

# User:Fm122/Ethiopia, Demographic Pressure & the Risk of Famine

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## Ethiopia, Demographic Pressure & Famine: Analysis, Trends and Solutions

### ONE-SENTENCE SUMMARY

This article examines Ethiopia's population growth trends in the context of famine and related poverty issues and shows that industrialized countries' present, low population growth rates nevertheless present an equivalent or greater ecological impact on planetary life support systems than predicted African population growth; secondly, it envisions alternatives beyond the four-century old system of "Westphalian states", which locks populations (but not capital and natural resources) into arbitrary geographic loci.

### BACKGROUND

In "With Every Mistake", the journalist Gwynne Dyer's 2005 compilation of articles, he writes that "[t]he crisis in Africa is real, but its major cause is truly awful governments. Even more than the AIDS epidemic, it is corruption and war that have driven Africa to the bottom of every index of human development during the past forty years [...] About one-fifth of the world is rich, and another fifth is desperately poor and getting poorer, but the middle three-fifths is actually making solid progress - not because of foreign aid or some special political or economic formula, but because it only takes security, sensible government and time for people anywhere to climb the ladder" (p. 350, "The Middle Three-Fifths", originally published August 3, 2003). Dyer prefaces his chapter on Africa in that book with the caveat that while he has "come to care about Africa [...] but too much to maintain the emotional distance that is best if you want to do really good analysis [...] I am not entirely to be trusted when it comes to judging African events, but I do the best I can" (p. 232). In his latest book, "Climate Wars", Dyer shows that those who have consumed disproportionately large shares of the earth's resources are predicted to be most responsible for ecological damage to the lands of those who have consumed least, in Africa and South Asia.

Development economists are strongly divided these days, consider the Munk Debate on Foreign Aid, held in Toronto, 2009. Mr. Dyer supports the Washington consensus or "primacy of institutions" camp along with William Easterly and much of the World Bank, emphasising behavioural re-engineering, where Africans have mostly themselves to blame, and must get their own houses in order, foreign aid mostly making things worse. The "geography matters" camp includes Jeffrey Sachs, and while not denying the importance of good governance, deems where people live, their geophysical endowments, or lack thereof, an important determinant of economic development wholly independent of what humans do with those endowments. It follows Adam Smith's assertion in "The Wealth of Nations" (1776) that Africa's lack of navigable inland access and extremely low coastline-to-land area ratio (one-sixteenth of Western Europe's, one-twelfth of East/Southeast Asia's) isolated most of the continent from ocean-based international trade, with its attendant cross-pollination of ideas (Bloom; Sachs; Collier; Udry. 1998. "Geography, demography and economic growth in Africa", Brookings Papers on Economic Activity, 1998(2):207-295). With the only large landmass centred on the Equator, Africa's climate - 91% in the tropics, compared to 73% for Latin America and 40% for South Asia - presents a high year-round disease burden to its inhabitants, posing fundamental handicaps to modernisation from the outset. The chicken (physical habitat) came before the egg (human behaviour) so it behooves the rest of the world to lend not just a hand, but a whole lot more hands than presently (Sachs, Jeffrey D. 2005. "The End of Poverty: Economic Possibilities for Our Time", Penguin). Jared Diamond notes Africa's lower biodiversity of domesticable animals compared to Eurasia (only the guinea fowl and donkey were African indigenes), its north-south axis with variable climate and soils inhibiting rapid cultural diffusion, and smaller area as key factors which delayed agricultural development in Africa (Diamond, Jared. 1997, 2005. "Guns, Germs and Steel: the Fates of Human Societies", 387-401). Either argument, the technocratic solutions

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are dominated by voices from the West. The climatologist Roger Revelle observed that the world has now become one giant "global experiment" (McElroy, Michael B. 2010. "Energy: Perspectives, Problems and Prospects", Oxford U.P., p. 322). Lamentably, this means Westerners are mostly wearing the white coats while the Africans are scurrying in the cages. Jeffrey Sachs's Millennium Villages Project - in 13 areas of 10 African countries, including Koraro and ten other villages in Ethiopia's Tigray Region since 2005, is an example of this technocratic approach ([http://www.millenniumvillages.org/aboutmv/mv\\_koraro.htm](http://www.millenniumvillages.org/aboutmv/mv_koraro.htm)).

Reviewed here are Ethiopia's potential for agricultural expansion, the reasons behind Ethiopia's continued high population growth, comparisons to nineteenth-century North American population growth, and the causes and characterization of Ethiopian famines and food insecurity. Three possible solutions are then considered: rapid child mortality reduction accompanied by widespread access to contraception, large-scale farming of unused Ethiopian land by international investors, and population resettlement, both domestic and international.

## **LAND, AGRICULTURE, BIOCAPACITY: AFRICA CAN DOUBLE ITS CULTIVATED LAND AREA**

What is remarkable and unique among the continents is that African population growth over the last half-century has been largely accommodated by land expansion in rain-fed agriculture. The UN Food and Agriculture Organization data show that Africa's harvested land area more than doubled (102%) between 1961 and 2008 as the African population rose 3.3-fold; by comparison, harvested land globally increased only 13% as the world population rose 117% (FAOSTAT, Production, Crops, Area Harvested). African crop yields (tonnes per hectare) rose only about 30% between the early 1960s and early 2000s, compared to 160% in Asia; this can be attributed to Africa having only about one-tenth the extent of irrigation and fertiliser use as in Asia (World Bank. 2008. "World Development Report", p. 55, 52). Just one to two per cent of Ethiopian and Nigerian cultivated land in the early 2000s was equipped for irrigation, compared to 38% in China and 34% in India (FAO, Aquastat Database, Irrigation and Drainage Development). Ethiopia's population also rose 3.3 times between 1961 and 2008, and the FAO reports a 3.1-fold increase in the country's cereal production, based on a 56% cropland increase and 2.0-fold productivity increase. Similar figures are obtained for oil, root and vegetable crops (FAOSTAT, Production).

As a ratio of global landmass, a 15% ceiling has been proposed for human crop cultivation purposes, while in 2000 the actual percentage was 12% of ice-free land area (15.0 mill. sq.km.), and pasture and rangeland consumed another 22% (28.0 mill. sq.km.) (Rockström, Johan et al. 2009. "A safe operating space for humanity", *Nature* 461: 472-475). But there is far from consensus on the eco-sustainable human limit, and it has been argued that integrated farming methods, replacing current intensive ones, can help restore the carbon dioxide-absorbing resilience of natural ecosystems (Bass, Steve. 2009. "Planetary boundaries: Keep off the grass", *Nature Reports Climate Change*, 113-114). Others argue that, at current and continued levels of anthropogenic release of carbon dioxide from fossil fuel combustion, humans must decrease utilisation from 36% to 29% of net primary productivity, corresponding to a reduction in land use from 86 million square kilometres to 80 million, so that the liberated land can be restored by natural ecosystems capable of absorbing anthropogenically-released carbon dioxide, and arrest its escape into the atmosphere (Danilov-Danil'yan, Victor I.; Losev, K.S.; Reyf, Igor E. 2009. "Sustainable Development and The Limitation of Growth: Future Prospects for World Civilization", Springer, p. 205, 210). Human appropriation of net primary productivity (HANPP), the share of global bioproductivity used by man, has been estimated from satellite and census data for 2000 at 23.8%, half of which is due to crop harvesting, and the remainder to deforestation, fires, etc. (Haberl, Helmut et al. 2007. "Quantifying and mapping the human appropriation of net primary production in earth's terrestrial ecosystems", *Proc.Nat.Acad.Sci.* July 31, 2007 vol. 104 no. 31 12942-12947). However, it is unknown whether this share already exceeds the limit beyond which ecosystem failure may occur (Foley, Jonathan A. et al. 2007. "Our share of the planetary pie", *PNAS* July 31, 2007 vol. 104 no. 31 12585-12586).

For the year 2000, tropical (sub-Saharan) Africa was estimated to utilise 8.0% of its total land area as cropland, and 30.1% for pasture, which compares to 12% and 22% of the Earth's ice-free land surface, respectively (Ramankutty,

Nivan et al. 2009. "Farming the planet: 1. Geographic distribution of global agricultural lands in the year 2000", *Global Biochemical Cycles*, Vol. 22, GB1003, Table 5). Regions with the highest cropland to landmass ratios were South Asia (48.2%), Europe (41.2%), and Southeast Asia (26.3%), while highest pastureland ratios were for Argentina, Uruguay, and Chile (33.0%), China and Pacific developed countries (32.7%) and Mexico, Central America and the western United States (31.4%). Thus, Mexico and Central America, with a combined crop and pastureland ratio of 50.5%, along with the western US (49.7%), South Asia (48.2%), China (45.6%), Argentina, Uruguay, and Chile (43.2%), and Europe (41.2%), all make more extensive use of their land area than Africa (38.1%). This suggests that cropland expansion in Africa is feasible, either directly, or through the conversion of pasturelands.

In 1975, the total biomass of humanity was estimated to be 50 billion kilograms (4.1 billion persons with an average dry-weight of 12 kg), representing 4% of the total terrestrial animal dry-weight biomass (1.3 trillion kg); humanity's livestock (cattle, sheep, pigs, horses, etc.) contributed an additional 15% of terrestrial animal dry-mass, meaning 19% of the dry mass of land-based animal life was directly attributable to *Homo sapiens* (Westing, Arthur H. 1981. "A World in Balance", *Environmental Conservation* 8(3):177-183). In 2010, with the human population at 6.9 billion, humanity's share of total land-based animal biomass can be extrapolated to 6.7% and our domesticated animals to 25.2%, for total of 32%; in 2050, at the UN Population Division's 2008 Revision, median variant projections of a 9.1 billion human population, this share will rise to 8.9% humans and 33.3% livestock, or a total 42%. However, absolute poverty shares are diminishing, and as the average world income per capita rises, meat consumption increases even more rapidly, so that in 2050, with more livestock per person, humanity is likely to have commandeered well over one-half of the total animal biomass.

According to the Global Footprint Network, Africa's measured biocapacity, the ability of its ecosystem (crop and grazing lands, forests, fishing grounds and built land) to provide biologically productive services to humans, was 1.48 hectares per capita in 2007, compared to a global average of 1.78; only in terms of grazing land does Africa exceed the average (0.41 ha./cap. vs. 0.23). By comparison, densely-populated Asia's biocapacity is 0.82 ha./cap., Europe has 2.89, North America (Canada and the United States) has 4.93, and Latin America and the Caribbean enjoy 5.47 hectares per person. If, as predicted, Africa's population doubles by mid-century, African biocapacity will decline to the same allotment as for Asians. Asia's per capita ecological footprint, the actual consumption of resources, exceeds its biocapacity by a factor of two at present (1.66 vs. 0.82 ha.), while Africa, at 1.41 hectares consumed per cap. has a very slight surplus biocapacity; at current population growth, it will soon convert to a deficit as well. In 2007, Latin America's surplus biocapacity over consumption, 2.9 ha./cap., nearly balanced the North American overshoot of -3.0 ha./cap. (Ewing B., et al. 2010. *The Ecological Footprint Atlas 2010*. Oakland: Global Footprint Network, footprintnetwork.org). For the 152 nations and regions evaluated for 2007 (with 99% of global landmass), only fourteen (Argentina, Australia, Bolivia, Brazil, Canada, Central African Republic, Congo, Finland, Gabon, Mongolia, Namibia, New Zealand, Paraguay and Uruguay) carry biocapacity which exceeds their citizens' present consumption levels by four or more hectares per person; they make up 4.9% of the human population and 26.0% of the area of all countries. Conversely, twelve nations have ecological footprints of consumption which overshoot their biocapacity by four or more hectares per capita (Belgium, Israel, Japan, Kuwait, Netherlands, Qatar, Republic of Korea, Saudi Arabia, Singapore, TFYR Macedonia, United Arab Emirates, and the United States of America), comprising 8.3% of world population and 9.3% of the area of all nations (FAOSTAT > ResourceSTAT > Land, <http://faostat.fao.org>). The Global Footprint Network reports that Ethiopia's ecological footprint (1.1 ha./cap.) overshoot its biocapacity (0.7 ha./cap.) by 57%; this compares to an overshoot in 2002 of 30%, 0.8 ha./capita in consumption compared to 0.5 ha./cap. in biocapacity (Mathis Wackernagel, [www.footprintnetwork.org/documents/GFN\\_Result\\_Tables\\_05.xls](http://www.footprintnetwork.org/documents/GFN_Result_Tables_05.xls)). The typical African currently consumes only 79% of the world's average biocapacity allotment per person (1.78 ha./cap.) while the typical North American (Canada and U.S.A.) is consuming 4.4 times this amount, 7.9 ha./cap ("Ecological Footprint and Biocapacity, 2007", Results from National Footprint Accounts 2010 edition, [www.footprintnetwork.org](http://www.footprintnetwork.org). Extracted on October 13, 2010). The American footprint, 8.0 ha./capita in 2007, exceeded global capacity (1.8 ha./cap.) by 4.5 times, hence four and

a half planet Earths would be required for all humanity to continually consume at the rate of those in the United States today, or only one-half planet Earth if everyone's lifestyle emulated people in India. What this all suggests is that there are regions in the world capable of accommodating the additional one billion Africans in our midst in 40 years' time, along with the one billion additional persons elsewhere (an increase of 32% over 2010). However if we were to maintain our existing consumption patterns until 2050, we would be exceeding the earth's regenerative capability by twofold: 2.7 hectare per capita usage will be made upon a reduced biocapacity base of 1.34 hectares per capita.

## **GLOBAL ECOLOGICAL OVERSHOOT: EACH CITIZEN BORN IN ADVANCED INDUSTRIALIZED NATIONS POSES FIVE TIMES GREATER THREAT TO BIOSPHERIC SUSTAINABILITY THAN AFRICANS**

The Global Footprint Network reports that in 2007, the average consumption footprint of North Americans (Canadians and Americans) was 4.4 times larger than the planet's annual biocapacity, whereas the ratios for all humans and Africans were 1.52 and 0.79, respectively ("Ecological Footprint Atlas 2010", p. 28-87); Africans and Asians were in 2007 the only human populations utilising less than or equal to their share of the biosphere's sustainable production. Collectively, humanity is "living beyond its means", an overdraft on the planetary life support system that was 44% in 2006 and 52% in 2007 according to this organisation. There are also significant regional differences, with North Americans consuming an average of 60% over their continent's biocapacity and 4.4 times over planetary biocapacity, while Africans are living at 5% below their continent's biocapacity and 21% below global biocapacity. Fifty-one out of the 152 nations in the 2007 dataset are reported to have a reserve of biocapacity or parity with their footprint of consumption; they comprise 55.6% of all countries' total area, but only 18.1% of the population sample in 2010, and 19.5% of the projected 2050 population. Only two of these nations are predicted to have a lower population in 2050 than today, Estonia (1.1 hectares reserve per capita in 2007, 106,000 fewer population in 2050), and the Russian Federation (1.3 hectares per capita, 24.3 million fewer persons in 2050) (United Nations, "World Population Prospects: The 2008 Revision"; FAOSTAT > ResourceSTAT > Land).

Put another way, the human population increased by approximately 766 million between the years 1999 and 2009 ("Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD", Vertical file, copyright Angus Maddison, University of Groningen), of which 198 million were Africans, and 35 million the citizens of chiefly Anglophone nations of Australia, Canada, New Zealand, the United Kingdom, and the United States. If, however, we count the African and industrialized Anglophone populations not simply in terms of individual members of the species, but by the impact each is likely to exert on the ecosystem according to their national average, the "population impact" increases are nearly equivalent. Americans, had for example in 2007, an average ecological footprint of 8.0 hectares compared to a global per capita biocapacity of 1.8 hectares, implying that Americans utilise 4.5 times more than the planet's "fair share" of biological capacity for each human being. Thus, the U.S.'s 27.9 million population growth over the last decade translates to 125.3 million in terms of potential future planetary impact, if consumption behaviour remained frozen at 2007 levels. Similarly, the UK's 1.8 mill. population increase translates to 5.0 million since they, on average have a footprint 2.8 times greater than the global per capita biocapacity share, and Canada's 2.7 mill. population increase inflates to 10.5 million in ecological consumption terms. Conversely, while the African population grew by 198 million over 1999-2009, their average footprint, 1.5 ha., was just 79% of the 1.8 ha. planetary biocapacity per capita share, meaning that, in terms of ecological impact, their "person-impact" increase diminished to 157 million. And the 35 million population increase in the five industrialised Anglophone nations, amplified according to each nation's ecological impact (a weighted factor of 4.2), means they have added 146 million "person-impacts" to the planet in the last ten years, or just seven percent (11 million) less than the Africa's 157 million. Envisioning human growth in these terms represents a very different perspective on "overpopulation": over the last decade, Anglophone countries accounted for 4.6% of the global headcount increase, but 16.7% of the

increase in human impact on the environment, while Africa accounted 25.9% of the headcount increase, but only 17.9% of the ecological impact. Ethiopia's ecological footprint in 2007, 1.11 ha. was only 62% of the 1.8 ha. global allotment, so that their 24.5 million increase over the last decade (3.2% of global increase) collapses to just 15.3 mill., or just 1.7% of the global increase in ecological impact terms. As additional stress on the global life support system, one newborn Ethiopian represents 85% less of a threat than one newborn citizen of the United Kingdom and its diaspora do (0.62/4.15). The painfully obvious but politically obstructed solution is a redistribution of consumption patterns from the richest to poorest billion. The consumption imbalance is well illustrated by the fact that the opportunity cost of maize biofuel to fill the tank of a sports utility vehicle (SUV) is equivalent to one year's human nourishment (Collier, Paul et al. 2008. "Climate change and Africa", Oxford Review of Economic Policy 24(2): 337-353).

**LIVING 50% BEYOND HUMANITY'S (ECOLOGICAL) MEANS:  
ENGLISH-SPEAKING POPULATION GROWTH IMPACT WILL BE TWO-THIRDS  
OF AFRICAN GROWTH IMPACT IN 2050; ANGLOPHONE NATIONS' COLLECTIVE  
FOOTPRINT WILL BE 46% GREATER THAN AFRICANS'**

Assuming that current national consumption patterns continue to at least the middle of this century, and applying similar correction factors to the United Nation Population Division's median variant projections for population growth between 2010 and 2050 shows that, while the increase in Africans is predicted to comprise 43.1% of the absolute global population increase (965 m. out of 2,241 m.) and the five Anglophone nations will comprise only 5.2% (115 m.), the footprint-attenuated ratios are 31.9% and 20.0% respectively (UN. 2009. "World Population Prospects: The 2008 Revision"). That is, with the average global footprint of consumption exceeding the Earth's biocapacity by a factor of 1.52 times (2.70 hectares in consumption per human in 2007 as opposed to available biocapacity of 1.78 hectares), the effective biospheric impact of a 2.2 billion headcount in 2050 is 2.4 billion persons, summing the population trends and ecological impacts for each continent. Since the present African consumption footprint is 79% of the average human footprint (1.41 ha. per African vs. 1.78 ha.), the 965 m. additional Africans in 2050 will constitute only 765 m. in terms of planetary impact (31.9% of the adjusted total), while for the five industrialised Anglophone nations, their population-weighted average per capita consumption footprint exceeds the global average biocapacity by 4.2 times (7.4 ha. vs. 1.8 ha.), so that their projected population increase of 115 m. (5.2% of the 2.2 bn. total) inflates to an effective ecological impact equivalent of 479 m. (20.0% of the 2.4 bn. adjusted total).

WORLD POPULATION GROWTH: HEADCOUNT AND ECOLOGICAL IMPACTS

	Population (millions) 2007 (1)	area per capita, hectares, 2007 (1)		Ratio, Ecological Footprint per capita to National Biocapacity	Ratio, Ecological Footprint per capita to World Biocapacity (1.78 ha.)	Population Increase, 1999-2009				Projected Population Increase 2010 - 2050 UN Median Variant			
		Ecological Footprint of Consumption	Total Biocapacity			Headcount Population Increase, thousands (2)	Population Increase Adjusted for Footprint: World Biocapacity Ratio	% of total increase		Headcount Population Increase, thousands (3)	Population Increase Adjusted for Footprint : World Biocapacity Ratio	% of total increase	
								Headcount Population Increase	Adjusted to Footprint: Biocapacity Ratio			Headcount Population Increase	Adjusted to Footprint: Biocapacity Ratio
World	6,671.6	2.70	1.78	n/a	1.52	766,280	877,388	100.0%	100.0%	2,241,306	2,399,595	100.0%	100.0%
Africa	963.9	1.41	1.48	0.95	0.79	198,348	157,118	25.9%	17.9%	965,423	764,745	43.1%	31.9%
Ethiopia	78.6	1.11	0.66	1.68	0.62	24,525	15,294	3.2%	1.7%	88,835	55,397	4.0%	2.3%

Asia	4,031.2	1.78	0.82	2.17	1.00	458,205	458,205	59.8%	52.2%	1,064,744	1,064,744	47.5%	44.4%
China	1336.6	2.21	0.98	2.26	1.24	78,665	97,668	10.3%	11.1%	62,899	78,094	2.8%	3.3%
India	1164.7	0.91	0.51	1.78	0.51	170,421	87,125	22.2%	9.9%	399,336	204,155	17.8%	8.5%
Europe	730.9	4.68	2.89	1.62	2.63	3,732	9,812	0.5%	1.1%	-41,711	-109,667	-1.9%	-4.6%
United Kingdom	61.1	4.89	1.34	3.65	2.75	1,820	4,999	0.2%	0.6%	10,466	28,752	0.5%	1.2%
Latin America and the Caribbean	569.5	2.58	5.47	0.47	1.45	70,734	102,524	9.2%	11.7%	140,535	203,697	6.3%	8.5%
Canada and USA	341.6	7.89	4.93	1.60	4.43	30,583	135,563	4.0%	15.5%	96,815	429,141	4.3%	17.9%
Canada	32.9	7.00	14.92	0.47	3.93	2,666	10,484	0.3%	1.2%	10,524	41,387	0.5%	1.7%
United States of America	308.7	7.99	3.87	2.06	4.49	27,917	125,314	3.6%	14.3%	86,291	387,340	3.9%	16.1%
Oceania	34.5	5.39	11.15	0.48	3.03	4,678	14,165	0.6%	1.6%	15,500	46,935	0.7%	2.0%
Australia	20.9	6.84	14.71	0.46	3.84	2,433	9,349	0.3%	1.1%	7,212	27,714	0.3%	1.2%
New Zealand	4.2	4.89	10.77	0.45	2.75	429	1,179	0.1%	0.1%	1,046	2,874	0.05%	0.12%
Anglophone Nations (Australia, Canada, New Zealand, United Kingdom, United States)	427.8	7.38	4.95	1.49	4.15	35,265	146,226	4.6%	16.7%	115,539	479,083	5.2%	20.0%

## Sources

(1) Ewing B. et al. 2010. "Ecological Footprint Atlas 2010", Oakland, California: Global Footprint Network.

[1]

Continental populations summed for World values.

(2) Maddison, Angus. 2009. "Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD",

Vertical file, copyright Angus Maddison, University of Groningen. Source (3) used for Oceania, 2000-2010.

(3) United Nations Population Division. 2009. "World Population Prospects: The 2008 Revision", <http://esa.un.org/unpp>

Most tellingly in reference to Gwynne Dyer's opinion piece, the actual headcount growth in the Ethiopian and United States populations, both during 1999-2009 and predicted for 2010-2050 are very similar, about 4% of the global increase each, but when their ecological impacts are factored in, the United States' effective population impact is 8.4 times (1999-2009, US 14.3% vs. Ethiopia 1.7%) and 7.0 times (2010-2050, US 16.1% vs. Ethiopia 2.3%) greater. Every extra American up to 2050 effectively equals seven additional Ethiopians when "more mouths to feed" takes into account their differing "appetites".

When regions' total population counts are considered, rather than increments, the five industrialised Anglophone nations represented 44% of Africa's population in 2007 (6.4% vs. 14.4% of the global total), however in ecological footprint terms, they were 2.3 times larger (19.4% vs. 8.3%). In 2050, the Anglophone countries are predicted to be only 28% of Africa's headcount (6.1% vs. 21.8%), but will still be 46% larger in footprint terms (19.5% vs. 13.4%), assuming that these regions' *relative* consumption rates continue in 2050 as in 2007. That this is reasonable assumption can be explained as follows. Despite the fact that during 2001-09, high income countries' average per capita GDP, in constant purchasing power terms, grew only 1.0% per annum compared to 3.4% in low income countries, the 31-fold purchasing power difference in 2009 GDP per capita values suggests that, were the past decade's growth rates to continue indefinitely, rich-poor nation income convergence could not be expected until the year 2150 (calculated from World Data Bank, GDP per capita, PPP (constant 2005 international \$), accessed Spring 2010, <http://databank.worldbank.org/ddp/home.do?Step=2&id=4>). A University of Toronto political scientist, Thomas Homer-Dixon, identifies this delay as the "dirty little secret of development economics" (Homer-Dixon, Thomas. 2006. "The Upside of Down: Catastrophe, Creativity and the Renewal of Civilization", Knopf, p. 189-191).

PRESENT & PREDICTED POPULATIONS: HEADCOUNTS AND ECOLOGICAL IMPACTS								
Total Population, millions								
	2007				2050, projected (UN Medium variant)			
	Headcount (1)		Footprint-Adjusted (1)		Headcount (2)		Footprint-Adjusted (1)	
World	6,672	100.0%	9,161	100.0%	9,150	100.0%	11,832	100.0%
Africa	964	14.4%	764	8.3%	1,998	21.8%	1,583	13.4%
Ethiopia	79	1.2%	49	0.5%	174	1.9%	108	0.9%
Asia	4,031	60.4%	4,031	44.0%	5,231	57.2%	5,231	44.2%
China	1,337	20.0%	1,659	18.1%	1,417	15.5%	1,759	14.9%
India	1,165	17.5%	595	6.5%	1,614	17.6%	825	7.0%
Europe	731	11.0%	1,922	21.0%	691	7.6%	1,817	15.4%
United Kingdom	61	0.9%	168	1.8%	72	0.8%	199	1.7%
Latin America and the Caribbean	570	8.5%	825	9.0%	729	8.0%	1,057	8.9%
Canada and USA	342	5.1%	1,514	16.5%	448	4.9%	1,988	16.8%
Canada	33	0.5%	129	1.4%	44	0.5%	175	1.5%
United States of America	309	4.6%	1,386	15.1%	404	4.4%	1,813	15.3%

Oceania	35	0.5%	104	1.1%	51	0.6%	155	1.3%
Australia	21	0.3%	80	0.9%	29	0.3%	110	0.9%
New Zealand	4	0.1%	12	0.1%	5	0.1%	15	0.1%
Anglophone Nations (Australia, Canada, New Zealand, United Kingdom, United States)	428	6.4%	1,774	19.4%	555	6.1%	2,312	19.5%
Sources								
(1) Ewing B. et al. 2010. "Ecological Footprint Atlas 2010", Oakland, California: Global Footprint Network. [2] Continental populations summed for World values.								
(2) United Nations Population Division. 2009. "World Population Prospects: The 2008 Revision", <a href="http://esa.un.org/unpp">http://esa.un.org/unpp</a>								

To support a human population increase of one-third by mid-century will require the collective adoption of consumption patterns equivalent to the typical citizen of Iraq, Liberia, or the Philippines, who, on average, consumed 1.3 hectares of the earth's biocapacity in 2007. Sri Lanka, with a 1.2 ha. consumption footprint that is just 44% the world average and two-thirds of the world biocapacity per capita (1.8 ha.), nevertheless has achieved a Human Development Index (HDI) bordering on "High Human Development". The Sri Lankan index value, based on longevity, education, and income, was 0.759 in 2007, ranking it 102nd-highest out of 182 nations (United Nations Development Program. 2009. "Human Development Report 2009", Table G, p. 167-170). Viet Nam similarly has a 1.4 ha. per caput consumption footprint, and an HDI of 0.725, 116th-highest. Both Sri Lankans and Vietnamese have 74-year life expectancies, only six years fewer than the high human development average, while their educational enrolment rates are 25-30 percentage points lower, and their per capita incomes are 89%-93% lower. In terms of providing money and help to strangers, Sri Lankans were recently ranked the eighth-most generous people among 153 nations, while the Vietnamese ranked 138th (Charities Aid Foundation. 2010. "The World Giving Index 2010", Kent, England, <http://www.cafonline.org>). Their inequality measures, expressed as ratios of the richest to poorest fifths' income shares, are within the range for developed countries; they are 6.9 (Sri Lanka, 2002) and 6.4 (Viet Nam, 2006), compared to 5.7 (Canada, 2000), 8.0 (China, 2005), 5.6 (India, 2005), 3.3 (Japan, 1993), 4.1 (Netherlands, 1999) and 9.2 (United States, 2000) (World Bank, "World Development Indicators", latest years available). Perhaps these two tropical nations represent "best practices" for sustainable human development. Outside of small islands and city-states, the only more developed countries with higher population densities were South Korea, Netherlands, Belgium, Japan and Israel, all of which have ecological overshoots more than double the world per capita biocapacity of 1.8 ha. Alternatively, humanity could maintain its existing collective consumption if only we reduced our carbon footprint to nil, because that represents exactly 1.4 ha. of our average 2.7 ha. footprint today ("Ecological Footprint and Biocapacity, 2007", [www.footprintnetwork.org](http://www.footprintnetwork.org)). Harvard environmental scientist Michael B. McElroy has calculated that wind energy - without compromising existing forested areas - could supply forty times the world's present electricity consumption, and five times the global energy consumption (Lu, Xi; McElroy, Michael B.; Kiviluoma, Juha. 2009. "Global potential for wind-generated electricity", *Proc.Nat.Acad.Sci.* 106(27): 10933-10938). Thus, switching entirely from fossil fuels to wind energy could conceivably provide every person with an American-style energy consumption pattern and simultaneously lower our collective consumption footprint to just two-thirds of the biosphere's annual regenerative ability (the American footprint, 9.0 ha./capita in 2006,

overshot global capacity, 1.8 ha./cap. by exactly five-fold).

Similar conclusions have been drawn recently by McGill University environmental scientist Peter G. Brown, who identifies North American population growth as significantly more deleterious to biospheric sustainability than other population groups: "The earth's ability to support life's complexity is being torn down faster than sunlight and photosynthesis can build it back up. Because affluence tends to correlate with consumption, each new wealthy European or North American for example, at this point in time is likely to be a curse for the planet rather than a blessing" (Brown, Peter G.; Garver, Geoffrey. 2009. "Right Relationship: Building A Whole Earth Economy", San Francisco: Berrett-Koehler, p. 78). "The countries that have achieved the most as defined by that [growth and development] model - the industrialized economies of North America, Europe, Australia and New Zealand in particular - do the most harm per capita. So it is here that reducing human numbers will pay the greatest ecological dividends" (p. 115). "Laws [of a proposed Global Federation] regulating the number of children people have, for example, would likely face serious resistance. Yet that kind of regulating limit cannot responsibly be kept off the table if the only way to stay within the earth's ecological limits is to reduce population and non-regulatory efforts or incentives are simply not working" (p. 132). At world fora, no chairs are set for the "Oceans", nor for the "Biosphere", nor the "Atmosphere".

Biocapacity, as defined by the Global Footprint Network, affords twice as much weight to croplands and human infrastructure (built-up land) than to forests, and five times more than to grazing land or bodies of water ("Ecological Footprint Atlas 2010", p. 14). As such it is highly anthropocentric, focusing on support for human life and not biocentric, for the aggregate global biota. The fact that most continents with the exception of Africa have already reached their arable capacity is not taken into consideration; were it the case, Africa's potential for doubling its agricultural area could both reduce its regional footprint size, and expand the global biocapacity. Further, the Network's calculation of footprint does not include a number of other ecological stresses, including freshwater drawing rates, biodiversity loss, ozone depletion, ocean acidification, or the release of pollutants. Both Johan Rockström and U. Thara Srinivasan have considered some or all of these factors, although not at the country-level, and they are discussed in later sections of this article.

Reapportioning or indeed "retributing" "common pool" planetary resources equally among humans is clearly very far off, as one political scientist sees it: "the means by which a more equal right to environmental space (including natural resources) can be translated into practical terms, institutions, policies, and mechanisms is a question that has hardly begun to be addressed, let alone implemented" (Bührs, Ton. 2009. "Environmental Space as a Basis for Legitimizing Global Governance of Environmental Limits", *Global Environmental Politics* 9(4): 111-135).

## **AFRICA'S DELAYED DEMOGRAPHIC TRANSITION**

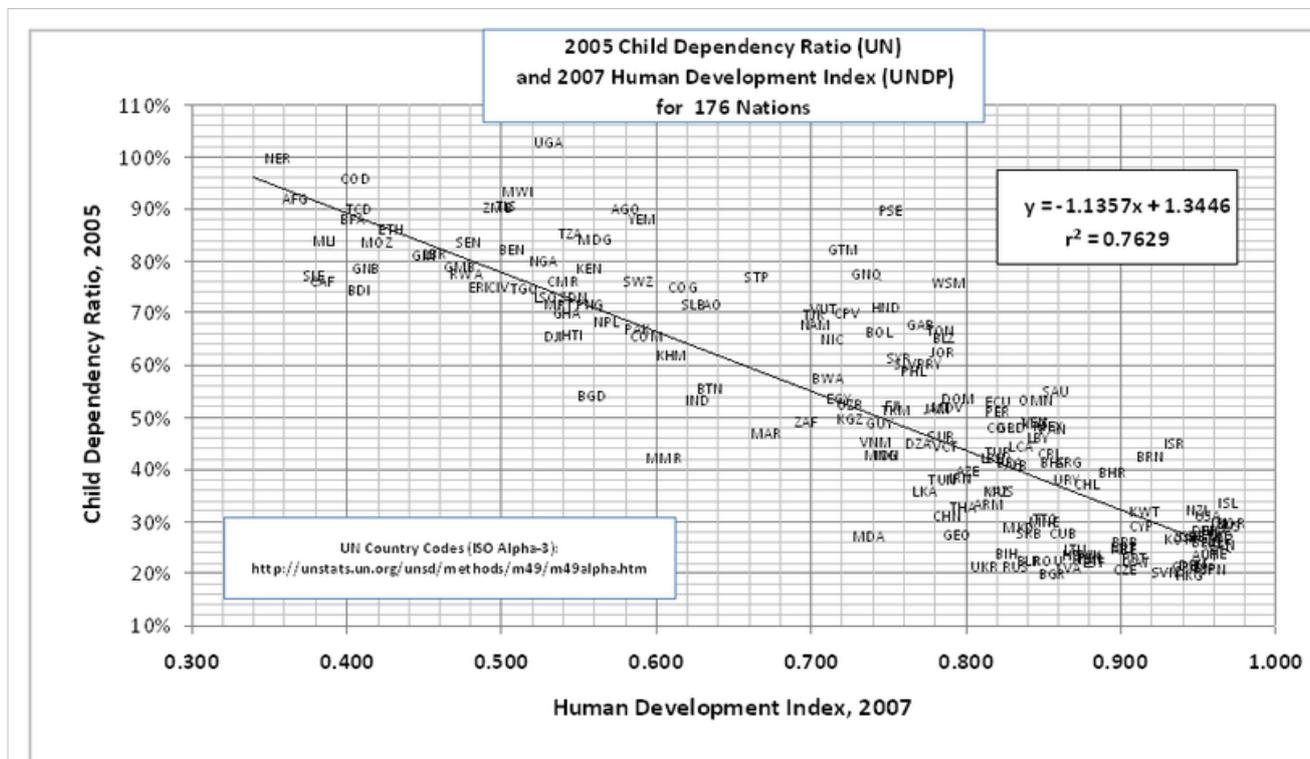
According to demographers at the United Nations, average fertility rates (children born per woman over her reproductive life) for Africa, Asia and Latin America in 1950 were quite similar and high, 6.6, 5.7 and 5.9 respectively, compared to a global average rate of 4.9; by 2005, these continents' rates had fallen to 4.9, 2.5 and 2.5 respectively, compared to a global rate of 2.7 ("World Population Prospects: The 2008 Revision", [www.un.org/esa/population](http://www.un.org/esa/population)). While Asians and Latin Americans over the last half-century have converged onto the global average fertility rate, African families still are having two additional children. Africa overall has indeed entered the third stage of the "demographic transition" (declining mortality rates, but still high birth rates), but at a slower rate of progress than the rest of the Global South. Fertility rates in some countries, notably South Africa and most of north Africa have fallen by 40% or more over their peak rates; Zimbabwe's and Botswana's fertility declines are in the 25-40% range, while those for Ghana, Kenya, Senegal and Sudan are in the 10-25% range (Wikipedia, "Demographic Transition"). In 2004, the UN had predicted that the death grip of AIDS in Africa would lower the projected population for 2050 by 15% (1.63 bn. instead of 1.90 bn.) and by 48%, from 38 m. in the absence of this disease, to 20 m. for the four southern African countries where HIV prevalence is over 20% ("World Population Prospects. The 2004 Revision", Vol. III. Analytical Report, p. 79-80). Revised estimates, accounting for improved

access to antiretroviral medicines and reduced mother-to-child transmission now predict Africa to double its population from 1.01 bn. in 2009 to 2.00 bn. in 2050, with Southern Africa going from 58.0 m. to 67.4 m.; however, HIV/AIDS will by 2050 have cut the African population by 7.5%, or 130m. fewer than under a hypothetical "No-AIDS" scenario ("World Population Prospects: The 2008 Revision. Highlights", pp. 2, 14). The most recent UN data, mostly for the mid-2000s, show fertility rates remain highest in Sahelian Africa (the band of savannah below the Sahara) and in central Africa (Guinea-Bissau: 7.4, Niger: 7.1, Uganda: 6.8, Mali and Somalia: 6.7, Chad: 6.6; Malawi and D.R. Congo: 6.3, Burkina Faso and Zambia: 6.2, Benin and Angola: 5.8, Nigeria, Ethiopia and Tanzania: 5.3), in addition to Timor-Leste (7.0) and Afghanistan; ten of these 17 are land-locked. Nevertheless, with the exception of Guinea-Bissau, whose fertility has steadily risen at least up to 2000, each of these highest-fertility nations has seen their rates decline by 15% on average from peak fertility levels of the 1980s and 1990s. For example, Ethiopia's 2003 fertility rate of 5.7 is 24% below the 7.5 peak of 1984-1994 and only slightly lower than the 1969 rate of 5.8, while the D.R. Congo's rate in 2006 has fallen 13% from the 1991-94 peak, Niger's has declined only 6% from 7.5 during 1987-1998 and Mali's fallen 5% from the 1991-96 peak (United Nations, Department of Economic and Social Affairs, Population Division. World Fertility Data 2008. POP/DB/Fert/Rev2008). Analysing recent fertility trends in 22 sub-Saharan African countries, Shapiro categorised Ethiopia along with 14 other nations as in decline (although "modest" in Ethiopia's case, 5.5 in 2000 and 5.4 in 2005), as opposed to eight others which are deemed to be in early- or mid-transition "stall" (Shapiro, David; Gebreselassie, Tesfayi. 2008. "Fertility Transition in Sub-Saharan Africa: Falling and Stalling", *Afr.Pop.Stud.* 23(1):3-23).

State-level comparisons of rates in the United States and India and province-level in China show similar low-coastal to high-inland fertility gradients, two-thirds higher in inland China and India, 25% higher in the inland USA (e.g., Pison, Gilles. 2009. "Atlas de la population mondiale", Autrement, p. 62, 64-65). It's also been argued that the reason there are sizable African populations so far inland, so distant from the African coast in the first place, in regions with irregular terrains and steep slopes unamenable to cultivation, was as historical refuge, to evade slave-raiding parties which, over five centuries, captured 18 million people destined for the trans-Atlantic and trans-Saharan slave trades; their strategy kept them and their descendents safely on African soil, but relegated to infertile soil with high transport and building costs (Nunn, Nathan; Puga, Diego. 2009. "Ruggedness: The blessing of bad geography in Africa", Dept. of Economics, Harvard University, [diegopuga.org](http://diegopuga.org), cited in Sachs, Jeffrey D. 2008. "Common Wealth: Economics for a Crowded Planet", Penguin, p. 358, n.226). During 2000-07, only 12.7% of Ethiopia's roads were estimated to be paved, compared to 15% in Nigeria, and 40% in Canada (World Bank, World Development Indicators, Roads, paved (% of total roads)). Indeed, UN Millennium Development Goal 8C is to "address the special needs of land-locked countries and small island states". Millennia-old Ethiopia only lost its maritime status in 1993 when Eritrea seceded.

Out of 194 countries, Ethiopia in 1990 had the seventh-lowest proportion of its citizens living in urban areas, just 12.6%; only Rwanda (5.4%), Burundi (6.3%), Trinidad (8.5%), Nepal (8.9%), Uganda (11.1%), and Malawi (11.6%) were more rural. In 2010, Ethiopia is ranked eighth-most rural with 17.6% now in urban areas; only Burundi, Papua New Guinea, Uganda, Trinidad, Liechtenstein, Sri Lanka and Niger remain more rural (UNDP. 2010. "Human Development Report 2009", Table L, Demographic Trends, Urban share of the population, <http://hdrstats.undp.org/en/indicators/142.html>). In terms of child dependency ratio - the proportion of children under 15, relative to the adult population aged 15 to 64 - Ethiopia at 86.5% was the 39th-highest in 1990, and at 80.5% was 16th-highest in 2010, with 12 of the higher-ranking nations being in Africa. Thus for every five adults of working age, there are four children (and fewer than one person over the age of 65); as fertility rates decline, the ratio will also decline, graduating youth into the workforce, and placing more Ethiopians into the economically-productive age strata. Up to one-third of the Asian tigers' rapid economic growth has been attributed to lowering child dependency ratios (Ringheim, K. 2009. "Ethiopia at a Crossroads", Population Reference Bureau, p. 2), however it remains to be seen what work these young Ethiopian adults will find. Rahmato argues that diversification of labour opportunities away from agriculture will be necessary (Rahmato, Dessalegn. 2007. "La pauvreté et la recherche de la sécurité alimentaire", in: "L'Ethiopie Contemporaine", Karthala, p.285-308).

The linear correlation between the United Nations Population Division's child dependency ratios (estimate variant) for 2005 and the United Nations Development Program's Human Development Index for 2007 for 176 nations where both data are reported is surprisingly strong ( $r$ -squared = 0.76).



Data sources: (1) Child-dependency ratio, per cent (Estimate variant, 2005): United Nations Population Division. "World Population Prospects: The 2008 Revision", <http://unstats.un.org> (2) HDI: United Nations Development Programme. "Human Development Indices: A statistical update 2009", <http://data.un.org> (3) Country Codes: United Nations Statistics Division- Standard Country and Area Codes Classifications (M49). ISO Alpha-3, <http://unstats.un.org/unsd/methods/m49/m49alpha.htm> Ethiopia appears directly on the regression line at HDI = 0.414 and Dependency Ratio = 86.0%.

Malmberg also notes that child dependency rates (the fraction of 0-14 year-olds to the economically productive workforce, 15-64 year-olds) have always been highest in Africa since 1950, around 0.8, while in China, for example, it fell from 0.7 in 1975 to 0.3 in 2005, and India's fell from 0.7 in 1975 to 0.5 in 2005 (Malmberg, Bo. 2008. "Demography and the Development Potential of Sub-Saharan Africa", Nordiska Afrikainstitutet, p. 22).

Ethiopia's crude death rate dropped steadily from its first recorded value in 1950 (29.9 per 1,000 population) to 1973 (20.4), but then hovered between 19 and 21 up to 1990; it's fallen steadily since then by about 0.3 deaths per 1,000 per year, reaching 11.7 in 2010 (UN World Population Prospects: The 2008 Revision). By contrast, the country's birth rate fluctuated narrowly between 46 and 49 all the way from 1950 to 1995, before declining steadily to 35.7 in 2010 (World Bank, "World Development Indicators", downloaded April 2010). So while Ethiopia's death rate has fallen by 64% since 1950 (52% for all of sub-Saharan Africa), its birth rate has only fallen 28% (24% for sub-Saharan Africa), and all of the latter has been in the last two decades alone. This has led to Ethiopia going from an annual population growth rate of 2.2% (1960, population doubling in 31 years) to a peak of 3.4% in 1992 (doubling time of 21 years), and back down to 2.6% in 2008 (doubling in 27 years). So Ethiopia is still growing faster than fifty years ago, and the UN predicts the Ethiopian growth rate will fall below the 1950 level (1.93%), to 1.87% during 2025-30 ("World Population Prospects: The 2008 Revision"). Thus, Ethiopia's peak growth rate, an average of 2.7%/year for the 45 years from 1965 to 2010, is less than Angus Maddison's historical estimates of 3.1% for Canada and 2.8% for the USA between 1820 and 1870. The difference, however, is that both Canadians and Americans grew steadily wealthier, real per capita income rising 1.3% annually over those fifty years (compared to a world average of 1.4%), while for Ethiopians, until the last ten years, there was stagnation; between 1965-2010,

Ethiopians' and Eritreans' real per capita income increased 1.1% per annum, compared to 2.0% globally (Maddison, Angus. "Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD", [www.ggd.net/maddison](http://www.ggd.net/maddison)).

According to demographer Charles Teller, fertility rate differences between Ethiopian Muslims and Christians are comparatively small; in 1998, the former rate was 6.8 children per woman, compared to 6.3 (Orthodox Christians) and 7.1 (Protestant Christians), however in Oromia and Benishangul-Gumuz regions where religious identity is equally distributed, Muslims have two more children than Christians, and where Muslims outnumber Christians, their fertility is also higher. Low education rates, rural residence and early marriage age, such as in Christian-dominated Amhara region determine fertility differences more strongly (Teller, Charles; Gebreselassie, Tesfayi. 2009. "Religious, Ethnic, and Regional Factors of High Fertility in Ethiopia", Population Reference Bureau, [www.prb.org](http://www.prb.org)).

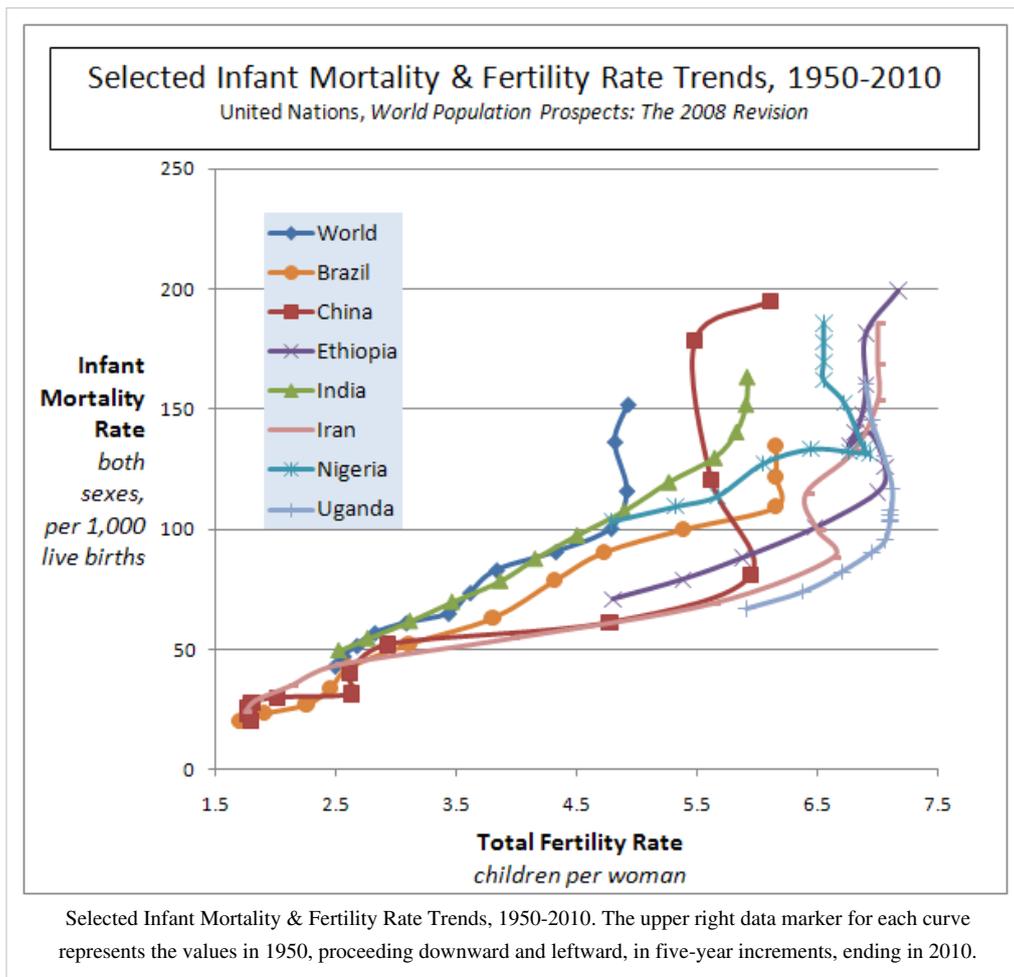
The Ethiopian government reported a decline in under-five mortality from 140 per thousand births in 2002 to 123 in 2005 (Ministry of Finance and Economic Development (MoFED). 2006. "Ethiopia: Building on Progress A Plan for Accelerated and Sustained Development to End Poverty (PASDEP)" [http://siteresources.worldbank.org/INTETHIOPIA/Resources/PASDEP\\_Final\\_English.pdf](http://siteresources.worldbank.org/INTETHIOPIA/Resources/PASDEP_Final_English.pdf), p. 16) while the UN's 2008 revision of "World Population Prospects" estimates Ethiopian child mortality at 149 (2000-05) and 131 (2005-10). Recently-published under-five mortality estimates show Ethiopia declining from 255 per 1000 in the 1970s to 202 in 1990, 137 in 2000 and 101 in 2010; if the past decade's 3% annual reduction rate continues, the country will have achieved a 1990-2015 reduction of 57%, reaching 87 instead of the two-thirds Millennium Development Goal target of 67 deaths per thousand births (Knoll Rajaratnam, Julie. 2010. "Neonatal, postneonatal, childhood, and under-5 mortality for 187 countries, 1970–2010: a systematic analysis of progress towards Millennium Development Goal 4", *The Lancet*, 375:1988-2008). According to Jeffrey Sachs, for peasant families to ensure at least one male heir at greater than 99% probability, the 2000-05 child mortality would require about five children per family, or halfway between the six needed at a rate of 200 deaths per 1000 live births and four needed at 100 ("Common Wealth: Economics for a Crowded Planet", 2008: 173-174).

In 1960, at 23.5, India's death rate was just six percent lower than Ethiopia's, but the decline was much more rapid, reaching 10.9 in 1986 (lower than Ethiopia, even in 2008) and 7.4 in 2008. The 1960 Indian birth rate was 0.7% below Ethiopia, but India's declined steadily to 22.8 in 2008. Thus, India's peak population growth of 2.3% (doubling every 30 years) occurred in 1966, three decades before Ethiopia's peak. Vital statistics collected by the Government of India in fact show that the Indian death rate has fallen steadily from a peak of about 49 per thousand population during 1911-21, while the birth rate has fallen steadily from 50 since 1901-11 (Hayami, Yujiro. 2005. "Development Economics: from the poverty to the wealth of nations", Oxford U.P., p. 71). It's important to note that it took almost 150 years into England's Industrial Revolution for her birth rate to begin falling irreversibly. Birth rates in the United Kingdom went from 30 per thousand in 1750 to a peak of about 36 in 1818, and did not decline below 30 until about the year 1895, even while the death rate had peaked at 28 in 1760, and fell steadily, though slowly to 20 in 1880, and more rapidly since then to 10 by 1950 (Hayami 2005: 68). Infant mortality rates in the UK and US fell significantly only following the public health advances made in the late 1800s (Malmberg, Bo. 2008. "Demography and the Development Potential of sub-Saharan Africa", *Nordiska Afrikainstitutet*, p. 12). Timelags between the onset of mortality rate declines and subsequent fertility rate declines were forty years in Sweden (1820, 1860) and 55 years in Mexico (1920, 1975) (Boyle Terry, Barbara. 2009. "Population, Agriculture and the Future Environment in Sub-Saharan Africa", IUSSP International Population Conference, September 2009, Morocco). Perhaps there is an element of Western impatience with regard to the African rates?

## CONTINUED HIGH AFRICAN CHILD MORTALITY

So why the delay? Why the 40-year gap between, for example, between South America and sub-Saharan Africa in terms of infant mortality, fertility, and population growth rates (Malmberg, Bo. 2008. "Demography and the development potential of sub-Saharan Africa", Nordiska Afrikainstitutet, p. 33). Why the "African fertility exception"? Shapiro and Gebreselassie's multivariate analyses of 24 sub-Saharan nations' found that, when rural and urban populations were separated out, the strongest determinants of fertility reductions were declining child mortality, and paradoxically, diminishing per capita GDP growth, followed by increasing education rates for women (Shapiro, David. 2008. *Afr.Pop.Stud.* 23(1):3-23). Jeffrey Sachs and colleagues have also found that child mortality rates are the single strongest determinant of Africans' persistently high fertility: in the absence of social security, only when parents are certain the risk of their children dying has fallen permanently, will they choose to have fewer. This relationship holds after differences in malaria infection rates and the introduction year of modern, "Green Revolution" crop varieties are accounted for. On average, Sachs's model predicts a fertility decline from a 2004 average of 5.3 to 3.3 children per woman if the child mortality rate is cut by two thirds (one of the Millennium Development Goals for 1990-2015); legalizing abortion further reduces the rate by 0.9 offspring, and doubling the percentage of modern seed varieties would lower it by an additional 0.5; collectively such measures would bring African fertility down to 1.9 ("Africa's Lagging Demographic Transition: Evidence from Exogenous Impacts of Malaria Ecology and Agricultural Technology", NBER 12892, 2007). Yet in Ethiopia, the under-five mortality rate went from 230 deaths per 1,000 live births in 1970 to 109 in 2008, a 53% decline; and the proportion of Ethiopians with incomes of \$1.25 per day or less (2005 international prices) has dropped steadily from 66% in 1982 to 39% in 2005, making it slightly less than India's extreme poverty rate of 42% in 2005 (World Bank, World Development Indicators). The latest UN plots of child mortality rate show that sub-Saharan Africa's rate was around 295 in 1950 (compared to 260 for South Asia and 235 World), falling to 150 in 2005 (South Asia: 90, World: 75). The rate of African child mortality decline was parallel to south Asia's up to 1970, but then slowed up to 2000, before accelerating again (UN. 2009. "World Population Prospects: The 2008 Revision. Highlights", p. 16). This suggests that Africa will meet only halfway the fourth Millennium Development Goal of cutting child mortality between 1990 and 2015 by two-thirds: instead of going from about 190 (1990) to 65 (2015), it now appears likely to fall to 127 (2015).

When infant mortality rates (IMR) are plotted against total fertility rates (TFR) for various countries over time, a distinct sigmoidal pattern emerges, where fertility rates remain constant and high until the IMR has descended to a certain threshold, in the vicinity of 100 infant deaths per thousand live births. For a developing country such as Brazil, the IMR fell to 109 deaths of infants per thousand live births in 1960 and to 100 in 1965, and TFR did not begin its decline until that time. In China's case, the TFR hovered around 6 children per woman until 1965, while the IMR fell rapidly from 195 (1950) to 81 (1965); only after 1965 did China's TFR decline rapidly. In the case of Ethiopia, while the IMR began the period at a similar rate to China's (199 in 1950), its reduction rate was much slower, not reaching 115 until 1990, at which point the TFR finally began its steady decline. Similar patterns are observed for Nigeria (an increase in TFR until 1980, decreasing then while IMR plateaued at 133 during 1975-90) and Uganda (TFR constant at 7.0 until 2000, when IMR halved its 1950 level of 161 level).



In the following section, two plausible explanations for the 80-120 infant mortality rate "turning-point" for fertility transition have been offered by Jeffrey Sachs: the critical need for a male heir, and Africa's virulent malarial-carrying mosquitoes.

### **ETHIOPIANS, AT CURRENT CHILD MORTALITY RATES, NEED FIVE OR MORE CHILDREN TO ENSURE A SON LIVING INTO ADULTHOOD; 99% CHANCE OF MALE HEIR @ 150 PER THOUSAND CHILD MORTALITY RATE REQUIRES 5 CHILDREN**

Boys have about a 10% higher risk of dying before age 5 than girls in Ethiopia: the UN 2008 revision places Ethiopia's male under-five mortality rate in 1995 at 181, falling to 138 in 2005, and 123 in 2010. Sachs points out that if parents wish to ensure at least a 99% likelihood of having the security of at least one adult male heir, they must produce at least six offspring when the child mortality is 200 per thousand live births since with three sons (half boys, half girls), the chances of all three dying prematurely are only 0.8% (Sachs. 2008. "Common Wealth", p. 173-4). Thus if Ethiopians currently have, on average, 1.23 in 10 boys dying young, they would need to have at least five children:  $0.123^{2.5} = 0.5\%$  chance of all sons dying. When the mortality rate declines to 100 per 1,000 births, only four children are required:  $0.1^{2} = 1\%$  chance of both sons dying. The earliest World Bank child mortality rate estimate for Ethiopia is in 1970, 229.7 per 1,000, implying that three sons would still have a 1.2% chance of all dying before maturity, however the fertility rate that year, 6.8, reduced the risk below 1%; the U5MR fell below 200 around 1992, while the fertility rate did not fall below 6.0 until 2002, reaching 5.3 in 2008 (World Development Indicators, April 2010). UN estimates, however, report the Ethiopian fertility rate falling earlier and rapidly, from 7.55 in 1994 to 5.87 in 1998 and 5.70 in 2003 (United Nations, Department of Economic and Social Affairs, Population Division. "World Fertility Data 2008", POP/DB/Fert/Rev2008). Thus, a 5.7 fertility rate in 2003 is

consistent with a 2005 male child mortality rate of 138, if Sachs's supposition is correct.

Malarial ecology is also important, because in West and East Africa, the predominant malaria-carrying mosquito species, *Anopheles gambiae* and *Anopheles funestus*, bite and feed on human blood (as opposed to animal blood) over 94% of the time, higher than any other mosquito worldwide, and since these two species flourish respectively during the rainy and dry seasons, the malaria parasite afflicts human hosts year-round; by comparison, India's predominant *A. fluviatilis* mosquito has a 97% preference for animal blood (Kiszewski, A. et al. 2004. "A global index representing the stability of malaria transmission", *Am. J. Trop. Med. Hyg.*, 70(5):486-498).

In 2002, the leading ten causes of mortality in Ethiopia, responsible for 66% of all 1.1 mill. deaths, were lower respiratory infections (11.8% of total mortality and mainly pneumonia, incidence 1.7 times greater than the global rate), HIV/AIDS (11.5%, 2.3), cardiovascular diseases (9.6%, 0.3), perinatal conditions - low birth weight, etc. (7.8%, 1.8), diarrhoeal diseases (6.0%, 1.8), childhood cluster diseases - measles, pertussis etc. (5.8%, 2.9), tuberculosis (3.9%, 1.4), malignant neoplasms (3.7%, 0.3), malaria (3.0%, 1.9) and respiratory diseases (2.7%, 0.4) (World Health Organization. 2004. "World Health Report 2004", Table 1. Estimated total deaths ('000), by cause and WHO Member State, 2002 (a), December, 2004). Acts of violence were responsible for 1.5% of Ethiopian deaths (1.0% globally), while war deaths, numbering just 280, represented 0.03%, an order of magnitude less than the 171,000 deaths comprising 0.30% of global mortality. Nigeria, the only African nation more populous than Ethiopia, had three times the level of mortality from malaria - 10.9% vs. Ethiopia's 3.0% - because the great majority of Ethiopians live in the highlands, above an elevation of 500 m. where the mosquito is less prevalent. However, Ethiopians dying of malnutrition in 2002, 21,400 (2.0% of total deaths, 13th-largest cause), exceeded that of Nigerians, 18,300 (0.9% of total) even while Nigeria that year was 75% more populous. It has been estimated that lowlands - where malaria is most prevalent - cover 61% of Ethiopia's area but are home to only 12% of the population (Getachew, Kassa Negussie. 2001. "Among the Pastoral Afar in Ethiopia: Tradition, Continuity and Socio-Economic Change", International Books, p. 27). Elevated temperatures in Ethiopia will extend the coverage of malaria-carrying mosquitoes above 1,000 m. where most of the Ethiopian population resides (Collier, Paul et al. 2008. "Climate change and Africa", *Oxford Review of Economic Policy*, 24(2): 337-353). Between the period 1960-99 and 2070-99, one synthesis of country-level climate change models predicts Ethiopia's average annual temperature to rise from 23.1 to 26.9 Celsius while average daily precipitation will decline slightly from 2.04 to 1.97 mm (Cline, W. R. 2007. *Global Warming and Agriculture: Impact Estimates by Country*. Washington, DC: Center for Global Development and Peterson Institute for International Economics, p. 39).

**A FIVE-CENTURY PERSPECTIVE: 1500-2009 ANNUAL POPULATION GROWTH: ANGLO-SAXON DIASPORA: 0.96%; AFRICA: 0.60%; WORLD: 0.54% PREDICTED 1500-2050 ANNUAL POPULATION GROWTH: ANGLO-SAXON DIASPORA: 0.94%; AFRICA: 0.69%; WORLD: 0.55%**

Ethiopia's current population growth needs to be placed in broader perspective. Between 1820 and 1900, the British-settled colonies of Canada, the USA, Australia and New Zealand expanded nearly eight-fold, from eleven million to eighty-six million citizens, or an annual rate of growth of 2.6%, five times faster than the global rate; in the previous century, these colonies' growth rate, 1.6% per year, was more than 3.4 times the global rate, and 1.5 times the global rate during 1900-1950. Canada's population grew by 3.1% annually from 1820-70, while the United States was growing at 2.8%/year, including both natural increase and immigration from the Old World; at the same time, Western Europe's population grew 0.7% per year and Africa by 0.4% per year, the latter exactly the world average (Angus Maddison, "Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD", [www.ggdc.net/maddison](http://www.ggdc.net/maddison)). By comparison, Africa's population grew at its maximum rate of 2.6% for only 50 years, from 1950-2000, while from 1900-1950 at 1.5% and from 1820-1900 at 0.5%; growth has now fallen to 2.3% (2000-2010), and is expected to fall to 2.0% during 2010-2025 (UN. 2009. "World Population Prospects: The 2008

Revision", Database, <http://esa.un.org/unpp/>). England's birth rate remained between 30 and 35 per thousand population between 1750 and 1900, even while the death rate, steady at 26 from 1750 to 1825, began to fall irreversibly after 1825, reaching about 20 by 1850 and remaining there until 1900. So in England's case the second stage of the "demographic transition", declining birth rate following declining death rate, took a century and a half to achieve (Hayami, Yujiro. 2005. "Development Economics: From the Poverty to the Wealth of Nations", Oxford U.P., p. 68). By comparison, India's birth rate began falling slowly from 50 per thousand in 1900, and their death rate fell from 50 much more precipitously beginning in 1910 (Hayami 2005: 71).

Over the period 1500-2009, the Anglophone diaspora's population growth rate, 0.96%/year, was 78% faster than globally, 0.54%/year, while Africa, at 0.60% per year, was just 12% faster (Maddison, Angus. "Historical Statistics of the World Economy: 1-2008 AD"). University of British Columbia geographer Graeme Wynn has noted that in eighteenth-century Quebec, "[t]he population of the Colony actually doubled every 25-27 years through the century - an increase of approximately 2.8 per cent per year, a rate similar to those now current in many African and Asian nations faced with a 'population explosion'" (Wynne, Greame. 2000. "On the Margins of Empire 1760-1840", in "The Illustrated History of Canada", Craig Brown, ed., Key Porter, p. 221). Extending to the UN-predicted continental populations for the middle of this century, the annual average growth rates for 1500 to 2050 will be 0.55% (World), 0.94% (Western offshoots), 0.68% (Latin America and Caribbean), 0.36% (Europe), 0.69% (Africa), and 0.53% (Asia) (Maddison, Angus. 2009. "Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD", Excel spreadsheet, [www.ggd.net/maddison](http://www.ggd.net/maddison) ; United Nations, "World Population Prospects: The 2008 Revision"). As mentioned in the section "Global Ecological Overshoot", counting population purely as bodies no longer suffices, since North Americans exert a ten-fold greater demand on biospheric sustainability than do Africans.

CONTINENTAL POPULATION HEADCOUNTS OVER FIVE CENTURIES						
	Western Europe	Western Offshoots (Canada, USA, Australia, NZ)	Latin America & Caribbean	Asia	Africa	World
Population, thousands						
1500	57,268	2,800	17,500	283,800	46,610	438,428
1950	305,629	176,458	165,488	1,385,239	227,939	2,527,960
2009	402,418	366,175	583,991	4,017,611	990,447	6,764,086
2050	421,592	482,537	729,184	5,231,485	1,998,466	9,149,984
Annual Percentage Change						
1500 - 1950	0.373%	0.925%	0.501%	0.353%	0.353%	0.390%
1500 - 2009	0.384%	0.962%	0.692%	0.522%	0.602%	0.539%
1500 - 2050	0.364%	0.941%	0.680%	0.531%	0.686%	0.554%
Percentage of World Population						
1500	13.1%	0.6%	4.0%	64.7%	10.6%	100.0%
1950	12.1%	7.0%	6.5%	54.8%	9.0%	100.0%
2009	5.9%	5.4%	8.6%	59.4%	14.6%	100.0%
2050	4.6%	5.3%	8.0%	57.2%	21.8%	100.0%
Sources						

- (1) 1500-2009: Angus Maddison. 2009. "Historical Statistics of the World Economy: 1-2008 AD", <http://www.ggd.net/maddison>
- (2) 2050: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, "World Population Prospects: The 2008 Revision", <http://esa.un.org/unpp>

The ratio of global population shares for Europe, coupled with its predominantly English-speaking areas of settlement, relative to Africa, went from 1.3 in the year 1500 to a peak of 2.1 in 1950, and has since fallen to 0.8, expected to stabilise at 0.6 at the middle of this century.

A brief history of Africans, as a percentage of the total human population over the last one thousand years: in the year 1000: 12%; 1500: 11%; 1700: 10%; 1820: 7%; 1900: 7%; 1950: 9%; 1981: 11%; 2000: 14%; 2009: 15% (Angus Maddison); 2050 (UN est., 2008 Revision): 22%; 2100: 25%; 2300: 24% (UN. 2004. "World Population to 2300", p. 22). By comparison, Northern America's population (Canada & the U.S.A.) first fell from 0.5% (1000 - 1500) to 0.2% (1700), then rose to 1% (1820), 5% (1900), peaking at 6.6% (1950), now at 5% (2009), and predicted to remain there up to 2100, rising slightly to 6% (2100-2300). Pulling back Dyer's telephoto focus on the last decade to the broad five-century sweep of the modern era exposes a forest, the West's responsibility for what is happening today in Africa. If we look at changes in continental populations from 1500 to 2009, we find that the total population of the principal areas of British settlement - Australia, Canada, New Zealand and the United States - increased 131 times, from 2.8 mill. to 366 mill., compared to a 21-fold increase for Africa (47 mill to 1.0 bill.), according to estimates made by the economic historian, Angus Maddison; this is consistent with any species encountering a previously uncolonised or lowly colonised habitat. By comparison, Asia grew just 14-fold, Latin America 13-fold, and Europe 7-fold, making the global increase 15-fold (438 m. to 6.76 bn.). The Anglo-settled colonies initially suffered losses of between 20% and 50% (possibly up to 90%) of their indigenous populations for the first two centuries, owing to lack of immunity to European diseases, and to warfare (Romaniuc, Anatole. 2000. "Aboriginal Population of Canada: Growth Dynamics under Conditions of Encounter of Civilizations", *Canadian Journal of Native Studies*, XX(1):95-137). In what became Canada, the population fell from 250,000 in 1500 to 200,000 in 1700, in the US, from 2 million to 1 million over the same period, and in Australia, from 450,000 to 334,000 between 1700 and 1820 ("Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD", [www.ggd.net/maddison](http://www.ggd.net/maddison)). Even at 2008 revision UN projections, the African population between the years 1500 and 2050 is predicted to increase by a factor of 43 times, compared to 172 times for the "Western offshoots", 42-fold for Latin America and the Caribbean, and 19.5-fold globally. If we combine populations for Western Europe with the four Anglophone offshoots, they increased 13-fold from 1500-2009 and are predicted to increase 20-fold for 1500-2009.

In 1500, Maddison's estimates show that Africans comprised 10.6% of the total human population, compared to 13.1% for Western Europe, while Asia comprised 64.7% and England's future settlements (Canada, the United States, Australia and New Zealand) comprised just 0.6%. In 1913, near the pinnacle of Western Europe's global dominance, its population share peaked at 14.6% of humanity, the "Western offshoots" of Anglo settlements held 6.2%, while Africa's share had fallen to an historical nadir of 7.0%; one century ago then, Europeans and their diaspora outnumbered Africans by three to one, 372 mill. vs. 125 mill. In 2009, Europe's share has fallen dramatically to 6%, Anglo regions have held steady at 5%, and Africa's rebounded to 15%: in other words, we are very nearly back to the same European-stock to African ratio as in 1500 (in fact the shares were 14% Europe & settlements and 11% Africa in 1981). However, by 2050, the UN predicts the African share will rise to 21%, finally plateauing around 27% from 2100 to 2300, while Europe and North America together will stabilise around 12%. Effectively, the great wave of Western modernity will have doubled Africans' share among humanity, while that of "the West" will remain unchanged, and our species numbers will have expanded twenty-fold (UN. 2004. "World Population in 2300"). Such expansion is unique within the mammalian kingdom, where an inverse logarithmic relationship has been found between the size of individual organisms and the number of living members for each species. There are, for example, an estimated ten billion mice (with weights under a hundred grammes), but only between ten and one hundred thousand whales, each weighing 10 - 100 tonnes. And as such, the "natural" limit for

50-100 kg Homo sapiens would be on the order of one to ten million persons (Danilov-Danil'yan, Victor I. et al. 2009. "Sustainable Development and the Limitation of Growth: Future Prospects for World Civilization", Springer, p. 30-31, 40). Maddison estimated the world population had already reached 226 m. by 0 C.E., and if the human population stabilises around 9 billion, we will have exceeded the upper bound for our size norm by 900 times.

The downward fertility trend, it now appears, is not permanently linked to improved standards of well-being: maybe prosperity isn't driving us inexorably to extinction. For the most highly developed countries in terms of income, education, and life expectancy, the fertility rates have reversed their steady decline and over the last two to three decades have rebounded somewhat. However, at a current average of 1.9, most are still below the replacement rate of 2.1, and Australia, Canada, Japan and several other countries are anomalies, still declining. While the US fertility rate reversed from a minimum of 1.74 in 1976, back up to 2.05 in 2005, Canada's rate fell from 1.82 children per woman in 1975 to 1.51 in 1999, and has remained there up to at least 2005 (Myrskylä, Mikko et al. 2009. "Advances in development reverse fertility declines", Nature 460, 741-743). These fertility dynamics hold even when "tempo-adjusted" for the postponement trend to the later child-bearing years (although these data for Canada and eight other countries were unavailable).

## **POPULATION DENSITY: FROM 8 AFRICAN NATIONS IN THE DENSEST 100 IN 2015 TO 15 IN 2050**

In terms of population density, both sub-Saharan Africa and North America are still well below the world averages: in 2010, there are estimated to be 36 Africans per square kilometre and 16 North Americans (Canada & USA) per sq. km., compared to 51 globally (UN. World Population Prospects: The 2008 Revision, <http://esa.un.org/unpp/>).

Even if Africa's population doubles by 2050, as is predicted in the UN's medium variant scenario, and it becomes the second-most densely populated continent after Asia's predicted density of 164/sq.km., Africa's overall density will be 72, compared to 21 for North America and 67 globally. In 2010, among the top one hundred most densely-populated countries, 39 are small states and islands under 500,000 population, while the other 61 constitute 64% of the world population, and of those 61, only eight are African. In the top 100: Rwanda: 24th-highest density, Burundi: 41st, Nigeria: 67th, Gambia: 72nd, Uganda: 76th, Malawi: 80th, Togo: 87th, Ghana: 98th. In 2050, 63 of the 100 densest countries are predicted at the medium variant to contain 66% of world population, and African representation will then increase to 15. In the top 100: Rwanda: 14th, Burundi: 23rd, Uganda: 38th, Nigeria: 47th, Malawi: 48th, Togo: 67th, Benin: 78th, Ghana: 80th, Sierra Leone: 85th, Ethiopia: 86th, Burkina Faso: 88th, Kenya: 90th, Côte d'Ivoire: 93rd, Senegal: 94th, Egypt: 98th. While Ethiopia's overall density in the 2007 census was reported to be 67.2 persons/sq.km., there is significant regional variation, from 6.6 persons per sq. km in Somali region, 15/sq. km. in Afar, 86 in Tigray, 108 in Amhara, up to 589 in the city-state of Harari Region, population 122,000 in 2005 (Government of Ethiopia, "Ethiopia Population and Development Indicators 2008"; Wikipedia, First-level administrative divisions of Ethiopia). Predominantly single-household agrarian countries like Ethiopia, Burundi and Malawi are very densely populated since they rely on non-mechanised farming for survival. The World Bank calculated rural population densities on the currently arable land for 2000 and found there to be 543 rural Ethiopians per square kilometre of arable land; this compared to Burundi (689), Niger (192), Uganda (377), and lower than in Bangladesh (1,208), Egypt (1,298), Puerto Rico (2,701), Sri Lanka (1,602), Vietnam (1,037) and a weighted world average of 503 ("World Development Indicators", 2003, p. 120-122). The latest available data, for 2007, show Ethiopia's rural population density to rank 69th out of 201 nations, at 467 persons per sq. km., compared to Burundi (708), DR Congo (622), Rwanda (646), and Bangladesh (1,452) ("World Development Indicators", <http://databank.worldbank.org/ddp/home.do>).

CONTINENTAL POPULATION DENSITIES OVER FIVE CENTURIES						
	Western Europe	Western Offshoots (Canada, USA, Australia, NZ)	Latin America & Caribbean	Asia	Africa	World
Population density, persons per square kilometre (1) (3)						
1500	15.43	0.10	0.85	8.88	1.54	3.26
1950	82.32	6.25	8.06	43.33	7.52	18.78
2009	108.39	12.97	28.45	125.68	32.67	50.26
2050 (2)	113.56	17.09	35.53	163.65	65.92	67.98
Ratio to World Population Density						
1500	4.736	0.030	0.262	2.725	0.472	1.000
1950	4.383	0.333	0.429	2.307	0.400	1.000
2009	2.157	0.258	0.566	2.501	0.650	1.000
2050 (2)	1.670	0.251	0.523	2.407	0.970	1.000
Sources						
(1) Populations 1500-2009: Angus Maddison. 2009. "Historical Statistics of the World Economy: 1-2008 AD", <a href="http://www.ggdc.net/maddison">http://www.ggdc.net/maddison</a>						
(2) Populations 2050: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, "World Population Prospects: The 2008 Revision", <a href="http://esa.un.org/unpp">http://esa.un.org/unpp</a>						
(3) Areas: Food and Agricultural Organization of the United Nations, FAOSTAT, ResourceSTAT, Land, Country Area, for the year 2008, <a href="http://faostat.fao.org">http://faostat.fao.org</a>						

## ETHIOPIAN FAMINES, DROUGHTS, & FOOD INSECURITY: A CENTURIES-OLD PHENOMENON

Dyer draws a direct and overly facile line between Ethiopia's 2009 food shortage and high population growth. It would be more informative to identify who exactly is going hungry in the current drought and how it fits into the country's history: what are the spatial and socio-economic determinants of food scarcity in Ethiopia? Henze contends that intensive agriculture and animal domestication in the Aksumite Empire - the northern highlands of what was later to become Ethiopia - was underway between 1000 and 500 B.C.E. (Henze, Paul. B. 2000. "Layers of Time. A History of Ethiopia", Palgrave, p. 20,26). By the eighth century C.E., the Aksumite Empire was in decline, speculated by some historians to be the result of increasing population or climatic changes: "erratic rainfall and depletion of soils and forests seem to have affected the prosperity of the area around the capital [Aksum]; 600 years of intensive exploitation had taken its toll" (Henze 2000: 45; Pankhurst, Richard. 1998. "The Ethiopians: a history", Blackwell, p. 41). Twenty-five Ethiopian famines are recorded in a chronology between 253 BCE and 1900 CE (Webb, Patrick et al. 1992. "Famine In Ethiopia: policy implications of coping failure at national and household levels", International Food Policy Research Institute, p. 20). Another accounting of Ethiopian royal chronicles identified 23 "major famines" between 1540 and 1800, or nearly one per decade; the severest on record killed an estimated one-third of the population during the Great Ethiopian Famine of 1888-1892 (Pankhurst, Richard. 1966. "The Great Ethiopian Famine of 1888-4892: A New Assessment", J Hist Med Allied Sci XXI: 95-124, 271-294). This last catastrophe potentially ranked with Europe's Black Death of the fourteenth century, which was responsible for thirty to sixty per cent of Europe's population perishing (Wikipedia, the free encyclopedia. "Black Death", read

May 2010). All subsequent Ethiopian famines have affected smaller proportions of the population. Rahmato estimates Ethiopia has suffered through eleven major famines between 1913 and 2000, with death tolls reaching 100,000 (1957/58), 100,000-200,000 (1973/74 - up to 1% of total population), 400,000-1,000,000 (1984/85 - up to 2.5% of the population) and 20,000 (1999/2000); the Wollo region in the northeast was affected in virtually every instance, followed in frequency by Tigray. Ethiopian government data show that 11% of the population on average has been vulnerable to famine during 1980 and 2001, with peaks of 20% (1985), 17% (1992) and minima of 5% (1988) and 6% (1996); female-led and elderly-male-led families are the most at risk (Rahmato, Dessalegn. 2007. "La pauvreté et la recherche de la sécurité alimentaire", in: "L'Ethiopie Contemporaine", Karthala, p.285-308).

According to the UN's Food and Agriculture Organization, the share of Ethiopia's population that is classified as "undernourished" has declined steadily since 1990-92 (71%, 37.5 million) to 2006 (44%, 34.6 million) (FAO. 2009. "The State of Food Insecurity in the World: Economic crises – impacts and lessons learned", Rome: Food and Agriculture Organization of the United Nations, p. 50). Ethiopians comprised 4.4% of the world's undernourished people in 1990-92, and 3.9% in 2004-06, as the corresponding shares for sub-Saharan Africans also fell, from 34% (168.8 m.) to 30% (212.3 m.). They likewise parallel global undernourishment trends, from 16% of humanity undernourished in 1990-92 (845 m.) to 13% in 2004-06 (873 m.) (FAO 2009: 48-49). After a steady decline in developing country undernourishment since at least 1969-71, when it was 33%, to 2004-06 when it was 16%, the rate in 2008 and 2009 is projected to reascend, with a projected 1.02 billion persons (19%) undernourished in 2009 (FAO 2009: 11). Ethiopia is among seven African nations along with Afghanistan, Haiti and Iraq who have suffered the longest consecutive years of crises (15) for all nations; eleven of Ethiopia's were of human causes, and 13 of natural causes, however the FAO reports Ethiopia's key vulnerability is its level of official development assistance (FAO 2009: 15). In 2007, Ethiopia ranked fifth-lowest out of 191 countries in total health care expenditures per capita, at \$30 (PPP international dollars), compared to an average of \$67 for all low-income countries, \$863 globally, and \$4,145 in high-income countries (World Health Organization. 2010. "World Health Statistics 2010", Table 7, [http://www.who.int/gho/database/WHS2010\\_Part2.xls](http://www.who.int/gho/database/WHS2010_Part2.xls)).

Over the long-term, Ethiopia, is certainly one of the most disaster-prone nations on earth, based on compilations of deaths and persons affected by events including droughts, earthquakes, epidemics, floods, insect infestations and other acts of nature. EM-DAT, the International Disaster Database identifies the ten most severe natural disasters (all droughts) in Ethiopia, during 1900-2010, with a total of 54 mill. affected persons, on average 11% of the population per event. Four of these droughts affected over a tenth of the country's population: 20% in 1983, 18% in 2003, 16% in 1987, and 14% in 1989 (Centre for Research on the Epidemiology of Disasters. "EM-DAT, The International Disaster Database", Data - Country Profile, Top 10 Natural Disasters in Ethiopia for the period 1900 to 2010 sorted by numbers of total affected people, <http://www.emdat.be/>). Expressed as a ratio of total disaster-related deaths between 1900 and 2008, to each nation's population in 2007, Ethiopia, with 417,234 disaster-related fatalities, ranked 13th-highest with 5,308 deaths per million citizens among 186 countries for which data are available; Russia (63k disaster deaths per mill. pop.), North Korea (26k), Bangladesh (19k), Niger (14k), China (10k) and India (8k) were the major countries with higher disaster-related mortality rates (calculated from: EM-DAT, Advanced Search, all 15 disaster types, all years, all countries, Total number of deaths; Population 2007: UNDP. 2007. "Human Development Report 2007/2008", Table L). Of the 417 thousand Ethiopian disaster-related deaths, 402 thousand or 96.4% were drought-related, followed a distant second by 11,600 epidemic-related deaths (2.8% of total). Restricting to individual disaster categories, Ethiopia ranks fifth-highest per capita (5k per mill. pop.) in drought-related mortality after Cape Verde (170k), Bangladesh (12k), Russia (8k), and Niger (6k); it is 31st-highest in epidemic mortalities, and 58th-highest for flood mortalities per capita. In the 1970s, an average of two million Ethiopians were in need of humanitarian food assistance (6% of population), and in the last decade, the number has increased to peaks of eight million in 2003 (20% of population), and fifteen million in 2009 (19% of 80 m. population). In mid-2009, there were six million chronically food insecure, with an additional nine million seasonally insecure; 48% of children under five are stunted (heights below the normal range) and 27% of women are undernourished; in drought-prone areas the most vulnerable groups typically have the smallest landholdings, are female-headed, and lack oxens (Teller, Charles

et al. 2009. "Population Dynamics, Food/Nutrition Security and Health in Ethiopia: Delicate Balance of Vulnerability & Resilience", Poster Session, "International Union for the Scientific Study of Population, Marrakech, Morocco, Sept. 2009).

Despite having been under the Marxist-Leninist Derg control from 1974 until 1991, previous inequalities in land area per household appear to have persisted, such that, with the exception of post-reform resettled households, present inequalities in distribution are similar to Kenya, Rwanda and Zambia, and female-headed families and families lacking an ox are more likely to own smaller plots than others, even smaller households (Kebede, Bereket. 2008. "Land Reform, Distribution of Land and Institutions in Rural Ethiopia: Analysis of Inequality with Dirty Data", *J. Afr. Econ.* 17(4):550-577). In fact, continuity more than disruption characterises the periods from Haile Selassie's reign to Mengistu to today's Zenawi. Philip Marsden's observations from 1988: "the truth is that the revolution did not change all that much [...] For the majority of Ethiopians, life is still much the same: an esoteric bureaucracy has replaced the court and the nobility, the priesthood still deliver prayers in Ge'ez, and hide the mysteries behind clouds of incense, and behind the iconostasis, bright with benign images of the Trinity, and bloody ones of martyrdom. The Church, the legacy of the Crown, centuries of civil wars and thwarted invasions - these things make Ethiopia more conservative than the newer countries on the African continent. The Ethiopians are a people deeply aware of their past, which gives them, on occasions, an air of weary fatalism" (Marsden-Smedley, Philip. 1990. "A Far Country: Travels in Ethiopia", London: Century, p. 106).

The UN World Food Programme reports there have been six major droughts in Ethiopia during the last two decades (<http://www.wfp.org/countries/ethiopia>). The Food and Agriculture Organization/World Food Program mission to Ethiopia in early 2010 estimated that 5.2 m. persons (7% of the population) required relief food assistance, possibly rising to 6.5 m. by June, and concentrated in Tigray, Somali and Harari regions; chronic problems include "land degradation with 50 percent of the highlands believed to be degraded; land pressure resulting in 37 percent of the farming households in the country cultivating less than 0.5 ha and some 87 percent cultivate less than 2 ha; the poverty level with 37 percent of the population [living] below the poverty datum line; and high population growth now estimated at 2.6 percent outstripping the cereal production though growing by more than 10 percent per annum" (FAO/WFP Crop and Food Security Assessment Mission to Ethiopia, 26 February 2010, Section 5.6.1). Average daily food energy consumption from all food sources during 1961-69 was 1,764 kilocalories per Ethiopian, declining to a low of 1,559 kcal during the 1990s, but since rebounding to 1,779 for 2000-2008 and 1,826 in 2008 (FAOSTAT, SUA/FBS, Food Balance Sheets). The US National Academy of Sciences recommends daily energy intakes of 1,848-3,720 kcal (males) and 1,625-3,141 kcal (females) at 30 years of age, depending on stature and level of physical activity (National Academy of Sciences. Institute of Medicine. "Estimated Energy Requirements (EER) for Men and Women 30 Years of Age", in: "Dietary Reference Intakes: Recommended Intakes for Individuals"). The FAO threshold value below which malnourishment is defined is 1,820 kcal per day, however on a higher threshold of 1,990 kcal, the proportion of undernourished Ethiopians has fallen from 66% to 46% between 2000 and 2005; despite this reduction, the food situation remains "extremely alarming", potentially resulting in stunting, cognitive impairment and increased disease susceptibility in children (Schmidt, Emily; Dorosh, Paul. 2009. "A Sub-National Hunger Index for Ethiopia: Assessing Progress in Region-Level Outcomes", IFPRI, p. 3, 14-16). As the IFPRI authors put it, in the country's northern Amhara, Benishangul-Gumuz, and Tigray regions where undernourishment is at its maximum rate of 47-59%, "[d]uring the first month of the meher [major, June-September] rains, a feeling of overwhelming anxiety characterizes most conversations throughout Ethiopia" and prior to these rains in some regions "adult weight loss is evident" (Schmidt 2009: 16,17). Ethiopia during 2004-06 had the eighth-highest undernourishment rate, exceeded only by five other countries in central Africa, by Sierra Leone, and by Haiti (Wikipedia, "List of countries by percentage of population suffering from undernourishment", accessed May 2010). FAO data show that the total cereals area harvested per Ethiopian has gone from 0.23 ha. (1960-69) to a low of 0.10 ha. (1990-99) to 0.11 (2000-08) while total fertilizer use per capita rose steadily from 0.1 kg/cap. (1961-69) to 2.5 kg/cap. (2000-07) (FAOSTAT, Production, Crops; ResourceSTAT, Fertilizers, Consumption; PopSTAT, [faostat.fao.org](http://faostat.fao.org)). The World Bank states that "land holdings per rural person have more than halved over the past 40

years and a land poor class is emerging — 20 percent of the rural households have not enough land to produce half of their caloric needs" (World Bank. 2008. "Country Assistance Strategy ... Ethiopia", 2008-2011, p. 29). The World Bank estimates that cultivated land as a fraction of total landmass grew from 10% in 1993 (0.19 ha. per cap.) to 14% in 2007 (0.18 ha. per cap.) for a total cultivated area of 14.0 mill. ha. in 2007; forested area declined from 14.7% (1993) to 12.7% (2007), placing it now at about one-half of sub-Saharan Africa's average forest coverage of 26.1% (World Bank, "World Development Indicators & Global Development Finance").

For the past three decades, since the Derg regime to the present day, ninety percent of families in Ethiopia are prohibited from owning land, and are limited to a government ceiling allocation of 2.5 ha., of which 37% own less than 0.5 ha. (Rahmato, Dessalegn. 2008. "Ethiopia: Agriculture Policy Review" in: "Digest of Ethiopia's National Policies, Strategies and Programs", Taye Assefa, ed., Forum for Social Studies, p. 139). Except for recipients of the government's food-for-work programme, there is no "crop insurance" aside from selling one's own assets: livestock or crops, or borrowing from one's social network when drought destroys their food source. This case study of one Ethiopian family illustrates how misfortune under an unpredictable climate can create an inescapable poverty trap:

'Ato [Mr.] Mohammed, 55 and illiterate, resides in the Bati district of South Wollo Zone (Ethiopia) and heads a household of nine. He has been chronically food insecure for more than 10 years when he lost his only oxen due to drought. He sold the animal to buy food at the time and has not been able to acquire another. Currently, Mohammed holds one hectare of farm land and he has no grazing land. Since he owns no oxen, he has been leasing out the land for share-cropping on a 50/50 sharing arrangement. Mohammed and his family members are engaged in various types of daily labor activities for cash and food, and the household is a regular recipient of food aid. Mohammed asserts "oxen are the crucial productive asset that would liberate me from this insecurity trap." On the other hand, however, he does not want to take credit from a regional credit organization to buy an ox as he does not want to be indebted and fears that the debt may be passed on to his children if he fails to repay. He fears that the ox may die due to lack of adequate feed or animal diseases for which there is no dependable animal health service in the community. He also fears that he may not be able to pay back since crop failure is frequent due to insects and droughts' (Carter, Michael R. et al. 2007. "Poverty Traps and Natural Disasters in Ethiopia and Honduras", *World Development* 35(5):835-56).

It is these types of families, on average one-tenth of the Ethiopian population, who cannot afford the rising cost of inorganic fertilisers to apply to their nutrient-impooverished plots and whose communities lack grain storage facilities to conserve their harvest during good years, who become beneficiaries of the Ethiopian government's partnership with foreign aid donors in the "productive safety net" ("Annual Report of Clusters of Koraro, Ethiopia", Millennium Villages Project, February 2007, p. 4; "A Sub-National Hunger Index for Ethiopia", IFPRI, 2009, p. 17). The Productive Safety Net Program, launched in 2005 by the Ethiopian government in concert with the World Bank and Canada, the U.S.A. and several European donors and intended to run only five years, is a food-for-work initiative serving seven million "able-bodied" but chronically food-insecure Ethiopians who provide physical labour on community public works projects such as tree-planting and soil/water conservation in exchange for food (Andersson, Camilla et al. 2009. "Impacts of the Productive Safety Net Program in Ethiopia on Livestock and Tree Holdings of Rural Households", *Environment for Development, Discussion Paper EfD DP 09-05*). Preliminary findings suggest that PSNP beneficiaries who receive support in a predictable pattern are less likely to sell their assets, and have greater access to credit; however, the program is still selective, and did not provide in 2009 for pastoralists in Ethiopia's eastern Somali region (FAO. 2009. "The State of Food Insecurity in the World: Economic crises – impacts and lessons learned", Rome: Food and Agriculture Organization of the United Nations, p. 42).

South Wollo area, in the northern highlands in Amhara Regional State, is one of the most famine-prone areas of the country. Although the Ethiopian government and World Bank claim that poverty is diminishing overall in Ethiopia, regional surveys in Wollo zone have found the average rate of persons needing food aid to progressively rise, with strong inter-annual fluctuations, from 15% of households in 1994 to 30% in 2001, and female-headed households were twice as likely to be destitute as male-headed ones (Devereux, Stephen; Sharp, Kay. 2006. "Trends in poverty

and destitution in Wollo, Ethiopia", *Journal of Development Studies*, 42(4):592-610). Another study in this region found that "female-headed households in South Wollo control on average less than 50 and 70 per cent of the total livestock and land, respectively, that males do"; in part this is for cultural reasons: "[s]trong cultural norms constrain women from ploughing fields. Thus, for a female-headed household without an adolescent or adult son(s) the head frequently must share-crop out her farm to have it plowed". With the share of "very poor" households (based on livestock assets) declining from 66% in 1997 to 47% in 2003, these authors were optimistic: "once the food crisis of a drought ends, poor households – including many headed by females – show considerable resourcefulness in rebuilding assets and livelihoods, and there is no reason to assume that they would not do the same if food risks were diminished through safety nets" and "South Wollo will continue to be challenged to feed itself even in good rainfall years, but with increased investments to generate meaningful employment, urban markets, and agricultural diversification, the incidence of persistent poverty in the region could decline in this decade". South Wollo, as the Rahmato famine survey revealed, is sometimes labeled the "buckle" in the Ethiopian "famine belt" (Little, Peter D. et al. 2006. "Moving in place: Drought and poverty dynamics in South Wollo, Ethiopia", *Journal of Development Studies*, 42(2): 200-225). Approximately 40% of mortality during Ethiopia's 1973/74 famine occurred there, between forty and eighty thousand deaths. South Wollo region is rather unique in Ethiopia as being more dependent on the short "Belg" rains (January-April) than the major "meher" rains (June-September) and has a "particularly rugged terrain with very steep slopes and drops of 1000 m. over a few kilometers not uncommon"; during the peak of the 1999-2000 drought, one-half of the South Wollo population (1.2 mill. out of 2.4 mill. persons) received monthly food rations, compared to a national average of 16% (10.2 mill. out of 62 mill.). Per capita incomes are \$36 per annum compared to a national average of \$104, and 24% of households are female-headed (Little, Peter. 2008. "Food aid dependency in northeastern Ethiopia: Myth or reality?", *World Development* 36(5):860-874). While international humanitarian relief organisations including Concern International and World Vision are active in South Wollo, Little judges food aid to be "not well targetted to the poor", and "for political reasons" it is distributed "to as many families as possible rather than target[ing] the neediest" because the great majority of food is distributed by Ethiopia's "powerful and deeply entrenched state bureaucracy centered on the Disaster Prevention and Preparedness Commission (DPCC)". Demonstrating that food aid recipients were more likely to be involved in three or more income-generating activities than non-recipients, Little refutes the "food aid dependency" argument and concludes that "few farmers would be foolhardy enough to depend on food aid in rural Ethiopia since its delivery is non-transparent, uncertain, poorly timed, and the amounts insufficient" (Little 2008). Economic modeling using Ethiopian data has however found the converse result, that "food aid has unambiguous disincentive effects on domestic food production. The removal of food aid caused a modest increase in food prices but this stimulated food production" (Gelan, Ayele Ulfata. 2007. "Does food aid have disincentive effects on local production? A general equilibrium perspective on food aid in Ethiopia", *Food Policy* 32(4):436-458).

Two months after Dyer's opinion piece appeared in September 2009, the Ethiopian government downplayed the threat of famine to simply drought, explaining that it had undertaken the appropriate storage and redistribution of food reserves. The country's ambassador to Britain stressed that any comparison to the 1984 famine was hugely misleading and deeply damaging to the nation's image and its ongoing efforts to build its economy through tourism, investment and trade ("Drought, not famine in Ethiopia" - minister Tesfa-alem Tekle. McClatchy - Tribune Business News. Washington: Nov 9, 2009). Henze notes that the 1984 famine was in part the willful consequence of the Mengistu government attempting to quell opposition, particularly from northern Tigray insurgents by denying food aid. "During this period nearby Kenya experienced drought and crop failures more widespread and intense than Ethiopia. The Nairobi government took timely preventive action by importing grain. Kenyan officials set up efficient distribution networks through local authorities. Stricken populations did not have to flee and be gathered in camps. Few people died and when rains came again rural areas recovered quickly. The world hardly knew that Kenya had a problem. The Ethiopia famine was publicised widely and gave the country a negative image that persisted into the 1990s" (Henze 2000: 307 n. 37). The 2003 drought affected the largest number of Ethiopians of any drought from 1900-2010, 12.6 mill. according to Belgium's EM-DAT, The International Disaster Database, yet the number of

associated deaths was unreported, and presumably very small. American journalists covering the 2003 famine attributed it less to a lack of food reserves elsewhere in the country (150,000 tons were provided by large-scale Ethiopian farmers, along with 2 mill. tons imported from donor nations), but to weak infrastructure, lack of credit and weak commodity markets. US foreign aid policy insists on sourcing humanitarian food shipments from American farmers and while half of Ethiopian food aid came from the US, one-half of that cost accrued to delivery charges; the European Union, on the other hand, provides the funds directly and permits disaster-afflicted governments to purchase food from the nearest available source (Thurow, Roger and Scott Kilman. 2009. "Enough. Why the World's Poorest Starve in an Age of Plenty", Public Affairs, p. 71-95). While the Ethiopian government's focus is on poverty reduction, there has been no stock exchange since the 1970s, however the Ethiopian Commodities Exchange opened in 2008 (Minney, Tom. 2010. "Spotlight Ethiopia: A rising giant", New African, p. 67-69).

## **AGRICULTURAL TRADITION & CULTURAL INVOLUTION: ETHIOPIAN FATHER-LESS & OXEN-LESS HOUSEHOLDS MOST VULNERABLE, AS WELL AS ALL OF SOUTH WOLLO REGION**

To quote Dessalegn Rahmato's critique of the Government of Ethiopia's current agricultural development policies: "[t]he most pressing reality in my opinion is the following: high population growth and intense pressure on natural resources; the fact that most peasants are micro-holders and agriculture is progressively turning into a system of micro-farming; and the immense natural resource loss that is taking place in the countryside due to many factors including the saturation of living and working space. [...] The strategy for agricultural development relies heavily on one formula: the provision of a package of modern technologies and the technical and human resource arrangements for providing the service. [...] The technology itself is not diversified but relies for the most part on agro-chemicals and improved seeds, which in aggregate may help to bring about land productivity but not necessarily labor productivity" (Rahmato, Dessalegn. 2008. "Ethiopia: Agriculture Policy Review" in: "Digest of Ethiopia' National Policies, Strategies and Programs", Taye Assefa, ed., Forum for Social Studies, p. 147). The anthropologist Peter D. Little and colleagues echo these concerns: "[W]hile political ideologies and regimes have drastically changed since the 1960s, the underlying policy principle of 'tying the peasant to the land' persists and it results in a relatively undiversified and undifferentiated rural sector" (Little, Peter D. et al. 2006. "'Moving in Place': Drought and Poverty Dynamics in South Wollo, Ethiopia", *J.Dev.Stud.* 42(2):200-225).

According to researchers at Addis Ababa University, "[t]here is a very complex web of multi-level factors balancing agro-economic and climatic vulnerabilities with socio-cultural and institutional change. A very high proportion (84%) of the population remains in rural areas with shrinking and eroding arable and grazing land per capita, less able to feed and [nurture] itself than the urban population" (Teller, Charles et al. 2009. "Population Dynamics, Food/Nutrition Security and Health in Ethiopia: Delicate Balance of Vulnerability & Resilience", IUSSP Marrakech, 30 September, 2009, Poster Session #3). While during 2000-08, foreign direct investment and emigrant workers' remittances contributed 2.9% and 1.8% of the sub-Saharan African GDP respectively, for Ethiopia they were only 1.8% and 1.0% respectively (World Development Indicators). And Ethiopia's 2008 Human Development Index, 0.414, is lower than India's in 1980 (0.427), although the gap is narrowing swiftly (UNDP, Human Development Report, 2009). Ethiopian social scientist Dessalegn Rahmato parallels the Ethiopian peasantry's decline from poverty to destitution to the "involution" of Indonesian rice farming culture in the 1960s, and traces Ethiopians' present vulnerability to ecological degradation involving soil fertility loss due to over-farming, deforestation and loss of vegetation cover, farming up onto hillsides, and surface and groundwater losses (Rahmato, Dessalegn. 2007. "La pauvreté et la recherche de la sécurité alimentaire", in: "L'Ethiopie Contemporaine", Karthala, p.285-308). Indonesia transformed itself industrially from what anthropologist Clifford Geertz called the "involution" poverty trap of ever-diminishing family rice paddies and farm plots, and Solutions 2 below examines how the Ethiopian government is attempting this process through large-scale agro-industry by foreign investors.

The next section considers three possible solutions to Ethiopia's poverty trap, focusing on fertility reduction, private agricultural investment, and population resettlement.

## **SOLUTIONS 1. SACHS: REDUCE CHILD MORTALITY & FERTILITY QUICKLY AND SIMULTANEOUSLY**

The development economist Jeffrey Sachs, director of the Millennium Villages Project, is now arguing for parallel, intensive efforts at child mortality reduction (malaria bednets, for example) and voluntary fertility reduction (encouraged through the green revolution, women's empowerment, widespread availability of legal abortion, contraceptives and sterilisation after desired family size is reached, etc.) to reduce Africa's rate of population growth. He reckons that such measures would bring world population to 8 billion in 2050, not the UN projection of 9.2 billion, and half of this reduction would come from India and sub-Saharan Africa (Sachs, Jeffrey D. 2008. "Common Wealth: Economics for a Crowded Planet", Penguin, p. 183). As a component of its health interventions in the Millennium Villages Project cluster around Koraro, Ethiopia, oral, injectable, and Norplant contraceptives along with condoms were supplied to nearly one thousand persons out of total village population of five thousand during 2005/06 (Kidanemariam, Tsegazeab et al. 2006. "Annual Report for Koraro, Ethiopia. Millennium Research Village July 2005 to June 2006", millenniumvillages.org).

Sachs writes that "any sensible development policy for Africa or any other high-fertility region should integrate aid for economic development (including health, agriculture, education, and infrastructure) with aid for family planning" (Sachs 2008: 184). For the Millennium Villages Project active since 2005 in northern Ethiopia, "in an effort to improve sexual and reproductive health care, a critical health issue in Koraro, local Hawzien government officials partnered with the Koraro cluster team to host a training and discussion for local health workers and traditional healers to develop a coordinated strategy", along with economically-focused reforestation and income-generating initiatives in fruit tree-growing and honey-making ("The Millennium Villages Project Annual Report", 2008, Earth Institute, p. 38).

The Population Reference Bureau notes that donor delays and retrenchment have limited Ethiopians' access to contraceptives; this, and men's disapproval of contraception practices are among the economic and cultural obstacles to rapid acceleration of fertility decline. "Nationwide, 80 percent of family planning services are provided by the public sector, and more than 85 percent of contraceptive users rely on just two methods — injections and oral contraceptives. More than a third of Ethiopian women would like to space their next birth or stop having children altogether, but are not using a method of contraception. The main reasons women give for not using a method of contraception include lack of information about the methods, lack of access, and rumors about side effects" (Ringheim, K. 2009. "Ethiopia at a Crossroads", Population Reference Bureau, p. 3-4). To accelerate fertility decline, the World Bank is recommending that Ethiopia focus on strengthening women's reproductive rights in the rural areas, as opposed to broad-based investments in general social infrastructure (Christiaensen, Luc et al. 2007. "Capturing the Demographic Bonus in Ethiopia: Gender, Development and Demographic Actions", Report No. 36434-ET, Washington, DC: World Bank). Ethiopian contraceptive usage rates (% of women ages 15-49) were 2% in 1980 and 4% in 1990 (World Bank, World Development Indicators). The Bank recommends "improving availability of contraceptives even in the most remote rural areas" by increasing the contraceptive prevalence rate from 15% in 2004/2005 to 25% in 2009/10 and male and female condoms distribution from 80 m in 2006/07 to 140 m in 2009/10 (World Bank. 2008. "Capturing the Demographic Bonus in Ethiopia" 2006, cited in: "Country Assistance Strategy ... Ethiopia", 2008-2011, p. 30, 54, 70). Ethiopia's present contraceptive prevalence is about two-thirds the overall rate for sub-Saharan Africa in 2008, 22.8% (World Development Indicators).

The official development planning document of the Government of Ethiopia (GOE) includes a fertility reduction target from the current 5.4 to 4.0 by the year 2015, through such means as increasing the contraceptive prevalence rate from 15% (2005) to 44% in 2015 (Ministry of Finance and Economic Development (MoFED). 2006. "Ethiopia: Building on Progress A Plan for Accelerated and Sustained Development to End Poverty (PASDEP)", p. 170, <http://>

siteresources.worldbank.org/INTETHIOPIA/Resources/PASDEP\_Final\_English.pdf). Periodic international surveys of government population policies show that the proportion of African governments that regard their country's population growth to be "too high" increased from 35% in 1976 to 68% in 2009, and those considering the fertility rate to be "too high" similarly rose from 38% to 75% over that period; African nations with official policies in place to lower fertility rates likewise increased from 25% (1976) to 70% (2009). In Ethiopia's case, the government went from viewing fertility as "satisfactory" in the 1970s to "too high" since the 1980s, and first implemented a fertility reduction policy during the 1990s (United Nations Department of Economic and Social Affairs/Population Division. 2010. "World Population Policies 2009", pp. 35-38, 41-44, 117).

### **ETHIOPIAN AID RECEIPTS: ONE-HALF THE PER CAPITA AFRICAN LEVEL, 1960-2008.**

Between 1960 and 2007, Ethiopia received a total of \$28 bn. (nominal US dollars) in development aid from Western donor nations, of which \$13bn came from multilateral sources such as the World Bank (SourceOECD. Geographical Distribution of Financial Flows to Aid Recipients). It also received funds from the Soviet Union during and following the Derg regime (1974-1991), primarily as military equipment, reaching close to \$1 bn. a year between 1987-89 (Henze, Paul B. 2000. "Layers of Time. A History of Ethiopia", Palgrave, p. 306-307, 314). During the 1960s and 1970s, Ethiopians received only between 26% and 36% of the average sub-Saharan African level of official development assistance per capita from donor nations according to the World Bank's World Development Indicators ("Net ODA received per capita (current US\$)"). In the 1980s and 1990s, this ratio improved to between 53% and 56%, and in 2000-2008, it was 67%: \$24 of net ODA per Ethiopian compared to \$36 per sub-Saharan African. By 2008, Ethiopians received 84% of the average African rate (\$41 vs. \$49), reflective of the West's alliance with the country following the 1993 overthrow of the Marxist Derg regime, and trebled again in its post-2001 war against terrorism, including Somalia. Food-related aid, both food-security-related and humanitarian aid, comprised 21.0% of Ethiopia's total bilateral and multilateral aid receipts over 2002-2008, or \$4.1 bn. out of \$19.3 bn.; as such, the Ethiopian food aid component was double the sub-Saharan Africa aggregate share of 10.6% of ODA, i.e. \$30.3bn. out of gross ODA disbursements of \$285.6bn (SourceOECD. Dataset: Creditor Reporting System, Sector VI.2. Dev. Food Aid/Food Security Ass. and Sector VIII. Humanitarian Aid, expressed as a ratio of gross disbursements to all sectors, constant 2008 US dollars, accessed May 2010). Food aid comprised 45% of Canada's gross Ethiopian aid disbursements over 2002-08 (\$186m. out of \$421m. total), 34% of UK's aid (\$332m out of \$982m.), and 72% of US aid (\$2,591m. out of \$3,607m.), which reduces Ethiopia's per capita aid receipts for non-immediate-survival needs in the health and education sectors even further. In 2008-09, Ethiopia was the fourth-largest recipient of the Canadian government's development assistance (\$176 mill. of which \$31 m. as humanitarian assistance), with a focus on health and food security; it was second-largest recipient (\$146 mill.) in 2007-08, and fifth in both 2006-07 and 2005-06 (CIDA. 2010. "Statistical Report on International Assistance - Fiscal Year 2008-2009", p. 9, 27; "Statistical Report on International Assistance - Fiscal Year 2008-2009", p. 6). There is no evidence that Canada is providing oral contraceptives to Ethiopia, however, as it has to other African countries. Canada exported on average \$3.6m. annually in contraceptives (oral hormones, spermicides and condoms) to Africa between 2003 and 2008, the major recipients being Madagascar, Chad, Benin, Niger, Zimbabwe, Kenya and Mali (Industry Canada, Trade Data Online, HS Codes 293723, 293792, 300660, 401410). In 2009, Canadian-made turbojets valued at \$5.7m. were supplied by Bombardier to Ethiopian Airlines, and coinage produced by the Royal Canadian Mint (\$1.5m.) together comprised 54% of Canada's total of \$12m. in exports to Ethiopia (bombardier.com - Press Release, November 20, 2008; mint.ca - Corporate Plan 2008-2012). Wheat constituted 52% of Canada's product exports to Ethiopia during 1991-2000 (Cdn.\$101m. out of \$196m.) and 49% in 2001-2009 (Cdn.\$97m. out of \$196m.), however none was exported to Ethiopia in 2009 (Industry Canada, Trade Data Online, Trade by Product, HS Code 1001).

## **SOLUTIONS 2: ETHIOPIAN GOVERNMENT LAND LEASING; PER CAPITA FOOD OUTPUT COULD TRIPLE BY 2050**

Dyer has noted that "[Africa is] the last place where there are large areas of good agricultural land that aren't already completely occupied by local farmers. There are usually some peasants scratching a living from the land, but they are few and poor, and they can easily be bought or driven out" ("African Land Grab", 9 May 2009, [http://www.gwynnedyer.com/articles/Gwynne%20Dyer%20article\\_%20%20African%20Land%20Grab.txt](http://www.gwynnedyer.com/articles/Gwynne%20Dyer%20article_%20%20African%20Land%20Grab.txt)). In 2009, the Ethiopian government's Agricultural Investment Agency announced that over the next two years it was offering 3 mill. hectares of arable land in sparsely settled areas, for leases of 40 to 99 years, to large-scale commercial developers ("Ethiopia targets 3 million ha for commercial farms", Reuters News, 5 November 2009). The government estimates the country has in total 74.5 m. ha. of tillable land representing 67% of its total landmass of 110 million hectares, yet only 15 m. ha., or 20% of the available farmland (14% of total landmass) are currently being used, mostly as small-holder plots, either subsistence or small-scale cash cropping; the World Bank's World Development Indicators also estimates that 14.0% of Ethiopia's total area was under cultivation in 2007. India is reportedly Ethiopia's largest foreign investor with \$4 billion in maize, rice, flower growing and sugar estates. Foreign land investors are free to export their harvested crops, however it is anticipated that much of it will be sold regionally to foreign aid donors such as USAID; foreign agribusiness is anticipated to facilitate Ethiopia's transition from oxen-ploughed subsistence plots to modern, commercial farming (Rice, Xan. 2010. "Ethiopia – country of the silver sickle – offers land dirt cheap to farming giants", *The Guardian*, 15 January 2010, p. 31). Ethiopians reportedly cannot own land, but are granted use certificates for their allocations, making mobility difficult (McCrummen, Stephanie. 2009. "The ultimate crop rotation; Lured by a new business model, wealthy nations flock to farmland in Ethiopia, locking in food supplies grown half a world away", 23 November 2009, *The Washington Post*, p. A01). Ethiopia is Africa's largest coffee exporter (2% of global exports in 2008), and ranked twelfth in global 2008 exports and seventh, excluding re-exporters (UN. "2008 International Merchandise Trade Statistics Yearbook", SITC Code 071, <http://comtrade.un.org/pb/CommodityPagesNew.aspx?y=2008>). In 2009, Ethiopia reported \$178m. in cut flower exports, compared to \$334m. by Zimbabwe, and \$446m. for Kenya in 2008 ("2009 International Merchandise Trade Statistics Yearbook", country pages). Ethiopia went from a 0.5% share of the world roses market in 2004 to 16% in 2008 ("More African roses via the Netherlands", *FloraCulture International*, March 26, 2009) and the IMF estimates it sold \$150m. in flower exports in 2009, compared to \$317m. in oil seeds (sesame) and \$419m. in coffee exports; the country received \$2.2bn. in emigrant workers' remittances and \$0.7bn in foreign direct investment (International Monetary Fund. 2009. *Country Report No. 09/296*, p. 17). In 2007, workers' remittance inflows amounted to just \$4 per Ethiopian citizen, compared to an average of \$26 per sub-Saharan African, and \$58 globally (UNDP. 2009. "Human Development Report 2009", Table E: International financial flows).

How accurate is the Ethiopian government's estimate of 70m. to 74.5m. cultivable hectares? Several studies have been undertaken to quantify the potential size of arable, yet unexploited land in Africa. One, estimating 43% of Ethiopia's total cultivable land to be actually under cultivation during 1988/90 was criticised as being unrealistically optimistic, given regions such as Wollo experience famine "every year that the rainfall is substantially below average. These phenomena would not happen if a land balance of over 50% existed" (Young, Anthony. 1999. "Is there really spare land? A critique of estimates of available cultivable land in developing countries", *Environment, Development and Sustainability* 1:3-18). More recently, Ethiopia has been calculated by former FAO scientist Nikos Alexandratos to possess 40.5m. ha. of rainfed and/or irrigable land, based on FAO measurements, 60% of which is rated as "very suitable" or "suitable", and 40% "medium" or "marginally suitable" (Alexandratos, Nikos. 2005. "Countries with Rapid Population Growth and Resource Constraints: Issues of Food, Agriculture, and Development", *Population and Development Review*, 31(2):237-258). This area is only 54% of the Ethiopian government's 74.5m. ha. estimate in 2009, and it assumes that Ethiopia maximizes its irrigation of irrigable land, of which in 2000 only 0.2 m. ha. (5%) were irrigated out of 3.6m. potentially irrigable. Thus, the 15m. ha. in use in 2009 would represent 37% utilisation, and 63% available. Increasing Ethiopia's irrigation levels using the Nile River and its tributaries may represent a geopolitical threat to the downstream agricultural productivity in Egypt,

particularly under future climate change scenarios (Dyer, Gwynne. 2008. "Climate Wars", Vintage Canada, p. 20).

The UN's "World Population Prospects: The 2008 Revision" (p. 39) predicts the Ethiopian population to go from 83m. (2009) to 174m. (2050), a 2.1-fold increase (1.8%/year), meaning that in 2050, if yields were to remain as they are today, 74% of total available Ethiopian land would be in use and 26% remain unutilised. FAO data show, however, that total Ethiopian cereal crop yields have risen 1.8-fold between 1960-69 (728 kg/ha) and 2000-08 (1,309 kg/ha) while total fertiliser use per capita rose from 0.1 kg (1960s) to 2.5 kg (2000-07) (FAOSTAT). Based on assumptions that 80% of Ethiopian farmland will remain devoted to cereal crops (barley, maize, sorghum, wheat and teff) to 2050, that yields per hectare will double between 2000 and 2050, and that the population will grow at 1.9%/year, Alexandratos estimates that the country would be capable of producing 418 kg of cereals per capita in 2050, compared to the actual production of 128 kg per cap. in 1993-2002 - a 3.3-fold improvement, if it were to farm its entire 39.1 m. ha - retaining its 1.4 m. ha. of UNEP-defined "protected forest" areas with over 40% forest cover and tree heights over 5 metres. Neighbouring Somalia per capita cereal production under similar assumptions is forecast to rise 3.2-fold, from 38 (2000) to 123 kg/head (2050). Of the 12 countries where agriculture exceeds 30% of their economies (Ethiopia's was 44.5% in 2008 - World Bank "Ethiopia at a glance") and the UN in 2004 predicted would have the highest 2000-2050 population growth rates - ranging from 1.8%/year for Ethiopia up to 2.9% for Niger and 3.3% for Uganda - four (Afghanistan, Burundi, Niger and Uganda) are predicted to have lower per capita cereal production in 2050 than in 2000, even when doubling yields (kg. per hectare) and maximising arable land potential. In Niger's case, productivity will fall severely to 61% less than in 2000, while for Afghanistan and Ethiopia's southern neighbour, Uganda, 22% less. Alexandratos notes, however, that threat of Malthusian scarcity is less determinable for Burundi and Uganda since cereals provide under one-quarter of food energy, the remainder derived from tubers such as yams and cassava, as well as plantains and bananas. But in the other eight countries, expanding potential ranges from 2.1 times (Benin) and 3.2 times (Burkina Faso) to 8.2 times (Madagascar) and 10.2 times (D.R. Congo) the 2000 cereal production levels. Given that the Global Footprint Network weights the biocapacity utility of croplands as five times that of grazing land, those eight nations may be able to significantly enhance the continent's biocapacity and compensate for the Ugandan and Somali reversals, provided sufficient forest cover is retained for uptake of anthropogenic carbon dioxide emissions.

The demographer John Caldwell, commenting on the UN's population projections to the year 2300 wrote that "[i]t seems scarcely possible that sub-Saharan Africa could feed two billion people. It lacks the alluvial soils of the great riverine basins of Asia and volcanic soils are largely confined to parts of East Africa that are already densely settled (Rwanda's population density is over 800 persons per square mile, a comparable Asian density being that of Sri Lanka). Water resources are largely in the wrong places: the Congo River is nowhere near good irrigable soils; the much less voluminous Niger River does flow through good savannah grassland soils but its water available for irrigation is mostly already employed" (UN Department of Economic and Social Affairs. 2004. "The Implications of the United Nations Long-term Population Projections", in: "World Population to 2300", p. 112-122).

Gwynne Dyer's concern for Ethiopia reflects both a Malthusian view of population growth exceeding the food supply, and a Westphalian view that, as a sovereign nation, it is responsible for its own food production. During 2000-2002, Ethiopia, along with 22 other West, East and Southern African nations as well as six Latin American nations, Russia, China and at least seven other Asian nations imported up to 25% more food, as measured in calories, than they exported. Angola, Democratic Republic of Congo, Eritrea, Gambia, Guinea, Guinea-Bissau, Liberia, Namibia and Sierra Leone all had net food import ratios between 25-50%, while ratios for Algeria, Botswana, Gabon, Gambia, Libya, Mauritania, Morocco, Senegal, and Tunisia, exceeded 50%, as they did for most of the Arabian Gulf states, Belgium, Cuba, Japan, Malaysia, Mexico, Netherlands (Food and Agricultural Organization of the United Nations. "Net trade in food",  $\%(\text{exports} - \text{imports})/\text{consumption}$ , FAOSTAT, Tradestat [http://faostat.fao.org/Portals/\\_Faostat/documents/pdf/map05.pdf](http://faostat.fao.org/Portals/_Faostat/documents/pdf/map05.pdf)). Conversely, only nine nations had food exports at 1.5 times or more of imports: Argentina, Australia, Canada, Guyana, Hungary, Kazakhstan, New Zealand, United States, and Uruguay; fourteen nations including South Africa, Zimbabwe, India and Pakistan export up to 25% more than they import. Given an adequate national income, with the purchasing power to feed its populace, food self-sufficiency is

largely irrelevant. In dollar terms rather than calories, Ethiopia imported more raw food than it exported, the values amounting to -6.4% (2000/01) and -3.0% (2004/05) of total imports, compared to sub-Saharan African averages of 0.0% and -0.1%; however, when total trade in all agricultural products is considered, Ethiopia had trade surpluses, with net agricultural exports valued at 21.9% (2000/01) and 21.3% (2004/05) of total imports, compared to 12.8% and 9.0% for sub-Saharan Africa (Ng, Francis; Aksoy, M. Ataman. 2008. "Who Are the Net Food Importing Countries?", World Bank, Policy Research Working Paper 4457).

### **IMPACTS OF GLOBAL CLIMATE CHANGE: EVEN WITH 31% LOWER YIELDS, ETHIOPIAN FOOD OUTPUT COULD STILL MORE THAN DOUBLE PER CAPITA IN 2050; BUT FOR NIGER, OUTPUT COULD DROP BY THREE-QUARTERS, BURUNDI BY 60%**

Alexandratos's African food production projections did not incorporate predictions for global climate change's impact on African ecologies (increasing drought and water scarcity), nor cultural factors such as Ethiopian highlanders' preference for living above 1,000 m. elevation. Predominantly agrarian countries like Ethiopia, where agriculture contributed 44.5% to the economy in 2008, are considerably more vulnerable to global fluctuations in temperature and precipitation than the industrialised world. A consensus of six climate models made by William R. Cline under "business as usual" greenhouse emissions, involving a global 4.4 degrees Celsius temperature rise and 2.9% rise in precipitation between 2000 and 2080 has found that Africa is likely to suffer a 28% decline in the value of its agricultural productivity, the highest for any region, compared to a 16% decline globally. In the case of Ethiopia, the productivity decline is predicted to be 31%, under a scenario where average temperatures will increase by 3 degrees Celsius between the last three decades of the twentieth and twenty-first centuries, in addition to a slight decline in precipitation from 2.04 mm per day to 1.97 mm per day (Cline, W. R. 2007. *Global Warming and Agriculture: Impact Estimates by Country*. Washington, DC: Center for Global Development and Peterson Institute for International Economics, p. 39, 67-71, 95-96). If, as some predict, "carbon fertilization" will partially mitigate anthropogenic CO<sub>2</sub> emissions through absorption and sequestration by biomass, the global agricultural impacts are predicted to be attenuated from -16% to -3%, for Africa from -28% to -17%, and for Ethiopia, from -31% to -21%. Under these two scenarios where the world makes no modifications to its current greenhouse gas emission levels and atmospheric CO<sub>2</sub> concentration rises to 735 ppm, Ethiopia's 3.3-fold boost in per capita cereal productivity, as projected by Alexandratos, would attenuate to 2.3-fold (without carbon dioxide fertilisation) or 2.6-fold (with carbon fertilisation). Other Horn of Africa countries (Eritrea and Somalia) are forecast to lose 16.6% of agricultural output (without c.f.) or 4.1% (c.f.); under the more likely former scenario, Alexandratos's 3.2-fold productivity enhancement attenuates to 2.7-fold. Uganda, already hampered by a 22% productivity decline according to Alexandratos, will suffer an additional climate-change induced loss of 16.8% (no c.f.), leading to an overall loss of 53%. Ethiopia's western neighbour, Sudan, is predicted to suffer the worst climate-change productivity loss of any individual nation, 56% (no c.f.) or 50% (with c.f.). Although Alexandratos published no estimates for Sudan, he did for neighbouring Chad: a 5.8-fold increase in productivity, so applying the Cline reduction factor, we may estimate Sudan's increase to narrow to 2.9-fold. Cline was interviewed by Gwynne Dyer in early 2008, where he expressed doubt that carbon fertilisation will indeed be significant (Dyer, Gwynne. 2009. "Climate Wars", Vintage Canada, p. 48-49). In either case, cereal kilograms available per Ethiopian will more than double, even after accounting for the predicted 2.6-fold population increase from 65.5m. (2000) to 173.8m. (2050); Ethiopia should manage to free itself from the chronic food insufficiency which has plagued it for two millennia if it maximizes its crop potential. Neighbours Sudan, Eritrea and Somalia are all predicted to increase productivity close to three-fold, so only Uganda's halving of output poses a refugee threat, and with Kenya slated to suffer only a 5.4% loss (no c.f.) or indeed an 8.8% increase (c.f.), it is likely that famine-stricken Ugandans will be heading there, or possibly the D.R. Congo instead.

Climate-change-induced declines in agricultural productivity will more adversely least-developed countries, where farming typically comprises large shares of the economy. Cline converted his productivity change predictions for

2080 to each nation's 2003 agricultural GDP, and when expressed as a share of national GDPs, seven out of 85 countries and regions will suffer ten percent or greater losses to their economies (in 2003 terms) under the "business as usual" carbon emissions scenario. Worst affected will be Sudan, a 21.9% fall in GDP without carbon fertilisation (19.3% c.f.), followed by Zimbabwe (-15.5%, -11.7%), Niger (-13.8%, -9.8%), Mali (-13.4%, -9.8%), Afghanistan (-12.7%, -6.9%), Tanzania (-10.9%, -5.8%), and Ethiopia (-10.2%, -6.2%); these seven nations had 3.3% of world population in 2003, predicted to rise to 5.9% in 2050. Seventeen of the 25 worst-affected countries economically are on the continent of Africa, and the remaining eight are in Asia including India, predicted to take an 8.4% GDP loss (6.4% c.f.). Conversely, among the 25 countries to be least affected economically - from losses of -1.1% to increases of 1.8%, only two are in Africa (Egypt, Kenya), three are Asian (China, Japan, S. Korea), and 15 are either European or North American (Cline, William R. 2007. "Global Warming and Agriculture: Impact Estimates by Country". Center for Global Development, p. 68-71; World Bank, World Development Indicators, GDP, Current US \$). While agricultural potential in Asia has been largely maximised already, these predictions must be tempered by the recognition that most African countries have considerable unexploited cropland potential. Without carbon fertilization, Cline predicted that the D.R. Congo would lose 14.7% of its agricultural production capacity or about 8.5% of its 2003 GDP, but Alexandratos calculated that through population growth, yield doubling, and maximisation of arable land, the country's productivity could rise 10.2-fold from 32 kg/head (2000) to 326 kg/head (2050). Thus, even under the worst-case climate change scenario, Congolese cereals output could still increase 8.7-fold, conceivably making it the bread-basket (or food bank) for Uganda, Burundi and Rwanda - if a distribution infrastructure can be realised.

Ignoring climate change productivity effects, Alexandratos predicted four least-developed countries to have reduced per capita cereal productivity in 2050 compared to 2005, based solely on population growth, maximisation of potential arable land and doubling of yields; all four are forecast by Cline to be further compromised by climate change by the year 2080: Afghanistan (-25% without carbon fertilisation, -13% with carbon fertilisation), Niger (-34%; -24%), and Uganda (-17%; -4%); estimates for Burundi were incorporated into the "other equatorial Africa" region (-60%; -54%). Canada's agricultural output is predicted to change by -2% without carbon fertilisation (but increase by 12.5% if carbon fertilisation occurs), the United Kingdom by -4% (or +10% with c.f.), and the United States by -6% (+8% c.f.) (Cline 2007: 67-71). It is effectively a "polluter wins" scenario, where ironically it is the industrialised nations who collectively are forecast to experience the least impacts, -6.3% change in agricultural output, or +7.7% with carbon fertilisation, while developing nations face a -21.0% change, or -9.1% with carbon fertilisation. Ethiopia's average annual temperature is forecast to rise from 23.1 Celsius (1961-90) to 26.9 Celsius (2070-99) and its average rainfall will decline slightly from 2.04 mm per day to 1.97 mm per day (Cline 2007: 39). The final column in each of the following two tables revises Cline's estimates by incorporating the most recent UN Population Division headcount estimates for 2050.

POTENTIAL CHANGES IN AGRICULTURAL OUTPUT FOR SELECTED AFRICAN COUNTRIES IN 2050														
	Total Area with Crop Potential (000 ha.)	Total Potential Crop Area, excluding closed forests (height > 5m.)	Potential Crop Area per inhabitant, ha.		Area harvested, 1999/2001 (000 ha.)	Harvested area, 1999/2001, % of potential	Crop area % devoted to cereals	Total Potential Cereals area (000 ha.)	Annual cereals yield, kg per hectare		Annual cereal production, kg. per capita			Ratio of per capita cereal production, 2050 vs. 1993-2002
			2000	2050					1993-2002	Predicted, 2050 (doubling 2000 yield, maximizing irrigation)	1993-2002	Predicted in 2050 (UN 2004 popn. estimates)	Predicted in 2050 (UN 2008 popn. estimates)	
Burkina Faso	20,621	20,346	1.709	0.480	3,707	18%	79%	16,073	869	1,738	226	718	684	3.03
Burundi	1,217	1,217	0.194	0.063	1,092	90%	18%	219	1,250	2,500	41	22	37	0.90

Chad	35,890	33,677	4.284	1.328	3,050	9%	62%	20,880	606	1,212	140	807	911	6.51
Congo, DR	187,934	116,831	2.405	0.770	6,098	5%	34%	39,723	727	1,454	32	326	392	12.24
Ethiopia	40,506	39,130	0.597	0.229	9,483	24%	80%	31,304	1,144	2,288	128	418	412	3.22
Mali	27,328	26,125	2.195	0.568	3,622	14%	77%	20,116	867	1,734	197	827	1,234	6.27
Niger	11,597	10,698	0.996	0.202	11,106	104%	68%	7,275	338	676	249	98	84	0.34
Somalia	4,021	3,842	0.441	0.097	703	18%	73%	2,805	468	936	38	123	112	2.94
Uganda	13,935	13,829	0.589	0.134	6,294	46%	22%	3,042	1,483	2,966	90	70	99	1.10

## Sources

Alexandratos, Nikos. 2005. "Countries with Rapid Population Growth and Resource Constraints: Issues of Food, Agriculture, and Development", Population and Development Review, 31(2):237-258. Population estimates for 2050 from: United Nations. 2005. "World Population Prospects: the 2004 Revision". Last column: Alexandratos yields adjusted by: UN. 2009. "World Population Prospects: The 2008 Revision".

CLIMATE CHANGE IMPACTS ON AFRICAN AGRICULTURAL OUTPUT					
	Predicted Climate Change-Induced Productivity Decline in 2080, relative to 1961-90 (Cline, 2007) (1)		Climate-adjusted Cereals Productivity Change, 2050, kg per cap. (2)		ratio of per capita cereal production, 2050 to 1993/2002 (adjusted for climate change yield reductions, without carbon fert.)
	Without Carbon fertilisation	With Carbon fertilisation	Without Carbon fertilisation	With Carbon fertilisation	
Burkina Faso	-24%	-13%	518	595	2.63
Burundi	-60%	-54%	15	17	0.41
Chad	-56%	-50%	400	460	3.29
Congo, DR	-15%	-2%	334	384	12.00
Ethiopia	-31%	-21%	283	326	2.55
Mali	-36%	-26%	795	915	4.64
Niger	-34%	-24%	56	64	0.26
Somalia	-17%	-4%	93	107	2.82
Uganda	-31%	-17%	68	82	0.91

Notes

(1) Cline, William R. 2007. "Global Warming and Agriculture: Impact Estimates by Country", Center for Global Development, p. 68-71. Lacking country-level estimates for Burundi, Chad and Somalia, "Other Equatorial Africa", Sudan and "Other Horn of Africa" were used in lieu, respectively. A global average temperature rise of 4.4°C is assumed under a central SRES scenario, A2, 1250 ppm CO<sub>2</sub>-eq., with high population growth, but slow economic growth.

(2) Using yield predictions of Alexandratos, corrected for 2050 populations in UN 2008 Revision. The 2080 yield reduction factors are assumed to apply for 2050.

Cline's estimates used primarily the Intergovernmental Panel on Climate Change SRES (Special Report on Emission Scenario) A2 scenario from 2001, which assumes rapid global population growth but slower economic growth than the A1 rapid global convergence case. While Cline assumed a 4.4 deg. C global temperature rise by 2080, the IPCC's fourth assessment report in 2007 predicted a best estimate increase of 3.4 deg. C for 2090-2099 compared to 1980-1999, that would be accompanied by a CO<sub>2</sub>-equivalent concentration around 1,250 ppm, the second-most extreme scenario out of six (IPCC. 2007. "Climate Change 2007: Synthesis Report", p. 45). The International Food Policy Research Institute (IFPRI) considers the impact of climate change in sub-Saharan Africa by 2050 to be much smaller than Cline's projections, however they employ one "relatively moderate" climate change model, the SRES B2 (intermediate growth, local adaptations), which the IPCC predicted would cause a 2.4 deg. C rise by 2090, and 800 ppm CO<sub>2</sub>-equivalent. Overall, IFPRI forecasts only a 1.5% reduction in total possible production compared to a "no climate change" scenario, if no changes in current farming practices were to be undertaken (Calzadilla, A. et al. 2009. "Economywide impacts of climate change on agriculture in Sub-Saharan Africa", Washington, D.C.: IFPRI). Alexandratos (2005) assumed that if eight of the eleven African countries with highest predicted population growth were to irrigate all potentially irrigable farmland as well as maximize total cultivable area, and double yields per hectare, they would achieve between two-fold (Benin), three-fold (Ethiopia) and ten-fold (DR Congo) improvements in cereal production per head despite the UN population growth predictions by 2050 (only Burundi, Niger, and Uganda will suffer losses in productivity). By comparison the IFPRI researchers assume that under a much more modest doubling of irrigated area and 25% increase in yields by 2050, under the moderate B2 climate change scenario, all these factors would effectively increase sub-Saharan Africa's overall production by 18%, raising the GDP by 1.5% and reducing child malnutrition from 32.0% to 30.4%. For Ethiopia specifically, IFPRI predicts that "the major impact of climate change on the economy is shown to be related to more frequent extreme hydrologic events, which cause losses in both the agricultural and nonagricultural sectors", however "the irrigation program proposed by the WSDP [Government of Ethiopia's Water Sector Development Plan]" has been shown to mitigate the negative impacts of climate change on the country's economy.

The UN World Urbanization Prospects (2009 Revision) predicts an increase in Ethiopia's urbanization rate from 16.7% in 2010 to 37.5% in 2050, which could conceivably reduce national nutritional requirements as people become more sedentary, untied from daily farm labour. However, the proportion of children who require only about two-thirds of the daily caloric intake of adults, will also decline as fertility falls, from 86% of the 15-64-year-old population in 2010 to just 48% in 2050 (World Population Prospects, 2008 Revision). One study predicts that these opposing trends in national trends will effectively cancel each other out (Boyle Terry, Barbara. 2009. "Population, Agriculture and the Future Environment in Sub-Saharan Africa", IUSSP International Population Conference, September 2009, Morocco).

It is plausible that fertile soil goes untilled because traditional Ethiopian ox-driven wooden ploughs cannot turn it, but it may be used for cattle-grazing. The Indian firm Karuturi Global, which has been leased 11,000 ha. in Ethiopia's Oromia region to grow rice, maize, and oil palms, has imported tractors to carry out the work: "the black clay soil is rich in nutrients but difficult to work without a mechanical plough - but some locals had grazed their cattle there and used to cross the farm to the nearest river, which is no longer possible" (Rice, Xan. 2010. "Ethiopia – country of the silver sickle – offers land dirt cheap to farming giants", The Guardian, 15 January 2010, p. 31). Should India - a nation predicted to lose 29%-39% of its agricultural productivity from global warming by 2080, representing revenue losses of \$38bn to \$50bn, the largest for any country or region - gain forty- to ninety-nine-year leases on significant tracts of fertile Ethiopian land, the likely scenario is that Ethiopia, a more famine-prone population, will see all those crops exported to feed Indians and not Ethiopians (Cline 2007: 69). An American diplomat with three decades' experience working in Ethiopia contends that "[t]here is still much underused and unused land that can be exploited for agriculture and livestock-raising. Irrigation is in its infancy and could have a major impact on productivity of existing cultivated land" (Henze, Paul B. 2000. "Layers of Time. A History of Ethiopia", Palgrave, p. 342). Sachs cites data from Johan Rockström showing that in Ethiopia, observed smallholder farm grain yields, about 0.5 tons per hectare, were exactly half of the values reported officially, while demonstration

plots on Ethiopian research stations, involving fertilizer application and water management, could produce yields of three tons per hectare (Sachs, Jeffrey D. 2008. "Common Wealth: Economics For A Crowded Planet", Penguin, p. 231, Figure 10.4). Ethiopian farmers' grain yields have been estimated to be only about 33% of achievable rainfed yields owing to gaps between traditional farming practices and improved methods involving soil and rainwater management and legume-based crop rotation (Rockström, Johan. 2007. "Managing water in rainfed agriculture", in: "Water for Food, Water for Life, A Comprehensive Assessment of Water Management in Agriculture", Earthscan, p. 315-352). Yet, a recent Millennium Research Villages comparison suggests that in comparison to Tanzania where maize yields increased by 4.9 tons per hectare through the application of fertilizers, the "[t]he highest cost for extra production came from the Koraro, Ethiopia 2006 crop where maize yields only increased by 0.8 tons [per] ha. Koraro probably is the most degraded site among the Millennium Villages" (Sanchez, Pedro A. et al. 2009. "The African Green Revolution moves forward", *Food Sec.* (2009) 1:37–44). To address drought which is considered to be a "persistent and critical challenge in Koraro", water access points were being increased by 39 during 2008-09, and nearly one thousand of the nine thousand farmers were using various small-scale irrigation methods with MVP assistance ("The Millennium Villages Project Annual Report, January 1 - December 31, 2008", The Earth Institute, Columbia University, p. 22-23). Rockström has recently postulated ten planetary boundary conditions, capping levels beyond which "the Earth system cannot continue to function in a stable, Holocene-like state", one that has been continuous since the Neolithic Revolution began ten millennia ago, and is otherwise "expected to continue for at least several thousands of years"; he further asserts that four global limits are rapidly being reached (ocean acidification, freshwater use, increase in cropland area, and phosphorus cycle interference) while three boundaries have already been transgressed during the two-century-old Anthropocene period, viz., the rate of biodiversity loss, perturbation to the nitrogen cycle and climate change (Rockström, Johan et al. 2009. "A safe operating space for humanity", *Nature* 461: 472-475). Thus, promoting the further adoption of nitrogen-based fertiliser application in developing regions such as Africa will withdraw gaseous nitrogen from the atmosphere even more than the proposed boundary level of 35 m. tonnes per year, a level currently exceeded already by three and a half times, 121 m. tonnes per year. One historian of technology, Vaclav Smil, has estimated that the Haber-Bosch process, first applied in 1913 for the industrial conversion of nitrogen in the air into ammonia through the use natural gas, accounted for four-fifths of the twentieth century's increased cereal production (Sachs, Jeffrey D. 2008. "Common Wealth", p. 65-66). The FAO estimates that cereal crops comprised approximately 50% of human caloric intake globally during 2001-03 ("Food and Agriculture Statistics Global Outlook", June 2006, p. 2).

Alternative, ecologically-sustainable agriculture approaches have shown some success in Ethiopia, including composting in the northern highlands. Since 1996, smallholder farmers in 42 communities of Tigray Region have collaborated with the Institute for Sustainable Development (ISD) in Addis Ababa and the Bureau of Agriculture and Rural Development of Tigray. Compost applied instead of purchased fertilizer was able to produce significantly higher grain yields over both fertilizer-applied crops and unfertilized crops during 2001-2006. For example, yields for teff, an endemic Ethiopian grain similar to wheat, under application of 5-15 tonnes per hectare of compost averaged 2,143 kg/ha. compared to 1,683 kg/ha. with recommended rates of urea/phosphate fertilizer; for seven cereal crops, grain yields under compost averaged 2,473 kg/ha vs. 1,812 with chemical fertilizer and 1,200 with no inputs. Restoration of soil fertility was demonstrated, and by 2007, 25% of farmers were composting, chemical fertilizer consumption had decreased by 40%, while grain production nearly doubled (Edwards, Sue et al. 2007. "The Impact of Compost Use on Crop Yields in Tigray, Ethiopia", Food and Agriculture Organization of the United Nations). Other techniques, such as the construction of check dams to diminish soil erosion from gullies, are being implemented in Tigray not only by ISD but by the Millennium Villages Project cluster around Koraro ("Annual Report, January 1 - December 31, 2008", [www.millenniumvillages.org/docs/MVP\\_Annual\\_Report\\_2008.pdf](http://www.millenniumvillages.org/docs/MVP_Annual_Report_2008.pdf)). A search of the United States Department of Agriculture's literature database, Agricola, identifies recent experiments in Ethiopia involving mulching, intercropping, tree-planting and increased manure to successfully increase yields. Capture and storage of rainwater runoff ("blue water") and its use during dry periods in low-cost gravity-fed irrigation systems has been shown to reduce erosion and land degradation and improve soil water retention (Bewket,

W.; Sterk, G. 2005. "Dynamics in land cover and its effects on stream flow in the Chemoga watershed, Blue Nile, Ethiopia", *Hydrological Processes* 19:445–458). It might be argued that, if the world were one giant farm, a prudent farmer would look at his or her severely-overworked "plots" such as Ethiopia's highlands and all of Haiti, and declare them "fallow": time to be abandoned from human and oxen tillage, to permit nature to renew the organic capacity of the soil. Nevertheless, one analysis of agricultural conservation projects attributed their abandonment by Ethiopian farmers in the central highlands to population pressure and land scarcity, failure to achieve short-term yield improvements, reduction of planting area and fertile soil availability, and increased damage from rats (Holden, Stephen et al. 2004. "Non-farm income, household welfare, and sustainable land management in a less-favoured area in the Ethiopian highlands", *Food Policy* 29: 369-392).

The Malthusian land/famine predicament then appears to be more cultural than technical (Boserupian) in origin: reluctance of highlander Ethiopians to resettle to the tropical lowlands ecosystem which they are unfamiliar with agriculturally, a paternalistic government which is slow in effecting modernisation through urbanisation and industrialisation, and the cultural prohibition of women in fatherless households tilling their land with oxen. Thus, the Ethiopian government's plan to attract foreign large-scale agricultural investment may be the best means to arrest highland soils stress and reduce famine risk. Philip Marsden: "the Ethiopian plateau has also isolated its human inhabitants. Having pushed south into the mountains, the highlanders resisted the great changes that took place in the lowlands - Islam, and later, the Europeans. The scarp has formed a cultural filter and allowed separate development. Like the fauna, many highland Ethiopians find it hard to survive lower down. There are the cultural differences, a different climate, different crops, diet and husbandry. All these make the environment a strange one, and there is the disease: centuries of living in the mountains, too high for tropical disease, have destroyed their natural resistance" (Marsden-Smedley, Philip. 1990. "A Far Country: Travels in Ethiopia", London: Century, p. 163-164).

### **SOLUTIONS 3. OUT-MIGRATION, POPULATION RE-SETTLEMENT**

Gwynne Dyer, with a doctorate in military history, ends his piece by concluding that "history is unfair"; Western Europe gained one-time territorial advantages unavailable to the rest of the world because there are simply no more North Americas or Australasias for the taking. Is aggressive population control the only possible solution, or is this unduly defeatist? While Jeffrey Sachs acknowledges Africa's geographical disadvantages for human development, he doesn't react with fatalism, arguing that land-locked Bangalore, India, has become a global knowledge industry hub through the virtual disencumbering of global trade in services via the Internet ("Common Wealth", Penguin, 2008: 218). However, it could be argued that if Africa is fundamentally inimical to human well-being, then for the running of an efficient global economy and for humanitarianism, Africans should be encouraged to pick up stakes and move elsewhere, where biocapacity surpasses the current human ecological footprint. Russia, for example, had in 2006 a per capita biocapacity of 6.3 hectares compared to an ecological footprint of consumption of 4.4 hectares, leaving a surplus of 1.9 hectares per Russian. Canada, Russia, Latin America and Oceania together hold 2.4bn. ha. of biocapacity in reserve, or one-fifth of the entire planet (Global Footprint Network, "Ecological Footprint and Biocapacity, 2006", [www.footprintnetwork.org](http://www.footprintnetwork.org)). Even within Africa, the two Congos, along with Angola, Central African Republic and Madagascar hold 270m. ha. of spare biocapacity. Present UN predictions are for a doubling of Africa's population by 2050, but a 17% drop in the Russian Federation's population, from the present 140 m. to 116 m.

In 2001, the biographer and broadcaster Victoria Glendinning was one of half-dozen Britons sent by The Daily Telegraph for a fortnight into southern Sudan, where she examined the work of humanitarian organisations. One evening in her Sudanese hut, in a reflective mood, she wrote: "I remembered the Rational Man [a Briton who had spent most of his working life in Africa, in industry] in Nairobi. What, he said, if aid is interfering in a system which doesn't work and shouldn't be kept going? Should people in inhospitable, backward and poverty-stricken areas of the earth be encouraged or condemned, to remain where they are, by small improvements in their standards of living? We could be trapping them in a situation where no one should be" ("Getting It Wrong, Getting It Right", in: "The

Weekenders: Travels in the Heart of Africa", Ebury Press, 2001: 321-322). Jeffrey Sachs in his technocratic zeal discounts such pessimism: "[t]he purpose of understanding geographical challenges is not to submit to fate but to identify practical steps to overcome barriers posed by specific natural endowments [...] In short, geographical impediments suggest priorities for public investment efforts, rather than reasons for surrender" (Sachs, Jeffrey D. 2008. "Common wealth: economics for a crowded planet", Penguin, p. 218).

During Ethiopia's communist Derg regime of the 1970s and 1980s, populations were both resettled and consolidated into villagisation schemes. Approximately 850,000 people from the northern highland regions of Tigray and Wollo were resettled in what one American observer described as "thinly populated lowland areas [...] The resettlement sites were poorly prepared. Destitute 'settlers' found themselves dumped in unfamiliar, malarial terrain. Tens of thousands died in most of them [...] The only crop produced was corn (maize) which Ethiopian highlanders seldom eat and which could not be transported profitably to ports for export" (Henze 2000: 309-310). Between twelve and fifteen million Ethiopians were moved into new villages modeled after Soviet collective farms, however many of them became heavily dependent on foreign humanitarian assistance: "[t]here has always been a good case for resettlement in Ethiopia. The county's long history is the story of settlers moving southward, introducing new crops, farming techniques, and other features of early northern Ethiopian civilization, including Christianity. There is a sound rationale now for encouraging some people to leave overpopulated, environmentally degraded regions beset by drought and famine. If the Derg had gone at resettlement in a more humane way, it would have had some chance of success" (Henze 2000: 310, n.2).

The Ethiopian government embarked on a voluntary resettlement program during the 2000s, where half of the targeted 2.2 million people was reportedly moved from land-degraded, densely-populated to less food-insecure areas during 2002-2005, with the other half's move scheduled by 2010; most resettlements are occurring in the Amhara and South regions, and oxen, 2 ha. of land and eight months' food provisions are allotted per household. Four times as many Ethiopians - 8 m. chronically food insecure, chiefly in the Amhara and Tigray regions - are not resettling, but are beneficiaries of the government's productive safety net program ("PASDEP" 2006: 95, 99).

Nevertheless it seems profoundly unjust that high-income countries hold one-sixth of humanity in regions that have per capita biocapacity that is nearly double the global mean, 3.3 hectares versus 1.8, while low income countries' citizens are allotted only one-half the average biocapacity, 1.0 hectares (Global Footprint Network. 2009. "Ecological Footprint and Biocapacity, 2006", Based on National Footprint Accounts 2009 edition: November 25, 2009). There are those who argue for the gradual dissolution of the boundaries of "Westphalian states", the arbitrary circumstances of birth which quantitatively limit the attainment of full human potential. Those European-controlled African states established by diplomats representing a dozen European countries at the 1884 Berlin Conference are particularly arbitrary as they divided, from a distance and often with straight lines, complex ethnic topographies. Former World Bank economist Lant Pritchett: "The years from 1945 to 2005 stand out as perhaps the best sixty years for human material progress in history. The postwar founders created institutions to promote the increased mobility of goods. They created institutions to facilitate capital movements. But people were frozen" [...] "Eventually, the citizens of the rich world must decide on what terms they will let the world's poor people come" (Pritchett, Lant. 2006. "Let Their People Come: Breaking the Gridlock on Global Labor Mobility", Center for Global Development, pp. 139, 142). Richard Dowden, a British journalist assessing his three decades' reporting from Africa: "The hypocrisy of promoting the free movement of money and goods but preventing the free movement of people is plain [...] [Globalization at present is] managed by the rich countries in their own interest" ("Africa: Altered States, Ordinary Miracles", New York: Public Affairs, 2009, p. 537-538). Christopher Clapham, an historian of Ethiopia, has written: "In a world of unrestricted population movement, there would be a massive shift of people from Africa and other parts of the developing world into Europe and North America, resulting in a corresponding level of social globalization and the incorporation into their cities of the issues that affect African cities, with a corresponding easing of pressures within Africa itself. While such movement has, of course, been heavily restricted, one must recognize that the (at least partial) insulation of the industrialized world from the problems of African demography rests on imposition of the political power of the West" ("The Political Economy of African Population Change",

Population and Development Review, 32 (2006), pp. 96-114). And the American social historian Howard Zinn often referred to the need to "wipe out the national boundaries that separate us from other human beings on this earth", and found it "horrifying" that "in this twenty-first century of what we call 'civilization', we have carved up what we claim is one world into two hundred artificially created entities we call 'nations' and are ready to kill anyone who crosses a boundary" (Zinn, Howard. 2005. "Howard Zinn at Spelman College", Commencement Address, Decatur, Georgia, May 14, 2005, <http://www.newtondialog.org/Speeches/ZinnAtSpelmanCollege.htm>). Accordingly, we need to work toward a supranational polity with the authority to mandate wealth transfers such that all humans will have a "level playing ground" in a global meritocracy: similar opportunities for socioeconomic mobility. The ultimate outcome would be that children of an Afar pastoralist in Ethiopia will have access to the same life opportunities and same level of health and educational benefits that a child of a Fortune 500 CEO receives, so that both children have equal chances of becoming a Nobel laureate (Moellendorf, Darryl. 2002. "Cosmopolitan Justice", p. 49; 2009. "Global Inequality Matters", p. 132). Britain's colonisation of North America and the ensuing Great Atlantic Migration relieved the risk of massive mortality from the crop failures in Ireland and Germany from the 1840s to 1870s, and a second wave of southern and eastern Europeans suffering agricultural failures from the 1880s to 1910 - a total of 37 million immigrants (Great Atlantic Migration. (2010). In Encyclopædia Britannica. Retrieved May 10, 2010, from Encyclopædia Britannica Online: <http://www.britannica.com/EBchecked/topic/242873/Great-Atlantic-Migration>).

During the nineteenth century, immigration accounted for an estimated 25% of population growth in the United States, 15.8 million out of the total increase of 64.3 million - the other 75% came from natural increase, births minus deaths; during 1900-1990, immigration accounted for 19.5% of the US population growth, 33 million out of 170 million (calculated from: Haines, Michael R.; Steckel, Richard H. 2000. "A Population History of North America", Cambridge U.P., p. 700). Viewed another way, immigration constituted nearly half of American population growth: "[i]f it could be assumed that no immigration occurred after 1790 and that the natural increase of the colonial stock population had been what it actually was (with no effect of immigration on the natural increase of the native-born), then the white population would have been about 52 million in 1920, or about 55% of what it actually was" (Haines 2000: 316). The data are more speculative for Canada in the nineteenth century, however, they suggest that from 1821-61 - no significant European emigration having occurred from 1790 until 1815 owing to the Napoleonic wars - immigration comprised 22% of British North America's (later, Canada's) population increase, or about 540,000 retained immigrants from the British Isles, out of a 2.5 million total increase; during 1790 to 1850, it is estimated that the natural rate of population growth fell from 2.8% to 2.3% per annum (McInnis, Marvin. 2000. "The Population of Canada in the Nineteenth Century", in: "A Population History of North America", Michael R. Haines and Richard H. Steckel, eds., Cambridge U.P., p. 371-432). Approximately half of Great Britain's emigrants arriving at British North American ports during 1815-1861 immediately re-emigrated to the United States since it was less expensive for a passenger's Atlantic crossing to British North American ports than American ones, and the U.S. imposed more stringent regulations on immigrant vessels (Robert, Jean-Claude. 1993. "An Immigrant Population", in: "Historical Atlas of Canada: The land transformed, 1800-1891", Geoffrey J. Matthews and R. Louis Gentilcore, Eds., University of Toronto Press, p. 21-23). From 1861-1901, Canadian emigration to the United States exceeded by two-fold Europe-to-Canada immigration levels, such that the country's total population increase of 2.1 million consisted of an estimated natural increase of 3.1 million and immigration from Europe of 0.9 million that was nevertheless offset by emigration of about 1.9 million (McInnis 2000: 422). Large-scale emigration from Canada, even while Canada's natural population annual growth rate fell steadily from 2.2% (1851-61) to 1.6% (1901), has been attributed to, among other factors, a "[lack] of agricultural land to absorb its increase of population", a "U.S. border [that] was completely open to Canadians [...] an era of unregulated international migration" and "better wage opportunities in the United States", resulting in the overall U.S. population growing at 2.2% per year compared to Canada's 1.3% between 1861 and 1901 (McInnis 2000: 426-428). During 1901-1991, 21% of Canada's overall population increase (4.3 m. out of 21.7 m.) has been attributed to net migration (Haines 2000: 700). Canada has certainly not been an open destination for the world's worst-off economically: "[t]he story of Canadian immigration is not one of orderly

population growth; it has been and remains both a catalyst to Canadian economic development and a mirror of Canadian attitudes and values; it has often been unashamedly and economically self-serving and ethnically or racially biased" (Harold Troper. 2010. "Immigration", in: "The Canadian Encyclopedia", Historica Foundation of Canada, <http://www.thecanadianencyclopedia.com/PrinterFriendly.cfm?Params=A1ARTA0003960>).

Modern history illustrates how migration can mitigate the effects of natural and anthropogenic failures. Traditional accounting of the Irish Potato Famine of 1846-1851 estimates there were one million famine-related deaths and 1.5-2 million emigrations, from a pre-famine population of 8.3 million (Mokyr, Joel. 2010. "Irish Potato Famine", Encyclopedia Britannica Online). This has been recently revised to 270,000 deaths as direct victims of the famine (in excess of natural mortality rates), however another 2.1 m. Irish emigrated overseas (71% to North America, 29% to Australasia) and 1.6 m. emigrated to Great Britain; thus, only about 7% of potentially four million actually starved to death (Nusteling, Hubert P. H. 2009. "How Many Irish Potato Famine Deaths?: Toward Coherence of the Evidence", *Historical Methods* 42(2):57-80). In any case, Ireland's pre-famine population peak of 8.5m. in 1845 fell to 6.9m. by 1850, further declining to a nadir of 2.8m. in 1960, and in 2008, at 4.2m was still less than half the 1845 level (Maddison, Angus. 2010. "Historical Statistics of the World Economy, 1-2008 AD", spreadsheet, [www.ggdc.net/maddison](http://www.ggdc.net/maddison)). The same source estimates Ireland's GDP per capita in 1820 at \$877 (1990 international dollars), rising to \$1,775 in 1870, however for the United States where the majority of Irish emigrants settled, the GDP per capita rose from \$1,257 to \$2,445: North American emigration greatly improved the quality of life for most Irish emigrants fleeing conditions of subsistence and poverty. Unfortunately for Ethiopia and other famine-risk nations, these "escape valves" have since been turned off. The estimated 100,000 Irish immigrants who settled in Upper and Lower Canada between 1842 and 1851 accounted for about one-seventh of the total population increase while another 200,000-250,000 arrivals immediately immigrated to the United States (Houston, Cecil J. and William J. Smyth. 2003. "The legacy of Irish emigration to the Canadas in 1847", in: "Fleeing the famine: North America and Irish refugees, 1845-1851", Margaret M. Mulrooney, ed., Praeger, p. 139; Statistics Canada, *Censuses of Canada 1665 to 1871, The 1800s (1806 to 1871)*, [www.statcan.gc.ca/pub/98-187-x/4064809-eng.htm](http://www.statcan.gc.ca/pub/98-187-x/4064809-eng.htm)). Fifteen per cent of Ireland's tenant farmers in 1845 held plots under 0.4 hectares in area (less than an acre), 20% held plots between 0.4-2 ha. (1-5 acres), 21% had 2-4 ha. (5-10 acres), another 21% had 4-8 ha. (10-20 acres), and the remaining 23% had more than 8 ha. (20 acres); such small holdings for the majority meant that the only crop capable of meeting sustenance was the potato (Bourke, P.M. Austin. 1965. "The Agricultural Statistics of the 1841 Census of Ireland. A Critical Review", *The Economic History Review, New Series*, 18(2): 376-391). By comparison, in 2003, 7.6% of Ethiopian households had been allotted under 0.1 hectares, 29.5% held between 0.1 and 0.5 hectares, 50.0% held between 0.5 and 2.0 hectares, leaving just 12.9% possessing over 2.0 hectares (Rahmato, Dessalegn. 2008. "Ethiopia: Agricultural Policy Review", in: "Digest of Ethiopia's National Policies, Strategies and Programs", Taye Assefa, ed. Addis Ababa: Forum for Social Studies, p. 139). The present-day Ethiopia situation is thus twice as grave: as many families living on farm plots under one-half hectare in area than the Irish did at the precipice of the Great Famine of 1845-1852. Ireland has never recovered its peak population in the early 1840s, it is today only half that level, and while the consumption footprints of most western European nations exceeded their biocapacity before 1960, Ireland was the last to do so, around 1985 (Global Footprint Network. 2010. "The Ecological Wealth of Nations", p. 127).

Comparison of Land Distribution, pre-famine Ireland and present-day Ethiopia		
	% of households	
size of holding, hectares	Ireland 1845 (1)	Ethiopia 2003 (2)
<b>Less than 0.5</b>	15.0%	37.1%
<b>0.5 - 2.0</b>	20.1%	50.0%
<b>More than 2.0</b>	64.9%	12.9%
<b>Total</b>	100.0%	100.0%
Sources		
(1) Bourke, P.M. Austin. 1965. "The Agricultural Statistics of the 1841 Census of Ireland. A Critical Review", <i>The Economic History Review</i> , New Series, 18(2): 376-391.		
(2) Rahmato, Dessalegn. 2008. "Ethiopia: Agricultural Policy Review", in: "Digest of Ethiopia's National Policies, Strategies and Programs", Taye Assefa, ed. Addis Ababa: Forum for Social Studies, p. 139.		

The demographer John Bongaarts attributes Africa's rapid post-World War II population expansion to the spread of immunization, antibiotics and related medical technology, dramatically lowering the mortality rates, while birth rate declines lagged behind (Bongaarts, John. 2009. "Human population growth and the demographic transition", *Philos.Trans.R.Soc.Lond B Biol. Sci.* 364(1532): 2985–2990). According to the economic historian Gregory Clark, "[h]istory shows that [...] the West has no model of economic development to offer the still-poor countries of the world. There is no simple economic medicine that will guarantee growth, and even complicated economic surgery offers no clear prospect of relief for societies afflicted with poverty. Even direct gifts of aid have proved ineffective in stimulating growth. In this context the only policy the West could pursue that will ensure gains for at least some of the poor of the Third World is to liberalize immigration from these countries" (Clark, Gregory. "Farewell to Alms: A Brief Economic History of the World", Princeton University Press, 2007: 371, 373). Perhaps the core reason that Africa's population is growing faster than elsewhere is because they were the last to benefit from the availability of off-patent Western medicines, vaccines, and health services. Clark writes: "[E]xisting differences in capabilities between societies could now express themselves through income per person rather than population densities. The escape from the Malthusian era is one factor in the Great Divergence. The second is that modern medicine has substantially reduced the subsistence wage in such areas as tropical Africa, allowing populations to continue growing at incomes which are substantially below the average of the preindustrial world. Even at wages that were low by preindustrial standards life expectancy in some of the poorest countries in Africa is still above the average preindustrial level" (p. 366).

Gwynne Dyer has elsewhere transcended the Westphalian perspective of competing nations, and stressed the importance of the United Nations in future world security, even if it is entirely ahistorical: "[f]or more than half a century, far-sighted people in many countries have been working on a program for international law and order that is our best and perhaps our only chance of avoiding global disaster on an unprecedented scale. It is obviously a hundred-year project at the very least, for it flies in the face of history and of traditional ideas about human nature [...] Either we get back to the building the international institutions we started working on sixty yeas ago, or we get used to the idea that we are working up to the Third World War" (Dyer, Gwynne. 2004. "Future: Tense. The Coming World Order", Random House, pp. 240, 246). Dyer also supports regional integration via the African Union:

"Africans are still there - all of them, in their hundreds and hundreds of different ethnic groups. Good. Survival is better than subjugation or extinction. But it means that Africa has to build modern states of the most ethnically diverse populations of the world [...] Perhaps the answer is to submerge them all in a sea of other ethnic groups, none of them big enough to dream of dominating the rest" ("With Every Mistake", 2005, p. 232). Development economist Paul Collier notes that "[i]n most of Africa land rights still reflect some ancestral claim and are not readily marketable" and "[e]ven where free movement of labour is part of long term regional integration plans, as in the East African Community, very little progress has been made to date" (Collier, Paul et al. 2008. "Climate change and Africa", *Oxford Rev. Econ. Pol.* 24(2): 337-353).

Dyer's latest book on the geopolitics of climate change, however, is more pessimistic: "Africa will be the continent that takes the biggest hit from climate change, and it is already home to more than half the wars in the world. The impacts of climate change will probably trigger many more wars, but the brutal truth is that most conflicts in Africa do not affect the rest of the world" ("Climate Wars", Random House, 2008, p. 59). Nevertheless, Dyer predicts that drought in Africa will trigger famines and waves of environmental refugees destined for Europe and South Africa (2008: 20). The Intergovernmental Panel on Climate Change predicts that "[b]y 2020, in some countries [in Africa], yields from rain-fed agriculture could be reduced by up to 50%. Agricultural production, including access to food, in many African countries is projected to be severely compromised" and that "[n]ew studies confirm that Africa is one of the most vulnerable continents because of the range of projected impacts, multiple stresses and low adaptive capacity" ("Climate Change 2007: Synthesis Report", p. 50, 65).

Sachs, however, does not envisage out-migration as a major solution to Africa's poverty trap: "A more deeply contentious route is migration from the poor countries to the rich countries, such as from Latin America into the United States, or from Africa into Europe. Immigration is certainly a hot-button issue. [...] The developed countries, meanwhile, are deeply conflicted internally about absorbing large numbers of unskilled workers. The economics of such in-migration are more favorable than the politics" (Sachs, "Common Wealth", 2008: 236). "[M]igration and remittances alone [cannot] solve the development problems back home. The developing world will add another one to three billion people by 2050, compared with a total population in today's developed world of around one billion. Only a small fraction of the unskilled workers in the poor countries will be allowed to migrate legally to the developed world, and only another modest fraction will make their way illegally. [...] We should understand, therefore, that the imperatives for homegrown economic development in the poorer regions must continue to have center stage, with or without migration" (Sachs 2008: 237). Immigration, as a share of Canada's population growth, rose from 20% (1981-86), to over 50% (1991-96), to two-thirds (1996-2006) and is predicted to account for 100% by 2030 (Francis, R. Douglas. et al. 2010. "Journeys: A History of Canada", Nelson, p. 553; Peschard-Sverdrup, Armand B.; Shaw, Robert S. 2008. "Outlook for security", in: "The future of North America, 2025: outlook and recommendations", p. 283). Europe, by contrast, is predicted to witness a 42 m. drop in its population, including a loss of 24 m. from the Russian Federation, which would disencumber an additional 32 million hectares of biocapacity, adding to the country's large present surplus (UN "World Population Prospects: The 2008 Revision"; Ewing, B. et al. "Ecological Footprint Atlas 2010"). Out of the 28 other nations predicted to lose population by 2050, 16 are former Soviet Union republics or other Eastern European, and 26 have deficits of biocapacity which may be reduced by depopulation.

The most developed countries - those longest industrialised - are most responsible for global climate change, yet they are predicted to suffer the least harm in terms of food production. United States Department of Energy data cited by the World Bank show that high-income countries, with 16% of the global population, produced fully 64% of global carbon dioxide emissions accumulated in the atmosphere between 1850 and 2005; Anglo-Saxons (UK, Canada, Australia, and the United States) with just 6% of humanity produced 37% of the total CO<sub>2</sub> emissions (World Bank. 2010. "World Development Report: Development and Climate Change", p. 362). However, with current models, the industrialised nations are predicted to experience the least impact on their agricultural output, a 6.3% reduction by 2080, were no reductions in current carbon dioxide emissions to take place; if carbon fertilisation occurs, and vegetation absorbs some excess CO<sub>2</sub>, then these nations would in fact enjoy a 7.7% increase in agricultural output.

By comparison, sub-Saharan Africa will suffer a 27.5% output decline (-16.6% if c.f.), Asia a 19.2% decline (-7.2% c.f.), Latin America a 24.3% decline (-12.9% c.f.) and the Middle East and North Africa a 21.2% decline (-9.4% c.f.). Of the ten nations predicted to suffer the largest output reductions, five are in sub-Saharan Africa, with highest-ranked Sudan's output predicted to decline by 56%, or 50% with a carbon fertilisation effect; Iraq, Cuba, Myanmar, India and Algeria complete the list, with no less than a 26% reduction including carbon fertilisation. Of the ten nations predicted to experience the least disruptions, five are in Europe, along with Egypt, New Zealand, Canada, Kenya and Japan (the United States ranks eleventh); with carbon fertilisation, their outputs are expected to increase between 28% and 8% (Cline, W. R. 2007. *Global Warming and Agriculture: Impact Estimates by Country*. Washington, DC: Center for Global Development and Peterson Institute for International Economics, p. 67-71, 96). Perhaps Gwynne Dyer's focus on the need for addressing African population growth in part reflects a concern that these nations' peoples will be the most likely to become environmental refugees to Europe and the Americas.

Recent studies have demonstrated the strong asymmetry between countries which are drivers of ecological disruption and those which are bearers of those damages; it is not necessarily the wealthiest nations' ecosystems that will bear the brunt of the damages, but rather a "polluter wins" scenario. Srinivasan and colleagues made a synthesis of ecological cost accounting studies according to nations' level of economic development (Srinivasan, U. Thara. 2008. "The debt of nations and the distribution of ecological impacts from human activities", *Proc.Nat.Acad.U.S.* 105 no. 5 1768-1773). Countries were partitioned according to low incomes (32% of global population, including India), medium incomes (50% of population, including China) and high incomes (18% population), and the ecological costs associated with climate change, ozone depletion, agriculture, deforestation, overfishing and mangrove loss quantified from a range of sources in relation to each country grouping. Total "ecological debt" for the 21st century was estimated to range between \$8.7 trillion (2005 PPP \$) and \$47 trillion, of which, at the upper bound, 40% is derived from climate change whose damages are global, and 45% from agriculture, whose damages such as drinking water contamination, erosion and salination are largely regional in scope and thus self-inflicted. They calculated that high-income countries' activities will be responsible for between -\$160 bn. and \$2.3 tn. of climate change-induced damages to low-income countries, or 43% of the total low-income-country-borne damages while low-income countries themselves will be responsible for only 14% at maximum of their received damages. Conversely, low-income countries' activities are predicted to be responsible for only 13% of climate change damages inflicted on high-income countries. High-income countries were found responsible for 70% of ozone layer depletion damages in low-income countries, while low-income countries themselves caused only 2%. Over all six categories of environmental change, 11%-13% of the global ecological debt is attributable to low-income countries (\$0.9 tn. - \$6.3 tn.) even as they comprise 32% of world population. Negating damages done by the low-income group to other groups, the upper bound on net ecological debt of rich and medium-income groups to poor nations, \$3.1 trillion (\$ PPP), is estimated to exceed the foreign debt owed by poor to rich nations, \$2.0 tn. by about one-half; 97% of this net debt stems from climate change and ozone layer-related causes. The authors state that their "analysis highlights the ecological harm poor countries bear to indirectly enable the living standards of wealthier nations", although they admit that these estimates are "provisional" given the high degree of spread in individually published cost estimates.

NET ECOLOGICAL DEBT OF LOW-INCOME NATIONS, 1961-2100				
	<b>Ecological Debt of Middle- &amp; High-Income to Low-income nations</b>			
	<b>2005 PPP \$, billions</b>		<b>Percentage</b>	
	Lower bound	Upper bound	Lower bound	Upper bound
Climate change (2000-2100)	\$1,150	\$3,060	91.3%	98.1%
Stratospheric ozone-layer depletion (1985-2100)	\$15	\$47	1.2%	1.5%
Agricultural intensification and expansion	\$10	-\$1	0.8%	0.0%
Deforestation	\$13	\$62	1.0%	2.0%
Overfishing	\$2	\$4	0.1%	0.1%
Mangrove loss	\$35	\$35	2.8%	1.1%
<b>Totals</b>	<b>\$1,260</b>	<b>\$3,120</b>	<b>100.0%</b>	<b>100.0%</b>
Source				
Srinivasan, U. Thara et al. 2008. "The debt of nations and the distribution of ecological impacts from human activities", Proc.Nat.Acad.Sci.U.S.A. 105(5):1768-1773. Period of coverage 1961-2000 unless noted. Calculated from Table 1 as: Net Ecological Debt of Low-income nations = CML+CHL-CLM-CLH where CML = contribution of middle-income countries to low-income countries, etc.				

NET ECOLOGICAL DEBT OF HIGH-INCOME NATIONS, 1961-2100				
	<b>Ecological Debt of Middle- &amp; Low-Income to High-income nations</b>			
	<b>2005 PPP \$, billions</b>		<b>Percentage</b>	
	Lower bound	Upper bound	Lower bound	Upper bound
Climate change (2000-2100)	\$3,560	-\$3,160	122.8%	78.6%
Stratospheric ozone-layer depletion (1985-2100)	\$20	-\$44	0.7%	1.1%
Agricultural intensification and expansion	-\$553	-\$423	-19.1%	10.5%
Deforestation	-\$19	-\$257	-0.7%	6.4%
Overfishing	-\$12	-\$34	-0.4%	0.9%
Mangrove loss	-\$105	-\$105	-3.6%	2.6%

Totals	\$2,900	-\$4,020	100.0%	100.0%
Source				
Srinivasan, U. Thara et al. 2008. "The debt of nations and the distribution of ecological impacts from human activities", Proc.Nat.Acad.Sci.U.S.A. 105(5):1768-1773.				
Period of coverage 1961-2000 unless noted.				
Calculated from Table 1 as:				
Net Ecological Debt of High-income nations = CMH+CLH-CHM-CHL				
where CMH = contribution of middle-income countries to high-income countries, etc.				

As a growing debate among philosophers indicates, in an era where investment capital, corporations and resources flow independently of national borders, it may well be time for the globalising world to call into question the sovereignty of nation-states, established by the Peace of Westphalia in 1648 ("Westphalian sovereignty", Wikipedia, accessed 16 October 2010). Amartya Sen has written that "[t]here is something of a tyranny of ideas in seeing the political divisions of states (primarily, national states) as being in some way, fundamental, and in seeing them not only as practical constraints to be addressed, but as divisions of basic significance in ethics and political philosophy [...] Collectivities of many different types can be invoked. International justice is simply not adequate for social justice" ("The Idea of Justice", 2008, Harvard University Press, p. 143).

But why were European families so much smaller than elsewhere, even before the Industrial Revolution? For example, England's fertility rate was 5.9 in 1775, falling to 4.7 by 1850 (Livi-Bacci, Massimo. 2007. "A concise history of world population", 4th ed. Blackwell. p. 114). Harvard environmental scientist Michael B. McElroy proposes a geographical theory: when continental drift joined the North and South American continents at Panama several million years ago, it altered the pattern of ocean currents, leading to the "deep-water conveyor belt" which circulates warm surface water from Asia around Africa and up to northern Europe, giving the continent a mild climate and uniform precipitation throughout the year, while Asia and Africa had monsoon climates, alternating dry and rainy seasons. Human agricultural settlements in China, therefore, evolved under strong central control, the oldest continuous polity from the third century BCE, in fact, in order to redistribute food surpluses to areas of lower productivity, and avert famine. When humans settled into heavily forested northwestern Europe, however, the soils were heavy and difficult to cultivate, requiring not so much concerted human muscle power, but draught animals and technology: heavy ploughs to turn over the dense soils. European geography thus selected early on for capital-intensive, innovative societies, and smaller families where young men married later and inherited their parents' property rather than the hierarchical, labour-intensive society that was China; McElroy proposes that the surfeit of energy for agriculture drove Europe's mechanization trajectory, from waterwheel mills to steam engine and factory (McElroy, Michael B. 2010. "Energy: Problems, Perspectives and Prospects", Oxford U.P., p. 8). Nevertheless, the temperate highlands of Ethiopia have, uniquely in Africa, also been tilled by plough and oxen for two and a half millennia, yet perhaps through its geographical isolation, there was little innovation in technology until recent investments by development groups, and Asian investors.

## **ETHIOPIA LIKELY TO ACHIEVE MILLENNIUM DEVELOPMENT GOALS 1-3, AND 87% of MDG4 and 66% of MDG5 BY 2015**

Some good things are happening in Africa, including Ethiopia, that tend to get obscured. We should not discount the lessening of parents' grief that modern medicine has brought to Africans: instead of one in every five children dying the number is now close to one in ten (185 deaths of sub-Saharan African children under five per 1,000 live births in 1980, 136 in 2010, according to the UN Population Division). Ethiopia's maternal mortality rate has nearly halved, from 1,061 per 100,000 live births in 1980 (2.5 times the world rate of 422) and 968 in 1990 to 590 in 2008 (2.4 times the global rate, 251) (Rajaratnam, Julie Knoll et al. 2010. "Maternal mortality for 181 countries, 1980–2008: a systematic analysis of progress towards Millennium Development Goal 5", The Lancet, Early Online Publication, 12

April 2010); thus, Ethiopia is likely by 2015 to have attained 66% of the fifth Millennium Development (MDG) goal of a three-quarters reduction, 487 maternal deaths per 100,000 live births as opposed to the goal of 242. True, longterm economic growth has been well below average, but in the past decade, it is near the top of nations. Between 1980 and 2006, Ethiopia's GDP per capita grew, in real terms, by an average annual rate of 0.8% (rank 136 out of 197 countries), compared to a world average of 1.7%, and much lower than Nigeria's 1.1% (126th), India's 4.1% (22nd) and China's 8.9% (4th). In 2000-2006, however, Ethiopia's per capita GDP according to the World Bank grew 4.4% annually, more than double the world average (1.9%) ("World Development Indicators"). In 2006-2009, initial IMF estimates are for annual growth of 7.6%, placing Ethiopia sixth-highest in the world, and second-highest in Africa after Angola (9.8%) and ahead of India (6.4%) (IMF. "World Economic Outlook", October 2009, Gross domestic product per capita, constant prices). This despite having the 34th-highest population growth rate over 2000-2008, 2.6%. In fact, half of the top ten fastest-growing populations in 2008 are not African: Qatar (rank #1), Singapore (2), Belize (6), Jordan (8), and Timor-Leste (9) (World Bank, "World Development Indicators"). In 1995, the proportion of Ethiopians living on less than \$1.25 per day (2005 US \$, proportional purchasing power) was higher than the sub-Saharan African average (61% vs. 59%), but by 2005 the Ethiopian rate had fallen to 39%, compared to 51% for sub-Saharan African; if it sustains this rate of improvement to 2015, and the IMF forecasts strongly suggest it, the MDG1 target of halving extreme poverty will be surpassed by Ethiopia (World Bank, World DataBank, Millennium Development Goals). Other World dataBank MDG data show that the prevalence of undernourishment (a second target within first MDG) in Ethiopia was more than double the sub-Saharan African average in 1992 (71% vs. 31%), however by 2006 it had fallen by a third to 44%, compared to sub-Saharan Africa's more modest decline to 28%. For MDG2, Ethiopian primary school enrolment tripled between 1991 (24%) and 2008 (78%), surpassing the sub-Saharan African average of 73% in 2007. Ethiopia appears on track to achieving MDG3, full gender equity in primary school enrolment, the female:male rate having risen from 65% in 1990 (sub-Saharan Africa: 84%) to 88% in 2007 (sub-Saharan Africa: 91%). Likewise, on MDG4, compared to the sub-continent average, the Ethiopian under-five mortality rate was 14% greater in 1990 (210 deaths vs. 185 per 1,000 live births) but lower in 2005 (122 vs. 152), and 24% lower in 2008 (109 vs. 144); this suggests that Ethiopia will in 2015 achieve a 60% reduction (to 84) from the 1990 level, narrowly missing the two-thirds reduction target of 70. And to reduce malaria mortality (part of MDG6), Ethiopia has gone from just 2% of its children sleeping under insecticide-treated bed nets in 2000 to 38% in 2008 (UN. 2009. "The Millennium Development Goals Report", p. 34). Adult HIV prevalence in 2009 was between 1.4% and 2.8%, with 29% of persons needing ARTs receiving them in 2007 (www.unaids.org). Nevertheless, analysis by Washington's Population Reference Bureau found that the 1990-2008 trends on Ethiopian reduction in underweight children prevalence (Millennium Development Goal target indicator 1.8), under-five mortality (MDG 4.1), HIV/AIDS prevalence (MDG 6.1) and antiretroviral drug accessibility (MDG 6.5) suggest these targets will be met by 2015, while the targets for absolute poverty reduction (MDG 1.1), gender education equality (3.1), maternal mortality (5.1) and improved drinking water (7.8) are probably unrealisable by that year (Teller, Charles et al. 2009. "Population Dynamics, Food/Nutrition Security and Health in Ethiopia: Delicate Balance of Vulnerability & Resilience", IUSSP Marrakech, 30 September, 2009, Poster Session #3).

MDG1. Eradicate Extreme Poverty and Hunger. Target 1. Halve, between 1990 and 2015, the proportion of people whose income is less than \$1 a day					
Measurement variable: World Development Indicators, Poverty headcount ratio at \$1.25 a day (PPP, 2005) (% of population)					
	<b>1990 (or actual measurement year)</b>	<b>2010 (or actual measurement year)</b>	<b>Projected to 2015 at 1990:current (linear) trend</b>	<b>Millennium Development Goal Target</b>	<b>Projected % Achievement of Target in 2015</b>
Burkina Faso	71.2%	56.5%	41.6%	39.3%	94.2%
	1994	2003			
Ethiopia	60.5%	39.0%	25.2%	37.3%	132.5%
	1995	2005			
Ghana	49.4%	30.0%	23.0%	24.0%	103.9%
	1989	2006			
Kenya	38.4%	19.7%	11.8%	21.3%	144.5%
	1992	2005			
Mali	86.1%	51.4%	35.0%	50.7%	131.1%
	1994	2006			
Mozambique	81.3%	74.7%	63.0%	44.9%	59.8%
	1997	2003			
Nigeria	68.5%	64.4%	59.2%	35.9%	35.1%
	1996	2004			
Uganda	68.7%	51.5%	43.1%	33.7%	72.2%
	1989	2005			
Zambia	65.3%	64.3%	63.3%	32.8%	6.8%
	1993	2004			

MDG1. Eradicate Extreme Poverty and Hunger. Target 3. Halve, between 1990 and 2015, the proportion of people who suffer from hunger					
Measurement variable: World Development Indicators, Prevalence of undernourishment (% of population)					
	<b>1990 (or actual measurement year)</b>	<b>2010 (or actual measurement year)</b>	<b>Projected to 2015 at 1990:current (linear) trend</b>	<b>Millennium Development Goal Target</b>	<b>Projected % Achievement of Target in 2015</b>
Burkina Faso	14.0%	9.0%	6.8%	7.4%	109.0%
	1992	2006			

Ethiopia	71.0%	44.0%	32.3%	37.9%	114.7%
	1992	2006			
Ghana	34.0%	8.0%	3.2%	20.5%	184.6%
	1992	2006			
Kenya	33.0%	30.0%	28.2%	16.7%	31.3%
	1992	2006			
Mali	14.0%	10.0%	8.1%	7.3%	90.2%
	1992	2006			
Mozambique	59.0%	37.0%	27.4%	31.5%	112.9%
	1992	2006			
Nigeria	15.0%	8.0%	5.3%	8.2%	134.7%
	1992	2006			
Uganda	19.0%	15.0%	12.9%	9.8%	68.8%
	1992	2006			
Zambia	40.0%	45.0%	48.5%	19.7%	-46.9%
	1992	2006			

MDG2. Achieve Universal Primary Education Ensure all children, girls and boys, able to complete full primary schooling					
Measurement variable: World Development Indicators, School enrollment, primary (% net)					
	1990 (or actual measurement year)	2010 (or actual measurement year)	Projected to 2015 at 1990:current (linear) trend	Millennium Development Goal Target	Projected % Achievement of Target in 2015
Burkina Faso	27.3%	60.1%	83.3%	100.0%	76.6%
	1991	2008			
Ethiopia	24.0%	78.2%	127.2%	100.0%	100.0%
	1991	2008			
Ghana	56.4%	73.9%	82.6%	100.0%	59.2%
	1991	2008			
Kenya	56.4%	81.5%	105.5%	100.0%	100.0%
	1998	2008			
Mali	23.1%	71.5%	113.8%	100.0%	100.0%
	1991	2008			
Mozambique	42.1%	79.9%	104.0%	100.0%	100.0%
	1991	2008			
Nigeria	53.8%	61.4%	65.6%	100.0%	24.6%
	1991	2007			

Uganda	51.2%	97.1%	126.4%	100.0%	100.0%
	1991	2008			
Zambia	71.4%	95.2%	116.5%	100.0%	100.0%
	1998	2008			

MDG3. Promote Gender Equality and Empower Women: Eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015					
Measurement variable: World Development Indicators, School enrollment, primary, female (% net)					
	1991 (or actual measurement year)	2008 (or actual measurement year)	Projected to 2015 at 1990:current (linear) trend	Millennium Development Goal Target	Projected % Achievement of Target in 2015
Burkina Faso	21.5%	55.7%	82.5%	100.0%	77.4%
	1991	2008			
Ethiopia	20.5%	75.4%	128.8%	100.0%	100.0%
	1991	2008			
Ghana	53.1%	74.4%	85.5%	100.0%	68.2%
	1991	2008			
Kenya	56.7%	82.0%	106.3%	100.0%	100.0%
	1998	2008			
Mali	17.4%	65.4%	112.9%	100.0%	100.0%
	1991	2008			
Mozambique	37.0%	77.3%	104.8%	100.0%	100.0%
	1991	2008			
Nigeria	46.8%	58.3%	65.0%	100.0%	33.5%
	1991	2007			
Uganda	46.4%	98.3%	134.0%	100.0%	100.0%
	1991	2008			
Zambia	78.7%	95.8%	103.9%	100.0%	100.0%
	1991	2008			

MDG4. Reduce Child Mortality: Two-thirds reduction in Under-five Mortality Rate					
Measurement variable: Number of children under age 5 who die per 1,000 children (Rajaratnam JK. 2010. Lancet 375: 1988-2008)					
	1990	2010	Projected to 2015 at 1990:current (linear) trend	Millennium Development Goal Target	Projected % Achievement of Target in 2015
Burkina Faso	204.7	133.7	120.2	68.2	61.9%
Ethiopia	201.9	101.0	84.9	67.3	86.9%
Ghana	122.2	77.5	69.2	40.7	65.1%
Kenya	103.8	82.2	77.5	34.6	37.9%
Mali	254.0	161.2	143.9	84.7	65.0%
Mozambique	226.6	133.7	117.2	75.5	72.4%
Nigeria	194.1	157.0	148.9	64.7	34.9%
Uganda	167.8	116.7	106.6	55.9	54.7%
Zambia	172.8	118.8	108.2	57.6	56.1%

MDG5. Improve Maternal Health 75% reduction Maternal Mortality Rate, MMR					
Measurement variable: Number of women who die during childbirth per 100,000 live deliveries (Hogan MC. 2010. Lancet 375: 1609-1623)					
	1990	2008	Projected to 2015 at 1990:current (linear) trend	Millennium Development Goal Target	Projected % Achievement of Target in 2015
Burkina Faso	488	332	285.8	122.0	55.2%
Ethiopia	968	590	486.7	242.0	66.3%
Ghana	549	409	364.8	137.3	44.7%
Kenya	452	413	398.8	113.0	15.7%
Mali	831	670	616.2	207.8	34.5%
Mozambique	385	599	711.3	96.3	-113.0%
Nigeria	473	608	670.4	118.3	-55.6%
Uganda	571	352	291.6	142.8	65.2%
Zambia	594	603	606.5	148.5	-2.8%
East Africa	690	508	451.0	172.5	46.2%
West Africa	582	629	648.3	145.5	-15.2%

	Predicted % Achievement of MDG Target by 2015 (summary of preceding tables)							Financial flows per capita			
	MDG1, Target 1 (Halve Poverty)	MDG1, Target 3 (Halve hunger)	MDG2 (100% Primary School Enrolment)	MDG3 (100% Female School Enrolment)	MDG4 (2/3 decrease in U5MR)	MDG5 (3/4 decrease Mat.Mort.)	Average, MDG 1-5	Average annual ODA + FDI + Remittances per capita, 1980-2008 (constant 2004 US\$) (World Bank)	Annual Capital Flight per capita, 1980-2008, 2004 \$ (2)	(ODA+FDI+Remitt.) - Capital Flight (const. 2004\$)	Average GDP per cap., PPP, 1980-2008, constant 2005 \$ (1)
Burkina Faso	94.2%	109.0%	76.6%	77.4%	61.9%	55.2%	74.5%	\$67.61	\$4.33	\$63.28	\$830.94
Ethiopia	132.5%	114.7%	100.0%	100.0%	86.9%	66.3%	95.4%	\$23.23	\$10.13	\$13.10	\$560.46
Ghana	103.9%	184.6%	59.2%	68.2%	65.1%	44.7%	76.3%	\$53.59	\$9.44	\$44.15	\$989.89
Kenya	144.5%	31.3%	100.0%	100.0%	37.9%	15.7%	68.3%	\$48.89	\$6.46	\$42.43	\$1,336.82
Mali	131.1%	90.2%	100.0%	100.0%	65.0%	34.5%	82.0%	\$77.73	\$23.49	\$54.24	\$773.18
Mozambique	59.8%	112.9%	100.0%	100.0%	72.4%	-113.0%	49.2%	\$79.98	\$11.93	\$68.05	\$472.92
Nigeria	35.1%	134.7%	24.6%	33.5%	34.9%	-55.6%	24.5%	\$31.81	\$57.75	-\$25.94	\$1,466.58
Uganda	72.2%	68.8%	100.0%	100.0%	54.7%	65.2%	78.1%	\$45.73	\$8.65	\$37.07	\$700.77
Zambia	6.8%	-46.9%	100.0%	100.0%	56.1%	-2.8%	46.6%	\$116.89	\$31.47	\$85.42	\$1,199.28

Sources:

(1) World Bank. "World Development Indicators", databank.worldbank.org. Accessed September 2010.

(2) Global Financial Integrity. 2010. "Illicit Financial Flows from Africa: Hidden Resource for Development", Dev Kar & Devon Cartwright-Smith, pp. 34-36, Real Illicit Financial Flows (CED+GER): 1970-2008 (\$US millions 2004 deflated)

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It has been noted that "[t]he MDGs remove the focus from [the] triumphs and speak solely of what remains undone. This is where the real trouble with the MDGs may lie: in their political cost" (Clemens, Michael A. et al. 2007. "The Trouble with the MDGs: Confronting Expectations of Aid and Development Success," World Development 35(5):735-751). However, the above summary analysis suggests that Ethiopia, with a projected average attainment of 95.4% of the first five targets, will by 2015 have performed better in meeting its targets than eight other sub-Saharan African nations, despite it having the lowest share of official aid, foreign investment and expatriate worker remittances of the group.

Nigeria appears as a stark anomaly in this sample. Ghana and Burkina Faso are two other West African countries which together span nearly the same lines of latitude, suggesting rather similar geographies, climates and even social histories. In 2002, mortality rates from malaria, as a proportion of total mortality were indeed quite similar, with Ghana at 11.2% (rank 6th-highest out of 192 nations), Nigeria at 10.9% (rank 9), and Burkina Faso with 10.3% (rank 12) (World Health Organization. "Causes of death [xls 3.03Mb]", December 2004, Table 1 www.who.int/entity/healthinfo/statistics/bodgbdeathdalyestimates.xls). Despite these contiguities, Nigeria appears destined achieve only one-third the predicted average attainment on the first five MDGs. The difference is even greater between Ethiopia and Nigeria, the two most populous sub-Saharan African nations, but at opposite ends of the achievement spectrum among the nine nations. In terms of the Human Development Index, Nigeria's 0.511 and rank of 158th compares favourably to Ethiopia's 0.411 & rank 171st in 2007 (UNDP. 2009. "Human Development

Report 2009", Table H). One possible explanation is the extent of ethnic diversity: according to the Ethnologue database of world languages, there are 521 languages currently spoken in Nigeria (about 3.3 languages per one million inhabitants) compared to Ethiopia's 88 (1.0 language per million Ethiopians); Nigeria is hence three times more culturally diverse than Ethiopia, and thus more challenging to govern (Ethnologue Languages of the World, Statistical Summaries, [http://www.ethnologue.com/ethno\\_docs/distribution.asp?by=country](http://www.ethnologue.com/ethno_docs/distribution.asp?by=country)). Another interpretation is the "resource curse" of oil. Nigeria is the only nation in the above nine-nation set in which, on an annual per capita basis averaged over the period 1980-2008 in US dollars, the "illicit" outflows of capital ("capital flight", \$58) exceed the sum of inflows from foreign aid (\$13 per Nigerian), foreign investment (\$6), and home remittances by expatriate workers (\$11) by nearly double (\$58 lost vs. \$30 gained per Nigerian). For every dollar of aid money, foreign investment and expatriate Nigerian workers' earnings sent back to Nigeria, two dollars is fleeing the country for foreign bank accounts. Restricting the time window to only the 2000s, the situation is acute: for every \$66 annually entering Nigeria in aid, investment and remittances, \$132 has exited via capital flight. Nigeria's social welfare, along with that of the Russian, Venezuelan, Algerian, Syrian, Guyanese and Gabonese petro-economies too may be impaired by the Dutch Disease, their extreme dependence on oil exports: "GNI is too low in these countries in the sense that they are achieving extremely low rates of return on their produced, human, and institutional capital. This is a classic symptom of the resource curse..." (World Bank. 2006. "Where Is The Wealth Of Nations? Measuring Capital for the 21st Century", p. 29). Ethiopia is unique among these nations for never having been colonised by a foreign power, with the exception of the Italian occupation, 1936-1941 ("Ethiopia", Wikipedia, the free encyclopedia, read 26 October 2010).

Ethiopia, along with food-insecure Niger and Burkina Faso and four others are the only African countries to have allocated more than ten per cent of their national budgets to agriculture in 2008 (Thurow, Roger; Kilman, Scott. 2009. "Enough. While the World's Poorest Starve in an Age of Plenty", Public Affairs, p. 268). Although Ethiopians have received only 47% of the average per capita development aid allotment for sub-Saharan Africa during 1961-2008, it has risen steeply in the past several years, attaining 84% of the region's average in 2008 ("World Development Indicators", Net ODA received per capita). Official development assistance is part of MDG7, to develop a global partnership, and Ethiopia's per capita ODA receipts rose from 60% of the sub-Saharan Africa average in 1990 (\$21 vs. \$35, current dollars) to 84% in 2008 (\$41 vs. \$49). That Ethiopia should be on track to achieve or come quite near to achieving so many development milestones with much less than typical international support in Africa is indeed remarkable.

While long-term data are unavailable, recent trends in the United Nations Human Development Index, a composite of longevity, education and income, also rank Ethiopia as the second-fastest improver after Niger, with an average annual increase of 3.9% between 2000 and 2007, and 19 of the 25 most rapidly-improving countries are in Africa (UNDP. "Human Development Report 2009", Table G, G: Human development index trends). Global gaps in holistic measures of human development do appear to be narrowing, and Ethiopia is at the head of the pack. At least one economic growth projection, incorporating an optimistic long-term annual 3.2% per capita GDP growth rate for Ethiopia to 2050 (three-quarters of its 2000-06 rate), and the UN Population Division's medium-variant population growth estimates, is also encouraging, with the country's poverty headcount predicted to decline from 2005's 42.9 m. (62.0% of population) to 40.0 m. (45.5%) in 2015, and 2.5 m. (1.4%) in 2050, similar to 2050 poverty ratio outlooks in the 0% to 2% range for Ghana, Kenya, South Africa, Tanzania and Uganda. The same study also presents a more sobering scenario for sub-Saharan Africa, growing annually at only 0.1% GDPPC to 2050: in this case, the region's poverty headcount grows from 427m. in 2005 to 1,039m. in 2050, compared to the former 2.6% GDPPC scenario where the 2050 poverty headcount declines to 306m. (Hillebrand, Evan. 2008. "The Global Distribution of Income in 2050", World Development 36(5): 727-740).

Then, the reality check. At 66%, sub-Saharan Africa's adult literacy rate in 2008 - an outcome indicator of a country's educational system - is now similar to India's 63% (2006) but much lower than Indonesia's 92% (2006) and China's 94% (2008). And Ethiopia is farther back at 36% in 2004, up from 27% in 1994 (World Bank. "World Development Indicators", Literacy rate, adult total (% of people ages 15 and above), searched May 2010). One

American academic perspective puts Ethiopia's underdevelopment this way: "[t]he majority of the population in Ethiopia is poor and illiterate. As a result, it does not know its rights and mainly depends on the government. Age-old mentality and feeling of resignation ("mintadargawalah?" what can you do?) have deprived people in Ethiopia of the motivation to fight for their rights. Furthermore, while preserving national pride in every thing that is Ethiopian, people in Ethiopia generally tend to be suspicious and unwilling to learn new ideas" (Teferra, Daniel. 2005. "Economic Development and Nation Building in Ethiopia", 2nd ed., University Press of America, p. 47). This author concludes that "[t]he State owns all rural and urban lands. The regime of Meles Zenawi is not willing to turn land over to the peasantry and get out of the real estate business [...] The United States and its allies give the regime in Ethiopia diplomatic and financial support, depriving it of the motivation to transform the country to a market economy and democracy" (Teferra 2005: 58). Voice of America (VOA), the US government's Amharic language radio service to Ethiopia, has been criticised by Ethiopian Prime Minister Meles Zenawi, in power since 1995 and re-elected in 2010, for exhibiting "wanton disregard of minimum ethics of journalism and engaging in destabilizing propaganda" and Zenawi stated that preparations were underway to block the transmission ("jam") of VOA Amharic broadcasts (Heinlein, Peter. 2010. "Ethiopian PM Says He Will Authorize Jamming VOA", 18 March 2010, voanews.com). There have been reports of dissent suppression and silencing of Ethiopian opposition parties, academics and journalists by the Ethiopian government in the months preceding the May 2010 presidential elections (Hunt, Nick. 2010. "Ethiopia's endangered democracy", *New Internationalist*, 431:21-23). Human Rights Watch also documented voter intimidation by the ruling party during this period ("Ethiopia: Government Repression Undermines Poll", May 24, 2010, <http://www.hrw.org>). The UN Economic Commission for Africa is one of many bodies that does not include Ethiopia among the African countries likely to achieve by 2015 any of the eight Millennium Development Goals for poverty, education and health, etc.; for each of the individual goals, only five to eleven out of sub-Saharan Africa's 46 countries were actually predicted to succeed: "given current trends and contexts, with few exceptions, Africa as a continent will not meet most of the MDG targets within the set timeframes" (UNECA. 2005. "The Millennium Development Goals in Africa: Progress and Challenges", [www.unece.org/mdgs/](http://www.unece.org/mdgs/)). Easterly argues that such pessimism fails to acknowledge the substantial progress that Africa has made (Easterly, William. 2009. "How the Millennium Development Goals are Unfair to Africa", *World Development* 37(1): 26-35). The MDG methodology, it is argued, severely handicaps Africa relative to other developing regions because the goals are either proportionally-based or level-based, and Africa is furthest behind on most indicators (Clemens, Michael A. et al. 2007. "The Trouble with the MDGs: Confronting Expectation of Aid and Development Success", *World Development* 35(5): 735-771).

The second-half of the 21st century may see a gradual "Africanisation" of the human population. The 2008 United Nations Population Division scenario forecasts that 69% of the annual increase in the human population in the years 2045 to 2050 will occur in sub-Saharan Africa, up from 25% in 2010. By mid-century, nearly one in ten new additions to humanity will be a Nigerian, and one in sixteen will be an Ethiopian, a respective annual growth of 2.9 m. and 1.9 m. out of world population increase of 20.7 m. The proportion of 15 to 24-year-olds in the global population who are sub-Saharan Africans will rise from 15% in 2010 to 26% in 2050 (Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, "World Population Prospects: The 2008 Revision"). Will this create a unique human resource pool for the rest of the world - caregivers and other service providers to an increasingly geriatric high-income world, for example - or will it create a teeming mass of discontented, jobless youth and climate refugees?

We might look at two of the most egalitarian societies in the rich world for a glimpse of the future. In previous centuries, both the Netherlands and Japan fell under severe population constraints on their agricultural productivity that led to highly cooperative systems, the "polder model" of give-and-take negotiation for dams and irrigation in the former, and terraced rice-farming in the latter. Yet, while both have among the ten lowest levels of income inequality among high-income nations (Wikipedia, "List of countries by income equality", UN Gini, accessed May 2010), in 2008 Japan's level of assistance to developing countries amounted to only 0.2% of its economy, compared to Netherlands' 0.8% ([oecd.org/dac](http://oecd.org/dac)). Agricultural necessity drew Japan inwardly-cooperative, and Netherlands both

inward- and outwardly-cooperative. In the world's most socially-progressive region, Europe, the European Union average personal taxation rate is 40%, however pan-Union redistributive transfers amount to only 1% (Collier, Paul. 2010. "The Plundered Planet", Oxford U.P., p. 27).

Canada, through its colonised aboriginal peoples, offers another insight into the well-being prospects of nonmodern societies, at least under the manner which developed areas interact with them. Using the UN Human Development Index methodology (HDI, equal weights to life expectancy, education and income), it has been shown that the wellbeing gap has steadily narrowed between "registered Indians" and all other Canadians (including both Inuit, Métis, non-registered First Nations and all persons whose ancestors immigrated from other continents after the first waves of North American population). While in 1981 the average HDI value for Registered Indians was 22% lower than for other Canadians, in 2001, it had narrowed to just 13% lower (Cooke, Martin, 2004. "Measuring the Well-Being of Aboriginal People: An Application of the United Nations' Human Development Index to Registered Indians in Canada, 1981–2001", Strategic Research and Analysis Directorate, Indian and Northern Affairs Canada). However, Canada's First Nations people have the choice of living "on reserve" on specifically designated aboriginal territory, or they may migrate "off reserve" and settle among the wider Canadian society. This study found that the HDI shortfall for on-reserve Indians compared to non-Indian Canadians diminished from 31.8% (1981) to 24.9% (1991) to 17.0% lower (2001) than the general Canadian population, while for off-reserve Indians, it was stagnant, from 9.4% (1981) to 10.8% (1991) to 9.1% (2001) lower. Similar shortfalls in income mobility have been identified among visible minority communities for the first two generations of immigrants (Aydemir, Abdurrahman, Wen-Ho Chen and Miles Corak. 2005. Intergenerational Earnings Mobility Among the Children of Canadian Immigrants. Statistics Canada Catalogue no. 11F0019MIE – No. 267; Palameta, Boris. Economic integration of immigrants' children", Perspectives on Labour and Income, 8(10): 5-16). Canadian census data show that the proportion of First Nations people living off-reserve rose slightly from 58% in 1996 to 60% in 2006, while only 22% of Inuit people lived in 2006 outside their Inuit homeland in Canada's far north (Statistics Canada. "Fewer First Nations people live on reserve than off reserve", 2006 Census: Aboriginal Peoples in Canada in 2006; "Inuit population: Young and growing", Inuit, Métis and First Nations, 2006 Census: First Nations people; Inuit). Cooke and colleagues concluded that "[i]f the changes found here are real and they do represent improvements in people's health, incomes, and education, these improvements have not occurred at a rate that will see the standards of living of Registered Indians converge with that of other Canadians in the near future". When indexed according to the Human Development Report's 2001 Human Development Index rankings, Canada overall ranked eight-highest (0.937) while Canada's Aboriginal peoples, at 0.851, collectively ranked 33rd, between Czech Republic and Argentina (Cooke, Martin et al. 2007. "Indigenous well-being in four countries: An application of the UNDP'S Human Development Index to Indigenous Peoples in Australia, Canada, New Zealand, and the United States", BMC International Health and Human Rights 7:9). It nevertheless shows that those who emigrate from traditional to long-modernised regions improve their absolute level of wellbeing much more rapidly than those who choose to remain where they have always lived and wait for development to come to them.

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In 2011, the book "The Demographic Transition and Development in Africa: Applying the case study of Ethiopia in developing countries" (Springer) is scheduled for publication. The table of contents is listed at: <http://www.springer.com/social+sciences/population+studies/book/978-90-481-8917-5>

## References

- [1] <http://www.footprintnetwork.org/images/uploads/Ecological%20Footprint%20Atlas%202010.pdf>
- [2] <http://www.footprintnetwork.org/en/index.php/GFN/page/ecologicalfootprintatlas2008>
- [3] [http://www.gfip.org/index.php?option=com\\_content&task=view&id=300&Itemid=75](http://www.gfip.org/index.php?option=com_content&task=view&id=300&Itemid=75)

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