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POPULATION-RESOURCE PRESSURE AND VULNERABILITY TO FOOD INSECURITY AND MALNUTRITION: MULTI-LEVEL ANALYSIS IN 16 DROUGHT-PRONE DISTRICTS THROUGHOUT ETHIOPIA

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I. INTRODUCTION AND JUSTIFICATION

Ethiopia has suffered from increasingly frequent hunger and malnutrition in the past 10 years, with the 1999-2000 and 2002-2003 famines affecting the most people ever. Up to 15 million people were highly affected in the agricultural year 2002-2003, that is, over 25% of the rural population of nearly 60 million, and over 5 million chronically food insecure each year (FEWS-Net, 2003).

With a high annual population growth rate of around 2.7%, pre-transitional fertility in rural areas (6.4 TFR; DHS, 2000) and low modern contraceptive prevalence rates in rural areas

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(under 3% CPR; DHS, 2000), increasingly smaller farm plots (under ½ hectare average) and rampant environmental degradation, the issue of how population factors may increase vulnerability to famine and food insecurity has been debated. Some international and national agencies maintain that the demographic factors are a major cause of the famine and [†]environmental problems, and that the 1993 National Population Policy, which recognizes this problem, must be re-invigorated. Others, including many in the government, feel that they are not major causes and are satisfied with the current policy.

There are four distinct types of literature that this paper taps into:
1) Vulnerability and Resilience to Disaster (Dejene A., 1997; Alwang,2001; Webb et al, 199?; Teller, 1997)
2) Causes of food insecurity and malnutrition (Von Braun, 1992; Debebe H., 2001) ;
3) Population, land, environment and development (Bilsborow, 1987, 2001; Pender, 2004 Turner, 1996; Marcos E., 1997).
4) Program assessment and evaluation of national and international efforts towards famine prevention and excess mortality reduction (Riley, 2002; Ferris-Morris, 2003; DPPC/SERA, 2002; Marchione and Paul, 2003; Lautze, 2004; USAID/Addis Ababa, 2004).

The uniqueness of the historical, political, socio-economic and cultural situation of Ethiopia, which has suffered increasingly from famine, environmental degradation, hunger and malnutrition in the last 20 years (Rahmato, 1999; Mesfin W/M, 1986; FEWS-NET, Monthly Reports, 2003-2005; Devereau et al, 2003; Lautze, 2004; Berhanu, 2005).

Unfortunately, the specific role and weight of population factors (eg., growth, distribution, migration, density, composition, etc.) in vulnerability and resilience to drought and food insecurity/malnutrition consequences has not been adequately measured. The few research efforts have taken a more Malthusian approach (eg., Belay T. 1996; Assefa H/M 1994, Getahun T., 2002; Berhanu N., 2005), while a more balanced view, taking into consideration both Bosrupian and Malthusian approach has been few (eg., Pender and Gebre-Mehdin, 2002; 2004; Teller, 1996; 1997; 2004).

Here we look at three more holistic aspects of the population/food insecurity interrelationships, and consider the policy implications of the continuation of high levels of chronic hunger and malnutrition:

1- Identify the demographic characteristics of vulnerable communities and households
2- Analyze the relationship between demographic factors among the multiple causal levels of land scarcity, food insecurity and malnutrition , and
3- Make evidence-based recommendations for population and famine-reduction policies and programs

III. OBJECTIVES, CONCEPTUAL FRAMEWORK AND METHODOLOGY

The objective of the vulnerability research and development project (called here VRDP) to drought in Ethiopia (SERA Project, DPPC, 2002) from which most of the data come, was to profile the types of populations (communities and groups) most vulnerable to the shocks of drought, and the causes of chronic vulnerability to food insecurity and chronic malnutrition in 16 drought prone districts in the 4 main regions of Ethiopia (Fig. 1).

(**FIGURE 1**: **MAP** of the study 4 regions about here)

Study Areas

- Tigray
- Amhara
- Oromiya
- SNNPR

The five leading research questions of the VRDP were (SERA/DPPC, 1999):

1. Who are vulnerable to a particular hazard?
2. Where do they live (by agro-ecology)?
3. When do they face these hazards most frequently?
4. What are the factors most highly associate with the vulnerability, and with the nature of their resilience and coping strategies?
5. Why/how do they become highly vulnerable?

This paper will focus on the role of demographic factors at different levels of analysis within a district, in the increase in vulnerability to famine and food insecurity, taking into account other physical, organizational, institutional, economic and socio-cultural and policy dimensions. It will utilize and triangulate multiple sources of data from primary household surveys and community interviews and focus groups, to secondary data from multiple government and non-governmental sectors.

The working hypotheses for this demographic paper are:

1- Neither the Malthusian nor the Bosrupian responses to population pressure can be readily predicted: high density can either increase vulnerability or strengthen resilience, depending on other historical, contextual (agro-ecological, cultural, institutional) and community factors.

2- There is large within country variation in vulnerability to food insecurity and malnutrition which makes program targeting difficult, all four levels of data presented here (agro-ecological, community, household, individual) need to be taken into account.

3- The household demographic factors that most effect food and nutrition insecurity are access to arable land and oxen, adult household labor and family size.

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The whole institutional and decentralized process of rigorous research, vulnerability profile development and intervention package design was a unique collaboration between the host Federal government institution, DPPC, and the 4 major regions , their 8 zonal and 169 district governments (DPPC/SERA, 2002).

The quantitative and qualitative primary data collection focused on district and subdistrict levels. The household surveys were a multi-stage, stratified random sample in 16 districts around the country – and 93 communities (Teller, 2000). The sample size was nearly 10,000 households, 9700 women of reproductive age, children aged 3-36 months. It also included 1300 key informants and 93 community group discussions. The data collection methods consisted of three different sources of data: secondary, multi-sectoral data, primary rapid rural appraisal and primary household and women's survey and women's and child anthropometry. The secondary data were collected between 1999-2001, and the primary

data between February and April, 2000, during the early stages of the 2000 (i.e., 1992-93 Ethiopian calendar) famine.

The whole institutional and decentralized process of rigorous and standardized research, vulnerability profile development and intervention package design was a unique collaboration between the host Federal government institution, DPPC, and the 4 major regions, their 8 zonal and 16 district governments. Key to the success were the formation of so-called Vulnerability Technical Working Groups established at Zonal level and manned by masters' degree researchers (from demography, social and agricultural sciences) from these very zones with extensive knowledge of the language, culture, history and politics. They, with the support of the regional and zonal governments, were able, to pull in experienced personnel and resources from related line ministries and NGOs working in the project districts.

The main spatial demographic variables are population size, agricultural density, agro ecological zone and spatial distance to urban centers, while the main micro factors included household size and composition, marital status, adult labor, land and cattle density, migration, fertility, mortality and morbidity.

The following is the conceptual framework utilized in the VRDP, which was then supplemented with a document on National Vulnerability Development Guidelines (DPPC/SERA, 1999):

(FIGURE 2: CONCEPTUAL FRAMEWORK ON CAUSES OF CHRONIC VULNERABILITY IN RURAL AREAS -- ABOUT HERE)

III. THE DEMOGRAPHY OF HUNGER, MALNUTRITION AND POOR HEALTH STATUS: EMPIRICAL FINDINGS IN THE 16 DISTRICTS

A. Demographic Profile of the drought-prone districts

Table 1: Demographic Indicators in sampled 16 drought-prone Districts, Household Survey*, 2000

Region, Zone (A,B) & District (1,2)	Rural Pop. 1999 (000s)*	Pop. Density per km2 (crude, Agri.)*	Rural Fertility (CEB 45-49/TFR 15-49)	Rural Mortality/ 1000 (persons <5 yrs.)	% Rural Female Headship	% Rural Females 15-49 formerly married	% Households with an outmigrant in last 10 yrs.	% adults as seasonal migrant past 12 months Male/Fem
Amhara								
A1	136	48	5.7/7.1	217	26.9	33.0	4.3	20/
A2	54	18	6.3/6.8	240	--	--	12.6	40/17
B1	172	84	7.1/7.3	278	16.0	19.8	7.5	--
B2	91	118	7.6/7.5	369	28.6	20.2	16.6	9/
Oromiya								
A1	166	82/562	8.8/	308	18.0	--	--	--
A2	196	147/	7.9/	268	21.9	--	--	10/
B1	153	106	8.3/	253	18.5	32.2	9.6	--
B2	111	108	7.7/	195	18.4	14.2	16.6	16/6
Southern								
A1	187	409	8.6/	251	8.8	18.3	28.6	--
A2	288	364	7.5/	218	15.1	6.3	17.1	--
B1	105	137	--	203	23.7	--	16.3	--
B2	112	89	--	213	8.3	--	4.0	1/
Tigray***								
A1	102	111	7.2	121	44.2	44.6	--	16/12
A2	90	127	--	131	43.4	40.4	--	4/4
B1	139	117	7.3	128	42.7	39.3	--	20/10
B2	63	50	--	174	26.0	29.3	--	16/4
NATIONAL				M/F				
Census 1994	46Mil			186/170				
DHS 2000**				187.8	21.3	12.3		

Sources: all but first two columns from SERA Household survey, Feb.- April, 2000, in Teller, 2001; stratified (by AEZ), random survey is representative of the wereda but not

of the entire Zone or Region; **DHS from CSA/Macro, 2001; *1994 Census in CSA, 1995; *** First 3 districts located on or near the border war zone with Eritrea, 1998-2001 conflict.

Table 1 shows……..

Figure 3-

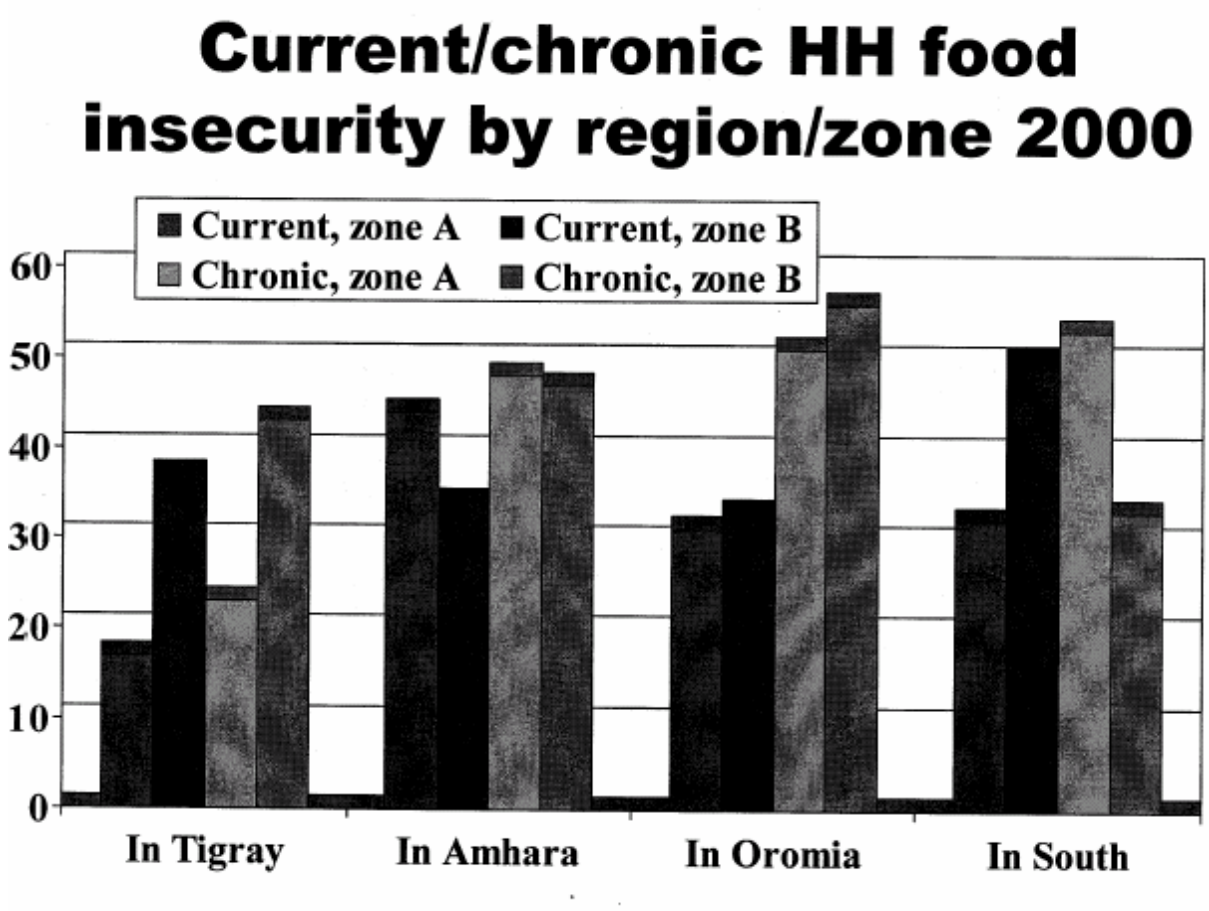


Figure 3 shows levels of current, acute food insecurity (the darker of the two columns to the left for the two drought-prone zones) in each region. On the far left, in the 4 study wereda in the 2 zones of Tigray, there is a range from a low of 17% current food insecurity in zone A, to more than double (38%) in zone B. In terms of chronic food insecurity, on the far right in the South, you find 32% in zone A and 52% in zone B (the infamous "green hunger zone" of Welleita) . The highest combined levels on both indicators are found in the second zone of Oromia (highly vulnerable Eastern Hararghe).

Figure 4-

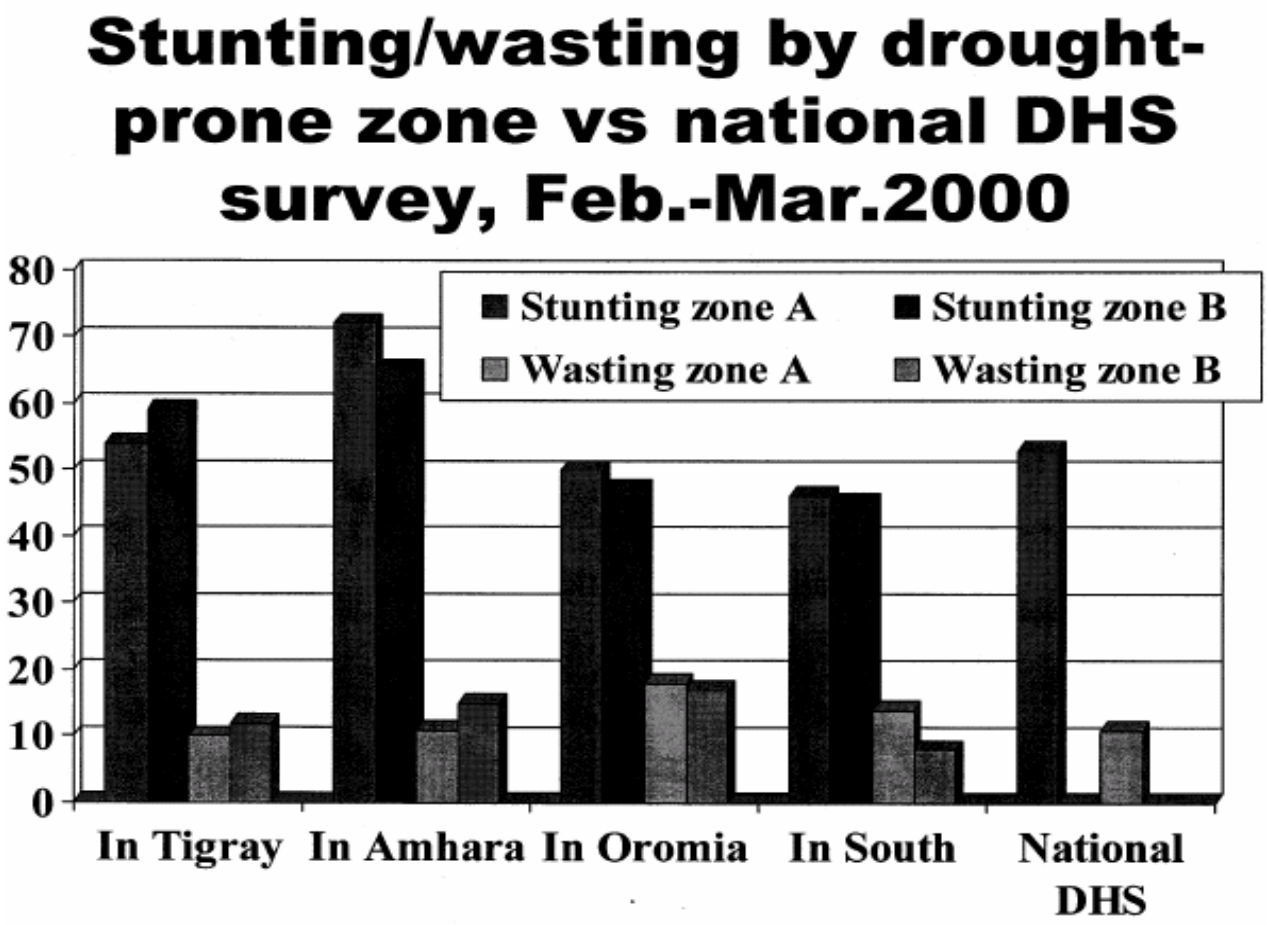


Fig. 4 shows that stunting in the 4 study districts of the two zones in Tigray and in the 4 districts of the two zones inAmhara are higher than the DHS national levels (far right bars). Wasting is alarmingly high (18%) in the 2 study zones of East Hararghe of Oromiya where famine hit hard, but also in those of North Shewa.

Table 2- Levels of literacy, health status, health care utilization, clean water and mortality by 4 study regions, 8 zones and 16 districts, Household Survey in Feb.-April, 2000, as compared to the National Rural DHS, 2000

Region, Zone (A,B) & District (1,2)	% Female Illiteracy, Age 7yrs.+	Prenatal: % Women with TT2	% children 12-23 mo. with BCG shot	% children 12-23 mo. with DPT 3 shot	Under five mortality (per 1000)	% HH w/ access to clean* drinking water, dry season	No. of Households Sampled**
Amhara							
A1	95	4	18	1	217	-	798
A2	--	0	16	3	240	-	
B1	89	10	77	41	278	31	812
B2	90	11	80	50	369	17	385
Oromiya							
A1	96 m&f	18	17	20	308	-	609
A2	90m&f	13	17	16	268	-	603
B1	86m&f	6	12	4	253	47	600
B2	93	5	--	5	195	-	600
Southern							
A1	78	--	12	35	251	-	588
A2	74	--	46	35	218	-	700
B1	70	15	39	48	203	27	598
B2	88	--	22	30	213	-	600
Tigray							
A1	76	46	91	57	121	33	651
A2	81	15	88	60	131	44	650
B1	68	36	96	54	128	45	779
B2	94	21	87	46	174	55	485
DHS 2000* Rural total	84	14	43	17	188		

*- piped and protected well;**- stratified random sample, representative of the three AEZs of each wereda, but <u>not</u> representative of the entire zone or region

Table 2 shows……..

B.The Demography of Hunger: Profiles of Vulnerable Populations in High Density and Low Density Districts

1. High Density: Badewacho and Lemu in Hadiya Zone, Southern Region
2. Low Density: Ziquala and Sekota in Wag Himra Zone, Amhara Region

Table 3: Population factors and food and nutrition security by a high density and low density zones and districts, 2000

High/low Density and Zone-District	Population Factors			% Population affected by disaster and needing food aid (1994-1998)	% Food Insecure (chronic/ current)	% Children malnou-rished (-2sd stunted/ wasted)
	Size 2000	Growth Rate ('84-'94)	Density (crude/Ag).			
HIGH-Hadiya						
Badewacho	187		410	4.3	--	46/16
Lemu	288	2.6%	292/325	5.1	86.1/22.1	43/13
LOW-Wag Himra						
Sekota	136	3.5%	48/280	51.9	/41.7	74/10
Ziquala	54	2.5%	18	61.8	/40.7	59/13

Sources: Teller, 2001, adapted for Hadiya from Yohannes and ? et al, Vulnerability Profiles, DPPC/SERA, 2002; and for Wag Himra, from Demeke et al, VP, DPPC/SERA, 2002; EWS, DPPC

Tables 3 shows……

Table 4: Intra-district variations in population-land pressure, food insecurity and malnutrition indicators, by selected high (Lemo) and low (Sekota) density districts and agro-ecological zone, 2000

District and AEZ	Pop./Agr Density (pop per km2/pop per km2 of arable land)	Ave. land holding/ HH (hectares)	Perceived severe soil erosion current-ly. (% HHs)	Perceived food insecurity (% can't satisfy annual food require-ment)	Current Food Insecurity (% no stocks left)	Young child (3-36mo.)mal-nutrition (% stunted -2sd)	Women's undernutrition (women 15-49 with thin mid-upper arm (MUAC) (% <22.5cm)	Ever-married women ever used family planning (% women 15-49)
SEKOTA (low density)	**48/280**		**57.9**	**45.4**	**41.7**	**73.8**	**68.8**	
-Dega		.65	80.0			93.8		
-W/Dega		.76	61.3			74.1		
-Kolla		.94	37.5			67.3		
LEMO (hi density)	**364/400**	**.80**	**44.0**	**21.1**	**22.0**	**43.1**	**24.9**	**2.4**
-Dega		.52	94.9		6.0	37.1		2.6
-W/Dega		.80	34.4		30.3	56.7		4.1
-Kolla		.91	26.7		19.3	36.6		0.5

Sources: Household survey and key informant interviews; Adapted from Yohannes Y and Demeke E. et al, Vulnerability Profiles, 2002, see above; N=800 HHs in Sekota, and 700 in Lemo

In writing their Vulnerability Profiles reflecting on the data in table 4, the local researchers from Sekota district, Wag Himra Zone comment on their data: "Nowadays, food production and population growth have ceased to keep in balance…It is not the pressure exerted on land resources due to growth of population that is increasing, rather it is the size and quality of cultivable areas that is decreasing and deteriorating, thereby decreasing the returns from the land… Agricultural density has grown to 280 persons per square kilometer in 2000." (DPPC/SERA, Vulnerability Profile, Sekota Wereda, November, 2001, Chapter 8.3.1)

The researchers from Lemo district, Hadiya zone, comment that land is the most scarce resource

throughout Lemo, but most scarce in the highland and next in the midland. However, the latter two area's carrying capacity is better than the lowland since a wide variety of crops grow there. "As a result of this population pressure, land resources are highly depleted. All sources agree that about 88% of the total land ara are already cultivate, and practices such as land fallow are almost impposible due to shortage of land. Similarly, area of land with natural forest is almost no existent at present. Rather, every field is invaded by eucalyptus. Due to repeated cultivation, soils are exposed to both visible erosion and invisible erosion." (DPPC/SERA, Vulnerability Profile, Lemo Wereda, September, 2001, Chapter 8.1)

C. Classification of the demographic and agricultural characteristics of highly vulnerable groups:

The qualitative data help to elucidate the context and process by which some communities and household are more resilient and others more vulnerable (see Ali Hassan, 2001 and District VPs):

Table 5: Characteristics of Highly Vulnerable Households in Low and High Density Districts

Highly Vulnerable Households (Agro/economic and Socio-demographic factors)	**Low Density**	**High Density**
POOR ASSET BASE		
Landless (or less than ¼ hectare)	X	X
Oxen less (w/o sharing mechanisms)	X	X
Poor access to market and vital services	X	
Old-Age head of household (w/disabilities)		X
Dependent only on agriculture	X	
Very small plot (of famine food)		X
SOCIO-DEMOGRAPHIC STRESS		
New formed household (inadequate adult labor)	X	X
Old age head of household (w/ disabilities)	X	X
Large family size (with >4 children under 10)	X	
Female-headed households (lacking farm labor)	X	X
Illiterate head (and spouse) of household		X

Source: Key informant interviews and focus groups, SERA project, 2000

D. IMPROVE RESILIENCE TO DROUGHT

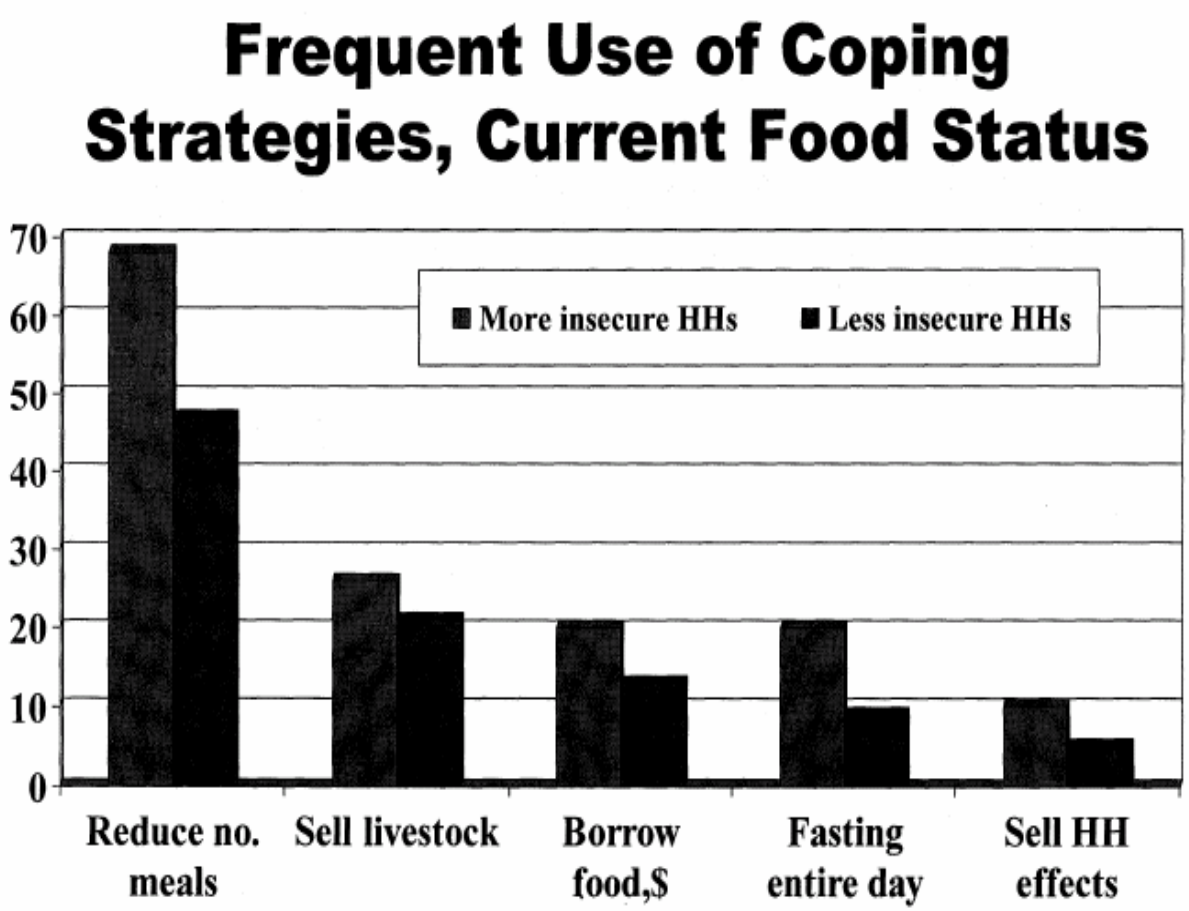
Table 6: Factors of Resiliency and Local Capacity in High and Low Density Districts

Resiliency factors/local capacity	Higher Density (Lemo)	Lower Density (Sekota)
Service centers nearer to the villages	X	
Off-farm petty trade and daily labor	X	X
Early famine warning	X	X
Seasonal outmigration	X	X
Relief/rehab programs	X	X
Small irrigation schemes		X

Source: Yohannes; Demeke E. and Ali H., 2001)

E. Coping Strategies: Frequency of Use by Degree of Asset Depletion and Irreversibility, Tigray Region (Alemtsehay A., 2001)

Figure 4:



In Figure 4, we can see how the more process oriented and qualitative research looks, among other things, at coping strategies during food scarcity. In the graph above, we compare the more insecure households on the left bar, and the less insecure ones on the right bar, for each of the five important strategies frequently used in times of food shortage in the 10 years prior to the survey (Alemtsehay A., 2001, in Tigray Region). The first (reduce number of meals) is considered a reversible strategy (more adaptive and risk aversion), the other four irreversible with permanent asset reduction. It is startling to see that nearly two-thirds of the more insecure households reduce the number of meals, and that 20% go the entire day fasting without eating. Female-headed households are

more likely to frequent meal reduction, while male-headed households the selling of livestock. Food for work and employment generation schemes are examples of risk minimization, in among 18% of the households across the 16 districts.

F. Multivariate and multilevel analysis of the demographic factors related to vulnerability to food insecurity and malnutrition

Table 7:

Multilevel factors related to high chronic food insecurity

LEVEL	% FOOD INSECURE (ave=43%)
Individual	Sex Head of HH: Male=40; Fem.=54
Household	Land Used: 1+ Ha.=42; None=62
Community	Distance from town: Near=34;Far=50
Sub-district	Agro-ecol.: Midland=40;Highland=50
District	Drought affected: Med.=42;High=53

In table 7, multivariate analysis was employed at the household, community and district levels to control for the many factors in the comprehensive conceptual framework. In the table above, odds ratios on both current and chronic food insecurity are presented to at least the .05 level**.** For current food shortage during the 2000 famine year (i.e., food stocks lasting under 3 months), land, oxen, female-headed household had a significantly

greater likelihood of being food insecure, as well as communities far from the district capital. The most significant co-variate is the percentage of the population assessed annually by the Early Warning System of the Ethiopian Government to be food aid needy. It is important to note that the low population density populations are more vulnerable to current insecurity. Looking at the chronic (last column), while the direction of the signs is the same, except for the density variable, where the highland communities are more chronically vulnerable (in all probability, the Belg and or short rain dependent areas).

Table 8:

Multi-level factors related to high chronic child malnutrition

FACTORS	% STUNTED (ave. 54%)
Individual	Sex Head of HH: Male=54;Fem.=58
Household	Land Use: Has land=54; None=58
Community	Water quality: Piped=52;Un-piped=56
Sub-district	AgroEcology:Highland=51;Lowland=56
District	Drought risk: Low=46; High=61

Table 8 shows the odds ratios on wasting and stunting, drought risk (satellite-generation vegetation density coefficients) was very importing for stunting, and percent food aid needy on wasting. The crude density, indicator, was not significant for either wasting nor stunting.

Table 9: Multi-level regression on household food insecurity (incomplete)

Level	Covariates	Household Food Security	
		Current	Chronic
		Out of food stocks <3 mo	Perceived highly inadequate
Household			
	Land owned		
	Oxen owned		
	Female-headed household		
	Age of household head		
	Literacy of household head		
	Number of adult laborers		
	Family size		
	Stress outmigration in HH		
Community			
	Distance to wereda capital/big town		
	Protected water supply		
	Access to basic services score		
	Piped water available dry season		
Agro-eco. Z.			
	Dega		
	Weina-Dega		
	Kolla		
District			
	Population density (crude)		
	Drought risk (NDVI ave. 1982-98)		
	% Population food aid needy (EWS)		
Total			

(TBD)

Table 10: Multilevel Regression on Young Child Malnutrition

Level	Covariates	Young Child Malnutrition (-2sd, 3-36 mo.)	
		Acute (wasting)	Chronic (stunting)
Individual	Age of child		
	Sex of child		
	Literacy of mother (y,n)		
	Nutrition status (MUAC) of mother		
	2 Other siblings under 5 yrs.		
	Age of HH head		
	Sex of HH head		
	Perceived size/health of child at birth		
	Immunization status (BCG or DPT3- y/n)		
Household			
	Land "owned"/used (timad)		
	Oxen owned (no.)		
	Literacy of household head (y,n)		
	Adult labor in HH (no.)		
	Family size (usual residence)		
	Outmigrant (stress reasons) left HH (in last x yrs)		
Communitmy			
	Distance (kms) to wereda capital/major market town		
	Dry season protected water supply (y,n)		
	Access to basic services (weighted score by importance and distance)		
Agro-eco. Z.			
	Dega (highland)		
	Weina-Dega (midland)		
	Kolla (lowland)		
District			
	Population density (pop/km2)		
	Drought risk (Vegetation cover, rainy season, coefficient of variation, 1982-98 ave., from satellite data and FEWS)		
	% Population "highly affected" by drought and in need of food aid (1994-98 ave.)		
Total			

(TBD)

IV. DISCUSSION: REGIONAL, DISTRICT AND LOCAL VULNERABILITY AND CAPACITY

We return to the three hypotheses and find that:

1- Neither Malthusian nor Bosupian: There seems to be no direct causal relationship between population pressure and food and nutrition insecurity. The effect of population density is contextual, technological, organizational and ecological; only one of the four major regions in taking the population pressure problem seriously (Southern).

2- Large in-country district variation in different types and timing of vulnerability makes it difficult to generalize and establish criteria for targeting of more effective famine prevention programs. The Belg-dependent areas seem to be suffering more often now that the traditionally vulnerable lowland areas.

3- The most important assets for household resilience to drought shock continue to be access to arable land, draft animals and adult labor.

The initial descriptive findings suggest that chronic food insecurity and chronic and acute malnutrition were major problems in these 16 districts over the ten-year period (1991-2000), but their magnitude differed by district, agro-ecological zone, community and household. Crude population growth and density were not consistently associated with hunger or malnutrition, but environmental degradation, land shrinkage, land and cattle pressure and family composition factors were.

However, even given these high vulnerability factors, the study weredas in Tigray showed better resilience and health/nutrition outcomes: higher health and nutrition status, lower mortality and better access to agricultural, education and health services. Thus the political and organizational factors make a different, even in the face of a bitter war on their border with Eritrea during the time of the study.

Qualitative, participatory research on local capacity included suggestions of

interventions to reduce vulnerability at the following three levels: (Ali H., 2001):

At household level: A savings culture; diversification of agricultural activities; off-farm activities; migration; small scale irrigation; drought-resistant crops; working long hours; practicing family planning; developing a savings culture/habit and reducing extra expenses or avoiding extravagancy; oxen sharing; growing early maturing crops

At Community level: participation in traditional welfare and savings societies; tree planting and harvesting and afforestation; livestock disease prevention; organizing for collective action; users association for river diversion

At Institutional level: participation in agricultural and credit services; modern land management schemes; water and soil conservation; clean water; constructing water dams and water harvesting; capacity-building, education and awareness creation on important issues; food for work employment.

V. CONCLUSIONS AND POLICY IMPLICATIONS: DEMOGRAPHIC DIMENSIONS OF FOOD SECURITY AND NUTRITION POLICIES AND PROGRAMS

A. Summary of Conclusions: TBD

B. Policy Implications

1. The Population and Development Policy of Ethiopia
2. The Poverty Reduction and Food Security Policy and Programs
3. Famine prevention and preparedness and food aid programs
4. Agricultural, Health and Nutrition Programs and Projects
5. Applied and Policy Research and Program Evaluation

This type of decentralized, participatory research has suggested the importance of taking into account demographic factors in poverty reduction, famine prevention and health policies and programs at national, regional and district levels. After the vulnerability

profiles and in depth research dissemination was completed in the project, famine reduction response packages were drawn up in a participatory way by each of the 16 districts, and population dimensions such as urbanization, rural resettlement, water diversion and land reform, child survival health extension, and family planning were included.

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