliver water to communities, a very expensive (but necessary) measure.

Community based water schemes can be considered as both an early response and/or resilience building measure. As with all of these measures, how and where they are implemented has a massive effect on whether they deliver benefits, and there is a great deal of discussion around permanent water posts both building and eroding resilience.

However, assuming that these schemes are implemented appropriately, there is the potential for significant gains. Three types of intervention are compared – shallow wells (20m depth) with a handpump, drilled boreholes (100-160m) serving 1000 people, schools and clinics, and drilled boreholes serving 5000 people, school and clinics. The model assumes a 10% recurring cost to cover operations and maintenance (O&M) and community capacity building. A further 50% of capital cost is allocated in year 10 to account for overhaul/upgrade.

The additional benefits of access to clean water are numerous, and include decreased incidence of water borne illness, reduced time collecting water, and increased attendance at school. The analysis values reduced time collecting water, using Kenya specific data and international standards for water access to be within half an hour walking distance. The time spent collecting water is high in drought periods, when pastoralists often have to travel for a full day to get water on a regular basis, decreasing in normal times.

Further to this, the World Health Organization (WHO) published a global study on the costs and benefits of access to water and sanitation.[21] The study estimates the benefits for access to clean water for East Africa, and includes a range of benefits, including time savings, increased productive days, avoided health costs, and avoided morbidity and mortality. The benefits for time savings are excluded, given that these are calculated separately for the study presented here, and the remainder used as a proxy for the additional benefits.

Benefits will also include the reduced cost of food and non-food aid, as well as the reduced loss of animals. It is not known how much clean water can contribute to this reduction. Therefore, as a very conservative proxy, the avoided cost of emergency water provision (such as water tankering) as one part of the aid package is included in the model, estimated at $2 per person[22]. (See Annex C for greater detail on cost calculations.)

Table 4: Benefits and Costs of Water Interventions

	Shallow well	Drilled Well, 5000 people	Drilled Well, 1000 people
Assumed population (HEA beneficiaries)	367k	367k	367k
Cost for total population, installation and O&M (discounted over 20 years)	$3.2m	$14.6m	$73m
Benefits, including avoided cost of water aid, time savings and other benefits (discounted over 20 years)	$83m	$83m	$83m
BCR	**26 : 1**	**6 : 1**	**1.1 : 1**

All three water interventions yield positive benefit to cost ratios, suggesting that they are value for money. **The shallow well yields an estimated $26 of benefit for every $1 dollar spent.** Even the drilled well serving only 1,000 people has a marginally higher benefit than cost. The results help to demonstrate the importance of design parameters in estimating value for money – for example, the more people

[21] Hutton, G. and L. Haller (2004). "Evaluation of the Costs and Benefits of Water and Sanitation Improvements at the Global Level." World Health Organization, Geneva
[22] ILRI (2010), "An Assessment of the Response to the 2008-2009 Drought in Kenya: A report to the European Union Delegation to the Republic of Kenya." ILRI, Nairobi. This study found that water tankering averaged $2 per person, though it should be noted that the variation in cost is significant depending on distance and amount of water supplied. As cited in the Kenya report, the recent WESCOORD annual report listed all emergency WASH expenditure provided by GoK and other agencies during the 2011 drought, at a crude annual average cost of US$1.87 per head.

that can benefit, the greater the benefit to cost ratio. It also highlights the important of design being fit for purpose – while the shallow wells have the highest ratio, the findings do not suggest that shallow wells should be prioritized. Shallow wells can run dry in a drought, and are only appropriate in areas with a higher water table. If they are used across the board, the ratio can be reversed if they are not delivering water in a drought. By contrast, the drilled wells, while more expensive, reach to a much greater depth and therefore are more likely to be able to ensure water supply in a drought.

Education

This scenario uses Baringo in Kenya as an example of how education can transform resilience by providing an internal safety net, as educated family members with paid employment send home remittances in times of drought. Evidence from Baringo on increases in incomes and decreases in reliance on food aid are used to construct this scenario.

Box 1 contains more details on Baringo and the way that education is becoming a pastoral risk management strategy. (See Annex A for greater detail).

Table 5: Costs and Benefits of Education

	Assumptions	**Total**
Assumed population (HEA beneficiaries)		367k
Cost for total population (discounted over 35 years)	Cost of constructing 412 schools @ $400k each; and $17 per person per year for running costs.	$225m
Benefits (discounted over 35 years, begin to accrue in year 15)	Revenues increase by $360 per household; 43% reduction in reliance on food aid (per Baringo case study)	$90m
BCR		**0.4 : 1**

This scenario is modelled over 35 years, simply because benefits such as increased revenues and decreased reliance on food aid cannot begin to be realized until a child has completed their schooling. The comparison of benefits to costs of investing in education yield a return of $0.4 to $1, suggesting that costs outweigh the benefits. However, there are clearly many benefits in year 1 to 15 of investing in education that were not accounted for in the model.

Box 1: Education in Baringo, Kenya

Research on the education levels of pastoral households in Baringo in 1980 and 1999[23] found that increased household education was becoming a critical component of pastoral risk management strategies during drought. The research was based on interviews with pastoral households in three communities Baringo in 1980 and again in 1999. At both times the communities were experiencing severe drought but in the intervening period there had been extensive investment in formal education[24] services in the area. Consequently the average number of household members who had completed primary education had risen from 3% to 18% and secondary from 0.3% to 7%. Over the same period the number of households who reported having an "income remitter with a salaried waged position" rose from approximately 9% to 26%. Total annual cash income increased from Ksh 27k to Ksh 56k in households with secondary education, and those reliant on food aid dropped from 66% to 23%. The contribution of livestock as a source of income reduced overall from 76% to 42%. The research also found that financial and food security benefits were greatest for those household where someone had completed secondary education.

[23] Little, P., A. Aboud and C. Lenachuru (2009). "Can Formal Education Reduce Risks for Drought-Prone Pastoralist?: A Case Study from Baringo District, Kenya". Human Organisation

[24] Baringo received disproportionately high investment during this time given it is the home district of the then President Daniel Arap Moi

4 Top-Down Assessment

The top down assessment uses national level estimates on humanitarian costs, and efforts to build resilience, to make an assessment from an aggregate level.

4.1 Late Humanitarian Response

As described in the methodology, the cost of humanitarian response was estimated using three components:

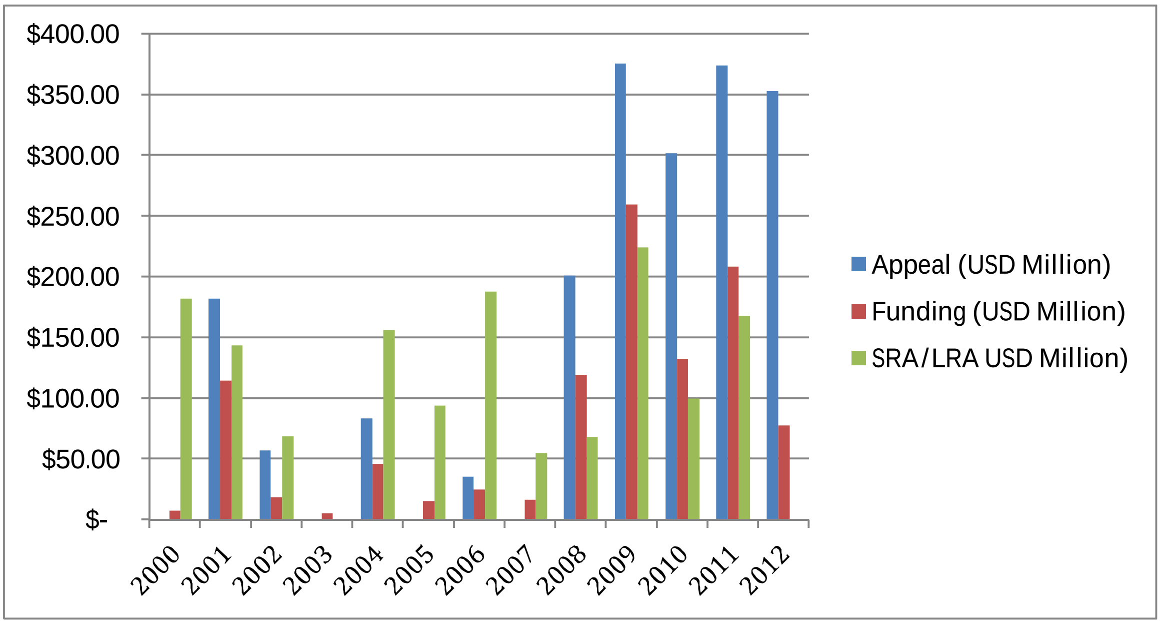
- The cost of food aid;
- The cost of non-food aid; and
- Estimated losses.

Estimating the cost of food and non-food aid:
While data is collected on humanitarian appeals and levels of funding, these figures do not necessarily reflect *needs* and hence the magnitude of the crisis. Humanitarian appeal and funding amounts, by year, were compared with the figures from the short and long rain assessment (SRA/LRA) data. These assessments are conducted twice yearly, and report the number of people in need of food aid for the whole of the country for 6 months. Figure 2 below maps appeal, funding, and SRA/LRA figures (the average of the two represents the needs for a year). Given that the SRA/LRA figures represent actual estimates of people in need, these figures are used in the model.

- *Cost of aid – estimate based on SRA/LRA:*
  The WFP estimates that the average yearly expenditure per capita on food aid in Kenya is $56[25], and this can be inflated to incorporate non-food aid to $70. The total number of people in need for the whole of Kenya is multiplied by the WFP average cost, and marked up to incorporate non-food aid costs. **On this basis, average requirements for food and non-food aid based on the SRA/LRA between 2000 and 2010 are a minimum of $131m per year**, with the highest recorded need in 2009 at $224m.

[25] The estimated cost of delivering food aid is based on figures from the WFP EMOPS costs for Kenya and Ethiopia, as presented in the 2011 DFID Nairobi paper "Value-for-Money in Humanitarian Aid for Kenya and Somalia." This is equivalent to the full cost of delivering food aid, including transportation and distribution costs.

Figure 2: Humanitarian Appeals, Funding, and Estimated Need based on the SRA/LRAs[26]



- *Cost of aid – appeal estimates:* The Kenya PDNA has done a significant amount of analysis around the 2009-2011 drought event. By comparison with the above figures, it estimates aid through the Consolidated Appeals Process (CAP) for four years (2008-1022) of $960m. When these funds are combined with Government of Kenya (GoK) humanitarian spend, and averaged over the four years of analysis, the estimate is $425m per year, significantly higher than the average estimated funds required based on the SRA/LRA. These figures are summarized in Table 6 below.

Table 6: Humanitarian aid appeal amounts and GoK spend, 2008-2011

Data	Amount (US$, millions)
Humanitarian Aid – allocated amount, 2008-2011 (PDNA)	$960
GoK humanitarian aid 2008-2011[27]	$739
Total	$1,699
Yearly average over 4 years	$425

Estimating Losses

The PDNA further estimates the total damages (destruction of physical assets, e.g. livestock and crops), losses (in flows to the economy)[28], and needs (the financial

[26] Note that data for 2003, 2012 are missing for the SRA/LRA.

[27] The GoK spent an average of $173m per year on humanitarian aid between 1999 and 2010. In the 2011 drought they spent $219m.

requirements to achieve economic recovery and reconstruction after the drought) as a result of the 2009/2011 drought. These estimates are in addition to the cost of humanitarian aid. The PDNA estimates these figures across all sectors, including livestock, which represents the vast proportion of losses in the drought. Table 7 below summarizes the findings. The cost modelling presented in this report uses the total figures for damages and losses, to be consistent with the aid figures, which are for drought as a whole (not specific to pastoralists – this is the focus of the bottom-up analysis). Needs are not included in the analysis to eliminate the possibility of double counting. The model assumes these losses every five years (in a high magnitude event).

Table 7: Damages, Losses, and Needs (2008-2011)

Data	Total Amount (USD, millions)	Livestock Sector (USD, millions)	Livestock as a % of Total
Damages and losses	$12,100	$8,426	70%
Needs: estimated recovery and reconstruction (R&R) costs	$1,770	$1,282	72%

Source: PDNA, 2012

Total cost of late humanitarian response

Table 8 summarizes the costs and losses described above that are inputted to the model. The combined impact of the average cost of humanitarian aid year on year, with damages and losses in a major event (inflated by 5% every five years to reflect increasing caseloads due to erosion of assets), results in a total economic cost of humanitarian response of **$29.8 billion** discounted over 20 years.

Table 8: Summary Table of Cost of Humanitarian Aid and Losses

	Amount (USD, millions)
Humanitarian Aid – yearly average	$131m
Damages and Losses – every fifth year	$12,100m

This is an underestimate for the following reasons:

- It is believed that these types of events are increasing, and may be occurring as often as every 3 years.
- The figures recorded for total CAP and GoK spend between 2008 and 2011 are four times higher than the figures used for this estimate.
- The Economics of Climate Change Study in Kenya estimates that, due to population growth and GDP changes, these economic impacts of drought

[28] This is specifically defined as “changes in the normal flows of the economy that may arise in all sectors of economic and social activity due to the external shocks brought about by the disaster.”

could increase by as much as five times by 2030 (in other words, they estimate losses based on damages alone at $5-10 billion per event by 2030).[29]

- While loss of livestock and livestock products are included for high magnitude events every five years, clearly these losses also occur in medium and smaller magnitude droughts, but the data was not available to quantify this.

4.2 Early Humanitarian Response

The scenario of early response assumes that if aid is delivered on time, as a crisis is becoming evident, that deficit levels are lower and therefore the magnitude of response required is less, and the unit cost of delivering aid is decreased. It also assumes that early response measures such as commercial destocking, early supplementary feeding, and veterinary services can reduce mortality of animals, and increase conception and milk production.

The HEA analysis for Wajir Grasslands estimates that early response through commercial destocking alone can reduce the cost of food aid by 50% and the value of animal losses by 24%. (These figures are conservative, and are higher if other interventions that improve the condition of the animals are included – see the bottom up analysis for greater detail). It is also estimated that it costs approximately $0.75 per person for commercial destocking (see bottom up analysis for greater detail). If we apply these figures to the 3.8 million people affected in the 2011 event, and adjust overall aid and losses for the country as a whole according to the HEA analysis, **the total cost discounted over 20 years is $22.3 billion.**

Similarly, when we apply the reductions in aid and losses that can occur under Storyline B2 in the HEA modelling (food aid by 62% and animal losses by 77%), and incorporate the cost of a package of destocking and measures to improve animal condition, **the total cost discounted over 20 years is $7.2 billion.**

4.3 Resilience

A variety of national level plans that aim to build resilience to drought are present in Kenya, in addition to several documents that try to estimate the cost of measures that build resilience.

[29] Stockholm Environment Institute (2009). "Economics of Climate Change: Kenya".

Table 9 summarizes these cost estimates.

Table 9: Estimates for Development/Disaster Risk Reduction (USD)

Plan/Policy	Estimated Cost
Draft Eliminating drought – over 10 years	2.4 billion
MTIP for Northern Kenya and Arid Lands (cost for 5 years, 2012-2016)	5.1 billion for 5 years
Economics of Climate Change	500 million per year
PDNA estimate for DRR (2012-2016)	2.1 billion

- ***Draft* Eliminating Drought Emergencies in Kenya** – This Country Programme Paper and Action Plan builds on the PDNA and the Kenyan Government's commitment to the IGAD-led Horn of Africa Drought Management Programme. Its production has been co-ordinated by the Agricultural Sector Co-ordination Unit (ASCU) and provides a 10-year estimate of investment required to end drought emergencies in Kenya. It contains measures and cost estimates for activities under seven themes: peace and security, humanitarian relief (linking relief to development, one year only), infrastructure, building human capital, sustainable livelihoods, coordination and institutional framework, and national drought contingency. It should be noted that this document is still in draft form to be approved by government.
- **Medium Term Investment Plan (MTIP) for Ministry of Northern Kenya and Other Arid Lands (MNKOAL).** Published in February 2012, the MTIP for the Ministry of Northern Kenya is a five-year plan that details the costs of implementing the Vision 2030 Development Strategy for Northern Kenya and other Arid Lands. It excludes costs already included in the other sector MTIPs but includes additional activities not highlighted by the Vision 2030 document.
- **The Economics of Climate Change study in Kenya** 2009 estimates the cost of adaptation per year. This estimate includes adaptation to all disaster events (includes flood, etc), and is therefore an overestimate compared with the figures that are specific to drought. The study costs four categories of adaptation – two are development activities that are targeted towards the large economic costs of current climate variability (accelerating development to cope with existing impacts and increasing social protection), and the second two are associated with tackling future climate risk (building adaptive capacity and institutional strengthening, and enhancing climate resilience, e.g. infrastructure design, flood protection measures). The immediate needs (for 2012) for building adaptive capacity and starting to enhance resilience (immediate priorities) are estimated at $100 – 150 million/year. However, a much higher value of $500 million/year or more is warranted if the categories of social protection and accelerated development (to address the current adaptation needs) are included. This is the figure used here.[30]

[30] Ibid.

- The PDNA makes an estimate for costs of disaster risk reduction. However, the methodology used to derive these estimates is not clear from the report, and the figure is quite low relative to other figures.

The modelling assumes a cost of resilience at $500 million per year, which is an approximate mid-point for the various studies above. It further assumes that residual risk will occur, e.g. ongoing aid and losses that would occur under Storyline B2. These are assumed to be 100% of aid and losses under early response in year 1, 50% in year 5 and 25% every fifth year thereafter (i.e. in each drought event). Modelled over 20 years, **the total discounted cost is $9.2 billion.** Clearly, this estimate does not account for the myriad of benefits that would occur from building resilience - benefits such as health and education occur year round and can be substantial (these are brought in with greater detail in the bottom-up analysis below).

4.4 Kenya - Comparison of National Level Costs

Table 10: Summary of National Level Cost Estimates over 20 years (discounted) - Kenya

	Humanitarian	Early Response (B1)	Early Response (B2)	Resilience	Resilience with benefits
USD million	$29,771m	$22,330m	$7,168m	$9,168m	$4,018m

These findings suggest that late humanitarian response costs nearly $21 billion more than resilience building activities over 20 years. Using a very conservative estimate, assuming a return of $1.1 for every dollar spent on resilience, which is assumed to persist for the full 20 years of the model, **the resilience scenario reduces costs even further, adding an additional $5b in savings.**

These factors are combined to model the "value for money" of investing in resilience. The costs of building resilience are offset against the benefits – the reduced aid cost, as well as a very conservative assumption around the additional benefits that would accrue from investments in resilience that deliver significant health, education and other gains. **When the costs of building resilience are offset against the benefits, the benefit to cost ratio is 6.5 : 1. In other words, for every $1 spent on resilience, $6.5 of benefits are gained.**

When this analysis is conducted on a 10-year timeframe, the results are similar, and still make a very strong case for greater investment in early response and resilience.

Table 11: Summary of National Level Cost Estimates over 10 years (discounted) - Kenya

	Humanitarian	Early Response (B1)	Early Response (B2)	Resilience	Resilience with benefits
USD million	$20,891m	$15,670m	$5,033m	$7,134m	$3,623m

This is clearly a rough estimate – the costs associated with each area of response could vary significantly, particularly in relation to building resilience, where the evidence base is thin. Further, these subdivisions of costs are somewhat artificial – humanitarian response can be designed to build resilience and therefore ideally each type of response needs to be part of a greater cycle of disaster management.

The individual cost estimates are considered to be conservative – the cost of late humanitarian response is estimated using lower bound figures and is likely to be higher. The cost of resilience will be offset by avoided losses, as resilience measures often result in much wider gains, such as reductions in disease, improvements in education and income, etc, that are not accounted for here.

5 Conclusions and Recommendations

5.1 Conclusions

The evidence above clearly points to three conclusions:

Early response is far more cost effective than late humanitarian response. The assumptions used in this analysis were conservative, and the findings nonetheless indicate that early response can decrease costs and losses substantially, with very high benefit to cost ratios indicating tremendous potential to improve value for money. Modelling of household level data for Wajir grasslands in Kenya suggests that early response could save between $107m and $167m for a population of 367k in a single event alone. A perceived risk in responding early is that humanitarian funds will be released incorrectly to situations that turn out not to be a disaster. However, these figures suggest that donors could mistakenly release funds two times in Kenya before the cost is even equivalent to the cost of humanitarian aid in one event.

There is a great deal of uncertainty around the cost of building resilience. Nonetheless, the estimates presented here suggest that, while the cost of resilience is comparatively high, the wider benefits of building resilience can significantly outweigh the costs, leading to the conclusion that investment in resilience is the best value for money. The model accounts for the time lag in resilience benefits reducing humanitarian cost, and therefore is a reasonable estimate of how the shift in balance from humanitarian aid to resilience might look over time. The cost of resilience would have to approach $200 per capita per year for 10 years (almost 50% higher than the figure assumed in this paper) before the modelled costs of resilience begin to approach the cost of humanitarian response.

Early response and resilience building measures should be the overwhelming priority response. These two categories of response are not mutually exclusive – indeed commercial destocking, if taken to its fullest extent, would represent a functioning livestock marketing system, which would be considered a resilience building measure. The findings in this study fully support an economic imperative for a shift to greater early response and resilience building.

There are also a number of important conclusions that can be drawn from the HEA modelling:

Drought recovery takes longer (or may be impossible) when a community is not resilient. The HEA modelling shows that the impact of a drought is not only felt in the drought year but for several years after. In fact, deficits persist beyond the drought year throughout the entire 5-year scenario period at levels higher than reference year levels, for both Storylines A and B1. Herd recovery also takes time – at least 5 to 6 subsequent consecutive years of average rainfall levels – an infrequent occurrence in Kenya.

Destocking interventions alone are often not sufficient to meet deficit levels faced by in-need households. One of the main reasons for this is that destocking primarily benefits middle and better off households, who have more animals that could be destocked and sold that would otherwise die. Poor households have very few animals to begin with, and can usually only destock one or two animals at most – which is usually not sufficient to meet the significant deficits faced mostly by those very households.

Other intervention types, such as supplementary feeding interventions, are required to have an impact on animal mortality, conceptions, abortions, births, and milk production rates. It is only these interventions that affect herd dynamics that will limit herd mortality rates and buoy birth rates, which will in turn speed recovery periods so that deficits in subsequent years are lower and resilience is higher.

These conclusions are mainly intuitive – most people can reason that resilience and early response are likely to be more cost effective strategies than repeated humanitarian aid and erosion of assets. So then why does response come late? A variety of issues were mentioned in the literature and consultations:

- Institutional inertia and rigidity – systems are set up for humanitarian response.
- Procurement procedures in agencies are not responsive and flexible enough.
- Poor coordination amongst NGOs – many are trying to do the same thing and lack of coordination results in late response.
- Lack of evidence of disaster – donors don't want to fund early and end up funding a non-disaster.
- Political will – it is more visible to fund a disaster, where results can be clearly demonstrated, as compared with funding resilience, where the result is that the disaster did not happen.

The following table shows just how little is spent on disaster preparedness (DPP).

Table 16: Donor Spend on DPP and DRR (USD)

	Average annual donor spend on DPP	Average donor spend on DPP as a percentage of humanitarian aid	Average annual donor DPP spend per beneficiary of the current drought	Donor spend on DRR as a percentage of total ODA
Kenya	2.22m	0.91%	59 cents	1.4%

Source: Oxfam (2011), "Briefing on the Horn of Africa Drought 2011". Donor spend figures adapted from Global Humanitarian Assistance Report 2011.

5.2 Recommendations

"The separation of relief and development is both artificial and unhelpful. Not only are the recipients the same, but also the underlying causes that create the need are the same—the vulnerability of dryland communities. But what often takes place, are emergency interventions that undermine development (for example some food aid and water trucking interventions), and long term programming and investments that do not pay sufficient attention to the inevitability of drought."[31]

Funding models must be changed to integrate relief and development in a coherent cycle.

The findings of this analysis fully support the HERR recommendation to change funding models by increasing predictable multi-year funding. Humanitarian funding is often restricted to a very short time frame, and has a clearly delineated humanitarian mandate. Development financing is longer term but does not have the flexibility to be re-allocated in times of crisis. Too often, NGOs lament that they could do much more with $1m over three years for a consistent and reliable water and sanitation programme, as compared with $25m that has to be spent in six months for humanitarian aid (for example). USAID has pioneered a crisis modifier in Ethiopia, in which development funding can be shifted into a humanitarian mode when needed – this was seen as a very successful innovation. These types of mechanisms need to be more widespread. Along similar lines, funding should be allocated under an umbrella mechanism that covers all four stages of drought cycle management – mitigation, preparedness, relief and reconstruction.

In the short term, a more cost effective approach would be to prioritize early response measures. Even if there is hesitation over whether a high magnitude drought will occur, the cost difference is such that it will still be much more cost effective to invest in measures such as commercial destocking, and measures to

[31] REGLAP MAGAZINE, Disaster Risk Reduction in the Drylands of the Horn of Africa: Good practice examples from the ECHO DCM partners and Beyond, Edition Two, December 2011

improve animal condition. Further, these services as an early response measure also help to build resilience in the longer term. Ways to take these types of interventions to scale should be investigated.

Spending on resilience needs to increase significantly, both in the short and the long term. Current efforts to build resilience for pastoralists have remained largely at a pilot/demonstration level. Donors and governments need to shift far greater portions of funding into resilience, and in the short term this will also require continued funding to humanitarian aid as asset depletion is reversed. The gap in general development spending by governments and donors between the most drought affected areas and other higher potential parts of the countries requires further examination. Findings can be used to advocate for higher long term revenue and capital allocations to these areas.

Adequate resources and capacity must be committed to building resilience. Short-term interventions, with no provision for long-term operations and maintenance, are unsustainable. Value for money can be justified for many resilience interventions, but these can quickly become a waste of money if they are not part of a longer-term plan of support and founded on participatory approaches.

5.3 Areas for further work

- Investigate innovative funding mechanisms that integrate development and relief, such as the crisis modifier introduced by USAID in Ethiopia.

- It would be useful to replicate and build on this work in another region experiencing drought, to test the methodology, particularly given that HEA data is not available in many areas and therefore a different approach may be required.

- Undertake a similar analysis within the context of a complex emergency (e.g. natural hazard and conflict), as well as rapid onset disaster. These are likely to bring up a very different set of issues to slow onset drought.

- Develop a more systematic approach to determining the relative costs and benefits of resilience measures, using both qualitative and quantitative data, so that measures can be prioritized.

- Conduct further research into the potential reductions in aid that can occur as a result of building resilience. This analysis assumed a stage reduction, with full aid and losses occurring in year 0, 50% in year 5, and 25% thereafter, but this was purely based on expert opinion and the evidence base on this is very thin.

- Expand the HEA and herd dynamic modelling to look at impacts by wealth group. This could be very informative, both in terms of targeting of the PSNP/HSNP, as well as showing the differential impacts by group.

ANNEX A: Detailed Calculations

This annex provides greater detail on the calculations included in the main report, both for the main model, as well as sensitivity analyses as follows:

- The discount rate is reduced from 10% to 5%;
- The percentage of need averted by resilience measures is reduced to 75% in the first year/drought, 25% in year 5, and 10% each year thereafter (from 100%/50%/25%/25%); and
- The potential benefits that can arise as a result of investing in resilience, outside of reduced aid and losses, is increased from a ratio of 1.1:1 to 2:1.

The first set of tables contain summary outcomes of the main model, and each of the sensitivity analyses. This is followed by snapshots of the modeling results for the main model.

Table A1: Kenya, Bottom-Up Assessment, 20 years

Analysis	Late Humanitarian Response	Early Response – B1	Early Response - B2	Resilience	Resilience – with additional benefits
Main findings	$606m	$354m	$214m	$464m	($54m)
Discount rate – 5%	$787m	$459m	$277m	$549m	($175m)
Percentage of need averted – 75%/25%/10%/10%	$606m	$354m	$214m	$422m	($96m)
Potential additional benefits - 2:1	$606m	$354m	$214m	$464m	($477m)

Table A2: Kenya, Top-Down Assessment, 20 years

Analysis	Late Humanitarian Response	Early Response – B1	Early Response – B2	Resilience
Main findings	$29,771m	$22,330m	$7,168m	$9,168m
Discount rate – 5%	$38,802m	$29,066m	$9,361m	$11,712m
Percentage of need averted – 75%/25%/10%/10%	$29,771m	$22,330m	$7,168m	$7,620m

Kenya – Bottom Up Assessment

Table A3: Cost Comparison of Response, 20 years, 10% discount, USD

USD						
YEAR	Humanitarian Cost		Early Response B1 COSTS		Early Response B2 COSTS	
	aid + losses	PRESENT VALUE	aid+losses + cost of destock	PRESENT VALUE	aid+losses + cost of destock/vet/supp	PRESENT VALUE
0	257,384,032	257,384,032	150,278,940	150,278,940	90,720,492	90,720,492
1						
2						
3						
4						
5	270,253,234	167,805,995	157,792,887	97,976,968	95,256,517	59,146,803
6						
7						
8						
9						
10	283,765,895	109,404,037	165,682,531	63,877,788	100,019,343	38,561,786
11						
12						
13						
14						
15	297,954,190	71,327,864	173,966,658	41,646,235	105,020,310	25,141,027
16						
17						
18						
19						
Total	1,109,357,351	605,921,928	647,721,016	353,779,931	391,016,663	213,570,109

Resilience				Resilience with Benefits				
$137 per person for 10 years	Ongoing aid + losses (B2)	Total Cost	PRESENT VALUE	$137 per person for 10 years	Ongoing aid + losses (B2)	Potential benefits	Total Cost	PRESENT VALUE
50,287,905	84,910,348	135,198,253	135,198,253	50,287,905	84,910,348	(55,316,696)	79,881,557	79,881,557
50,287,905		50,287,905	45,716,277	50,287,905		(55,316,696)	(5,028,791)	(4,571,628)
50,287,905		50,287,905	41,560,252	50,287,905		(55,316,696)	(5,028,791)	(4,156,025)
50,287,905		50,287,905	37,782,047	50,287,905		(55,316,696)	(5,028,791)	(3,778,205)
50,287,905		50,287,905	34,347,316	50,287,905		(55,316,696)	(5,028,791)	(3,434,732)
50,287,905	42,455,174	92,743,079	57,586,155	50,287,905	42,455,174	(55,316,696)	37,426,383	23,238,839
50,287,905		50,287,905	28,386,211	50,287,905		(55,316,696)	(5,028,791)	(2,838,621)
50,287,905		50,287,905	25,805,647	50,287,905		(55,316,696)	(5,028,791)	(2,580,565)
50,287,905		50,287,905	23,459,679	50,287,905		(55,316,696)	(5,028,791)	(2,345,968)
50,287,905		50,287,905	21,326,981	50,287,905		(55,316,696)	(5,028,791)	(2,132,698)
	21,227,587	21,227,587	8,184,154		21,227,587	(55,316,696)	(34,089,109)	(13,142,827)
						(55,316,696)	(55,316,696)	(19,388,164)
						(55,316,696)	(55,316,696)	(17,625,604)
						(55,316,696)	(55,316,696)	(16,023,276)
						(55,316,696)	(55,316,696)	(14,566,615)
	21,227,587	21,227,587	5,081,716		21,227,587	(55,316,696)	(34,089,109)	(8,160,662)
						(55,316,696)	(55,316,696)	(12,038,525)
						(55,316,696)	(55,316,696)	(10,944,113)
						(55,316,696)	(55,316,696)	(9,949,194)
						(55,316,696)	(55,316,696)	(9,044,722)
502,879,050	169,820,695	672,699,745	464,434,687	502,879,050	169,820,695		(433,634,165)	(53,601,746)

Table A4: Cost Comparison of Response, 10 years, 10% discount, USD

YEAR	Humanitarian Cost		Early Response B1 COSTS		Early Response B2 COSTS	
	aid + losses	PRESENT VALUE	aid+losses + cost of destock	PRESENT VALUE	aid+losses + cost of destock/vet	PRESENT VALUE
0	257,384,032	257,384,032	150,278,940	150,278,940	90,720,492	90,720,492
1						
2						
3						
4						
5	270,253,234	167,805,995	157,792,887	97,976,968	95,256,517	59,146,803
6						
7						
8						
9						
Total	527,637,266	425,190,027	308,071,827	248,255,908	185,977,010	149,867,295

Resilience				Resilence with Benefits				
$137 per person for 10 years	Ongoing aid + losses (B2)	Total Cost	PRESENT VALUE	$137 per person for 10 years	Ongoing aid + losses (B2)	Potential benefits	Total Cost	PRESENT VALUE
50,287,905	84,910,348	135,198,253	135,198,253	50,287,905	84,910,348	(55,316,696)	79,881,557	79,881,557
50,287,905		50,287,905	45,716,277	50,287,905		(55,316,696)	(5,028,791)	(4,571,628)
50,287,905		50,287,905	41,560,252	50,287,905		(55,316,696)	(5,028,791)	(4,156,025)
50,287,905		50,287,905	37,782,047	50,287,905		(55,316,696)	(5,028,791)	(3,778,205)
50,287,905		50,287,905	34,347,316	50,287,905		(55,316,696)	(5,028,791)	(3,434,732)
50,287,905	42,455,174	92,743,079	57,586,155	50,287,905	42,455,174	(55,316,696)	37,426,383	23,238,839
50,287,905		50,287,905	28,386,211	50,287,905		(55,316,696)	(5,028,791)	(2,838,621)
50,287,905		50,287,905	25,805,647	50,287,905		(55,316,696)	(5,028,791)	(2,580,565)
50,287,905		50,287,905	23,459,679	50,287,905		(55,316,696)	(5,028,791)	(2,345,968)
50,287,905		50,287,905	21,326,981	50,287,905		(55,316,696)	(5,028,791)	(2,132,698)
502,879,050	127,365,522	630,244,572	451,168,818	502,879,050	127,365,522		77,077,617	77,281,956

Kenya – Top Down Assessment

Table A5: Cost Comparison of Response, 20 years, 10% discount, USD millions

USD MILLIONS													
YEAR	Late Humanitarian Response				Early Response (B1)			Early Response (B2)			Resilience		
	Aid (needs)	Losses	Total	Present Value	Aid+losses	Cost Destock	Present Value	Aid+losses	Cost Destock+ Vet/Supp	Present Value	Total	Residual Risk (B2)	Present Value
0	131	12,100	12,231	12,231	9,275	2.9	9,278	2,831	60.1	2,891	500	2,831	3,331
1	131		131	119	66		60	49		45	500	49	499
2	131		131	108	66		54	49		41	500	49	454
3	131		131	98	66		49	49		37	500	49	413
4	131		131	89	66		45	49		34	500	49	375
5	138	12,705	12,843	7,974	9,739	2.9	6,049	2,973	60.1	1,883	500	1,486	1,233
6	138		138	78	69		39	52		29	500	26	297
7	138		138	71	69		35	52		27	500	26	270
8	138		138	64	69		32	52		24	500	26	245
9	138		138	58	69		29	52		22	500	26	223
10	144	13,340	13,485	5,199	10,226	2.9	3,943	3,122	60.1	1,227	500	780	494
11	144		144	51	72		25	54		19	500	14	180
12	144		144	46	72		23	54		17	500	14	164
13	144		144	42	72		21	54		16	500	14	149
14	144		144	38	72		19	54		14	500	14	135
15	152	14,007	14,159	3,390	10,737	2.9	2,571	3,278	60.1	799	500	819	316
16	152		152	33	76		17	57		12	500	14	112
17	152		152	30	76		15	57		11	500	14	102
18	152		152	27	76		14	57		10	500	14	92
19	152		152	25	76		12	57		9	500	14	84
Total	2,823	52,153	54,976	29,771	41,106	11.4	22,330	13,053	241	7,168	10,000	6,329	9,168

Table A6: Cost Comparison of Response, 10 years, 10% discount, USD millions

USD MILLIONS													
YEAR	Late Humanitarian Response				Early Response B1			Early Response (B2)			Resilience		
	Aid (needs)	Losses	Total	Present Value	Aid+Losses	Cost Destock	Present Value	Aid+losses	Cost Destock+ Vet/Supp	Present Value	Total	Residual Risk (B2)	Present Value
0	131	12,100	12,231	12,231	9,275	2.9	9,278	2,831	60.1	2,891	500	2,831	3,331
1	131		131	119	66		60	49		45	500	49	455
2	131		131	108	66		54	49		41	500	49	413
3	131		131	98	66		49	49		37	500	49	376
4	131		131	89	66		45	49		34	500	49	342
5	138	12,705	12,843	7,974	9,739	2.9	6,049	2,973	60.1	1,883	500	1,486	1,233
6	138		138	78	69		39	52		29	500	26	282
7	138		138	71	69		35	52		27	500	26	257
8	138		138	64	69		32	52		24	500	26	233
9	138		138	58	69		29	52		22	500	26	212
Total	1,343	24,805	26,148	20,891	19,551	5.7	15,670	6,208	120	5,033	5,000	4,618	7,134

Kenya – Sector Assessment

Livestock

- The cost of a livestock resilience package of interventions is estimated to be $24 per person (see Kenya report). This is multiplied by the beneficiary population of 367,065, for Wajir Grasslands under the HEA model. The total cost is $8.8m per year. This is assumed to occur year on year, dropping half the cost in year 10.
- Benefits accrue every fifth year in a high magnitude drought, and are represented by avoided aid costs and livestock losses, at 67%, as modeled in the HEA.

Table A7: Livestock Interventions, USD

YEAR	COST (USD)		BENEFITS	
	Total	Present Value	Avoided Aid + losses (B2)	Present Value
0	8,809,560	8,809,560	172,473,684	172,473,684
1	8,809,560	8,008,691		0
2	8,809,560	7,280,628		0
3	8,809,560	6,618,753		0
4	8,809,560	6,017,048		0
5	8,809,560	5,470,044	172,473,684	107,092,588
6	8,809,560	4,972,767		0
7	8,809,560	4,520,697		0
8	8,809,560	4,109,725		0
9	8,809,560	3,736,113		0
10	4,404,780	1,698,233	172,473,684	66,496,072
11	4,404,780	1,543,849		0
12	4,404,780	1,403,499		0
13	4,404,780	1,275,908		0
14	4,404,780	1,159,916		0
15	4,404,780	1,054,469	172,473,684	41,288,829
16	4,404,780	958,608		0
17	4,404,780	871,462		0
18	4,404,780	792,238		0
19	4,404,780	720,217		0
Total	132,143,400	71,022,426	689,894,737	387,351,173
BCR			**5.45**	

Water

- The total cost of a shallow well is estimated at $4,435, assuming 1,000 beneficiaries, equates to per capita cost of $4.44. The total cost of a drilled well is approximately $100,000 (depending on depth). This is estimated to benefit between 1,000 and 5,000 people, equating to $8.5 to $42.5 per capita.[32] These figures are then multiplied by the total number of beneficiaries under the HEA modeling (367,065). The full cost is allocated in year one, 10% of total capital cost is assumed year on year for O&M, with 50% of the total cost allocated in year 10 to account for upgrades/rehabilitation of infrastructure.
- Benefits include:
    - The avoided cost of providing water tankering (water aid), estimated at $2 per capita, assumed to occur every fifth year (in a drought).
    - Time savings: In year one of a drought, it is assumed that 2 people out of each household (assume to average 6) spend 6 hours every other day travelling to a water source. During the other 4 years, it is assumed that existing water sources become available again, and that travel times are reduced to one person per household travelling between 1 and 2 hours (see Kenya report). In both cases it is assumed that the presence of water supply reduces travel time to a minimum of 30 minutes (according to water availability standards). Time saved is valued using average rural wage rates at $1.50 per day.
    - WHO savings are calculated using the WHO estimated total benefits arising from access to clean water in East Africa, at $6.50 per capita.[33] The WHO benefits encompass a wider range of impacts, including avoided mortality, increased productive time, and avoided health care costs. Time savings account for 65% of total benefits in the WHO study. To avoid double counting with the time savings already calculated specific to Kenya, the benefits of $6.5 are reduced by 65%, resulting in remaining per capita benefits $2.30.

[32] Costs for the North West and Rift Valley Water Service Boards were used as they most closely reflect the ASAL environment.

[33] Hutton, G. and L. Haller (2004). “Evaluation of the Costs and Benefits of Water and Sanitation Improvements at the Global Level.” World Health Organization, Geneva

Table A8: Water Interventions, USD

YEAR	Shallow Well - COST		Drilled Well Low - COST		Drilled Well High - COST		BENEFITS	BENEFITS OF B/C		TOTAL BENEFIT	
	Total	Present Value	Total	Present Value	Total	Present Value	Avoided cost of tankering	Time Savings	WHO Savings	Total	Present Value
0	1,627,933	1,627,933	7,341,300	7,341,300	36,706,500	36,706,500	734,130	25,121,011	835,073	26,690,214	26,690,214
1	162,793	147,994	734,130	667,391	3,670,650	3,336,955		2,407,430	835,073	3,242,503	2,947,730
2	162,793	134,540	734,130	606,719	3,670,650	3,033,595		2,407,430	835,073	3,242,503	2,679,755
3	162,793	122,309	734,130	551,563	3,670,650	2,757,814		2,407,430	835,073	3,242,503	2,436,141
4	162,793	111,190	734,130	501,421	3,670,650	2,507,103		2,407,430	835,073	3,242,503	2,214,673
5	162,793	101,082	734,130	455,837	3,670,650	2,279,185	734,130	25,121,011	835,073	26,690,214	16,572,523
6	162,793	91,893	734,130	414,397	3,670,650	2,071,986		2,407,430	835,073	3,242,503	1,830,308
7	162,793	83,539	734,130	376,725	3,670,650	1,883,624		2,407,430	835,073	3,242,503	1,663,917
8	162,793	75,944	734,130	342,477	3,670,650	1,712,385		2,407,430	835,073	3,242,503	1,512,652
9	162,793	69,040	734,130	311,343	3,670,650	1,556,714		2,407,430	835,073	3,242,503	1,375,138
10	813,967	313,819	3,670,650	1,415,194	18,353,250	7,075,972	734,130	25,121,011	835,073	26,690,214	10,290,233
11	162,793	57,058	734,130	257,308	3,670,650	1,286,540		2,407,430	835,073	3,242,503	1,136,478
12	162,793	51,871	734,130	233,916	3,670,650	1,169,582		2,407,430	835,073	3,242,503	1,033,161
13	162,793	47,155	734,130	212,651	3,670,650	1,063,257		2,407,430	835,073	3,242,503	939,238
14	162,793	42,869	734,130	193,319	3,670,650	966,597		2,407,430	835,073	3,242,503	853,852
15	162,793	38,971	734,130	175,745	3,670,650	878,724	734,130	25,121,011	835,073	26,690,214	6,389,425
16	162,793	35,429	734,130	159,768	3,670,650	798,840		2,407,430	835,073	3,242,503	705,663
17	162,793	32,208	734,130	145,244	3,670,650	726,219		2,407,430	835,073	3,242,503	641,512
18	162,793	29,280	734,130	132,040	3,670,650	660,199		2,407,430	835,073	3,242,503	583,193
19	162,793	26,618	734,130	120,036	3,670,650	600,181		2,407,430	835,073	3,242,503	530,175
Total	5,372,180	3,240,742	24,226,290	14,614,394	121,131,450	73,071,972	2,936,520	139,002,927	16,701,458	158,640,905	83,025,980
BCR Shallow		**25.62**									
BCR Drilled Low		**5.68**									
BCR Drilled High		**1.14**									

Education

- The cost of education is estimated using official government statistics on the costs of building schools and staffing them (see Kenya report). It is estimated that 412 schools are required for the population in Wajir grasslands, at a cost of $400k each, for a total capital cost of $164.8m (see Kenya report, the cost of building a school is considered to be generous, but used here because it is the official government statistic). The average yearly cost of teacher's salaries is estimated at $17 per capita. This is then multiplied by the total number of beneficiaries.
- The benefits are delayed until year 15, to account for the fact that children have to complete school before benefits begin to accrue. These benefits include:
    - Increased income, estimated at $360 per household per annum, based on the evidence from the Baringo study.[34]
    - In Baringo, those on food aid dropped from 66% to 23%, a change of 43%, as a result of increased education. This is applied to our full population - assuming that 43% of food aid costs estimated under the HEA model are avoided. These benefits are assumed to occur every fifth year in a high magnitude drought.

[34] Little, P., A. Aboud and C. Lenachuru (2009). "Can Formal Education Reduce Risks for Drought-Prone Pastoralist?: A Case Study from Baringo District, Kenya". Human Organisation

Table A9: Education, USD

USD						
YEAR	COST		BENEFITS			
	Total	Present Value	Increased income	Avoided Aid	Total	Present Value
0	164,800,000	164,800,000				0
1	6,240,105	5,672,823				0
2	6,240,105	5,157,112				0
3	6,240,105	4,688,283				0
4	6,240,105	4,262,076				0
5	6,240,105	3,874,614				0
6	6,240,105	3,522,377				0
7	6,240,105	3,202,161				0
8	6,240,105	2,911,055				0
9	6,240,105	2,646,414				0
10	6,240,105	2,405,831				0
11	6,240,105	2,187,119				0
12	6,240,105	1,988,290				0
13	6,240,105	1,807,536				0
14	6,240,105	1,643,215				0
15	6,240,105	1,493,832	22,023,900	75,714,308	97,738,208	23,397,750
16	6,240,105	1,358,029	22,023,900		22,023,900	4,793,042
17	6,240,105	1,234,572	22,023,900		22,023,900	4,357,311
18	6,240,105	1,122,338	22,023,900		22,023,900	3,961,192
19	6,240,105	1,020,307	22,023,900		22,023,900	3,601,084
20	6,240,105	927,552	22,023,900	75,714,308	97,738,208	14,528,162
21	6,240,105	843,229	22,023,900		22,023,900	2,976,102
22	6,240,105	766,572	22,023,900		22,023,900	2,705,547
23	6,240,105	696,883	22,023,900		22,023,900	2,459,589
24	6,240,105	633,530	22,023,900		22,023,900	2,235,990
25	6,240,105	575,937	22,023,900	72,685,735	94,709,635	8,741,320
26	6,240,105	523,579	22,023,900		22,023,900	1,847,925
27	6,240,105	475,981	22,023,900		22,023,900	1,679,932
28	6,240,105	432,710	22,023,900		22,023,900	1,527,211
29	6,240,105	393,373	22,023,900		22,023,900	1,388,374
30	6,240,105	357,611	22,023,900	72,685,735	94,709,635	5,427,672
31	6,240,105	325,101	22,023,900		22,023,900	1,147,416
32	6,240,105	295,547	22,023,900		22,023,900	1,043,106
33	6,240,105	268,679	22,023,900		22,023,900	948,278
34	6,240,105	244,253	22,023,900		22,023,900	862,071
Total	376,963,570	224,758,516	440,478,000	296,800,086	737,278,086	89,629,074
BCR	**0.40**					