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COSTS IMPOSED BY CLIMATE CHANGE IN THREE ECOREGIONS OF EAST AFRICA

Study prepared for USAID East Africa
Office of Regional Economic Growth and Integration

Presentation to USAID/Washington - February 2011

JOY E. HECHT, KATHARINE VINCENT, & JANE KAHATA
INTERNATIONAL RESOURCES GROUP

ENVIRONMENTALLY SOUND DESIGN & MANAGEMENT
CAPACITY BUILDING SUPPORT FOR AFRICA

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WHY DO A STUDY ON CLIMATE CHANGE?

- Climate change will affect all aspects of life in East Africa.
- Climate is one of the President's three major development initiatives; however it has major implications for design and effectiveness of Food for the Future and the Global Health Initiative as well.
- This study considers costs imposed by climate change, to provide evidence for use in policy and program design, both within the climate initiative and in the other two initiatives.

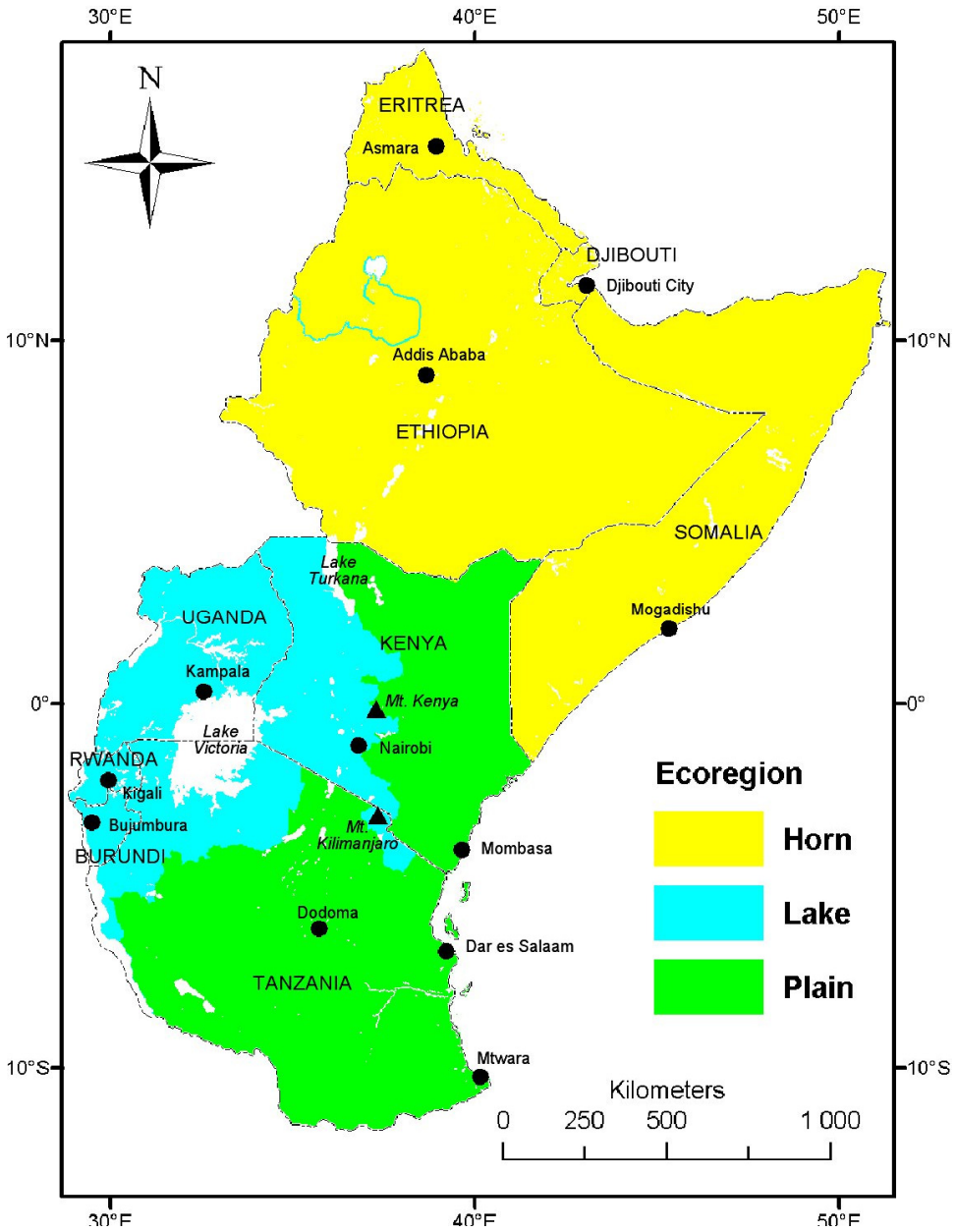
WHAT DID WE DO IN THE STUDY?

- We compared the costs that climate change will impose in three ecoregions of East Africa.

What makes our study unique?

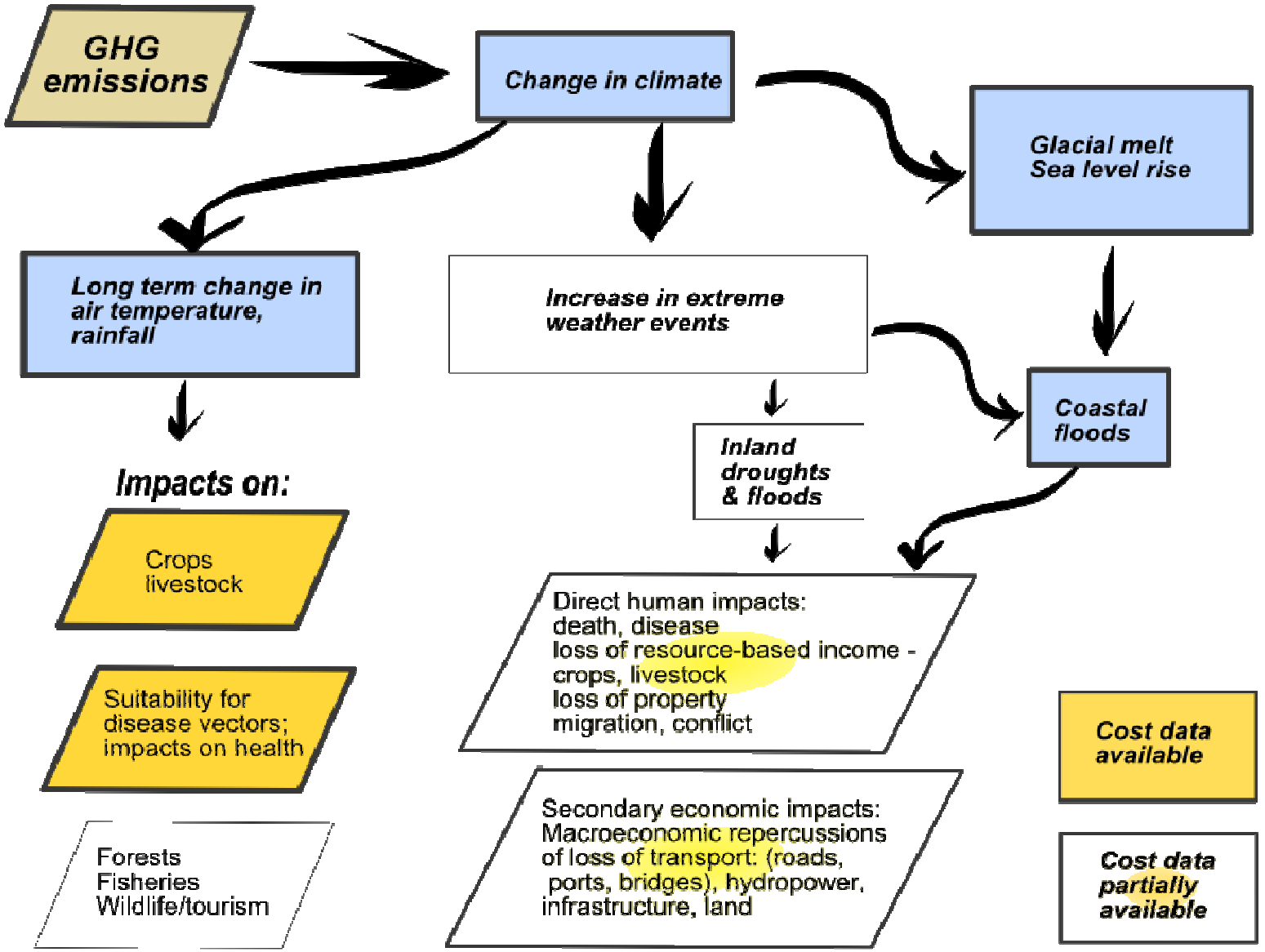
- It considers impacts on ecoregions rather than political boundaries
- It compares the burden in two ways:
  - across ecoregions
  - across areas of climate change impact
- It quantifies impacts in monetary terms.

WHERE ARE THE ECOREGIONS?



1. Horn of Africa – all of Eritrea, Ethiopia, Djibouti, and Somalia
2. Lake Victoria Basin – all of Burundi, Rwanda, and Uganda, plus the highland areas of Kenya and Tanzania and high-elevation areas around Kilimanjaro
3. Plains – the eastern areas of Kenya and Tanzania

WHAT ARE THE AREAS OF CLIMATE CHANGE IMPACT?



WHAT DID WE LEARN?

Maximum impact of CC, in constant $US 1000s		2050
Horn	crops	**$279,244**
	livestock	**-$23,173**
	health	**-$18,735,515**
	coastal flooding	**-$244,100**
Lake	crops	**-$1,462,686**
	livestock	**-$90,942**
	health	**-$10,291,811**
	coastal flooding	**not available**
Plain	crops	**$534,509**
	livestock	**$8,825**
	health	**-$1,302,610**
	coastal flooding	**-$287,100**

METHODOLOGY: WHY MEASURE COST?

- To compare impacts and provide clear evidence for policy choice, we must use a standard metric.
- Many assessments of climate vulnerability are qualitative; this does not permit aggregation or standard comparison.
- Assessments use a variety of indicators; these also do not do not permit aggregation or comparison.

- Quantifying in terms of number of people affected does permit aggregation and comparison; however it does not capture significance of effects.

- Monetary measures can be aggregated and compared, and they show magnitude of impact.
- Therefore they provide quantitative evidence to prioritize resource allocation.
- If desired, monetary measures can later be linked to cost-effectiveness analysis when considering adaptation choices.

HOW WE DID IT

- To estimate costs, we worked from other published studies that projected climate change impacts in Africa.
- This gave us results in four areas:
  - Crops
  - Livestock
  - Health
  - Coastal flooding and sea level rise

SUMMARY RESULTS: CROPS

	Actual value	Impact of CC on value of crops, in constant $US 1000s	
	2005	projected 2020	projected 2050
Horn of Africa			
IFPRI - impact of CC (a)	**$2,609,214**	**$162,616**	**$279,244**
For comparison: GDP (b)	$14,165,915	$45,406,644	$498,548,055
Lake Victoria Basin			
IFPRI - impact of CC	**$6,597,037**	**-272,645**	**-1,462,686**
For comparison: GDP	$31,328,363	$86,507,100	$706,148,368
Plains			
IFPRI - impact of CC	**$1,547,854**	**380,986**	**534,509**
For comparison: GDP	$13,736,871	$38,501,225	$310,860,006

(a) Does not include Djibouti (b) Does not include Somalia

KEY POINTS: CROPS

- IFPRI data show climate change **increases** crop production in Horn and Plains.
- In Horn and Plains impacts of climate change are greater in 2020 and level off somewhat by 2050.
- Change due to CC up to 2050 almost always less than 0.5% of GDP – useful for comparison with other areas of climate change impact. Shares of agriculture GDP range from 1 to 3%. **However GDP projections are only general estimates.**
- These projections combine values of rice, wheat, maize, and other crops; we do not know breakdown or whether they are for export or domestic consumption. These distinctions will be important in designing Feed the Future activities.
- These projections assume land is available to increase production and/or that yields will increase. Testing the applicability of these assumption in the region will be essential for Feed the Future program design.

SUMMARY RESULTS: LIVESTOCK

	Value in 2002	Change in value of Livestock due to CC, 2002 - 2050, in constant $US 1000s					
		Beef cattle	Dairy cattle	Goats	Sheep	Chickens	Total
Horn							
livestock:	$1,715,018	**$7,186**	**-$34,424**	**$1,259**	**$2,924**	**-$119**	**-$23,173**
GDP: (a)	$14,165,915						$498,548,055
Lake							
livestock:	$1,915,605	**$12,688**	**-$110,854**	**$7,322**	**$1,175**	**-$1,273**	**-$90,942**
GDP:	$31,328,363						$706,148,368
Plain							
livestock:	$1,109,561	**$14,698**	**-$3,591**	**-$487**	**$1,329**	**-$3,124**	**$8,825**
GDP:	$13,736,871						$310,860,006

(a) Does not include Somalia

KEY POINTS: LIVESTOCK

- Impact on livestock depends on animal; dairy cattle and chickens generally do worse, beef cattle, goats and sheep do better.
- Camels were not part of the study from which these data derive; they will be important in East Africa.
- Total change in livestock value is always less than 0.1% of GDP; much less than crops
- The plains region is overall better off, whereas the others are worse off; this is similar at the country level.
- Understanding how livestock suitability will evolve with climate change is important for ensuring adequate nutrition through Feed the Future.

SUMMARY RESULTS: HEALTH

Costs in constant $US 1000s:	2004-5	2050 W/out CC	2050 due to CC
Horn			
Malaria	**-$298,518**	**-$12,692,899**	**-$18,735,515**
Protein-energy malnutrition	**-$202,256**	**-$7,118,106**	
Diarrheal diseases	**-$756,594**	**-$26,627,191**	
Comparison: GDP (a)	$14,165,915		$498,548,055
Lake			
Malaria	**-$1,385,358**	**-$21,672,484**	**-$10,291,811**
Protein-energy malnutrition	**-$351,270**	**-$7,917,713**	
Diarrheal diseases	**-$1,691,411**	**-$38,124,790**	
Comparison: GDP	$31,328,363		$706,148,368
Plains			
Malaria	**-$148,479**	**-$1,704,821**	**-$1,302,610**
Protein-energy malnutrition	**-$119,146**	**-$2,696,232**	
Diarrheal diseases	**-$614,725**	**-$13,910,979**	
Comparison: GDP	$13,736,871		$310,860,006

(a) Does not include Somalia

KEY POINTS: HEALTH

- Health literature suggests climate change will have significant impacts on malaria, diarrheal diseases and malnutrition. Projections only available for malaria.
- In 2004-5 malaria costs are:
  - 2.3% of GDP in the Horn
  - 4.4% of GDP in the Lake region
  - about 1% of GDP in the Plain region
- In 2050 average impact of malaria **due to CC** will be:
  - just under 4% of GDP in the Horn
  - 1.5% in the Lake region
  - 0.5 % in the Plain region
- Impact of CC in Lake region is less than in Horn because it was high in Lake region to start with.
- Relative to GDP, malaria costs are as much as 20 times greater than costs due to agriculture.
- This suggests that impacts of climate change on malaria must be part of the Global Health Initiative.

SUMMARY RESULTS: COASTAL FLOODING

Costs due to sea level rise under three climate scenarios, in constant $US 1000s						
		2000	2025	2050	2075	2100
Horn	A1F1	-$0	-$3,700	-$244,100	-$161,800	-$458,600
	A1B	-$0	-$2,000	-$60,100	-$2,149,800	-$249,500
	B1	-$0	-$1,300	-$5,900	-$55,900	-$114,600
	GDP (a)	$14,165,915	$54,399,610	$498,548,055	$3,767,537,390	$28,695,694,275
Plains	A1F1	-$130	-$19,400	-$287,100	-$160,800	-$445,000
	A1B	-$100	-$14,700	-$76,800	-$2,626,800	-$378,400
	B1	-$200	-$14,900	-$194,600	-$1,710,800	-$729,200
	GDP	$13,736,871	$67,394,927	$310,860,006	$1,814,883,343	$10,781,267,353

(a) Does not include Somalia

KEY POINTS: COASTAL FLOODING

- We show results for three different climate change scenarios for coastal events.
- Estimates vary greatly over time and scenario; this is due to predictions in the model for when population change and flooding will occur.
- Even with highest sea level rise, costs relative to GDP are low, less than 0.1% of GDP.
- However the model assumes that all flooded land is agricultural, so it probably underestimates costs, especially of harm to ports, coastal roads, and other transport facilities.
- This undervalued harm may have significant implications for transport corridors, and particularly for shipping food into and within all of East Africa.

EXTREME EVENTS

- Extreme events include droughts, floods, drought-induced fire
- Data not available because they are much harder to model
- Consequences:
  - Direct humanitarian impacts on human life; death, illness, displacement, migration, conflict, loss of property
  - Direct loss of crops, livestock, other resource-based income
  - Damage to infrastructure with macroeconomic repercussions; e.g. power generation, ports, water and land-based transport
- Data to analyze direct costs would help determine where prevention is cost-effective and where it is not. This information is important in building resilience to unavoidable impacts of climate change.
- Damage to infrastructure will increase unreliability of transport corridors, with implications for food and commodity distribution throughout East Africa.
- Macroeconomic repercussions of infrastructure damage should be analyzed in order to prioritize the investments needed to increase resilience in the face of drought or flood.
- However, **response to immediate humanitarian crises should not be determined by economic assessment.**

IMPLICATIONS FOR USAID PROGRAMMING

- Target areas of climate change impact rather than ecoregions
- Biggest costs are in public health.
- However climate change will also have implications for other USAID initiatives.

IMPLICATIONS FOR GHI and FtF

- Activities crucial to the Global Health Initiative:
  - Work with regional institutions to identify specific places within the countries affected where malaria will become a particular problem with climate change
  - Work with national institutions to strengthen existing malaria control programs or create them where they do not yet exist.
  - Develop early warning systems predicting malaria or other epidemics based on rainfall and temperature data.
  - Analyze the impacts of climate change on health concerns other than malaria.
- Activities crucial to Feed the Future:
  - Work further with IFPRI data to answer additional questions about future agricultural production.
  - Downscale analysis of agricultural impacts to address availability of land for increasing production.

IMPLICATIONS FOR GLOBAL CLIMATE INITIATIVE

- Activities piloted by Climate Change Initiative:
  - Complement cost analysis with:
    - qualitative assessments of vulnerability in key areas
    - quantitative assessment of number and characteristics of people affected by different areas of climate change impact
  - Develop systematic data on extreme weather events, and insofar as possible analyze cost-effectiveness of alternate mechanisms for reducing disaster risk.
  - Run models on sea level rise with region-specific assumptions, incorporating both macroeconomic impacts of infrastructure loss and data on the consequences of extreme weather events.
  - Use data on consequences of extreme events to estimate how climate change may change the transport costs estimated through the Corridor Diagnostic Study.