



Conference Paper No. 4

Diversity, Challenges and Opportunities
in the Greater Horn of Africa

by

Jordan Chamberlin, Xinshen Diao, Steven Haggblade,
Steven Were Omamo and Stanley Wood

Paper presented at the NEPAD/IGAD regional conference
“Agricultural Successes in the Greater Horn of Africa”

Nairobi

November 22-25, 2004

TABLE OF CONTENTS

1. Challenges	1
2. Diversity	6
3. Opportunities	10
4. Conclusions	17

LIST OF TABLES

1. Population distribution in the Greater Horn of Africa
2. Hunger and malnutrition in Africa, 2000
3. Land and water resources
4. Trends in child malnutrition
5. Cereal food aid imports
6. GDP growth under business as usual in agriculture
7. Food consumption profile
8. Value of agricultural markets in the region
9. Impact of reduced marketing costs

LIST OF FIGURES

1. Population density
2. Agro-ecological zones
3. Market access
4. Food consumption patterns
5. Distribution of agricultural production
6. Political and agro-ecological boundaries
7. Projected regional gains from beans research
8. Research and development benefits with technology spillovers
9. Trends in maize imports into the Greater Horn
10. Poor consumers gain from regional trade
11. Falling poverty in Uganda, 1992-1999
12. Trends in poverty in Ethiopia through 2020

ANNEX TABLES

- A.1. Food availability in the Greater Horn of Africa
- A.2. Food consumption profile
- A.3. Caloric availability

I. CHALLENGES

Over 220 million people live in the Greater Horn of Africa (Table 1). Roughly 40% remain chronically hungry, even in good years, making it one of the poorest regions of Africa (Table 2). From this chronically high level, undernutrition increases still further during the lean season in the region's cereal-dependent arid zones and during food emergencies triggered by periodic drought and intermittent conflict in many parts of the region. In the more diversified cropping areas, prospects for year-round harvest of cassava, bananas and plantains provide a seasonal and inter-annual cushion that largely buffers them from the aggravated hunger experienced in the cereal-dependent zones.

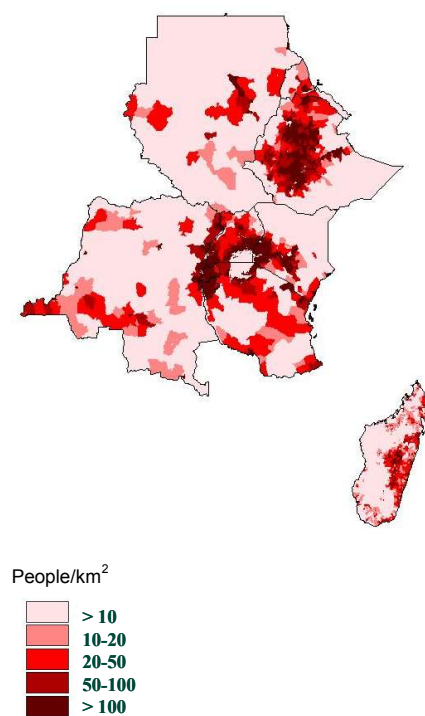
In spite of current high poverty levels, this region houses some of the most productive agricultural land in Africa. The well-watered highland areas boast fertile soil, abundant rainfall, and an absence of human and animal disease, providing some of the most favorable agricultural conditions in Africa. These high-potential zones have attracted human settlement and supported heavy population growth over the past several millennia (Schoenbaum, 1999). As a result, population density remains among the highest in Africa in the highland areas of Rwanda, Burundi, Uganda, Ethiopia and Kenya (Figure 1). Today, population pressure remains particularly acute in Ethiopia and Kenya, where cultivated land per person stands at 0.11 hectares, roughly half the regional average (Table 3).

Table 1 -- Population Distribution in the Greater Horn of Africa, 2002

Country	Population (millions)	Area ('000 km ²)	Density (people/km ²)
Burundi	7	28	236
Djibouti	1	23	30
Eritria	4	118	34
Ethiopia	69	1,104	62
Kenya	31	580	54
Rwanda	8	26	318
Somalia	8	638	13
Sudan	33	2,506	13
Tanzania	36	945	38
Uganda	25	241	104
Total	222	6,209	36

Source: FAOSTAT.

Figure 1 – Population Density



Source: Diao et al. (2004)

Table 2 -- Hunger and Malnutrition in Africa, 2000

	Hunger		Child malnutrition	
	Kcal/person	Undernourished	Stunted	Underweight
Greater Horn	2020	0.388	0.44	0.32
Burundi	1610	0.703	0.57	0.45
Djibouti	-	-	0.26	0.18
Eritria	1670	0.595	0.38	0.44
Ethiopia	1910	0.42	0.52	0.47
Kenya	2040	0.375	0.35	0.21
Rwanda	2000	0.413	0.41	0.27
Somalia	1600	0.705	0.23	0.26
Sudan	2290	0.248	-	0.17
Tanzania	1970	0.433	0.44	0.29
Uganda	2370	0.193	0.39	0.23
Central Africa	1810	0.583	0.36	0.28
Southern Africa	2050	0.413	0.39	0.23
West Africa	2590	0.147	0.37	0.32

Source: Benson (2004), FAO (2003), WHO (2003).

Table 3 -- Land and Water Resources in the Greater Horn of Africa

	Cultivated land (ha/rural pop)	Growing season (LGP > 180 days) (% rural population)		Irrigated land (% of total)
Burundi	0.16	88%	93%	8%
Djibouti	-	0%	0%	-
Eritria	0.24	0%	0%	5%
Ethiopia	0.11	80%	79%	2%
Kenya	0.11	55%	62%	2%
Rwanda	0.25	100%	100%	0%
Somalia	-	-	-	-
Sudan	0.64	4%	12%	11%
Tanzania	0.20	75%	71%	1%
Uganda	0.31	98%	94%	0%
Average*	0.24		66%	6%

Source: Diao et al. (2004)

Table 4 -- Trends in Child Malnutrition

	1980	2000 change	
Stunting			
Africa			
Greater Horn	44.4%	44.4%	0.0%
Central	46.6%	37.8%	-8.8%
Northern	34.0%	21.7%	-12.3%
Southern	26.2%	24.6%	-1.6%
West	36.5%	32.9%	-3.6%
All Africa	39.0%	35.2%	-3.8%
All developing countries	48.6%	29.6%	-19.0%
Underweight			
Africa			
Greater Horn	24.3%	29.2%	4.9%
Central	29.6%	26.1%	-3.5%
Northern	15.4%	9.7%	-5.7%
Southern	14.3%	13.7%	-0.6%
West	28.4%	27.1%	-1.3%
All Africa	23.5%	24.2%	0.7%
All developing countries	37.6%	24.8%	-12.8%

Source: Onis et al. (2004).

Table 5 -- Cereal Food Aid Flows into the Greater Horn of Africa

Desitnation	Year												
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Burundi	3,526	1,041	5,505	55,817	57,080	5,130	366	0	110	10,838	31,181	35,219	54,957
Djibouti	7,486	15,546	24,091	8,054	18,143	13,639	2,443	14,494	13,157	8,825	12,567	9,969	13,933
Eritrea				247,215	135,607	54,857	9,000	63,343	102,678	94,410	235,963	251,899	184,209
Ethiopia				590,299	727,358	491,482	119,857	548,296	463,336	1,030,860	1,210,790	299,341	1,218,480
Kenya	76,151	180,659	281,885	262,113	109,014	22,366	48,228	102,324	77,596	116,411	348,665	132,619	84,306
Rwanda	8,380	7,980	88,254	86,146	289,195	267,041	347,223	180,463	162,891	206,258	43,117	48,599	20,096
Somalia	80,468	129,298	371,259	79,443	32,582	21,795	2,616	18,990	33,519	43,085	16,689	25,768	15,957
Sudan	489,047	596,951	337,703	255,263	117,055	43,734	83,609	49,790	226,780	114,652	176,614	86,111	125,779
Tanzania	13,337	4,020	26,176	27,034	108,670	14,789	13,536	87,847	33,929	40,060	71,438	90,394	50,730
Uganda	14,445	22,242	11,544	18,932	28,364	17,491	46,950	52,886	38,004	50,472	48,079	46,290	112,767
Total	689,314	956,696	1,140,912	1,574,499	1,565,988	947,194	673,462	1,118,433	1,151,890	1,705,033	2,163,922	990,990	1,826,257

Source: FAOSTAT.

Two-thirds of the region's population lives in these high-potential agricultural zones. Because of heavy population pressure there, production increases will require technologies permitting increased productivity per unit of land. The remaining one-third of the region's population lives in lower-potential, fragile zones, where water scarcity, environmental fragility and armed conflict underlie a precarious, uncertain existence. In these zones, livestock and improved water management for cultivated agriculture offer the clearest routes to agricultural advance.

Armed conflict interrupts normal economic pursuits across large swaths of the region. Fighting currently rages in Uganda, Sudan and Somalia. Recently subsided conflict between Ethiopia and Eritrea and among Tutsis and Hutus in Rwanda and Burundi has led to massive population movements and millions of dead. Recurring conflict deprives the region of the manpower and security required for productive agricultural livelihoods.

As a result, agricultural growth in the region has proven sluggish relative to population (Table 6). The Greater Horn of Africa remains the only region of Africa where child malnutrition has failed to improve over the past 20 years (Table 4). Erratic production, chronic poverty and intermittent fighting have resulted in growing food aid dependency (Table 5). Currently, food aid shipments to the region, centered heavily in Ethiopia, contribute approximately 10% of regional calories.

Table 6 -- GDP Growth under Business as Usual in Agriculture, 2003-2015

Country	Base Growth Rate (past 5-8 years)			Projected Growth Under Business as Usual	
	staples	cash crops	livestock	agriculture	GDP/capita
Burundi	2.4	2.3	-0.2	1.8	-0.1
Eritrea	1.3	0.8	0.8	1.2	-1.3
Ethiopia	1.6	2.6	4.8	2.2	-0.2
Kenya	2.1	1.2	4.9	2.4	0.0
Rwanda	3.9	3.1	4.3	3.6	0.3
Sudan	5.3	3.1	2.0	3.3	1.2
Tanzania	2.9	3.4	3.5	3.0	0.8
Uganda	3.6	2.2	5.1	4.2	1.4

Source: Chamberlin, Diao, Omamo and Wood (2004).

Business as usual projections in agriculture suggest that a continuation of the region's anemic performance will result in continued high levels of poverty. Only in Uganda, Tanzania and Sudan (should they prove able to maintain rapid recovery from past low levels of production growth) will per capita incomes grow in excess of 0.75% per year (Table 6). A continuation of business as usual will not prove good enough to make a dent in the millennium development goals. Only improved agricultural productivity can simultaneously increase incomes of the majority of poor workers and lower food prices, which govern the real incomes of both rural and urban poor.

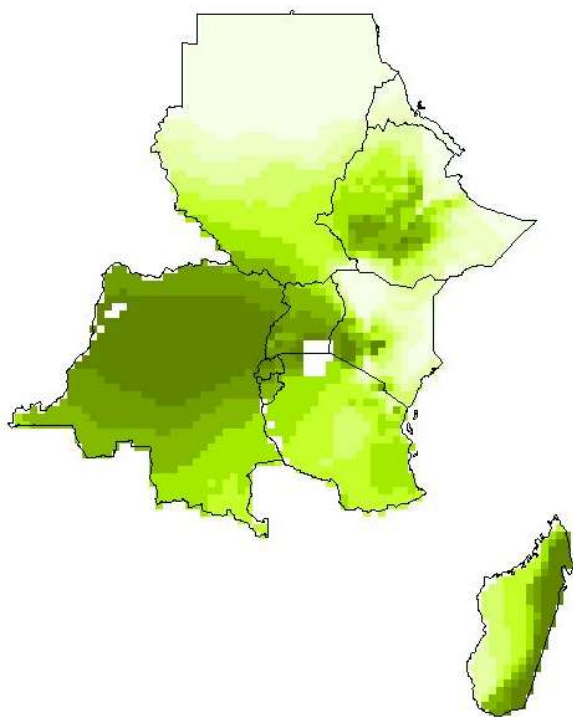
The region must do better in the future than it has in the past. Given that three-fourths of the region's population works in agriculture and that food expenditure accounts for the majority of spending by both rural and urban poor, it is difficult to see how the region can significantly reduce currently high poverty levels without dramatically improving agricultural performance.

II. DIVERSITY

The Greater Horn of Africa cuts across a wide range of agro-ecological zones, from expansive deserts to equatorial highland regional with dual rainy seasons of nearly continuous year-round rainfall (Figure 2). These zones cut across country boundaries, leading to similar cropping patterns and agricultural practices in contiguous zones of neighboring countries.

Market access likewise varies across locations, both within and across countries. (Figure 3). High value export crops remain concentrated in highland areas near to major airports in Kenya, Uganda and Ethiopia.

Figure 2 – Production Potential



Length of growing period

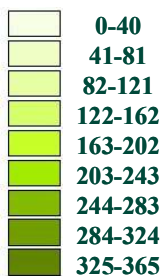
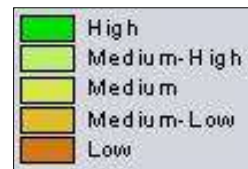
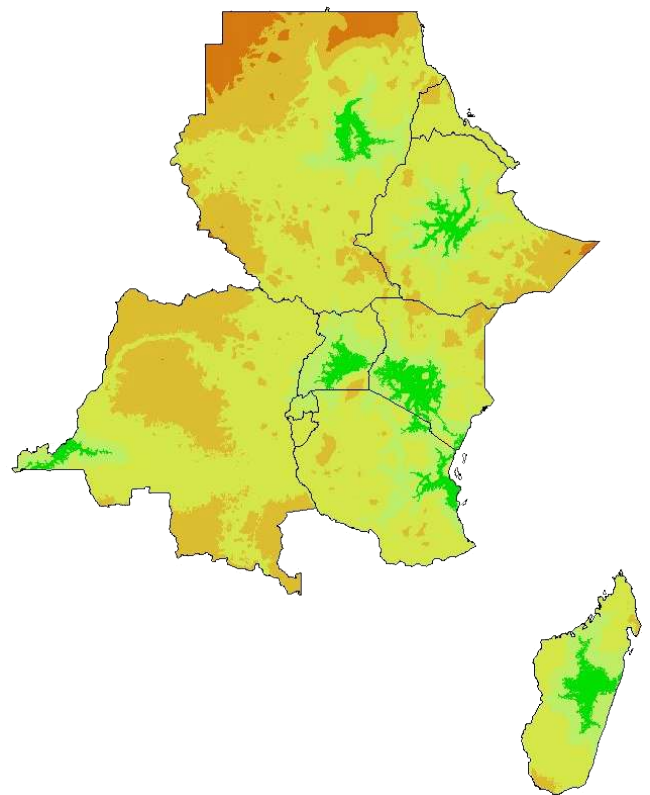


Figure 3 – Market Access



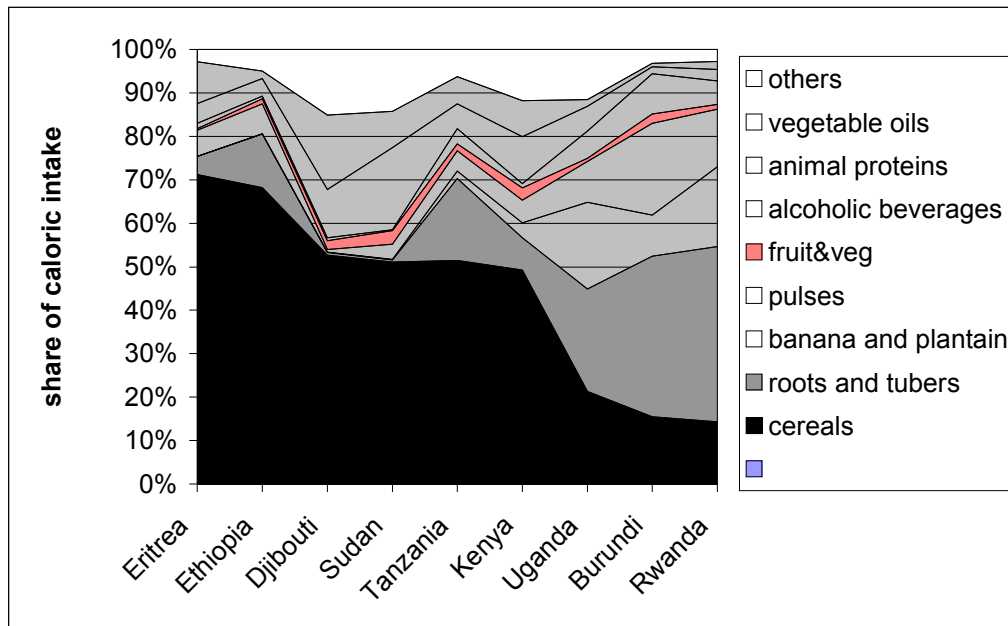
Source: Diao et al. (2004)

Source: Diao et al. (2004).

Food production and consumption patterns vary across agroecological and market zones (Figure 4). In arid zones, cereal production predominates, sorghum and millets in the drier zones and maize elsewhere (Figure 5). Cereals constitute the principal food staple in Ethiopia and Eritrea. Elsewhere, roots and tubers predominate, as in Uganda, Rwanda and Burundi, where cassava, sweet potatoes, bananas and plantains provide the bulk of caloric intake. In other countries of the region, such as Tanzania, Sudan and Kenya, regional diversity lead to an array dietary preferences.

Livestock holdings and meat consumption assume particular importance in Ethiopia, Kenya, Djibouti, Tanzania, Somalia and Sudan. Milk consumption proves most important in Sudan, Kenya and Djibouti (Table 7).

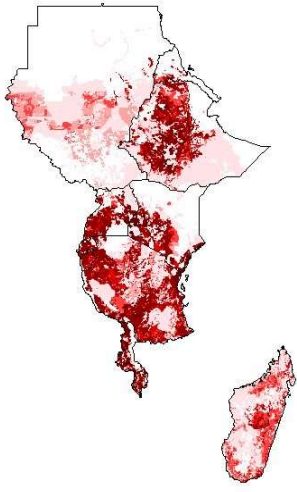
Figure 4 -- Composition of Caloric Intake, 2002



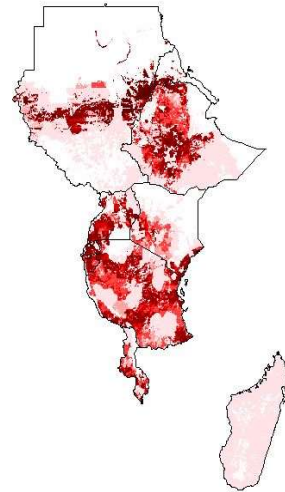
Source: FAOSTAT.

Figure 5 – Distribution of Agricultural Production

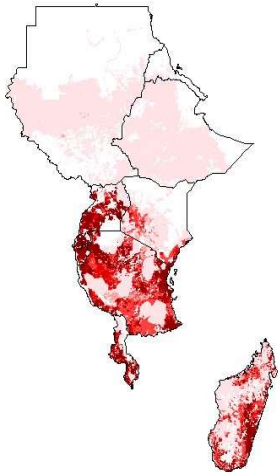
Maize



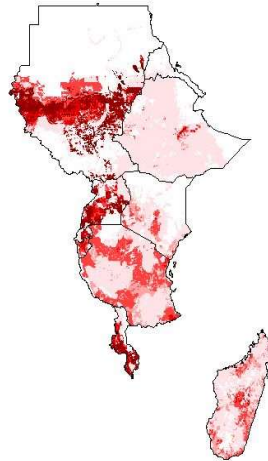
Sorghum



Cassava



Groundnuts



Source: Strategic Agricultural Knowledge Support System (SAKSS).

Table 7 -- Food Consumption Profile of the Greater Horn of Africa, 2002

	Per capita availability for human consumption (kg/person/year)								
	Burundi	Djibouti	Eritrea	Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda
Cereals	29	138	122	140	124	34	132	114	63
maize	21	2	4	42	87	10	2	73	31
sorghum & millet	2	1	41	27	3	18	86	14	22
wheat	2	95	72	34	28	3	43	12	6
others	5	40	6	38	6	3	1	15	5
Roots and tubers	236	7	27	62	65	340	5	186	206
cassava	98	0	0	0	19	81	0	155	103
sweet potato	120	0	0	5	16	147	0	25	88
others	18	7	27	57	30	113	4	6	15
Pulses	38	2	10	14	12	30	8	10	24
Vegetable oils		16	6	1	7	2	8	5	2
Vegetables	34	46	8	11	45	29	30	28	20
Fruits	106	17	1	10	56	163	28	30	206
banana and plantain	95	1	0	1	32	156	2	15	204
others	12	15	1	9	24	7	26	15	2
Alcoholic beverages	75	5	15	9	15	58	0	75	137
Animal proteins	10	102	25	30	100	24	175	44	46
meat	4	17	7	8	15	4	21	10	12
milk	5	83	15	21	80	18	151	26	27
eggs	0	1	0	1	2	0	1	1	1
fish	1	1	2	0	5	1	2	7	7
Total calories (kcal/person/day)	1,649	2,220	1,513	1,857	2,117	2,084	2,228	1,975	2,410

Source: FAOSTAT.

III. OPPORTUNITIES

A. Past Successes in the Region

The Greater Horn of Africa has witnessed a series of well-publicized successes in agricultural performance, in spite of lackluster aggregate growth in many of countries of the region.

Maize breeding. In the mid-1960's, Kenyan maize breeders released the first of a stream of improved open pollinating and hybrid varieties that radically altered productivity of rainfed maize cultivation. Yields rose by about 40%, even without fertilizer. Large commercial farmers adopted the new high-yielding varieties rapidly, and smallholders quickly followed suit. In favorable zones, 95% of both large and small farmers adopted the HYVs (Byerlee and Eicher, 1997). Although unsustainable financial subsidies artificially inflated production gains in many locations, the breeding breakthroughs have proven an undeniable success, with improved maize germ plasm shared across countries and currently benefiting roughly 60% of maize planted throughout the region (Smale and Jayne, 2003)

Cassava mosaic virus. In the late 1980's, a virulent new mutation of cassava mosaic virus emerged in Uganda and moved gradually southwards to Kenya and Tanzania destroying a over 500 local varieties of cassava on its way and threatening famine in the region. Rapid import of mosaic-resistant varieties from the International Institute of Tropical Agriculture (IITA) and accelerated trials by Ugandan breeders enabled a veritable army of agricultural research, extension staff and NGO's to multiply resistant varieties and distribute them to farmers in the region. Within five years, this crash testing and distribution program had brought the virus under control reversed the decline and resurrected production to its pre-invasion upward-trajectory (Otim-Nape et al., 2000; University of Greenwich, 2000).

Horticulture exports. From the early 1970's onwards, private traders from Kenya have steadily expanded high-value exports of fruits, vegetables, and later flowers. In Kenya, smallholders supply about 75% of all vegetable exports and 60% of all fruit exports. One of the country's fastest growing foreign exchange earners, horticultural exports have tripled in real terms over the past 30 years, growing to \$175 million in 2000. More recently, exporters from Ethiopia and Uganda have entered this lucrative trade, particularly in flower exports where high altitude improves quality (Minot and Ngigi, 2003).

Small-scale dairy. Dairy production in Kenya has grown rapidly in recent decades resulting in per capita production double the levels found elsewhere on the continent. Smallholders have captured a steadily rising share of that market. Today 600,000 small farmers operating 1 to 3 dairy cows produce 80% of Kenya's milk. By the year 2000, nearly 70% of Kenyan smallholders produced milk and it had become their fastest growing income source. Among the small farmers who produce milk, annual net earnings from milk average \$370 per year (Ngigi, 2003; Ahmed, Ehui and Assefa, 2003; Gabre-Madhin and Haggblade, 2003).

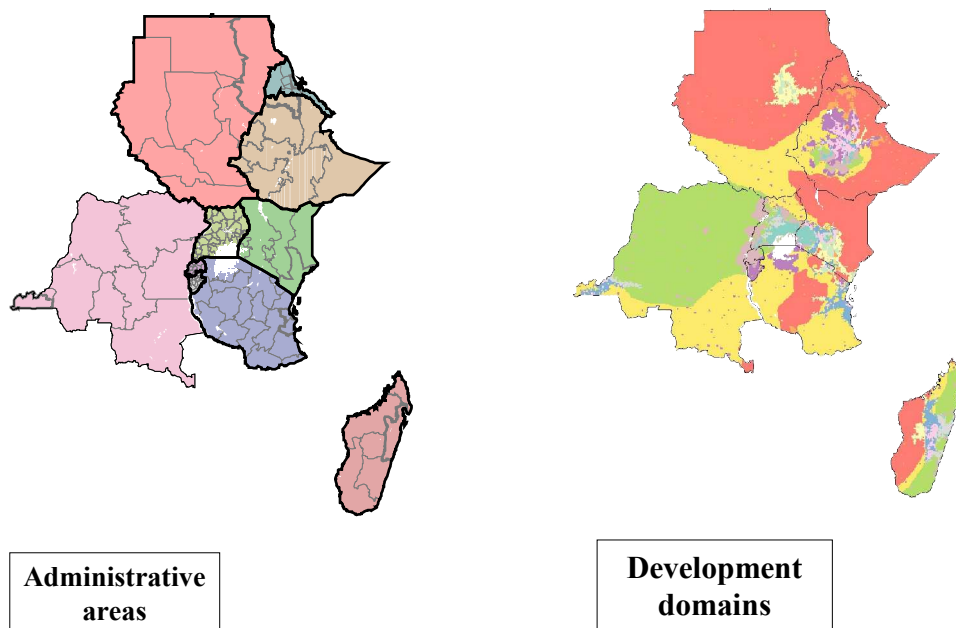
Rice. In Sukumaland during the 1980's and 1990's, Tanzanian farmers responded to changing market and ecological conditions to develop new systems for rice intensification in lowland valleys. By constructing bunds and experimenting with new agronomic practices, they achieved relatively high yields of 3-4 tons per hectare. Within a decade, they converted this semi-arid region into a significant rice-exporting zone (Meertens, 1999).

Tissue culture bananas.

B. Sharing across countries

Because agro-ecological zones cut across political boundaries (Figure 6), technologies developed in one country frequently find fertile ground across the border in similar environments of neighboring countries. With maize breeding, cassava, bananas and pulses, the region has benefited from regional technology sharing and spillovers. Figure 7 illustrates projected regional benefits from research and development expenditures on beans research.

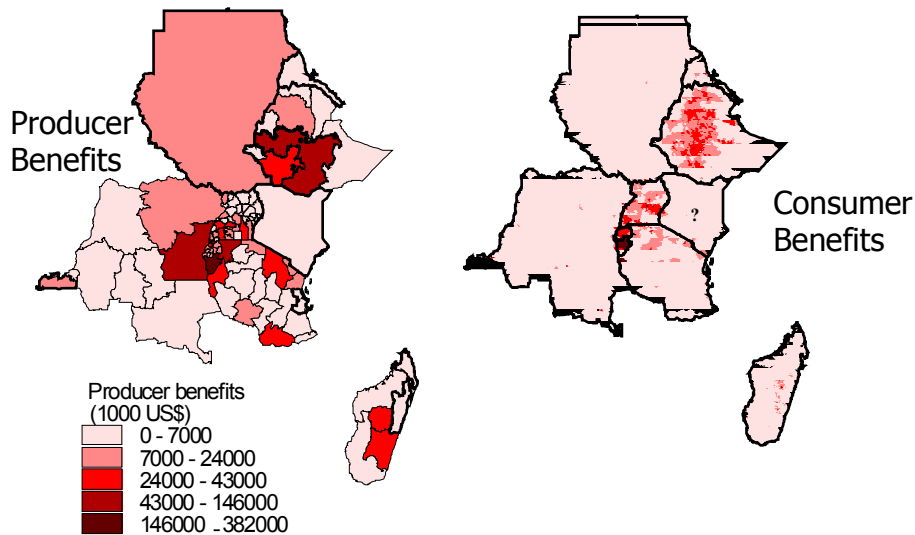
Figure 6 – Political and Agro-ecological Boundaries



Source: Thornton, Wood and Freeman (2003).

Figure 7 – Projected Regional Gains from Beans Research

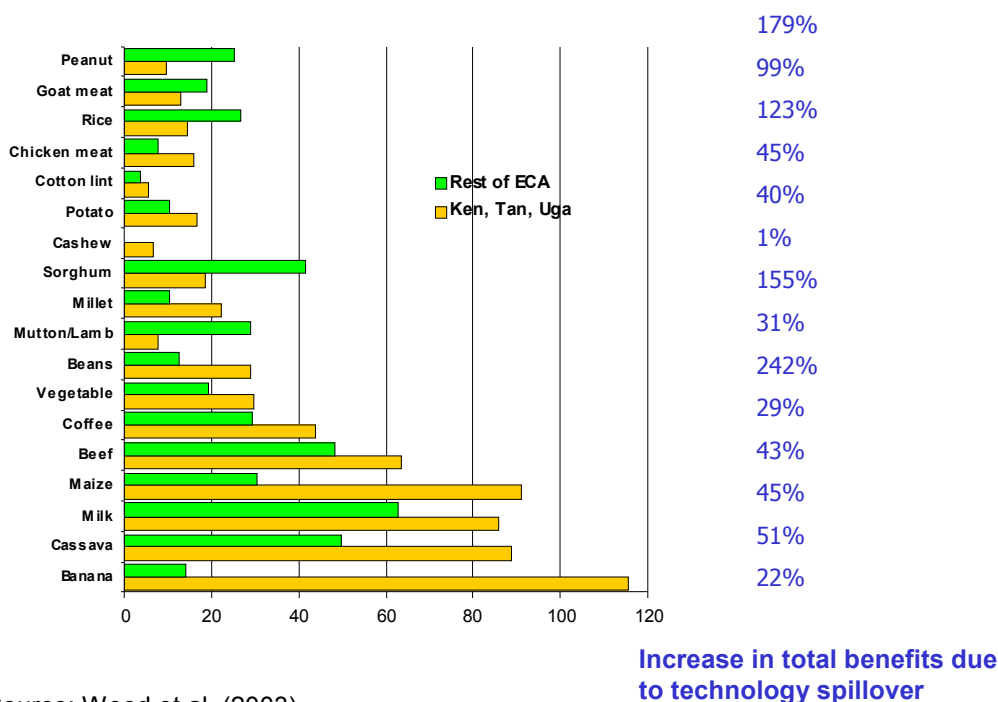
Approximate Geographic Mapping of Benefits from Beans R&D in East Africa



Source: Wood et al (2000)

Using IFPRI's DREAM model, Figure 8 illustrates anticipated benefits from agricultural technology development in the Greater Horn, with and without regional spillovers (see Wood et al, 2000 for a full description of the DREAM model). The simulations which produce these estimates first compute income gains to producers and consumers from R&D expenditures in Kenya, Tanzania and Uganda for over a dozen specific commodities. The yellow bar indicates the direct gains, in the case of bananas over \$100 million in anticipated direct benefits. Spillovers to other banana growing and consuming countries in the region increase total benefits by an additional \$15 million over the 2004 to 2020 time period. With other commodities, spillovers are even greater. In cassava, for example, direct gains amount to about \$90 million while spillovers add an additional \$50 million. Clearly the regional spillovers can be substantial. One primary goal of this conference is to identify specific significant prospects for such technology sharing.

Figure 8 – Research and Development Benefits with Technology Spillovers, (projected benefits of a 1% productivity gain from 2004-2020)



Source: Wood et al. (2003)

C. Opportunities for regional trade

Because the timing of rains and crop seasons differ across regions and across countries, countries consuming the same crops may find lower prices across the border than domestically, particularly during the local lean season. In response to such seasonal price differentials, private maize traders ship grain from Uganda to western Kenya, from northern Tanzania to coastal Kenya and from southern Tanzania into Malawi.

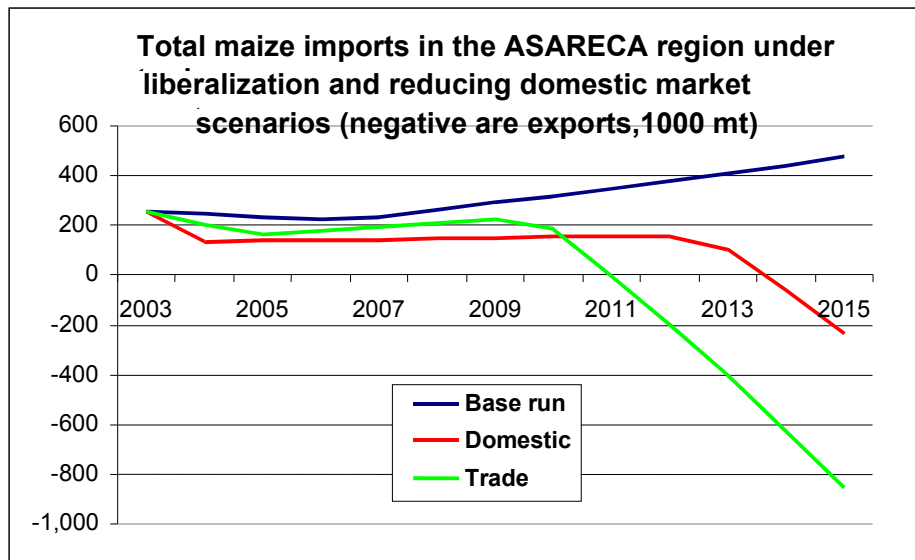
Markets for domestic food staples currently account for 80% of the value of all agricultural commodities in the region (Table 8). And given income levels and the structure of incremental consumer spending, projections through 2020 suggest that these markets will grow most rapidly of all (Diao et al., 2003). As a result, incentives for cross-border trade in food staples are likely to grow significantly over the next several decades. Yet trade protocols and policies across countries are not fully harmonized, constricting these flows and forcing significant share of cross-border trade to informal channels (RATES, 2003).

Using a multi-market regional trade model, in which prices and production are endogenous and equalized by trade flows, Diao and colleagues (2004) project aggregate gains to investments in marketing infrastructure and agricultural trade liberalization in the region. Table 9 summarize the impact of a 50% reduction in domestic marketing margins or trade barriers on GDP within the region. Both increase aggregate income gains compared to the baseline, although reduction of domestic marketing margins yields the higher gains.

Trade liberalization involves tradeoffs in aggregating gains and losses to farmers and consumers. While consumers in importing countries win, as do farmers in exporting countries, surplus farmers in importing countries see their incomes fall. For this reason, the detailed simulations discussed by Diao et al. (2004) emphasize the benefits of trade liberalization coupled with simultaneous investments in productivity increasing technology and reduced marketing margins in importing countries.

Trade liberalization significantly alters the profile of net regional maize imports, reducing them below zero (that is the region becomes a net maize exporter) by about 2012 (Figure 9). Likewise, trade liberalization offers important equity gains by enabling poor consumers price relief from high staple food prices. For example, cross border maize flows from Uganda to Kenya help to reduce food prices of low-income Kenyans in the Lake Victoria region of Western Kenya (Figure 10).

Figure 9 – Trends in Maize Imports into the Greater Horn

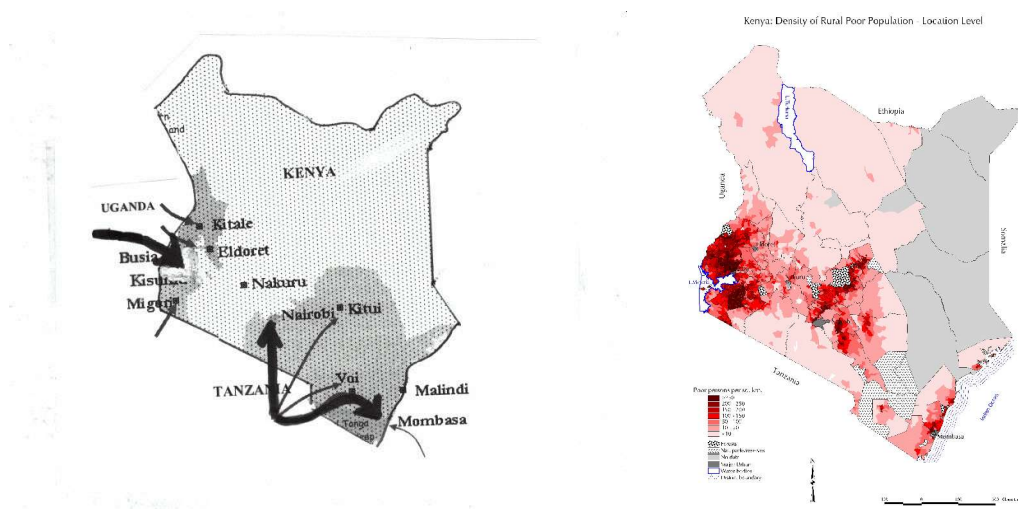


Source: Diao et al. (2004)

Figure 10 –Poor Consumers Gain from Regional Trade

Regional maize flows

Kenya poverty map: poor people per km²



Source: FEWSNET, Foodnet, RATES, ILRI.

Table 8 -- Agricultural Markets in the Greater Horn of Africa, 2000

	Market Value, 2000	
	(\$ billions)	percent
Traditional exports	2.2	11%
Nontraditional exports	1.5	8%
Regional trade	0.3	2%
Domestic food staples	15.9	80%
Total	19.9	100%

Source: Diao (2003).

Table 9 -- Impact of Reduced Marketing Costs

Country	GDP Growth Rate, 2004-2020		
	Baseline	50% reduction in	
		domestic marketing margins	regional trade barriers
Burundi	2.1	2.8	2.2
Eritrea	1.4	2.1	1.6
Ethiopia	2.5	3.3	2.6
Kenya	2.5	3	2.6
Rwanda	3.7	4.6	4
Sudan	3.6	4.2	3.7
Tanzania	3.6	4.4	3.9
Uganda	4.1	4.8	4.3

Source: Diao et al. (2004)

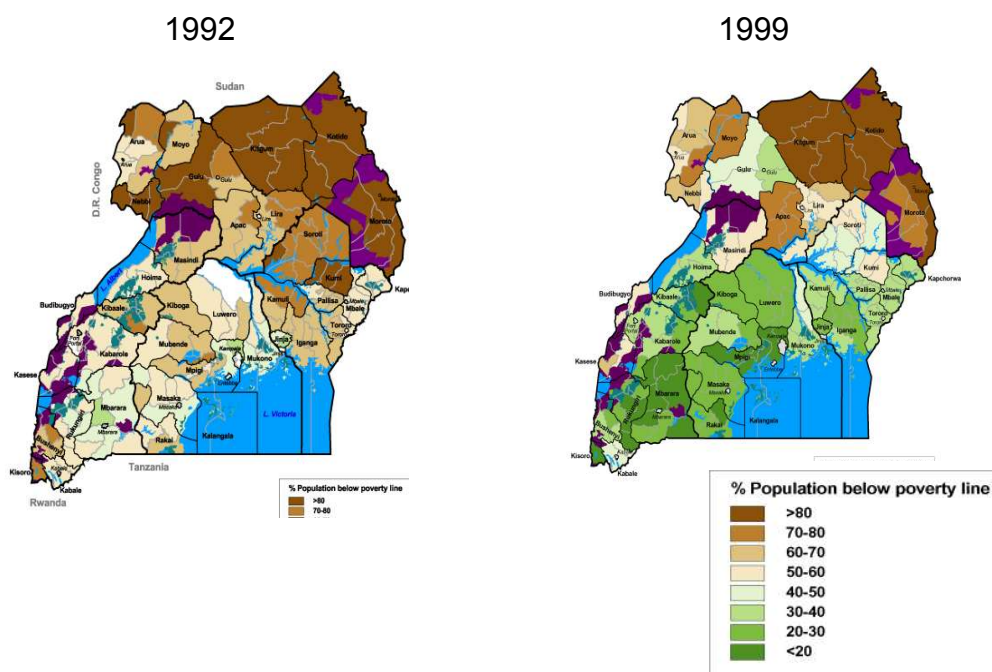
IV. CONCLUSIONS

Agricultural growth is not only necessary for significant poverty reduction, it is also clearly possible as recent performance from Uganda suggests. With the region's fastest growth in agricultural incomes in the past decade, Uganda has also achieved the most rapid poverty reduction (Figure 11). Productivity growth in agriculture, which raises incomes and lowers food prices, can prove a powerful vehicle for poverty reduction.

Recent projections from Ethiopia demonstrate that commodity selection will also play a role and that productivity gains in food staples will result in the most rapid poverty reduction over the next decade and a half (Figure 12). Improved regional trade, by increasing incentives for the most efficient farmers in the region and by softening price hikes confronting poor consumers of basic staples, can likewise contribute to improved regional food security (Figure 10).

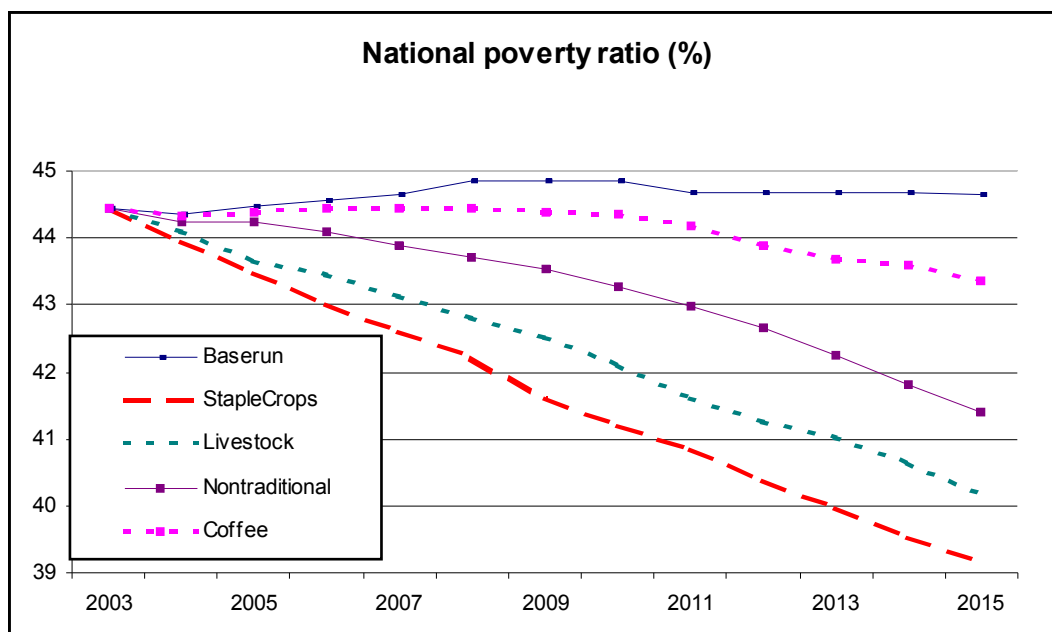
The region has witnessed many significant agricultural successes over the past four decades. Goal of this conference to look regionally to identify promising new efforts and through them seize priority opportunities for accelerating agricultural growth and improving food security in the region.

Figure 11 – Poverty Reduction in Uganda, 1992-1999



Source: UBOS, ILRI, World Bank (forthcoming)

Figure 12 – Payoffs to Agricultural Growth in Ethiopia
 (impact of 4% productivity growth in alternate commodity subsectors)



Source: Diao et al. (2004).

REFERENCES

- Ahmed, Mohamed A.M.; Ehui, Simeon and Assefa, Yemesrach. 2003. "Dairy Development in Ethiopia." Environment and Production Technology Division Working (forthcoming). Washington, DC: International Food Policy Research Institute.
- Benson, Todd. 2004. "Africa's Food and Nutrition Security Situation: Where Are We and How Did We Get Here?" Keynote paper prepared for the 2020 Africa Conference "Assuring Food and Nutrition Security in Africa by 2020" Kampala, Uganda, April 1-3. Washington, DC: International Food Policy Research Institute.
- Byerlee, Derek and Eicher, Carl, editors. 1997. Africa's Emerging Maize Revolution. Boulder, Colorado: Lynn Reinner.
- De Onis, M.; Blossner, M.; Borghi, El; Morris, R.; and Frongillo, E.A. 2004. "Methodology for estimating regional and global trends of child malnutrition." International Journal of Epidemiology.
- Diao, X.; Dorosh, P. and Rahman, S. 2003. "Market Opportunities for African Agriculture: An Examination of Demand Side Constraints on Agricultural Growth." Development Strategy and Governance Division Discussion Paper No.1. Washington, DC: International Food Policy Research Institute.
- Diao, X.; Chamberlin, Jordan; Omamo, Steven Were; and Wood, Stanley. 2004. "Strategies for Agricultural Productivity Increase in the ASARECA Region." Kampala, Ugand: ASARECA.
- Gabre-Madhin, Eleni and Haggblade, Steven. 2004. "Successes in African Agriculture: Results of an Expert Survey." World Development 32(5):745-766.
- Meertensj, H.C.C. 1999. Rice Cultivation in the Farming Systems of Sukumaland, Tanzania. Amsterdam: Royal Tropical Institute.
- Minot, Nicholas and Ngigi, Margaret. 2003. "Are Horticultural Exports a Replicable Success Story? Evidence from Kenya and Cote d'Ivoire." Environment and Production Technology Division Working Paper No.114. Washington, DC: International Food Policy Research Institute.
- Ngigi, Margaret. 2003. "The Case of Smallholder Dairying in Eastern Africa," Environment and Production Technology Division Working Paper No.118. Washington, DC: International Food Policy Research Institute.
- Otim-Nape, G.W., Bua, A.; Thresh, J.M., Baguma, Y., Ogwal, S., Ssemakula, G.N., Acola, G., Byabakama, B., Colvin, J., Cooter, R.J., and Martin, A. 2000. The

Current Pandemic of Cassava Mosaic Virus Disease in East Africa and its Control. Greenwich: Natural Resources Institute.

Regional Agricultural Trade Expansion Support (RATES) Program. 2003. Regional Maize Trade Policy Paper. Nairobi: RATES.

Schoenbaum, D.L. 1993. "Cattle Herds and Banana Gardens." African Archaeological Review II:39-72.

Smale, Melinda and Jayne, Thomas. 2002. "Maize in Eastern and Southern Africa: 'Seeds' of Success in Retrospect." EPTD Discussion Paper No.97. Washington, DC: International Food Policy Research Institute.

University of Greenwich. 2000. "An Application Nominating the National Agricultural Research Organization of Uganda (NARO) for the King Baudouin International Development Prize." January 19, 2000. Greenwich: United Kingdom.

Wood, Stanley. 2000. "The DREAM Model." Washington, DC: International Food Policy Research Institute.

ANNEX TABLES

Table A.1 -- Food Availability in the Greater Horn of Africa, 2002

	Total Availability for Human Consumption ('000 metric tons)									Total
	Burundi	Djibouti	Eritrea	Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda	
Cereals										
production	261	0	68	9,107	3,270	311	3,736	4,347	2,328	23,428
+ net import	38	197	470	1,596	911	40	1,264	788	181	5,485
- seed, feed and waste	105	102	49	1,022	345	70	656	997	948	4,294
= human consumption	194	95	489	9,681	3,836	281	4,344	4,138	1,561	24,619
Roots and tubers										
production	1,707	5	118	4,724	2,284	3,489	172	8,089	8,511	29,099
+ net import	0	0	0	-3	3	-413	2	7	0	-404
- seed, feed and waste	150	0	10	480	284	263	20	1,350	3,357	5,914
= human consumption	1,557	5	108	4,241	2,003	2,813	154	6,746	5,154	22,781
Bananas and plantains										
production	1,603	0	0	82	1,138	2,785	74	752	10,503	16,937
+ net import	0	1	0	-1	0	0	0	0	-2	-2
- seed, feed and waste	978	0	0	8	137	1,492	11	207	5,392	8,225
= human consumption	625	1	0	73	1,001	1,293	63	545	5,109	8,710
Pulses										
production	280	0	39	1,043	387	263	273	445	696	3,426
+ net import	3	2	6	20	3	10	31	-31	-4	40
- seed, feed and waste	34	1	6	131	11	25	35	55	83	381
= human consumption	249	1	39	932	379	248	269	359	609	3,085
Meat										
production	23	11	28	549	458	36	697	361	293	2,456
+ net import	0	1	0	-1	1	0	-8	1	0	-6
- seed, feed and waste	0	0	0	0	0	0	0	0	0	0
= human consumption	23	12	28	548	459	36	689	362	293	2,450
Milk										
production	28	14	57	1518	2595	158	5056	935	700	11,061
+ net import	3	44	7	13	29	0	116	19	7	238
- seed, feed and waste	1	1	3	63	149	8	210	25	37	497
= human consumption	30	57	61	1,468	2,475	150	4,962	929	670	10,802

Source: FAOSTAT.

Annex Table A.2 -- Food Consumption Profile of the Greater Horn of Africa, 2002

	Per capita food availability (kcal/person/day)									
	Burundi	Djibouti	Eritrea	Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda	Total*
Cereals	256	1,169	1,078	1,267	1,042	299	1,137	1,016	514	1,011
maize	179	14	42	396	755	87	21	657	260	392
sorghum & millet	15	8	344	228	24	162	737	125	167	244
wheat	16	761	643	302	210	20	365	91	43	220
others	46	386	49	341	53	30	14	143	44	154
Roots and tubers	609	14	63	229	157	841	13	372	568	281
cassava	253	0	0	0	56	230	1	296	307	111
sweet potato	315	0	0	12	43	386	1	65	232	73
others	41	14	63	217	58	225	11	11	29	97
Pulses	348	14	90	127	112	276	77	91	227	134
Vegetable oils	14	380	146	33	176	38	186	124	37	96
Vegetables	21	28	5	10	27	15	19	18	14	16
Fruits	170	18	1	13	104	390	54	50	484	113
banana and plantain	156	2	0	2	73	381	3	35	481	93
others	14	16	1	11	31	9	51	15	3	20
Alcoholic beverages	153	15	19	12	23	113	4	68	151	47
Animal proteins	26	247	69	75	226	55	421	113	136	162
meat	18	97	39	41	74	21	116	50	74	61
milk	5	147	25	32	139	31	297	43	46	91
eggs	0	2	2	2	5	1	5	3	2	3
fish	3	1	3	0	8	2	3	17	14	6
Total calories (kcal/per/day)	1,649	2,220	1,513	1,857	2,117	2,084	2,228	1,975	2,410	2,034

* Population weighted average.

Source: FAOSTAT.

Table A.3 -- Caloric Availability in the Greater Horn of Africa, 2002

	Per capita food availability (kcal/person/day)									Total*
	Burundi	Djibouti	Eritrea	Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda	
Cereals	16%	53%	71%	68%	49%	14%	51%	51%	21%	51%
maize	11%	1%	3%	21%	36%	4%	1%	33%	11%	20%
sorghum & millet	1%	0%	23%	12%	1%	8%	33%	6%	7%	12%
wheat	1%	34%	42%	16%	10%	1%	16%	5%	2%	11%
others	3%	17%	3%	18%	3%	1%	1%	7%	2%	8%
Roots and tubers	37%	1%	4%	12%	7%	40%	1%	19%	24%	14%
cassava	15%	0%	0%	0%	3%	11%	0%	15%	13%	5%
sweet potato	19%	0%	0%	1%	2%	19%	0%	3%	10%	4%
others	2%	1%	4%	12%	3%	11%	0%	1%	1%	5%
Pulses	21%	1%	6%	7%	5%	13%	3%	5%	9%	7%
Vegetable oils	1%	17%	10%	2%	8%	2%	8%	6%	2%	5%
Vegetables	1%	1%	0%	1%	1%	1%	1%	1%	1%	1%
Fruits	10%	1%	0%	1%	5%	19%	2%	3%	20%	5%
banana and plantain	9%	0%	0%	0%	3%	18%	0%	2%	20%	4%
others	1%	1%	0%	1%	1%	0%	2%	1%	0%	1%
Alcoholic beverages	9%	1%	1%	1%	1%	5%	0%	3%	6%	2%
Animal proteins	2%	11%	5%	4%	11%	3%	19%	6%	6%	8%
meat	1%	4%	3%	2%	3%	1%	5%	3%	3%	3%
milk	0%	7%	2%	2%	7%	1%	13%	2%	2%	4%
eggs	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
fish	0%	0%	0%	0%	0%	0%	0%	1%	1%	0%
Total calories (kcal/person/day)										
percent	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
kcal/person/day	1,649	2,220	1,513	1,857	2,117	2,084	2,228	1,975	2,410	2,034

* Population weighted average.

Source: FAOSTAT.