At Issue ezine


A Zambian farmer grows maize and drought-resistant cowpeas.
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THE IMPACTS OF CLIMATE CHANGE

No. 5 - April 2009
GENDER AND CLIMATE CHANGE: A PRESENT DANGER

By Anene Ejikeme Resource scarcity and conflict in Africa are both caused and exacerbated by climate. As the author shows in examples from Sudan and Chad, where these are present the burden on women and the violence they suffer clearly increase. Positive examples from Kenya and Senegal also show the strength and resourcefulness of African women and what they are doing to tackle the adverse effects of climate change.

No. 4 - March 2009
TRADITION AND SCIENCE: ENVIRONMENTAL CHANGE ON EAST AFRICAN MOUNTAINS

By Danielson R. Kisanga For many years, the mountains of East Africa have been sources of perennial streams and rivers for large but fragile ecosystems and the human populations they sustain. In recent decades, however, montane water flows have become intermittent and unpredictable. Focusing on Mount Kilimanjaro as an example of this disturbing trend, Danielson Kisanga discusses possible causes, including climate change and changes in forest cover. He also emphasises the importance of collaboration between indigenous communities and the scientific community for correctly identifying causes and implementing participatory solutions.

No. 3 - February 2009
THE MANY FACES OF CHANGE: INFECTIOUS DISEASES AND CLIMATE IN EAST AFRICA

By Claire Standley Climate change is definitely affecting the spread of both well-known and emerging infectious diseases in East Africa - but not always in ways that predictive models might indicate. As Claire Standley shows in relation to two major diseases, malaria and schistosomiasis, accurately predicting the emergence and spread of disease is an extremely complex science due to the large number of variables and interactions involved. While this does not diminish the critical importance of research, it is nonetheless imperative that research and capacity building for health care and rapid response happen simultaneously - since so many lives are under immediate threat.

No. 2 - January 2009
CLIMATE CHANGE AND COCOA PRODUCTION IN CAMEROON: FARMERS' EXPERIENCES AND LIVELIHOOD IMPLICATIONS

By Judges Mpako and Ivo Ngome Cameroonian farmers have been growing cocoa for generations. They are well acquainted with the many challenges involved and are experts at surviving the vagaries of nature and the volatility of the global market. More recently, however, despite the encouraging price of cocoa, they have been contending with a formidable new challenge - climate change. As the authors of this article show, the sustainability of these farmers' livelihood is now far from certain.

No. 1 - December 2008
Editorial: CLIMATE CHANGE IN AFRICA

By J-P Thompson Climate change is having a disproportionate effect on Africa: the impacts are more devastating than elsewhere and the people have contributed less to cause it. This editorial highlights the problem of carbon dioxide emissions and discusses the role of deforestation. It is a potent example of opportunities squandered by the skewed, profit-driven mitigation strategies of the North, which fail to include local African knowledge and input. Without a more holistic, bottom-up approach, the fate of millions is extremely bleak.

GENDER AND CLIMATE CHANGE: A PRESENT DANGER

by Anene Ejikeme

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Herders converge on a well in Chad to water their camels: water availability affected by climate change can be a major cause of conflict.
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In June 2007 Ban Ki-Moon, United Nations Secretary-General, identified global warming as the root cause of the crisis in Darfur. Writing in an op-ed in the *Washington Post*, Ban noted that "It is no accident that the violence in Darfur erupted during the drought... [in the past] black farmers would welcome [Arab] herders as they crisscrossed the land, grazing their camels and sharing wells. But once the rains stopped, farmers fenced off their land for fear it would be ruined by the passing herds. For the first time in memory, there was no longer enough food and water for all. Fighting broke out. By 2003, it evolved into the full-fledged tragedy we witness today." Ban concluded that there can be no lasting solution that does not address that root problem, namely, the issue of enough basic resources for all. In his article, Ban went on to identify other African countries in which access to limited basic resources (land, and especially water) were at the root of other "troubles". Ban concluded by noting that "There are many other parts of the world where such problems will arise, for which any solutions we find in Darfur will be relevant."[1]

"We know that men and women experience war differently. If more wars and conflicts arise as a result of climate change, then we must acknowledge that the impact of climate change is gendered."

There was one very important issue that Ban's article did not mention: that women and men experience conflict situations in significantly different ways. If, as many predict and signs indicate, climate change brings more conflicts over resources (land, water, fuel), then it is important to pay attention to the gendered dimensions of climate change. We know that men and women experience war differently. If more wars and conflicts arise as a result of climate change, then we must acknowledge that the impact of climate change is gendered. This essay highlights two interconnected aspects of climate change that have gendered consequences: conflict and water scarcity. First, I turn to the war in Darfur, then to water scarcity in general, as troubling outcomes of climate change.

Darfur: A Prelude to Future Conflicts?

The world's attention has been focused on Darfur by campaigns declaring the Sudanese government policy in Darfur genocide. The prevailing opinion is that the conflict in Darfur is a genocidal war in which Arab militias, with the support of the government, are attempting to eliminate black African populations. Others, however, insist that this is not the case, sometimes noting that it is difficult to distinguish physically between "*Janjaweed*" (literally, "men on horseback") and the "black Africans".[2] This is in part because, while Darfur is a region of great heterogeneity, there is a history of crossing of ethnic lines and intermarriage.[3] French historian Gerard Prunier argues that while notions of race are indeed socially constructed, they can be activated to political ends, and this, he argues, is what happened in Darfur. While recognizing the fluidity of constructions of identity in Darfur (and indeed Sudan), Prunier argues that in Sudan race "became a new and acknowledged dimension of the war" between North and South in the 1980s.[4] This was, of course, after the drought which ravaged the whole sahelian belt of Africa from Mali to Ethiopia, including Darfur. Violent conflict in Darfur began precisely in this period, as Ban Ki-Moon points out, although it did not become a full-scale war until much later.

While scholars and commentators disagree on whether Darfur is a genocide or not, almost all agree that a critical element in the struggle is access to resources. Sudan occupies three ecological zones in Africa: desert, the Sahel and equatorial forest in the south. The desertification of the Sahelian belt has hit Sudan particularly hard. In a report issued in June 2007 the United Nations Environment Programme (UNEP) declared desertification Sudan's greatest challenge. Desertification was blamed on climate change and human activities. However, it is not just the Sahelian and Saharan zones of the Sudan that are facing ecological challenges due to climate change and human activities: between 1990 and 2005 Sudan lost 11.6% of its forest cover. While according to the United Nations Food and Agriculture

Organization (FAO), the loss of forest cover in the same years in Darfur was an astounding 33%. The FAO estimates that 13 percent of Sudan's GDP derives from the forest sector.[5]

In his classic work, *Famine that Kills* (originally published in 1989), Alex de Waal, argued that while "experts" believed that Darfur had excellent access to water and that it was this oversupply that led to "overfarming" and "overgrazing", the Darfuri themselves felt that they were undersupplied with water. De Waal noted that "During the drought [of 1984/5] many hand-dug wells ran dry, often for the first time ever."[6] What did people do in the absence of water? They had to endure, sometimes, "up to twelve hours' walk on foot" to secure water from neighboring communities. It was no doubt the women who undertook the task of procuring water.

Internally displaced women return to their camp at Sisi in West Darfur after scouring the surrounding countryside for firewood: conflict situations compound the burden on women.
© Doug Mercado, Courtesy of Photoshare

Whether it is fetching water or fetching firewood to provide for the needs of the entire family, it is women who typically do this work. Writing in the late 1980s about a village in Darfur, Alex de Waal noted that "Though there is hardly a tree or a blade of grass to be seen, women can be seen bringing firewood and fodder into the village: they have clearly walked for miles."[7] In conflict situations, scant basic resources will become even scarcer. This compounds the burden on women – who are then faced with greater challenges in their efforts to procure these resources for their families.

Women and Violence in a Conflict Situation: Darfur

An increased and onerous work load is not the only challenge women face in conflict situations. The reports about the widespread use of rape as a weapon of war in Darfur are well-known. According to some relief workers most of the women who managed to make it to refugee camps have been victims of rape. In a report, the organization Refugees International concluded that "The raping of Darfuri women is not sporadic or random, but is inexorably linked to the systematic destruction of their communities."[8] Under Sudanese law, *any* members of the state security services are immune from prosecution, and government critics charge that many Janjaweed have used this provision to escape justice.

In her autobiography, the young Sudanese medical doctor Halima Bashir recounts the horror of having to operate on young girls who had been gang-raped in a rural clinic without adequate painkillers and other medical supplies. She writes, "At no stage in my years of study had I been taught how to deal with eight-year-old victims of gang rape in a rural clinic without enough sutures to go around."[9] Dr. Bashir herself was subject to gang-rape by the Janjaweed.

Victims of rape gather at a 'peace hut' in South Kivu, DRC: rape is often used as a weapon of war.
© USAID / L. Werchick

Even when women escape from the conflict and arrive at a refugee camp, the hardships are far from over. As refugees, women face some burdens which are unique to them. In the context of refugee camps, which are often fragile environments themselves– politically, ecologically, economically, and socially – women find themselves facing new challenges as well as all the old ones. It is women who again take up the lion's share of looking after the young, the elderly and the sick. It is women who must provide the food, water and fuel for the family. Even when there are international peace-keepers, this may offer little or no protection, as the rape trials of U.N. peacekeepers in Congo should remind us. According to H. Patricia Hynes, a specialist in environmental health, "women refugees of war are particularly vulnerable to poverty, prostitution, the extortion of sex for food by post-war peacekeepers, and higher illness and death in the post-conflict period."[10]

Water and conflict in Chad

An estimated one-quarter million Darfuris have sought refuge in Chad. Chad, like Darfur, is in the Sahelian zone, and faces similar environmental challenges. According to the UNCHR,

> It is one of the most inhospitable environments UNHCR has ever had to work in. Vast distances, extremely poor road conditions, scorching daytime temperatures, sandstorms,

the scarcity of vegetation and firewood, and severe shortages of drinkable water have been major challenges since the beginning of the operation.[11]

According to the Atlas of Africa produced by UNEP, "Chad has the third-lowest level of access to safe water and the lowest level of access to adequate sanitation in all of Africa. … people are forced to walk long distances to fetch fresh water for domestic use and livestock. The arrival of thousands of Sudanese refugees in recent years has worsened the problem in eastern Chad. Lack of access to adequate water and sanitation has had pronounced impacts on human health: approximately one out of every five children dies before reaching the age of five, primarily due to water-related diseases."[12]

What happens when refugees move into a space that is ecologically fragile, as in Chad? Conflict between the refugees and the "locals" can be expected, unsurprisingly. In Chadian and Sudanese camps where Darfuri refugees live, there have been clashes between locals and refugees over access to water.[13] Adam Youssouf Terri, the mayor of a town on Lake Chad told reporters that his community was "seeing more violence, even deaths."[14]

Lake Chad, on the western border of Chad, was once the sixth largest lake in the world. Today, it is a fraction of its former self, having declined by 95 per cent in about 35 years.[15] Such a drastic and precipitous reduction in size naturally has affected the availability of fish, a prime resource of the lake. According to one recent report, fishermen now "are forced to travel overland to reach the lake but once there find themselves caught up in bitter territorial disputes with fishermen from neighbouring territories claiming long-established legal rights to fish in that particular part of the lake." The same report noted other radical changes in the physical geography of the region: "Bago, which was once a thriving waterfront town, is stranded many miles from the lake as the desertification of the area marches on." As many as 30 million people live along the shores of this vanishing lake.[16]

Men prepare to go fishing on Lake Chad: a rapidly shrinking lake has given rise to bitter disputes.
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The increasing desertification of this region of Africa spells major trouble. Ever-increasing numbers of people are trying to sustain life on ever-shrinking water and land resources. A recent headline in the newspaper the Independent (UK), declared, "Water scarcity 'now bigger threat than financial crisis.'"[17] Is this the future: fewer resources leading to more conflicts; and with this, women subjugated to more violence and increasing poverty, and girls less likely to attend school?

"The increasing desertification of this region of Africa spells major trouble. Ever-increasing numbers of people are trying to sustain life on ever-shrinking water and land resources."

Water "Bubble"

According to a report produced by the World Economic Forum, "We are living in a water 'bubble' as unsustainable and fragile as that which precipitated the collapse in world financial markets."[18] Lester Brown of the Earth Policy Institute in Washington DC and editor of the annual "State of the World" series, cites water scarcity as a major concern, noting, "Unlike disappearing rainforests, which you can see being burned or cut down, falling water tables are happening but we often discover them only when the well goes dry."[19] As noted above, in the Lake Chad area, conflicts and tensions are already becoming increasingly commonplace. Cattle herders complain of being attacked by farmers who complain that the pastoralists' animals eat their corn and deplete their water supplies.[20] It is from such relatively low-grade incidents that major wars over resources develop. And as we have noted above, war, which suspends "normal life", does not afford women any suspension from their usual obligations; indeed, wartime brings extra challenges.

The future does not have to be dictated by the past: African women take charge

While climate change affects everyone, countries that are economically disadvantaged face greater challenges as they have fewer resources with which to tackle the challenges precipitated by climate change. This is especially ironic since the countries of the global north have been, historically, the biggest contributors to CO2 emissions. With less than one-tenth of the world population, the U.S. was until recently the biggest producer of greenhouse gasses. In 2007, China overtook the U.S. as the largest single producer carbon emissions.[21] Many

share the view of Marthinus Van Schalwyk, South Africa's Minister of Environmental Affairs and Tourism, who complains that "Africa is one of the regions least responsible for climate change, and is also least able to afford the costs of adaptation." Africa is thought to produce just 4 % of total global carbon emissions.[22]

Cooking with firewood: poverty allows little choice for less harmful fuels or technology.
© Melodie Sheppard

Despite the fact that Africa contributes relatively little carbon emissions, it is necessary to acknowledge that those in the global south also engage in practices that contribute to climate change and degrade their environment. The burning of firewood is one frequently mentioned example. The reality, of course, also is that poor people have few options and they must use the most inexpensive and accessible forms of fuel.

The Green Belt Movement started by Wangari Maathai addresses the two major drawbacks of the over-consumption of fossil fuels: first, by getting women to plant trees, stocks are replenished, and secondly, by planting trees closer to their homes the time women must spend fetching firewood is reduced significantly.[23] Trees "capture" carbon dioxide; indeed, many believe that reforestation may be the single most effective means of combating the greenhouse effects produced by carbon dioxide emissions.[24]

"Maathai's life and work is a wonderful refutation of the notion that African women, especially when they are poor and/or illiterate, need those from the global north to tell them what to do."

The award of the Nobel Prize brought Maathai immediate international celebrity. But before the Nobel, Maathai had been working for decades on issues of social justice, and her environmental activism was one aspect of this work. Maathai's life and work is a wonderful refutation of the notion that African women, especially when they are poor and/or illiterate, need those from the global north to tell them what to do. In her book describing the Green Belt Movement, Maathai speaks of the collective labour on which the Green Belt Movement was based. She notes that one woman, Priscilla Ng'endo Mereka, "mobilized thousands of women to become tree planters and, in the process, changed the landscape of the [Kiambu] area."[25] These women tree planters were rural women with little or no schooling and resources, but they clearly saw the "decline in soil erosion, the return of wildlife to their farms… and the benefits of cleaner air and shade."[26] Maathai speaks of these women as "foresters without diplomas". The tree planting on which the Green Belt Movement is based began in 1977, with the women collaborating with the national forestry department and recognizing the latter's preeminence as "the experts". But after a while the women became more confident:

> Then came the revolution. The women decided to do away with the professional approach to forestry and instead use their common sense! After all, they had for a long time successfully cultivated various crops on their farms. What was so difficult about applying this knowledge to tree planting? The campaign encouraged them to use their traditional skills, wisdom and plain common – and perhaps women – sense. … The women quickly became very innovative and used techniques that would have been completely unacceptable for professional foresters. Indeed at one point, the foresters complained that the women were adulterating their profession! Women substituted broken pots for seedbeds, used granaries or any raised ground to keep seeds and seedlings away from domestic animals and learned to observe the flowering cycle of plants so they could harvest seeds, and also how to differentiate weeds from seedlings.[27]

The Green Belt Movement not only empowers women and measurably improves their lives (by paying them for their work and using agro-forestry to regenerate their soils) but also targets children as "youth are the decision makers of the future."[28] The Green Belt Movement initiated the maintenance of public tree nurseries in schools, providing students with a hands-on experience on the importance of conservation.

Another group of women who are achieving noteworthy success in protecting their environment is the Regroupement des Femmes de Popenguine Pour la Protection de la Nature (RFPPN) in

Senegal. The village of Popenguine is located on the Atlantic coast. The RFPPN was founded in 1988 by a local resident, Woulimata Thiaw, who was concerned about environmental degradation. The women initiated and maintain an active reforestation programme which, similar to the Green Belt Movement in Kenya, achieves three objectives: (i) reforestation and land renewal, (ii) greater availability of firewood and (iii) a means of earning income from the sale of firewood. Since its inception in 1988, the RFPPN has gone on to attract members in several other villages.[29]

Workers at a reforestation project in Senegal: women are doing much to protect the environment and improve living standards.
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Conclusions

Climate change brings droughts and floods, heat waves and cold fronts, more frequent and powerful tropical storms, and loss of permafrost. Floods and rising temperatures bring disease, from the diarrheal diseases which attend floods to the spread of malaria-bearing mosquitoes into new areas. Although desertification is the most severe challenge confronting Sudan, floods are common.[30] The cycle of drought (or severe aridity) and floods is one we seem to be seeing more frequently all across the continent. In 2008 large parts of Africa – from Ghana and other parts of West Africa to large swathes of southern Africa - suffered debilitating floods after long droughts. This year, the pattern appears to be repeating in parts of southern Africa. While experts forecast that Bangladesh could have as many as 30 million climate refugees by 2030,[31] one can only wonder what the numbers for Africa may be. Africa, with a significantly smaller population than Asia, has almost as many refugees as Asia and the Pacific region combined.[32] It is unclear how many of Africa's refugees are climate refugees.

"If climate change brings greater resource scarcity and more conflicts, it is not hard to see that this spells more hardships for millions of African women, already struggling to provide basic necessities."

Women carry water home in Geles, Darfur: many in conflict zones face additional challenges procuring basic necessities.
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According to the Women's Environment and Development Organization (WEDO), since the mid-1980s there has been a *three hundred percent increase every year* in food emergencies in Africa, and these result often from drought or flood.[33] In the best of times, women bear a disproportionate share of the burden for the general wellbeing of their communities and for providing community members with sustenance. When food emergencies occur, the burdens on women – which often are already enormous – become significantly worse.

When a woman is forced to spend five to six hours a day procuring water for the use of her family it means that she will have to cut down on other obligations and pursuits.[34] A girl child who spends hours a day gathering water for the family has little or no time left to go to school or train for an occupation. The same is true if a girl must spend countless hours procuring firewood. In the conflict situations, as in Darfur, we have seen that women face especial burdens, namely, the increased difficulties of procuring basic necessities, and (the threat of) rape. If climate change brings greater resource scarcity and more conflicts, it is not hard to see that this spells more hardships for millions of African women, already struggling to provide basic necessities for themselves and their families.

Notes and links:

1. See Ban Ki-Moon, **"A Climate Culprit in Darfur"**, *Washington Post*, 16 June 2007, **http://www.washingtonpost.com/wp-dyn/content/article/2007/06/15/AR2007061501857.html?referrer=emailarticle**.

2. There is a huge and ever-growing literature on Darfur, from first-person narratives to accounts by researchers and policymakers. Here are some of the most influential: Mahmood Mamdani, **"The Politics of Naming: Genocide, Civil War, Insurgency"**, *London Review of Books*, 8 March 2007,

available at **http://www.lrb.co.uk/v29/n05/mamd01_.html**; Wole Soyinka, **"The Avoidance Word Still Screams Its Name"**, *Transition* (Volume 13, Number 3, 2007); Alex de Waal, ***Darfur: A Short History of a Long War*** (New York, 2005).

3. R. S. O'Fahey, ***The Darfur Sultanate: A History*** (Cambridge, 2008).

4. Gerard Prunier, ***Darfur: The Ambiguous Genocide*** (Ithaca, New York, 2005), p. 163. Prunier argues that access to land is not possibly a factor in the Darfur conflict because this idea "is not backed by any evidence other than the shouts hurled at the victims by the perpetrators themselves. The 'Arabs' are mostly nomads who do not seem much interested in becoming agriculturalists." Prunier is quite right that pastoralists may have no desire to become agriculturalists; however, he misses the point: both pastoralists and agriculturalists need water, and in a context in which water resources are rapidly declining, agriculturalists, who may have formerly welcomed occasional visits by pastoralists, may seek to block access to what they consider their lands, thus also denying access to water. See Prunier, p.157.

5. See the section on Sudan in the ***Africa Atlas***; UNEP, **"Sudan Post-Conflict Environmental Assessment"**, **http://postconflict.unep.ch/publications.php?prog=sudan**, accessed 30 January 2009.

6. Alex de Waal, ***Famine that Kills: Darfur, Sudan*** (Oxford, 2005), p. 139.

7. Ibid., p. 41.

8. Refugees International, **"Laws Without Justice: An Assessment of Sudanese Laws Affecting Survivors of Rape"**, quoted in Nora Boustany, "Janjaweed Using Rape as 'Integral' Weapon in Darfur", *Washington Post*, 3 July 2007, available at **http://www.washingtonpost.com/wp-dyn/content/article/2007/07/02/AR2007070201627.html**.

9. Hailma Bashir, ***Tears of the Desert: A Memoir of Survival in Darfur*** (New York, 2008), p. 211.

10. H. Patricia Hynes, **"On The Battlefied of Women's Bodies: An Overview of the Harm of War to Women"**, *Women's Studies International Forum*, vol. 27, no. 506 (Nov-Dec 2004).

11. UNHCHR, **"The Environment in Chad"**, **http://www.unhcr.org/cgi-bin/texis/vtx/photos?set=chad-environment**, accessed 20 March 2009.

12. UNEP, ***Atlas of Africa***, p. 53.

13. Cathy Majtenyi, **"Darfur Camps Face Water Shortage"**, VOA News, 16 March 2005, accessed 29 March 2009.

14. **"Shrinking of Lake Chad: Tale of Human Abuse, Climate Change"**, Associated Press, 14 December 2006, **http://www.globalpolicy.org/security/natres/water/2006/1214lakechad.htm**, accessed 30 March 2009.

15. ***Atlas of Africa***, p. 71. See also **"Vanishing Lakes Prove Impact of Man"**, *The Scotsman*, 3 September 2007, **http://news.scotsman.com/climatechange/Vanishing-lakes-prove-impact-of.3323448.jp**, accessed 20 March 2009.

16. David McAlary, **"UN Effort Aims to Bring Safe Water to Billions"**, VOA News, 17 March 2005, **http://www.voanews.com/english/archive/2005-03/2005-03-17-voa26.cfm?CFID=147328085&CFTOKEN=70310838&jsessionid=de30ff69bfd586fd02ce296e305a31481d7d**, accessed 20 March 2009.

17. **"Water Scarcity 'Now Bigger Threat Than Financial Crisis'"**, *The Independent*, 15 March 2009.

18. Ibid.

19. Serena Parker, **"Water Issues Becoming Increasingly Important in US Foreign Policy"**, VOA News, 17 March 2005, 19 March 2009.

20. **"Shrinking Lake Chad Sparks Tension, Ingenuity"**, Voice of America News, 18 March 2005, **http://www.voanews.com/english/archive/2005-03/Shrinking-Lake-Chad-Sparks-Tension-Ingenuity.cfm?CFID=144175265&CFTOKEN=36476414&jsessionid=8830eaf1e133b0c64a60476a412d5713686d**, accessed 20 March 2009.

21. John Vidal and David Adam, **"China Overtakes US as World's Biggest CO2 emitter"**, **http://www.guardian.co.uk/environment/2007/jun/19/china.usnews**, accessed 19 March 2009.

22. Quoted by Devon Haynie, **"Atlas Shows Effects of Climate Change in Africa"**, 10 June 2008, **http://www.huffingtonpost.com/huff-wires/20080610/africa-environment/**, accessed 29 March 2009.

23. Wangari Maathai, ***The Green Belt Movement: Sharing the Approach and the Experience*** (New York, 2006), p. 35.

24. See Introduction to this Volume.

25. Maathai (2006), p, 24.

26. Ibid., p. 25.

27. Ibid., pp. 28-29.

28. Ibid., p. 37.

29. WEDO, **"Gender, Climate Change and Human Security: Lessons from Bangladesh, Ghana and Senegal"**, pp. 29-30, **http://www.wedo.org/wp-content/uploads/hsn-study-final-may-20-2008.pdf**, accessed 19 March 2009; Nadia Aissaoui, **"Senegal: Les Femmes de Popenguine se Liguent Pour La Rehabilitation de la Reserve Naturelle"**, January 1996, **http://base.d-p-h.info/fr/fiches/premierdph/fiche-premierdph-3767.html**, accessed 30 March 2009.

30. **"Sudan Post-Conflict Environmental Assessment"**, **http://www.unep.org/sudan/**, accessed 30 January 2009. See chapter 3.

31. Roger Harrabin, **"Climate Fears for Bangladesh's Future"**, **http://news.bbc.co.uk/2/hi/science/nature/5344002.stm**, accessed 21 February 2009.

32. See Table 1, **"2007 Global Trends: Refugees, Asylum-seekers, Returnees, Internally Displaced and Stateless Persons"**, UNCHR, **http://www.unhcr.org/statistics.html**; accessed 31 March 2009.

33. Oxfam, New Economics Foundation (NEF) and working Group on Climate Change and Development, **"Up in Smoke 2"**, NEF, London 2005, cited in WEDO news bulletin, "Women: Essential to Climate Change Solutions".

34. One of the major areas for concern for those working on issues of social justice and equity is the increasing trend to privatize water in Africa. The World Bank and IMF have been leaders in the call to make water delivery more efficient by allowing water supply to be run by for-profit private bodies. If one has to pay for water, where does that leave those who can hardly afford to provide adequate food for their families? And since it is women who are typically in charge of providing water for their families, the privatization of water hits them especially hard. It means that in order to secure water women and girls must travel farther and farther from home.

TRADITION AND SCIENCE: ENVIRONMENTAL CHANGE ON EAST AFRICAN MOUNTAINS

by Danielson R. Kisanga

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Introduction

Mount Kilimanjaro: many East Africans rely on water from the slopes of mountains like this.
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This article examines the environmental changes to water resources on the slopes of East African mountains, specifically Mount Kilimanjaro. These fragile ecosystems host a higher population density than corresponding lower lands and plains. Most water used in East Africa for domestic, agriculture and hydro-power generation originates from these mountain ecosystems. For a long period of time, stream and river flows from the slopes of these mountains have been perennial. In recent decades, however, water flow from these mountain ecosystems has become intermittent, flowing only during rainy seasons.

After an overview of environmental change and some of the elements involved, I will discuss factors responsible for stream and river flow changes from two points of view, namely, traditional knowledge, beliefs and myths embedded in the mountain communities and that of the scientific community. The important explanatory factors for changes in river flow, such as climate change, the loss of vegetative cover, including change in tree species and changes in land-use practices, especially deforestation, have been perceived differently by these two groups.

More research is needed to understand the impact of climate change on water resources on the slopes of East African mountain ecosystems. So far such investigations have been inconclusive. There is not much discussion among local communities related to climate change and its possible impact on water resources. In

1990, Anderson Lema studied the possible effects of climate change in East Africa from 1880 to 1980 and found no evidence of any effect on the region. Many other studies, however, have shown that the globally averaged surface temperature is now warmer than it has been for at least 150 years. The global trend in surface temperature is remarkably well correlated with a trend in atmospheric carbon dioxide concentrations. The current temperature trends are increasing, and the warmest years on record are in the last decade.

"More research is needed to understand the impact of climate change on water resources on the slopes of East African mountain ecosystems. So far such investigations have been inconclusive."

Climate change in the highlands of East Africa

The slopes of Mount Kilimanjaro, like many other global ecosystems, have witnessed clear changes, such as decreasing amounts of snow and glacial ice on its peak, reduced stream and river flows and frequent high flood incidents, the cause of which could partly be associated with **climate change** as a result of **global warming**.

The slopes of Mount Kilimanjaro in Tanzania have been chosen for discussion in this paper because they are typical of most mountain ecosystems in East Africa, sharing the same socio-economic, ecological and terrain characteristics. These include: Mount Kenya, Mount Elgon, Taita and Chyulu in Kenya, and the Ruwenzori Mountains (often called the Mountains of the Moon), Mount Mahavura, Mount Mgahinga, Mount Sabinio, Mount Zulia, Mount Morungole, the Labwor and Dodoth Hills in Uganda.

Looming change: a rushing stream flows through Mount Kenya's fragile ecosystem.

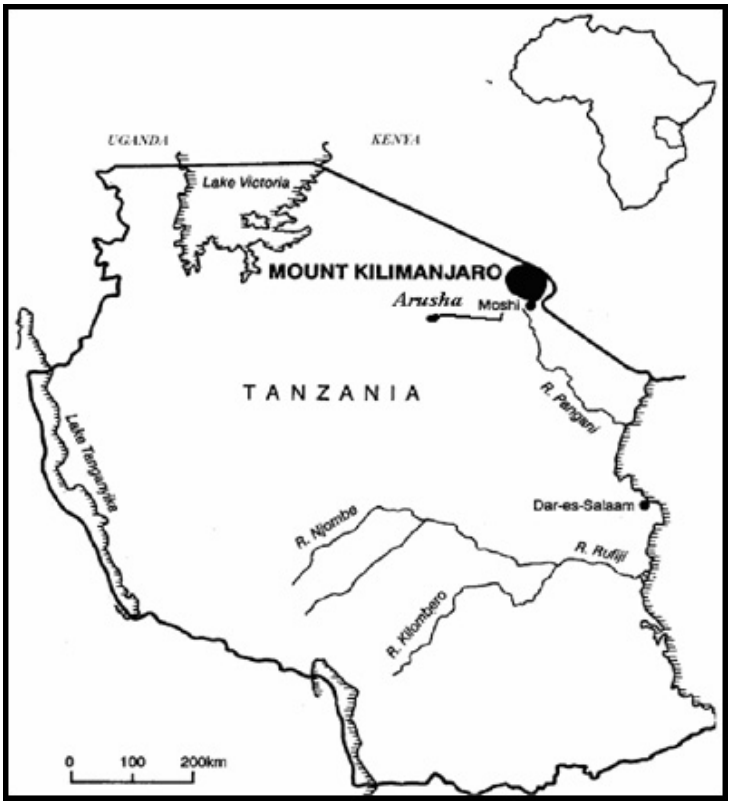
© Alex Edwards

The Pangani, which depends largely on water flows from Kilimanjaro, is one of the major river basins of East Africa and is economically important in Tanzania. Water from the Pangani River is extensively used for irrigation of food and cash crops (e.g., paddy, sugarcane and coffee) and hydroelectric power (e.g. Nyumbaya Mungu, Pangani Falls, and Kikuletwa power stations) (see Map 1 below). In the past spring water sources from the slopes of Mount Kilimanjaro were directed to traditional irrigation furrows. Many of these have now dried up and diversion of water has not been determined as a major cause for changes in water flow in these areas.

Local knowledge regarding changes in water flow is of paramount importance in understanding the nature of declining water resources on the slopes of East African mountains. The local communities do not emphasize the impact of climate change on reduced or intermittent water flow; instead, they associate it with forest cover changes and understand such changes in the form of traditional beliefs and myths, some of which can be scientifically verified.

"Local knowledge regarding changes in water flow is of paramount importance in understanding the nature of declining water resources on the slopes of East African mountains. The local communities ... associate it with forest cover changes."

Marrying this traditional perspective with an evidence-based perspective is important in order to understand the actual causes and effects of declining water resources in these areas. The extinct natural **forests of Kilimanjaro's lower slopes** provide an example of a large-scale environmental change that has a history of over 2000 years on Kilimanjaro.



Map 1: Location of Mount Kilimanjaro (adapted from D. R. Kisanga, 2005)

Forest change and water resources on Mount Kilimanjaro

Changes in stream flow on the slopes of Mount Kilimanjaro are associated by indigenous mountain settlers with the disappearance of forest cover and the introduction of exotic tree species. Local communities believe that thick forest cover with certain types of trees ensures a stable supply of water from natural springs, streams and rivers. It is inevitable that, in the absence of a truly scientific perspective from hydrology, myths and legends concerning the role of forests on water resources will be promulgated and, with time, will be accepted with all the authority of belief. Examples of beliefs concerning the relationship between forests, forest tree species changes and water resources are discussed below:

(i) *Forests 'make' rain*

The belief that forests induce higher rainfall and hence increase the total stream flow is strongly held by local East African communities and foresters. There is little literature showing the origin of this belief in East Africa; however, there is some documentation in other parts of the world. For instance Kitteridge in the West Indies and Rakhmanov from Russia have attributed the notion that forests make rain to Christopher Columbus, as he contrasted the plentiful rainfall in the heavily forested West Indies with that of the deforested Azores and Canary islands. The idea gained scientific support from findings that rain gauges in small forest clearings often catch more precipitation compared to those outside the forest.

Now, if local communities know that forests make rain, why do they clear forests? This question and others will be discussed in the section analyzing the causes and effects of deforestation.

(ii) *Indigenous forests reduce floods and erosion*

Mountain dwellers in East Africa believe that indigenous forests reduce erosion. In fact, they attribute erosion and drought to newly introduced Eucalyptus trees. Scientifically, however, we know that the infiltration of rain into the soil is more effective through *any* canopy and its underlying forest litter than through grassland or agricultural crops. The leaf litter and the more porous soil beneath forests encourage infiltration and water storage, rather than rapid overland flow. The result is a reduction of surface runoff and erosion, through the binding action of tree roots, and a resupply of underlying strata and groundwater. This ensures the continuation of base flow well into, and perhaps throughout, the dry season.

(iii) *Exotic tree species dehydrate wetlands and water sources*

Changes from indigenous tree species to exotic Eucalyptus and Cypress tree species have been blamed for the drying up of natural springs and water streams in general. This belief is widespread among people in the mountain forest ecosystems in East Africa. It was noted during the introduction of afforestation programs, which were enforced by East African governments. The belief calls for research to verify the impact of exotic tree species on water resources given that it and similar beliefs continue to affect afforestation programs in mountain ecosystems.

Loss of indigenous trees: a group in Kenya examines erosion due to deforestation.
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Local and national policy and water resources

Since the early 1970s there have been government campaigns for tree planting along the riverbanks and natural spring water sources in Tanzania. The campaigns were aimed at managing those sites against excessive deforestation and reduced stream and river flows from mountainous areas. Since the government extension workers were few, primary school students and their teachers were required to raise seedlings. Some tree nurseries were also established by town councils. These were used for afforestation programs. Each farmer whose piece of land, locally called *kihamba*, bordered a river or surrounded a natural spring water source, was required by the village authorities to leave uncultivated at least 30 meters around these water courses. Further, they were required to plant tree seedlings issued by the town councils or nearby primary schools. The farmers adopted the measure as a government edict.

A eucalyptus forest: doubts persist about species chosen for Tanzania's afforestation programme.
© Don Bayley

Ten to fifteen years after implementation of government enforced afforestation, some negative impacts were noted. For example, certain previously swampy areas were completely dry. The drought was attributed by farmers to exotic tree species such as Java palm, locally called *Mzambarau*, cypress, wattle, pine and eucalyptus. Despite socialist government rule under the ***ujamaa* village** system, the farmers persistently complained about these exotic trees. To date they still associate them with the desiccation of wetlands and natural springs and a lack of adequate undergrowth in the newly established forests.

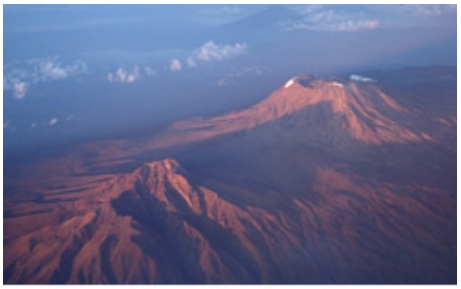
The farmers' complaints about exotic tree species were overruled by forestry officials. For instance, in 1979 government forest researchers conducted a brief survey of the available information about the effects of eucalyptus on the major components of the hydrological cycle. The scientists reported that the claims regarding the adverse effects of eucalyptus stands on water supply seemed to be exaggerated. The studies conducted by these scientists were only preliminary. This makes the contradiction between their reports and the farmer's complaints more complicated, intensifying the call for collaborative and participatory research among local communities and scientists. Some farmers still cultivate to the riverbanks and claim that there is no longer government follow-up on the former campaign.

"To date farmers still associate exotic trees with the desiccation of wetlands and natural springs and a lack of adequate undergrowth in the newly established forests."

Water flow on the slopes of Kilimanjaro is declining. Most of the indigenous vegetation has been cleared and replaced by exotic tree species. The riverbanks and natural spring water sources have been cleared. Any observation of areas around natural springs reveals huge tree stumps and very little evidence of the re-growth of indigenous trees like *mkuu* and *mtembo*. Farmers associate these tree species with natural springs. Their deep taproots are believed to intercept shallow aquifers. Currently, most of the stream and river flow on the slopes of **Kilimanjaro** results from rainfall or snowmelt on its two

peaks (see below right) which occurs during the rainy seasons of April and November, the long and the short rainy seasons respectively.

Causes and effects of deforestation on East African mountains



Aerial view of Mount Kilimanjaro, with Mawenzi peak in the foreground and Kibo behind: taken in January 2009, this photo shows how little ice and snow remain on these peaks.

© Anka Kaczmarzyk

Deforestation has been singled out as a major threat to water flow. Even though studies indicate that the slopes of Mount Kilimanjaro are experiencing abnormally high rainfall, it is poorly distributed and very intense where it does occur. Andrea Hemp of the International Human Dimensions Program on Global Environmental Change (IHDPGEC) remarks that *"… if the current trend towards a drier and warmer climate on Mount Kilimanjaro proceeds lower, vegetation zones of Kilimanjaro will move upwards and will get more and more fragmented. Savanna species will spread from lower altitudes to the submontane, montane and even afro-alpine zone due to loss of forest and a warmer microclimate, drying up the natural springs."*

Continuous deforestation, cultivation of marginal lands and increased incidence of soil erosion and landslides close to rivers and streams lead to the conclusion that sediments from eroded soils are transported through runoff to streams and rivers. When accumulated in water channels, the sediments are transported to lower lands during rainfall. Deforested land, increased agriculture both in upper and lower lands of the mountain and concurrent sedimentation of water channels lead to excessive seasonal flash flooding and desiccation of water bodies. In this case a connection can be established between land use changes, changes of land use cover, climate changes, and disrupted and declining fresh water resources on most of the mountains of East Africa.

In order to be able to manage and conserve the forest resources, it is vital to understand the root cause of the problem. *Ujamaa* village policy implemented by Tanzania in 1970s failed because local communities were ordered to plant tree species brought by the government. Local communities were not involved in the decisions. The failure belongs to the government. This kind of "top down approach" does not consider local knowledge or invite participation in decisions.

To understand the failure of the top down approach, one needs to distinguish between direct and underlying causes of deforestation. For example, subsistence farmers deforest because they need to provide a means of survival for their families. They are poor and have few alternatives to deforestation. They are poor because present power structures discriminate against them and they have little or no access to alternative means of survival. These power structures originate with the colonial era. There is a causal chain beginning with colonization and continuing to unequal control over key resources, leading to poverty and the need to survive, and finally to deforestation. Most trees removed from the mountain forests in East Africa are used for construction, fuel, fodder and furniture without immediate replacement. As human and livestock populations increase, along with the demand for forest products in urban and rural areas, the use of various tree species increases. This exposes the land surface to various degrading factors, mainly rainfall and solar radiation. Since most of the de-vegetated areas have been converted to farmlands, soil erosion continues.

Conclusion

The temporal and spatial variations of rainfall, frequent flash floods, and change of stream and river regimes from permanent to intermittent are some of the major problems on the slopes of East Africa's mountains. In addition, the forests of Kilimanjaro have been subjected to intense pressure since the colonial period. These forests continue to be threatened by a variety of demands, including livestock fodder, construction and fuel. Land cover on the slopes of Kilimanjaro is altered principally by direct human use: through agriculture, raising livestock, forest-harvesting, forest management, and cultivation of marginal areas such as river banks, steep terrains and areas around natural springs. The impacts from other human activities, such as forests damaged by acid rain from fossil fuel combustion and other industrial gases such as chlorofluorocarbons, are not common or have not been reported in East African mountains. While land-use change is often a driver of environmental and climatic changes, a changing climate can, in turn, affect land use and land cover. On the slopes of Kilimanjaro, crops and some vegetation adapted to high altitude colder terrains with high precipitation can no longer be grown in such areas because precipitation has

Changes in stream regimes: these Ugandans farm in one of many marginal areas.
© USAID

declined and average temperatures have increased.

"Temporal and spatial variations of rainfall, frequent flash floods, and change of stream and river regimes from permanent to intermittent are some of the major problems on the slopes of East Africa's mountains."

Local communities have begun to realize the importance of soil and water management in some areas. Some bylaws have been introduced for the middle and upper altitudes of slopes of Kilimanjaro, restricting people from cutting certain tree species in specific areas. Such areas include natural spring water sources, graveyards and sacred places associated with traditional beliefs. However, the *kihamba* land tenure system (Personal observations in the areas concerned, 1999), together with tremendous human and livestock population increases, have continued to lead people to clear more vegetation along riverbanks and the so-called sacred areas, resulting in soil desiccation and erosion.

The interaction between climate change, water flows and land use in the mountain ecosystems of East Africa remains poorly understood, requiring greater cooperation on management and conservation issues between local communities and the scientific community. A scientific perspective has to complement traditional knowledge to improve understanding and acceptance of the processes of land-use changes and the ways such changes are affected by a changing climate. This will better prepare local communities when making decisions about land-use. Traditional beliefs and myths embedded in local communities can inform the work of the scientific community on observed environmental problems through collaboration and participatory studies.

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THE MANY FACES OF CHANGE: INFECTIOUS DISEASES AND CLIMATE IN EAST AFRICA

by Claire Standley

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"He who desires but acts not, breeds pestilence" – William Blake

"We are involved in a situation for which 'N is 1, an experiment that cannot be repeated' ..." – Dr. Paul Epstein

Introduction

A multidisciplinary approach is required: researchers in Ethiopia examine malaria-infected blood.
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"Climate change" is a buzzword on the lips of many, and has been the heart of many controversies. The debate ranges from the reality of warming atmospheric temperatures to the level of anthropogenic influence as well as long-term predictions of change. However, the publication of the Intergovernmental Panel on Climate Change's Fourth Assessment Report (IPCC, 2007) heralded a consensus of scientific opinion: the planet's climate is changing, and it is "very likely" caused by human activity. This by no means suggests the debate is closed, but it indicates an important shift towards a global community that takes climate change as a real and present danger, and that emphasises research into making predictions about the impact of these changes on our future, and recommendations as to how to mitigate any impending negative consequences.

This research, by necessity, will be multidisciplinary, combining meteorological and environmental sciences with a range of fields of study. Here, the focus will be on the impact of climate change on infectious diseases. This is an enormous topic, and one rife with uncertainty at a global level. This piece will concentrate on East Africa, and attempt to summarise the predicted outcomes of climate change on the spread of infectious diseases in this region. Any disease that is correlated to environmental variables is likely to be affected by climate change, but the specific effects depend on a vast number of other details associated with both the disease and the region; these include life cycle of the disease, method of infection, present distribution and even human behavioural patterns. Although these complicate the picture, we can still attempt to use what data and tools we do have to try to make predictions, and develop strategies for the mitigation of the predicted effects. This process will be explained here, first through the theory of climate change and epidemiological modeling, and then illustrated through the examples of malaria and schistosomiasis, which have been with us for some time, as well as the problem of emerging infectious diseases.

"Any disease that is correlated to environmental variables is likely to be affected by climate change, but the specific effects depend on a vast number of other details associated with both the disease and the region."

Climate change models: East Africa

One important consideration is how climate change models are created, and how they are then integrated with infectious disease data in order to make predictions. Climate change models use data gathered from long-term monitoring weather stations to create data series on climatic conditions. This provides information from approximately the past century or so, when modern recording techniques were developed. For more ancient data, meteorologists turn to sources such as the geological record, fossils and ice cores for evidence of past climatic conditions. When added to modern data, this information allows scientists to build models of the Earth's climate. When values that reflect future environmental conditions, such as atmospheric carbon levels, or decreasing ozone, are put into these models, predictions can be made as to the overall effects on the global climate. On a regional level, other factors can be included as well. For example, El Niño events occur when known climatic variables, such as ocean temperatures, change.

Therefore the regional effects as seen in El Niño years can be used to predict regional climate changes over a longer-term scenario, provided the starting conditions are comparable.

So, given this information, what climatic conditions can be expected for the future in East Africa? On a very broad scale, most theories suggest that warmer ocean currents in the Indian Ocean will increase precipitation in the region, and most noticeably during the "wet season" months of December through February (IPCC, 2001). Going back to the application of data from El Niño years, during the El Niño event of 1997/1998 increased rainfall was observed throughout the region, but particularly in the highlands of Uganda, Kenya and Tanzania. On the other hand, it is also thought that areas which are currently arid or semi-arid will become more pronouncedly dry. This demonstrates the need for an appreciation of the scale of the effects of climate change, even within a single region.

A mother and child in a high elevation area of southern Uganda: residents here took part in a malaria and helminth infection treatment study.
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One fundamental issue, as mentioned earlier, is that the parameters used in the model are mostly based on European and North American climatic data from the recent past, as well as ancient data from other sources. Therefore there is considerable room for error when extrapolating these trends to other regions of the world, and these must be taken into consideration when applying the models to East Africa and other such areas.

"Most theories suggest that warmer ocean currents in the Indian Ocean will increase precipitation in the region... it is also thought that areas which are currently arid or semi-arid will become more pronouncedly dry."

Once the climate models have been developed, it remains to add epidemiological and other disease-based data to create a picture of how infectious disease distribution will change with climate. At this point, it is worth remembering the complex interactions between biotic factors that not only may act in synergy with each other, but also may be affected by climate change itself. However, although models may never be perfect, they are developed for a purpose: once satisfactory models have been developed, they can be applied to the task at hand and used to predict the impact of climate change on the distribution and transmission of infectious diseases in East Africa.

What diseases are important in East Africa and likely to be affected?

A young Kenyan man cycles to get water from a river 24 km from home: lack of clean water in his area brings frequent bouts of typhoid fever.
© Felix Masi / Voiceless Children, Courtesy of Photoshare

Generally speaking, any disease which has a distribution or transmission affected by environmental variables has the potential to be affected by climate change; precipitation and temperature are likely to be the main, recognized, drivers of these changes. Under this umbrella fall big killers such as malaria and diarrheal diseases such as cholera and typhoid, as well as some of the "neglected tropical diseases", such as schistosomiasis, soil-transmitted helminths, leishmaniasis and lymphatic filariasis. As well, the wider social effects of climate change could lead to changes in patterns of other disease transmission and distribution, such as HIV and TB, although this goes beyond the direct effects of climate change and thus the scope of this essay. Even without including these, the list of infectious diseases that may be affected by climate change is worryingly long, and each is defined by the particular characteristics of its mode of transmission, life cycle and environmental constraints. The focus here will be on two diseases, malaria and schistosomiasis, which have similarities but also some key differences, to illustrate the main points of how climate change may affect infectious diseases in the East African region.

These diseases are furthermore important due to their large social impact on the people of East Africa. Malaria is known to affect poorer communities and pregnant women and infants more severely, strengthening existing socioeconomic and gender barriers. It has

also been correlated with a range of other social and physiological variables, such as poorer work performance and decreased savings of income. Perhaps surprisingly, high-risk malaria regions are also associated with elevated birth rates, as families overcompensate for infant mortality caused by the disease. This reduces economic investment per child, lowering education levels and literacy rates, particularly for daughters (Sachs and Malaney, 2002). Schistosomiasis, generally perceived as a chronic rather than acute condition, is also associated with reduced working capacity, as well as decreased concentration in school children and in some cases, loss of fertility. Social behaviours are also very important in contracting schistosomiasis, with the effect that groups who utilize contaminated water sources, whether for work, recreation or household tasks, are at an increased risk of infection (Huang and Manderson, 1992). These groups include young children, particularly boys, teenage girls, mothers and fishermen.

"Malaria is known to affect poorer communities and pregnant women and infants more severely, strengthening existing socioeconomic and gender barriers."

Many of the characteristics of these two diseases also overlap with other infections, as will be explored in more detail later, and thus understanding the future dynamics of these diseases may help us better monitor the wider picture of infectious diseases in the region.

Malaria

These kids are ready for bed under a mosquito net in an IDP camp in Minakulu, northern Uganda.
© Gilbert Awekofua, Courtesy of Photoshare

Malaria is one of the world's biggest killers of people in the tropics, claiming well over a million lives each year (WHO, 2004). It is caused by a plasmodium parasite, which requires a mosquito intermediate host; the mosquito transmits the parasite to humans when feeding on human blood. Both mosquito and parasite require warm temperatures to develop, and the mosquito further needs areas of still water in which to rear its larvae. These environmental conditions currently constrain malaria mainly to the tropics and sub-tropics, and moreover lend seasonality to the transmission of the disease, with heightened occurrence being associated, for the most part, with seasonal flooding events or rainy seasons. This inherent reliance on environmental conditions, together with its high prevalence and fatality rate, make it an important candidate disease to focus on in the face of climate change. Moreover, its reliance on an insect vector, which are used as climate change indicators in other settings, adds a layer of complexity to the model which mirrors that of many other parasitological infections (Epstein, et al., 1998).

As mentioned above, predictions for climate change in East Africa involve increased annual average temperatures and precipitation in many parts of the region; intuitively these changes would be expected to lead to increased malarial transmission, which is indeed what several different models have shown (Rogers and Randolph, 2000; Thomas, et al., 2004b). However, whereas temperature increases might be expected to extend the latitudinal zone of transmission, in fact the models suggest the increases will be due partially to the malarial zone moving up in elevation but, more importantly, to an extension of the annual transmission season due to the elongation and increased severity of the rainy season.

"Models suggest the increases will be due partially to the malarial zone moving up in elevation but, more importantly, to an extension of the annual transmission season due to the elongation and increased severity of the rainy season."

It is worth remembering at this point that climate change is not just something that is going to happen in the future; we are already seeing signs of its effects now, and East Africa is no exception. Therefore it would seem prudent to start testing some of these predictions of malarial distributions against our current knowledge of climate change in the region. Hay and colleagues (Hay, et al., 2002) did exactly this, and found, somewhat

surprisingly, that although there were significant increases to malarial distribution in the East African highlands during their study period, there was no corresponding significant changes to temperature. Similarly, during the El Niño event of 1997/1998, increased rainfall in these highlands appears to have contributed to malarial increases in Uganda but not in Tanzania (Lindsay, et al., 2000).

Targeting still water: a worker in Tanzania sprays larvicide to kill malaria-carrying mosquito larvae.
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These points emphasise the lack of resolution that direct changes in climate alone bring to the picture of malaria distribution; indirect effects may prove to be even more important. For example, although annual precipitation levels are expected to rise, these rains are predicted to be more confined to the wet season, leading to more severe periods of drought in many areas. Under this scenario, farmers will need to invest in irrigation to water their crops in dry months, requiring the digging of canals and ditches, which are perfect habitats for malaria-carrying mosquitoes, as well as the vectors of other parasite species (Rogers and Randolph, 2006). Moreover, there is a fear that increased drug resistance, completely unlinked to climate change, will alter patterns of prevalence in very unpredictable ways. In all, what is clear is that climate change predictions support the hypothesis that malaria will increase throughout much of the East African region, though predictions on a local level will be much more difficult to judge accurately, and may even depend more heavily on factors other than those linked directly to climate change.

Schistosomiasis

Schistosomiasis is another widespread parasitic disease found primarily in the tropics, which also requires an invertebrate intermediate host species. In this case, however, rather than a mosquito, the first larval stages of the schistosome worm must pass through a freshwater snail; there it undergoes further development, before emerging out of the snail into the pond or lake in which its living. When humans come into contact with water containing these parasites, for example through fishing, washing clothes or bathing, the parasite can enter through the skin, undergo final stages of development in various organs and finally come to rest in the blood vessels surrounding either the bladder or the intestine, where they spend the rest of their lives, laying eggs that are expelled in the urine or faeces. In regions with poor or no sanitation, infected human waste is washed into local water bodies, where the eggs will hatch and seek out snails to infect, and the cycle is renewed. Although not usually immediately fatal, schistosomiasis is a chronic condition which can debilitate patients for decades if left untreated, with early stages of anaemia and abdominal discomfort leading on to ruptured spleens, bladder cancer, infertility, and cirrhosis of the liver. With an estimated 200 million people worldwide at risk from infection with the parasite, schistosomiasis may not be as big a killer as HIV or TB, but it is a public health burden of huge proportions.

"Schistosomiasis is a chronic condition which can debilitate patients for decades if left untreated... (It) may not be as big a killer as HIV or TB, but it is a public health burden of huge proportions."

The summary of the life history of the disease demonstrates the reliance on water bodies, and, as seen in the malaria example above, changes in hydrological regime could thus be very important in making predictions as to the spread and prevalence of schistosomiasis in the face of climate change in East Africa. Furthermore, because of the free-living stages of the parasite requiring fresh water directly, schistosomiasis distributions can be used as a good model for the presence of other similar parasitic diseases, such as soil-transmitted helminthes, which include hookworm and other intestinal worms.

With malaria, in the example above, it was shown that latitudinal increases in range would probably be less important than altitudinal increases and greater length of transmission season. Schistosomiasis is also currently limited in terms of elevation by temperature, and so it is expected that the change in its range at higher altitudes would mirror that of malaria. However, the host snails are more tolerant of cooler temperatures than mosquitoes, and so already inhabit higher latitudes; this suggests that it might prove easy for the schistosome parasites to spread north and south of their

current range in a manner that malaria might not. Furthermore, although schistosomiasis has shown to vary seasonally in some areas, the continuous requirement of fresh water in both the parasite and the snail's life histories means that temporary water bodies may contribute less to transmission than permanent ones, which allow for transmission throughout the year. Therefore even if East Africa's climate changes towards a more marked dry and wet season, as predicted, the transmission season, such that it is, of schistosomiasis is unlikely to change very much, in contrast to that which is predicted for malaria.

Emerging diseases

It is one thing to model the effects of climate change on diseases which have been studied intensely for decades, and for which a huge amount of information has already been gathered; one of the greatest risks of climate change will be the emergence of new diseases for which such data are lacking. Already in the past 20 years, 30 new diseases have emerged, with climate change potentially a key culprit for worsening the most deadly of these (WCS, 2008). Africa has received more than its share, with outbreaks of Ebola and other horrific new illnesses hitting the headlines. In East Africa, the presence of wild animals may facilitate conditions for the emergence of new diseases; many of the most feared recent ones have been "zoonotic", which means that they changed from being a disease that only affected animals into one which is also capable of infecting humans; HIV is a zoonotic viral infection, and it was fear of such a change that prompted the media frenzy around avian 'flu in 2005/2006.

Outbreaks of horrific new illnesses: a health worker in western Uganda prepares to take blood samples from suspected Ebola patients.
© Bizimungu Kisakye, Courtesy of Photoshare

"Already in the past 20 years, 30 new diseases have emerged, with climate change potentially a key culprit for worsening the most deadly of these."

Are there any ways in which models such as the ones described above can be adapted to try to predict the emergence of new diseases, or perhaps even just the region in which they may develop? As mentioned above, the presence of large mammals in a region may assist the emergence of zoonotic diseases. Mammals closer to humans, such as monkeys, apes and even pigs, provide better reservoirs of future diseases. Similarly, a "new" disease may already exist elsewhere on the planet and only be considered emergent due to its new location; this might be predictable, using the methods described above. However, the vast number of variables makes it prohibitively difficult to predict the emergence of novel pathogens, particularly, as we have seen before, when these variables may act in synergy with each other. For example, one of the theories behind the emergence of Ebola was the penetration of "virgin" portions of the Central African rainforest, where people came into contact with ape carriers of the disease for the first time. Now we understand that it is carried by fruit bats. If human presence in these jungles increases, coupled with a change to more favourable climatic conditions for the bats in other regions, the two in combination could drive the bats to seek out new habitats, thus changing the potential range for transmission of the infection. Although a hypothetical scenario, that example demonstrates once again the complexities of making predictions when climate change, human behaviour and other factors are combined.

The response

Having outlined the predictions that have, with varying success or accuracy, been made in relation to the effects of climate change on infectious diseases in East Africa, what should the response be? What can be done to preempt these dangers?

"The consensus is that we are facing immediate consequences of climate change, and so need provision to act now, based on the models we do have."

The first step, started already by creating the models themselves, is to improve our knowledge of the current distributions of these diseases, and to carry on researching

their favoured climatic conditions, in order to improve on the accuracy of our existing models. To these databases should also be added historical data, again to heighten the resolution of the predictions. Ultimately, however, this takes time, and the consensus is that we are facing immediate consequences of climate change, and so need provision to act now, based on the models we do have. In the words of Dr Paul Epstein, we are involved in a situation for which "N is 1, an experiment that cannot be repeated" (Epstein, 2002); we must learn from this situation as it unfolds, and thus must have the ability to react quickly and effectively to changes.

Residents of Kibera slum in Nairobi wash clothes at a stream: outreach programmes and renewed investment in public health can help reduce risks.
© Felix Masi / Voiceless Children, Courtesy of Photoshare

One such response, of course, would be to tackle climate change directly, and make the decision to try and prevent the more extreme models from coming to fruition, by limiting our carbon output, investing in clean energy technology and reducing our reliance on fossil fuels. However, on a more basic, health-related level, there are a number of courses of action which must be taken to limit the potential dangers of increased spread and number of infectious disease, in East Africa and elsewhere. For example, there should be renewed investment in public health, not simply on the level of individual disease programmes, but also in terms of creating health systems that are capable of rapid responses to change, and resilient in the face of health catastrophes such as outbreaks or extreme climatic events. This sort of capacity building can also take place at the level of the individual, through education and outreach programmes designed to make local communities more aware of the health risks they face every day, and how to minimize them. Already there are a huge number of organizations, running programmes based on this kind of education and capacity building, as well as mitigation and treatment, tackling nearly the whole spectrum of infectious diseases across Africa (for an example, see EU-CONTRAST, working on schistosomiasis throughout East Africa). Perhaps what will be needed is for these disparate programmes to come together and create a more holistic set of solutions for the problems facing East Africa, particularly in the face of the dual on-going threats of climate change and infectious diseases.

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CLIMATE CHANGE AND COCOA PRODUCTION IN CAMEROON: FARMERS EXPERIENCES AND LIVELIHOOD IMPLICATIONS

by Judges Mpako and Ivo Ngome

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Cocoa pod and beans: local farmers insisted that most problems affecting production are somehow linked to climate change.

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Literature on cocoa production in West Africa indicates that, alongside climate change, factors influencing cocoa production include low soil fertility, high incidence of pests and pathogens, high cost of pesticides, lack of access to improved planting materials, the fluctuating price of cocoa, political instability, and poor farmer education. But in this study, local farmers insisted that most of the problems that affect cocoa production are somehow connected to climate change.

An example is Mr Mesumbe Emmanuel Nkwelle who was a grade II teacher in Cameroon. He went on voluntary retirement in 1993 - more than half a decade before his official retirement time - to fully embrace cocoa farming. His reason was to escape the economic crisis that paralysed the country's public service. Today he says, "The economic crisis has returned to my household and the cause is climate change."

From one crisis to another

The economy of Cameroon experienced a recession from the mid-1980s to the early 2000s. The result of the economic crisis was increasing prices of basic commodities, trade deficits, and loss of government revenue. The government of Cameroon acknowledged the crisis in 1987. While critics placed the blame on poor government stewardship of the economy, the government pointed fingers at the fall of export commodities. In 1988, President Paul Biya announced that "all our export commodities fell at the same time." By 1990, the majority of civil servants had lost access to subsidized housing, electricity, and telephones; part of the government's vehicle fleets had been sold; and official working hours had changed.[1]

Because of disruptions to the public service at the time, many workers and especially those near retirement age opted to leave the service early. The majority of them went straight into cocoa farming. The attraction of cocoa agriculture is that it often allows farmers to plant food crops for subsistence and cocoa for cash on the same parcel of land.

"The attraction of cocoa agriculture is that it often allows farmers to plant food crops for subsistence and cocoa for cash on the same parcel of land."

"There is no way we could survive staying in public service," explains Mr. Manfred Mokoko, a former secondary school English language teacher who opted for voluntary retirement seven years early. "I saw more advantage in cocoa farming than in teaching because I could use one piece of land to grow food to feed my family and cocoa for my children's school needs."

But it has not always been a bed of roses for cocoa producers. As the number of people that turned to cocoa farming increased, the production of the beans escalated to unprecedented levels. This led to a fall in prices in the world market. By November 2000, prices were at a 27-year low of $714 per tonne in New York.[2] This forced Africa's biggest producers - Ivory Coast, Cameroon, Ghana, and Nigeria - who account for 70% of the world's production, to withdraw 250,000 tonnes of cocoa from the market and destroy it.[3]

By March 2002 cocoa prices had risen again to a comfortable level, a 14-year high, reaching £1,190 a tonne in London.[4] The reason was a drastic fall in production due to political instability in Ivory Coast, one of the world's leading producers. But there was also a slight fall in production in Ghana and Cameroon reportedly due to bad weather.

Bad weather or climate change?

It is well known that cocoa production is highly sensitive to changes in climate, from length and intensity of sunshine, to rainfall and water application, soil condition and temperature due to evapotranspiration effects. It has been reported widely that climate change also plays a major role in altering the development of cocoa pests and pathogens and shifting their interactions.[5] This translates into lower crop yields, which in turn impact farm income and livelihoods.

"Cocoa production is highly sensitive to changes in climate, from length and intensity of sunshine, to rainfall and water application, soil condition and temperature..."

"Rainfall in this area is now a heap of confusion," complains 59-year-old Ahidjo Ngomnkalle. "I have been a cocoa farmer all my life but have never witnessed such confusion in the pattern of rainfall."

Most farmers in southwest Cameroon perceive climate change in terms of changes in rainfall. This is one of the rainiest regions in Cameroon and also the highest producer of cocoa. Experienced cocoa farmers such as Ngomnkalle, who have never had any formal education, claim to have a near perfect understanding of rainfall patterns in the village of Mbabe.

"In the past there were a number of people in this village who could predict the exact day that the first rains would drop from the cheeks of heaven to bless our land and mark the end of the dry season," he continued, "but not anymore. Our climate has gone mad and we don't know why."

The majority of people who took part in this study, from every cocoa producing region in Cameroon, reported that rainfall patterns in the last 12 years have been unsteady. They said years of extreme rainfall alternate in no particular order with years of drought.

"Not too long ago cocoa farmers prepared ahead of the rainy season," said 52-year old Ajasco Nzeme, "now the rainy season prepares ahead of us. There is no order to what comes first, but what comes last is that the farmers suffer."

Cocoa farmers said some years do come with adequate rainfall but most people fail to maximize the opportunity because of the confusion in rainfall patterns. However, they intimated that good rains result in strong growth and yields of cocoa. Unfortunately, recent rainfall patterns have been either excessive, resulting in a high incidence of black pod disease and yield losses, or insufficient, leading to high seedling mortality and poor yields. In terms of annual rainfall, most farmers said it was decreasing continuously and this did not bode well for their business.

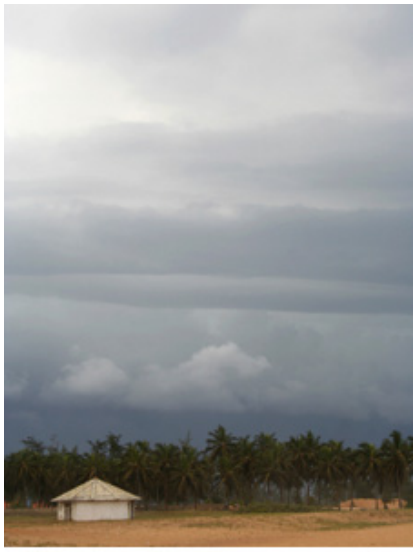
"Cocoa is water," said Ms Albertine Alougou. "From the way the weather is changing, in 20 years cocoa farmers may have to pay water bills both at home and on their farms. Rainfall is decreasing everyday and there is nothing we can do about it. Everything falls like hell in one or two months, and you can forget about it for the rest of the year."

But cocoa farmers in Cameroon are not only concerned about rainfall; they are also

worried about temperatures.

In the village of Nanga Eboko in the South Region of Cameroon, Mr Pierre Nvondo is spraying his cocoa. Every now and again, he strikes his shoulders with cocoyam leaves to drive away the flies that could enter his ears or eyes. In some villages these flies are called sun flies because they become most active in the afternoon when the sun is high. Elsewhere they are called chockchockge, a Bakossi word used to describe things that would like to play with you even when you don't feel like playing.

"Only 10 years ago we would not see these flies before midday," explains Mr Nvondo. "The fact that they start bothering you this early [at 9:30 am] is an indication that climate is changing, temperatures are rising. And the flies are the biggest nuisance you can imagine."



Unpredictable skies: cocoa farmers say years of extreme rainfall now alternate in no particular order with years of drought.
© Peter Viisimaa

However great a nuisance those flies may be to farmers, they neither affect the growth nor yields of cocoa. Temperature affects both. It hampers replacement of cocoa trees by drying out seedlings.

"This cocoa farm is the only hope my husband left for me when he died 8 years ago," says Ms Margaret Wangobe. "The harvest has dropped because the trees are too old – they were planted 26 years ago. But how do I replace them when the sun keeps burning my seedlings out?"

"All respondents blamed climate change for the poor success rate of cocoa seedlings. They complained that the combination of increased temperatures and substantially reduced rainfall meant that cocoa seedlings were being attacked on two fronts."

This is becoming a rather serious problem in Cameroon's Centre Region. Of the 550 farmers interviewed in that region, 434 said renewing their cocoa farms is proving more difficult than they expected. They complained that the success rate for cocoa seedlings has dwindled; in reverse order of severity, 20% said it had dwindled to 1 in 5 planted seedlings, 27% reported 1 in 4, and 43% placed it at 1 in 2 planted seedlings. All respondents blamed climate change for the poor success rate of cocoa seedlings. They complained that the combination of increased temperatures and substantially reduced rainfall meant that cocoa seedlings were being attacked on two fronts.

"Climate change is killing my cocoa farm in front of my eyes," lamented Antoine Etundi of Bapende village. "Too much sunshine is burning cocoa seedlings and young cocoa pods while too little rainfall denies young seedlings the water they need to survive. This climate will not give seedlings a chance to replace old trees, and the whole thing is getting worse."

"Some people say we produce less and less cocoa because we are not learned," declares Adolf Mendo in Edea. "But they forget that the number of learned people currently involved in cocoa farming is higher than it has ever been, yet production is falling everyday. As the weather changes so the harvest falls."

Asked to what extent fluctuating prices affect cocoa production, Jean Mwelle echoed the view of several respondents, "Prices are high now, but where is the cocoa? Climate madness has made it difficult for us to track cocoa diseases, so the loss to pests and pathogens is plenty."

Effect on present and future livelihoods

Owners of cocoa farms may be relatively rich but the actual cocoa farmers – those who plant and harvest cocoa – generally come from poor households. This ownership issue may be a little confusing and should be explained.

In most parts of Cameroon the labour intensive nature of cocoa production does not allow for large farm sizes. Hence farm sizes are generally small, ranging from 0.5 to 13

ha. In this survey, 15% of respondents said their farms were more than 10 ha large, 29% said theirs ranged from 5-10 ha, and 56% said their farms were less that 5 ha in size.

A cocoa tree and pods: for most farmers, the work is hard and the land is not theirs.
© Irtati Hasan

But the majority of those farms did not belong to the actual farmers. Most respondents, 56%, called themselves tenants involved in two-party farming where the tenant manages the farm and the proceeds are divided equally between the tenant and the farm owner at the end of the farming season. Most of these farms were owned by civil servants, businesspersons, women (mostly widows), politicians, and people who are too old to farm. A few of the farms, 13%, were mortgaged. The owners have given the farms out to cultivators for a specific time period in return for a specific amount of money. At the end of that period they will take back their farms. Only 25% of respondents owned their farms.

Interestingly the household size of tenant farmers was found to be very large when compared with the other two groups. The average household size for tenant farmers was 6.3 persons as against 5.2 for those who farmed on mortgaged holdings and 3.8 for whose who cultivated the crop on their personal farms. Also, while the majority of tenant farmers had no farm holdings of their own, almost all farm owners reported owning at least one other farm being managed by a tenant.

"My children will find it hot in school this year," said Mr Sone Ekambe of Nyasoso village. By "hot" he was not referring to the temperature but to poverty. "The harvest is terrible and I wonder from where they'll get their fees." Looking around his farm as if he did not recognise it, he added "This year the rain stopped before it started leaving the sun to burn out the few cocoa pods that managed to sprout. By the time I share this harvest with the farm owner I'll have only my fingers to take home."

Cocoa farming requires a lot of effort; the farmers do not have time for any other economic activity. Moreover, the majority of them still regard cocoa production as a very lucrative business if production is kept high.

"The problem is no longer that of price," explains Ms Dorine Yangki, "it is a matter of yields. This erratic climate benefits only pathogens and the fungicide companies. We spend much money on fungicides but the changing climate undermines the effectiveness of those medicines and the losses are heavy." But she also added that if the price of fungicides could be passed on to consumers of cocoa products, as in the petroleum sector, "perhaps farmers would not be so miserable."

For some farmers, the best way to secure their children's future is to teach them how to cultivate cocoa. The children learn the trade that has sustained thousands of farmers for generations. But with climate change rendering the sustainability of this trade doubtful, some farmers are disturbed about the future of their children.

"The children learn the trade that has sustained thousands of farmers for generations. But with climate change rendering the sustainability of this trade doubtful, some farmers are disturbed about the future of their children."

"My father and his father planted cocoa on this farm," Mr Solomon Ekoto narrates. "I just wonder whether my son will be able to pass this farm on to his son. If the weather continues to change like this, there may be no rain when my son's son is ready to farm. And you cannot have cocoa without rain."

Cocoa farming, which has been an important lifeline in the recent past for thousands of households in Cameroon, is becoming a death trap. Many poor people want to get involved, but the odds are gradually turning against them. Those who left the public service and embraced cocoa farming in order to escape the economic crisis were well prepared for many factors: low soil fertility, high incidence of pests and pathogens, high cost of pesticides, lack of access to improved planting materials, the fluctuating price of

cocoa, political instability, and poor farmer education. But were they prepared for climate change? Our findings indicate they were not.

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Editorial: CLIMATE CHANGE IN AFRICA

by J-P Thompson

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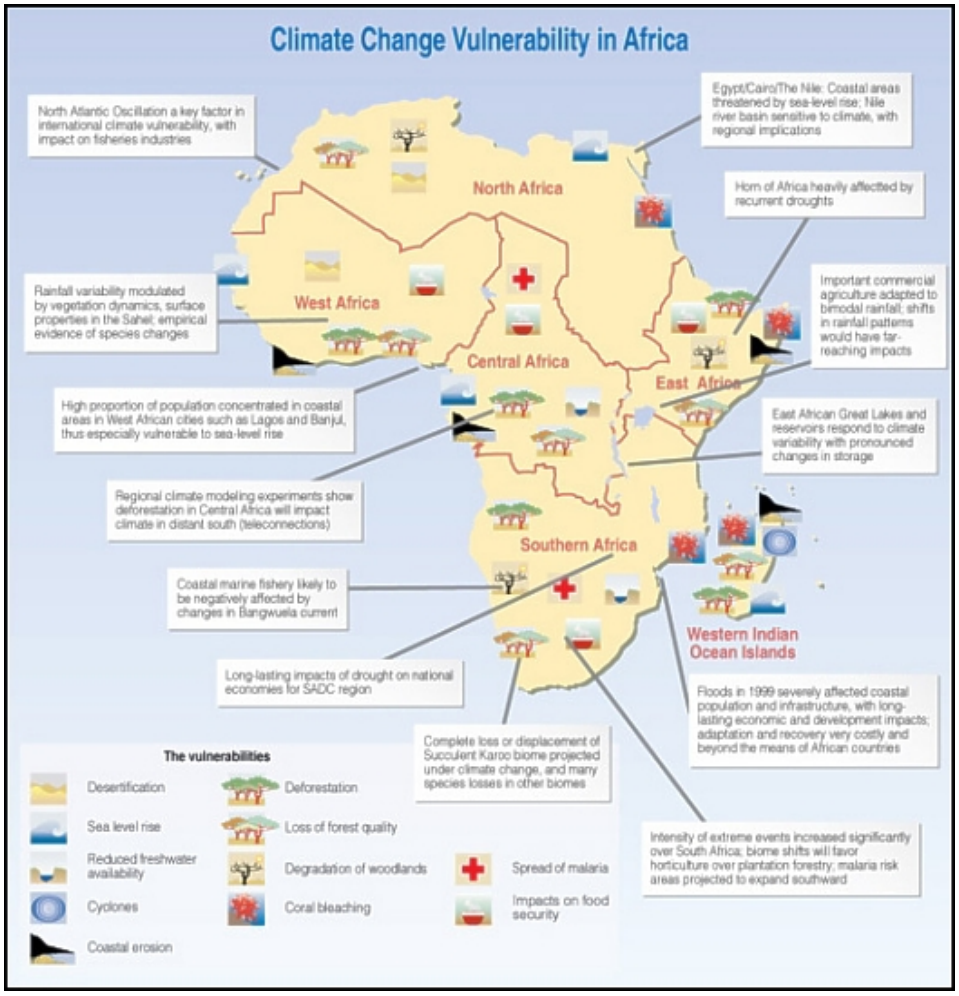
Climate change is a global crisis now and for the foreseeable future. Africa is impacted disproportionately and this situation will only deteriorate without immediate and comprehensive solutions. Figure 1 illustrates some of the key elements of climate change, including deforestation, desertification and coastal erosion. In addition, the average temperature rise in Africa is estimated to double the global average over the next 70 years.[1] This alone will have catastrophic consequences for the people of Africa, impacting negatively on crop yields, biodiversity, water availability, land degradation and health outcomes. Another estimate predicts that over 180 million people in sub-Saharan Africa could die of diseases directly linked to climate change by the end of the century.[2] The fuse to these ecological time-bombs is carbon dioxide emissions. Industrialized and industrializing nations are principally responsible for these emissions.

Figure 1: Climate change vulnerability in Africa[3]



Carbon Dioxide Emissions

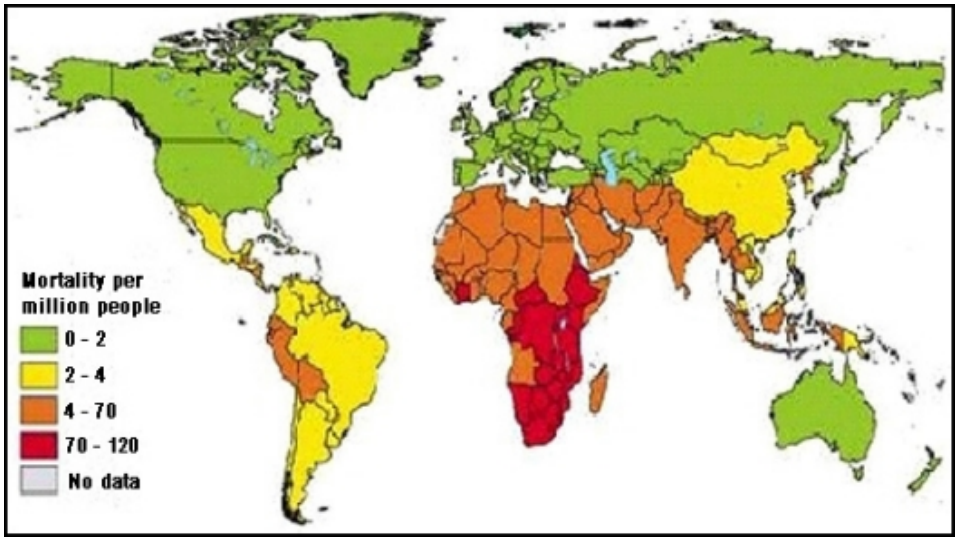
CO2 emissions are generally regarded as a central element of climate change because of their role in global warming. Yet for the most part the contribution of Africa's population pales in comparison to the peoples of the developed world. For example, the state of Texas, with a population of 23 million, emits more CO2 than all 720 million residents of sub-Saharan Africa.[4]

The responses and solutions favoured by governments, however, show how self-interested and profit-driven the leaders of the current world are. For example, with regard to cuts in carbon emissions by developed countries, the recent G8 summit in Japan saw a consensus between the USA, Canada and Japan blocking meaningful action on developing short-term carbon emission targets based on the framework established at the Bali summit in 2007.[5] Instead, the G8 declared a 50% reduction by 2050. This mentality of '**rearranging the deckchairs**' is clearly insufficient, especially compared to most who have called for 90% cuts by 2050[6] and even others insisting that 120% reductions by 2020 are necessary.[7]

Without immediate action, global warming is currently predicted to cause average temperatures to rise from 2.4º up to 5.4º C over the following decades. However, in Africa, the same estimates predict the rise in temperature could be almost double the global average, ranging between 7º and 8ºC.[8] Significant changes in rainfall patterns will be keenly felt across the continent. The droughts of the 1980s in Ethiopia were a result of climate change, and Oxfam estimate that 25 million people will be affected by the latest drought there.[9] Across Africa this pattern will be repeated in various ways.

According to the World Health Organisation (WHO), Africa bears the brunt of the approximate 150,000 deaths per year that occur globally because of climate change. These figures will more than likely double by 2030. The disproportion between those who contribute to global warming and those that suffer from it is stark. Figure 2 illustrates this disparity.

Figure 2: WHO - Estimated mortality attributable to climate change[10]



The politics of this disparity is reflected in the nature of deforestation. While deforestation is but one of several major problems linked to climate change, other problems such as increases in disease and impacts on farming will be examined in other articles of this ezine volume. The role of deforestation as a key driver of climate change is explored here. In doing so, it is possible to examine the systemic failure to address the challenge and the future possibilities that exist.

Nightmare Scenario – Deforestation

The roles of tropical rainforests are many. They are central to maintaining soil fertility through storing and transpiration of water for precipitation. They are the natural habitats of a multitude of animal and plant species, not to mention the many indigenous peoples and local communities who depend on the forests for their subsistence needs. More broadly, tropical rainforests play a vital role in carbon sequestration, acting as the Earth's natural storage facilities for CO2.[11] Global deforestation is a leading cause of greenhouse gas emissions (GHGs). The IPCC estimate that 1.6 billion tonnes of CO2 are released into the atmosphere every year through deforestation activities.[12] Annually, approximately 25% of GHGs are directly attributable to the cutting and burning of tropical rainforests.[13] For example:

> [I]n the next 24 hours, deforestation will release as much CO2 into the atmosphere as 8 million people flying from London to New York… [T]he destruction of those forests will in the next four years alone… pump more CO2 into the atmosphere than every flight in the history of aviation to at least 2025.[14]

African forests make up 17% of the world's forests,[15] covering over 630 million hectares,[16] or about one fifth of the continent's land area.[17] The forests are principally located in the tropical zones. (See **here** and **here** for visual representations of forest cover in Africa.) The Democratic Republic of Congo (DRC) contains the world's second largest tropical rainforest.[18]

Table 1: Top 10 Forested African Countries (2005)[19]

Country	Hectares (1000s)	% of Land Cover	Country	Hectares (1000s)	% of Land Cover
1) DRC	133,610	58.9	6) Central African Republic	22,755	36.5
2) Sudan	67,546	28.4	7) Congo-Brazzaville	22,471	65.8
3) Angola	59,104	47.4	8) Gabon	21,775	84.5
4) Zambia	42,452	57.1	9) Cameroon	21,245	45.6
5) Tanzania	35,257	39.9	10) Mozambique	19,262	24.6

Africa has lost a higher percentage of tropical rainforests than any other region. In its comprehensive report, '**Africa- Atlas of Our Changing Environment**', the UN Environment Programme (UNEP) states:

> Africa is losing more than 4 million hectares (9.9 million acres) of forest every year

— twice the world's average deforestation rate.[20]

Carrying firewood: about a third of Sudan's forests have disappeared in the past 20 years.
© FAO photo

This is approximately the size of Switzerland.[21] According to UNEP, the primary causes of deforestation are commercial activities of logging, converting forest for agricultural purposes or grazing livestock and expanding human settlements. Although local activities such as harvesting firewood and charcoal have an impact, the problem is mainly driven by the unquenchable thirst of industrialized and industrializing countries for natural resources in return for some form of 'assistance'. According to the World Rainforest Movement and a prominent environmentalist respectively,

> …deforestation is the inevitable result of the current social and economic policies being carried out in the name development.[22]
>
> The roots of the problem of deforestation and waste of resources are located in the industrialized countries, where most of our resources, such as tropical timber, end up. The rich nations with one quarter of the world's population consume four fifths of the world's resources.[23]

Whatever the label—be it some misguided notion of 'development', debt burden or consumerism–the bottom line is that developing countries are forced to trade in their resources, destroying their environment (and the world's) for meager short term returns. It is evident that the current situation is detrimental to both industrialized and developing countries in the long term.

The statistics on logging and the commercial export of raw tropical logs alone reinforces this grim picture. More than 3.5 million cubic meters of raw tropical logs were exported from Africa in 2006, much of it illegally. Spurred on by regulations that are both inadequate and shoddily enforced, China and other Asian countries have taken over from the European Union as the main destination in recent years.[24]

Forest-dependent indigenous communities: men prepare to gather honey from wild hives in the jungle of the Congo.
© FAO / M. Marzot

A fairly standard scenario would be as follows. Industrial logging concessions are parceled out to commercial loggers, sometimes with the blessing of the host government. The building of roads or railways to access the area will sometimes be facilitated by funds designated as 'development aid'. They may temporarily hire the labor force in local communities, on menial wages, to carry out the logging process. After the timber has been logged and other non-timber forest products have been exploited to their maximum potential, the firms will move onto their next concession. The previously employed labor force is left to fend for itself. Despite the virtual destruction of their homeland, local communities are highly unlikely to see any meaningful or lasting benefits from the profits derived from logging, processing timber or producing value-added goods such as furniture. More likely they will be left with little choice but to resort to subsistence agricultural practices, usually involving the slashing and burning of additional forest, thereby exacerbating land degradation.[25] In addition, there are also the stresses of commercial logging on forest-dependent indigenous communities, such as the Pygmy populations in the Congo Basin. Such is the pattern which might lie ahead for Gabon.

Deforestation in Gabon

Within the Congo Basin, Gabon makes for an interesting case study with regard to deforestation. It is located on the west coast of Africa, with Cameroon and Equatorial Guinea as neighbors to the north and Congo-Brazzaville on its eastern and southern borders. It ranks 8th in the list of countries with the most forested area (see Table 1); and in terms of forest cover as a percentage of total land, it ranks 2nd with 84.5%.[26] The forests contain 8,000 plant species, of which 20% are endemic to Gabon, nearly 200 mammals and over 670 species of birds. The forests are also home to several

indigenous groups, namely, the Baka, Bakoya and Babongo Pygmies.[27]

Gabon is often held as a shining star of conservation practices. In 2002, the government declared its intent to create a national park system consisting of 13 parks and reserves. This initiative, enacted in 2003, designated 10% of the country as protected areas.[28] More recently, Gabon was one of 14 developing countries to become a member of the Forest Carbon Partnership Facility (FCPF). This international financing mechanism is part of the larger Reduced Emissions from Deforestation and Forest Degradation (REDD) strategy to fight tropical deforestation and climate change.[29] Moreover, between 1990 and 2000 Gabon's annual deforestation rate averaged an impressively low 0.05%, or a total of 152,000 hectares.[30] There are few spots in the world where primary tropical rainforest stretches to the beaches of the ocean, but Gabon is one of them.

However, despite this encouraging picture, Gabon's forests face serious challenges. The lack of extensive commercial logging can be largely attributed to Gabon's off-shore oil deposits. Yet, heavy reliance on oil exposes the Gabonese government to fluctuating oil prices—and the current drop in prices. Relying on the granting of large-scale commercial logging concessions, under the banner of diversifying the economy, does not seem a good response. However, that seems to be the pattern for Gabon even to the point of threatened its non-timber forest products (NTFPs)[31] which are currently protected by Gabon's Forestry Code.

Sustainable forest management or logging in line with World Bank and IMF policies?

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Despite the Forestry Code legislated by the Gabon government being regarded as adequate,[32] it is also regarded as being favorable for commercial logging and the industrialization of the forests, principally at the behest of the World Bank and the IMF.[33] Although adopted in the spirit of increasing sustainable forest management and improving the development of their timber processing industry, the legislation does not tackle the supremacy of foreign capital controlling its logging concessions, nor does it deal with issues of poverty. This is evidenced by the fact that there are virtually no mechanisms to protect or educate the affected local communities about their rights. In other words,

> [O]nce again, "development" schemes generally fostered from outside and replicated along southern countries rich in natural resources, bring money to national and international elites but not to the people.[34]

The stresses on, and challenges for Gabon's forests, its accompanying ecosystems and local populations are plain to see. Yet, Gabon is thought of as lucky, and its forests are considered to be relatively 'untouched' when compared to forests in other African countries that experience the same issues at an exacerbated level, or are further damaged by other issues like civil unrest. This suggests significant failings in planning for the future. Without adequate long-term strategies that integrate all local communities, can anyone expect these circumstances and, by inference, the broader climate change issues to improve? What more holistic mitigation strategies are available to address deforestation issues in Gabon, or anywhere else in Africa? Necessarily this requires that broader climate change initiatives be examined.

Climate Change Mitigation

Mitigation refers to the act of lessening the severity of the effects of climate change. In recent years the international community has given much attention to mitigating climate change. The most prominent response to the dangers of climate change is carbon trading, brought into being by the Kyoto Protocol in 2005. The basic principals of carbon trading are rooted firmly in free market economics. It is a profitable business. The World Bank estimated that the carbon market was worth nearly US$65 billion in 2007 alone.[35]

With GHG reductions in mind, carbon trading established a market aimed at countries and companies to meet reduction targets. To achieve these targets, this mechanism gives countries the option of reducing their own emissions or the option of buying emissions credits from other countries and companies who have reduced their GHGs farther than their pre-determined levels. Also, polluters may purchase emissions credits by investing in sustainable development projects that demonstrate additional reductions in emissions. This is known as the Clean Development Mechanism (CDM).[36]

Pollution in the North: carbon trading is based on a flawed system of allocating pollution rights.
© Jaap Hart

Carbon trading and the CDM have far greater complexity than can be fully described here. However, some important flaws are worth noting. First, carbon trading is based on a 'historical allocation of pollution rights',[37] which favours industrialized nations. Fundamentally, the pollution rights of industrialized nations were established off the back of exploiting the developing world. Therefore, grand-fathering in a system steeped in inequity is not the basis of any progressive solution. Countries distribute their allocation of credits to their national industries for the CDM in much the same way. In other words, the biggest polluters have the most credits. Second, while billions of dollars are invested in emissions trading schemes, there are few resources being directed towards the regulation or accountability of the markets or the CDM.[38] This opens up the probability that the system will be exploited by the unscrupulous who can defraud the system by claiming non-existent reductions.[39] Third, the CDM's most controversial flaw is its concept of 'additionality'. That is to say, a proposed project must establish that it would reduce emissions more than would have occurred if it did not happen. Not only is this extremely difficult to establish but it allows polluters to present alternative scenarios with greater carbon emissions.[40] Fourth, many initiatives are unable to redress the balance of previous carbon emissions.[41] In part, because there is little evidence that developing new carbon sinks equalizes previously used fossil fuels. Also, some projects like the planting of trees will not be given the time to act as carbon sinks before the trees themselves are cut down.

Overall, carbon trading and CDM schemes allow polluters to unload the cost of their pollution to someone else. There seem to be no real incentives for the largest polluters to reduce their own emissions. Yet it does not stop terms like 'carbon-neutral' and 'carbon-offset' being thrown about as measures of success within the system. Meanwhile, resources are still being drained from the developing world. Little or no attention is being paid to the people who are affected the most and polluters keep polluting, albeit at a price. However, it is a small price compared to their overall profits. The primacy of economic self-interest over genuine environmental protection within this current system is implacable.

Approaches to Mitigating Deforestation

Macro-strategies will not work and will only make things worse in the case of Africa because it can only pay lip service to the micro-elements at best. Conspicuous by their absence in carbon trading and CDM initiatives are the necessary tools for sustainable management which has to incorporate local communities:

> …for climate change in Africa, the dichotomy between environment and economic development is particularly false. There is and will be no durable economic development unless it is based on sustainable management of Africa's land, soils, forests and water.[42]

Initiatives set up through the current system largely ignore the rights and the needs of local populations. For example, evicting people from their homes to plant trees is neither an equitable nor sustainable strategy, as in the case of Mount Elgon National Park in Uganda, which resulted in the trees being cut down and growing hostility between farmers and local authorities.[43]

Situations like the above are commonplace and benefit no-one in the long term. To be successful, climate change strategies must engage and enable local communities not just on an ad hoc basis but in an institutionalized way throughout the decision-making process. However, this is far from actually happening at the moment. The World Bank's REDD strategy is a case in point. Currently REDD is widely criticized for excluding local communities and indigenous populations from being participants in negotiations and not addressing the broader social justice needs of these communities. This exclusion is evidenced in recent negotiations involving REDD to formalize the participation of the world's rainforests in carbon markets.[44]

Adopting a holistic approach will greatly improve the chance of successful forest conservation policies because all the players will have a vested interested in the outcome. Sustainable forest management strategies to reduce deforestation rates should include natural regeneration of local species, community-based natural resource management and improved local technologies. This requires that decision-making and

revenue allocation and authority is decentralized and placed in the hands of local communities. According to Friends of the Earth International and others, this can happen when greater emphasis is placed on the following issues:

- **Strengthening land rights** – "The recognition and enforcement of customary and territorial land rights of Indigenous Peoples and forest-dependent communities must be the basis of any forest policy".[45]
- **Equitable funding for stopping deforestation** – "Funding to stop deforestation should be invested in national programs and infrastructure that directly provide support to alternative, rights-based community-driven forms of forest conservation, sustainable management and ecosystem restoration".[46]
- **Education and advocacy** – Informing and empowering local communities helps to strengthen the grass-roots level to address deforestation issues. Local knowledge and experience can be shared with others facing the same concerns. This will also help local communities to create linkages with other organizations, groups and coalitions and ultimately give the collective with a stronger voice.
- **Innovation and developing technology** – Developed countries should be more willing to align with local actors for knowledge transfer. Researching and investing in innovative methods or development technologies will lead to more efficient practices. These could be centred on improving any number of elements, for instance: creating less harmful logging practices, adaptive agricultural strategies, more cohesive resource management or improved cooking and heating equipment.

Enthusiastic young Zambians learn about the importance of protecting their environment.
© USAID

These components help to fill in the gaps that are currently visible in broader efforts, thereby making them more comprehensive strategies in addressing climate change issues. Continued pressure from a 'bottom-up' perspective can have the ability of steeling a government's resolution to consider alternative futures for their forests.

Unless such pressure is applied, it will be the population of sub-Saharan Africa who will be most vulnerable to, and suffer the most from, the effects of climate change in the decades to come. They will continue to pay a terrible price because both domestic and international governments along with institutions are failing to address key issues coherently and adequately while largely neglecting grassroots strategies. That is to say, broader mitigation strategies employed by international actors, will ultimately fail unless there is greater recognition of the knowledge and capacities to respond to climate change inherent at the local level. Not only should local knowledge be incorporated into macro-economic, technological and political policies but these policies should be significantly derived from this knowledge. Without a holistic approach to climate change, Africa will be a continent further ravaged, awash with environmental refugees.

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