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Climate Change

food and nutrition security implications

In this issue:

Feature papers on Climate
Change

Special feature: the Brussels
High Level meeting report

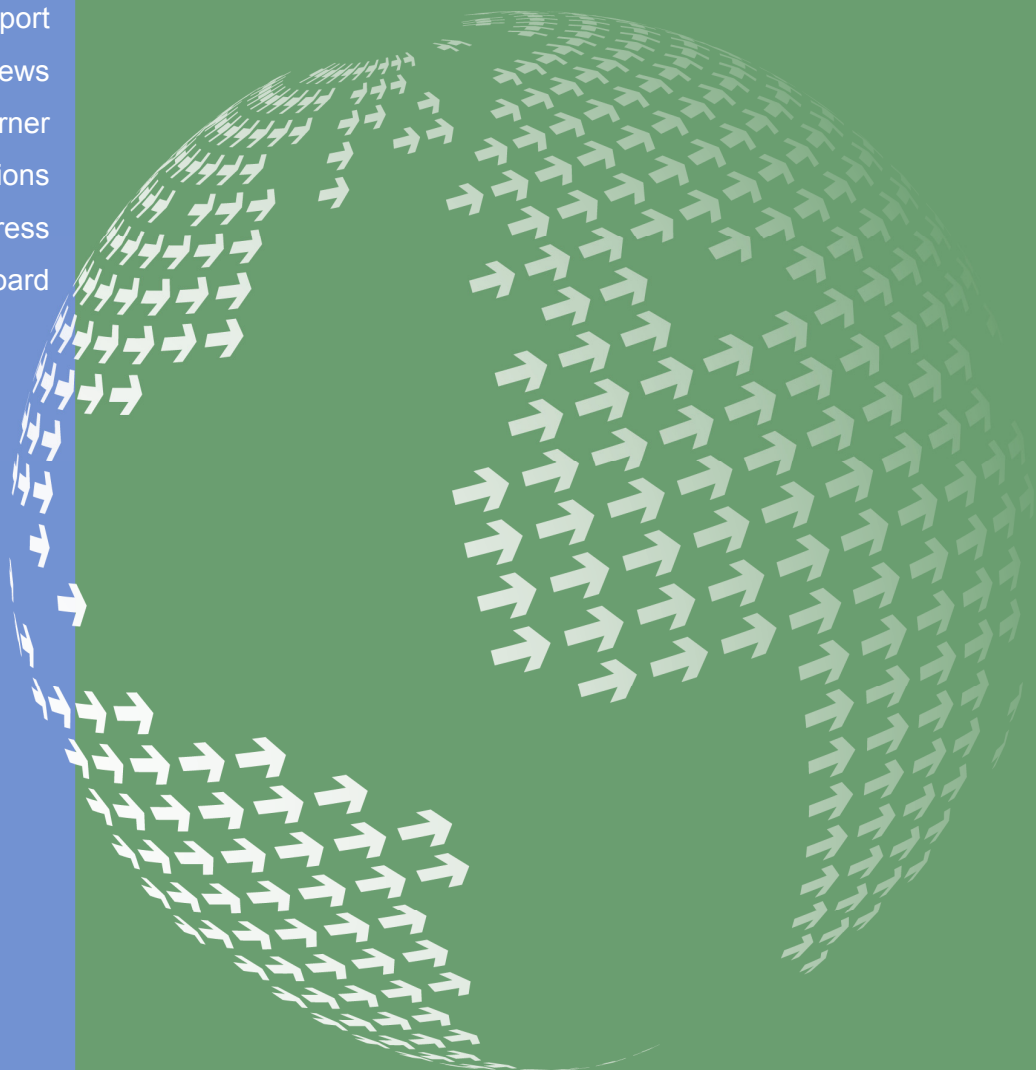
Programme News

Speaker's Corner

Publications

Press

Bulletin Board



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CONTENTS:

CHAIR'S ROUND-UP	1
FEATURES: CLIMATE CHANGE—FOOD AND NUTRITION SECURITY IMPLICATIONS EDITORIAL	2
• Philippe Crahay et al.—The threats of climate change on undernutrition — A neglected issue that requires further analysis and urgent actions	4
• Kristie L. Ebi et al.—Climate change impacts on food security and nutrition	11
• Butler C. Climate change, crop yields and the future	18
• Ya-Wen Betty Chiu et al.—The implications of climate change on food security in the Asia-Pacific Region	26
• Molly Brown—Climate change, nutrition and food security in sub-Saharan Africa	32
• Ina Schonberg et al.—Opportunities for action: linking climate change adaptation to nutrition and food security programs and policies	37
• Jean Lapegue—How is the water, sanitation and hygiene sector implicated in the link between undernutrition and climate change?	44
• Anna Burns et al.—Effects of increasing carbon dioxide emissions and climate change on nutritional quality of food crops: a case study on cassava	49
• Lars Bygren—Epigenetic epidemiology and food availability	54
• Alan Dangour et al.—Health co-benefits of climate change mitigation policies: the role of food production	56
• FIAN—Human rights and climate change	60
• Siri Damman—Indigenous peoples, rainforests and climate change	63
• Stuart Gillespie—Climate change, AIDS and nutrition security: responding to long-wave processes	68
• Roseline Remans et al.—Addressing undernutrition and climate change in the millenium villages: enhancing resilience of rural communities	71
• Rachel Berger—Increasing food security for marginal farmers in the face of climate change: programme experience and policy recommendations	78
SPECIAL FEATURE	83
• Summary report on the high level meeting on nutrition	83
OBITUARIES	85
• David C. Morley	85
• José María Bengoa Lecanda	86
PROGRAMME NEWS	87
• SOKOINE UNIVERSITY—Food security, adequate care and environment quality: development and testing of eco-nutrition guidelines for community actions in the context of climate change	87
• HARVESTPLUS—Biofortified wheat improves Zn absorption in adult women	87
• WHO—Mapping the health impacts of climate change action on agricultural systems; Joint FAO/WHO expert consultation on fats and fatty acids; WHO nutrition guidance expert advisory group (NUGAG)	88
• REACH—Partnership to explore links between agricultural development and nutrition improvement	89
• Gbičs—The global breastfeeding initiative for child survival	89
• ALIVE&THRIVE—Country programs, grants, website, and series of technical updates	90
SPEAKER'S CORNER	91
• Schuftan C—A scathing critique of Landscape Analysis: where has the right to nutrition gone?	91
• Nishida C—The Landscape Analysis and human rights-based Approaches	94
• Shaxson and Kassam—Conservation agriculture and climate change	96
• WHO's work on salt/sodium reduction	97
PUBLICATIONS	98
PRESS	100
Jaspreet Kindra—Empower people to become resilient	100
BULLETIN BOARD	101



Alexander Julius Müller, Assistant Director-General, Natural Resources Management and Environment Department of FAO, became the 10th SCN Chair on 19 December 2008, when the SCN Steering Committee welcomed and unanimously agreed to his appointment.

As Assistant Director-General, Natural Resources Management and Environment Department from April 2006 to date, Mr Müller has emphasized the role of the food and agriculture sector in fostering sustainable livelihoods for food security and good nutrition. In the period June 2006 through April 2007, he was simultaneously Officer-in-Charge of the Agriculture and Consumer Protection Department, where the Nutrition and Consumer Protection Division is housed.

Before joining FAO, Mr Müller has had an outstanding career in the German government. From 2001 through 2005 he was State Secretary of the German Federal Ministry of Consumer Protection, Food and Agriculture. In the period 1995-2001 he was Member of Parliament in Hessen, Chairman of the Caucus of the Green Party, and Member of the Committees of Environmental Affairs, of Finance and for New Media in Wiesbaden. From 1992 to 1995, he was State Secretary in the Hessian Ministry of Youth, Family and Health Affairs in Wiesbaden.

Chair's Round-Up

Dear SCN News Reader,

As SCN Chair, I am very pleased to have the opportunity to communicate with all of you - committed and interested members of the food and nutrition community. A year has gone by since the publication of the SCN News 37 and many conferences, meetings and initiatives important for moving the nutrition agenda forward have taken place. We can see that nutrition is high on the political agenda. But there is more to do and we have many opportunities: e.g. the ongoing climate change negotiations have to address nutrition. Climate change has serious implications on food and nutrition security and the SCN has issued a [statement on the implications of climate change and undernutrition](#). This edition of the SCN News is rightfully dedicated to climate change and its implications on food and nutrition. It is hoped to be thought provoking, showing you how climate change impacts on nutrition. The topic has been approached from very different angles: impacts on food security (in general, in the Asia-Pacific region and sub-Saharan Africa), effects on the quality of food crops, links to access to safe water, health benefits of climate change mitigation, human rights, epigenetics and food availability, AIDS etc. You will also find information about ongoing community-based climate change adaptation and mitigation activities (from the Millennium Villages, Practical Action). I am delighted that the guest-editor of the SCN News is Hans Herren, co-chair of the important International Assessment of Agricultural Knowledge, Science and Technology for Development report (IAASTD).

This edition of the SCN News also contains a short summary report on the High-Level Nutrition meeting which took place in Brussels at the end of November 2009. During this meeting, formal endorsement by the SCN constituencies of the planned reform of the SCN has been obtained as well as commitment of the 4 core UN Agencies (WHO, UNICEF, WFP and FAO) to ensure core funding of the SCN Secretariat for one year. As a result of this funding commitment, a new Executive Secretary, Dr Denise Costa Coitinho Delmuè, has recently taken office. Denise will focus on helping me and the Steering Committee with the reform process. In the very near future, a transparent and inclusive consultation process will be initiated with members of the SCN Constituencies asking for comments on the soon-be-shared SCN reform document. So, where are we today with SCN? We are undergoing reform and we have a new Executive Secretary. Despite the current difficult position, SCN organized an IUNS satellite meeting in Bangkok and a networking event in Rio de Janeiro (March 2010, during the World Urban Forum). The SCN is soon to launch the 6th Report on the World Nutrition Situation. The SCN Secretariat has seen Kaia Engesveen, the SCN News editor, leave the SCN Secretariat to take up a position at WHO. I use this opportunity to thank Kaia for her dedication and splendid work and welcome Lina Mahy as the new editor.

Looking towards the future, I am very confident that a new SCN, **Strong and Committed for Nutrition**, will emerge, demonstrating true leadership in support of the global food and nutrition agenda, advocating for more investments in nutrition, constructing bridges between different sectors leading to more and better collaboration and coordination. SCN will stand for partnership building with the various nutrition actors, it will stand for initiative and innovation in nutrition, SCN will constitute the avant-garde of the global nutrition network. I am seeking the continuous support of the SCN members, so that SCN has the courage to take decisions, which might cause temporary discomfort for any one member, but are in support of the greater good. The driving force is the SCN membership, the process is human-rights based, our destiny is the sustainable eradication of malnutrition.

Editorial

The discourse on the impact of climate change (CC) has been on-going for a while. The actions, however, to act decisively to avert triggering the tipping point have been few and overall rather uncoordinated. The latter is not surprising given the many different interests that predominant in different parts of the world. It's not that we lack ideas or solutions to both seriously mitigate and then prepare to adapt to climate change impact. We can rest assured: impacts there will be, regardless of how much some would like to make believe that there is nothing to worry about, either because there is no proof or technology will fix it.

The areas where impacts will be most felt are in agriculture, food systems and nutrition. There will be other impacts, eg. health will be affected by shifting diseases and by impaired nutrition. Water will become even more of an issue, affecting both agricultural output and health. At every turn, there will be issues that policy makers and everyone else along the development continuum will have to deal with. As the health sector knows better than others, prevention is better than cure. It may be worthwhile to contemplate this axiom in light with climate change and nutrition by acting on the prevention side.

What would prevention in that instance mean? First and foremost, it would mean dealing with issues that we can control, such as the development agenda, and in particular the areas that fall under the realm of the MDGs, since all need to be considered in order to make progress. The synergies across the MDGs are key to success in the nutrition area.

The series of articles in this issue of SCN clearly maps out the problems and solutions that policy makers and practitioners can follow, to take action before problems grow beyond control. The nutrition problems that are building up across the regions of the world are multifaceted, but have some common threads too. One of them is the issue of poverty, which manifests itself in two opposite directions: undernutrition and obesity. In this as in many other problems, the causes are the same while the outcome is different.

Among other key nutrition issues is the lack of diversity and on-going trends to further narrow down the offer, by promoting a few commodities over a larger number of nutritious and locally specific foods. Developing local foodsheds to supply a rich diversity of local produce would help in reducing the poverty problem, while addressing the hunger / nutrition and poverty nexus.

Access to food remains a main problem, intricately related to poverty and inequality. India, for example, country experiencing both commodity surpluses, while the undernutrition among children is amongst the highest in the world. The solution to better nutrition does not lie in more rice and maize as often suggested. Nor does it lie in more rice and maize that is fortified with vitamins and oligo-elements with the help of genetic engineering. Simpler and more effective solutions can be found rather by diversifying the food sources.

By doing so, we can then address climate change and the need to add resilience to the food production system. Resilience can best be secured through diversification rather than simplification and reductionism.



Dr. Herren's main interests and experience are in the area of integrated and sustainable development. He has hands-on experience in research, capacity development, management of research organizations in the field of agriculture and ecology and now moved to the policy level, to assure that knowledge, science and technology do contribute effectively to sustainable development by informing development policies at national (i.e., MDGs), regional and global levels.

Dr Herren currently is the President and CEO of the Millennium Institute (MI) USA, since May 2005. MI provides "Development Intelligence" tools (system dynamics models such as the T21) and capacity development services to empower developing countries in the design and ex ante evaluation of their own sustainable development strategies and supporting policies for the medium and long term. SD tools are also developed to support the in their long term planning. Before joining the Millennium Institute, Hans Herren was the Chief Executive and Director General of the International Centre of Insect Physiology and Ecology (ICIPE) in Kenya (from 1994 to 2004). ICIPE deals with research and capacity development in insect and ecosystem sciences as relevant to human, animal, plant and environmental health in support of sustainable development.

In the face of the challenges that lie ahead of the professional in nutrition, health and also food production, there is little time to waste. The reports from the IAASTD, "Agriculture at a Crossroads" have analyzed the food system of the past 50 years and come up with options for action to deal with these problems, perhaps for the first time in such a comprehensive and interdisciplinary manner. Going beyond food production, the reports that looked at global and sub-global levels, have made ample mention of food AND NUTRITION security, as well as food sovereignty issues, all of critical interest given the challenges placed on the already rocky road to sustainable development by the pressures wrought by climate change.

I look forward for the issue of SCN to elevate the nutrition debate and actions to the next level, a level that looks at the issues in a holistic and integrated manner, cutting across the past silos. The well-thought-out approaches elucidated here can link policy makers as well as end-users, and all the specialists in between into a TEAM that will mount an appropriate response to the challenges faced.

Hans R Herren, President Millennium Institute and Guest Editor

Other positions of Hans R. Herren:

- International Institute of Tropical Agriculture (IITA) Nigeria: Director Biological Control Program 1979 -1991; Director Plant Health Management Division 1992 to 1994. Developed and implemented one of the world's largest and most successful biological control programs ever carried out. The cassava mealybug biological control program has resulted in a cost-benefit ratio of 1 to 243, saving over 20 million lives and the livelihood of 200 million people in the African cassava belt, from Senegal to Mozambique.
- Co-Chair of the International Assessment of Agricultural Science and Technology for Development (IAASTD)
- President of the International Association for the Plant Protection Sciences (IAPPS) 1999 to 2007.
- President Biovision Foundation for Ecological Development, Switzerland (HRHerren's own Foundation)
- Member of the CGIAR Science Council
- Member Scientific Advisory Committee EPFL-Switzerland

Main Awards and Honors:

- Sir and Lady Rank Prize for Nutrition. Awarded 28 February 1991 by Mrs. M. Thatcher in London.
- Kilby Award for Extraordinary Contribution to Society through Science, Technology, Innovation, Invention, and Education. Dallas, May 1995.
- **World Food Prize** 1995, awarded in recognition for having advanced human development by improving the quality, quantity and availability of the world's food supply, October 1995.
- Member US National Academy of Sciences (1999)
- Brandenberger Preis (2002) for guiding contributions and improvement of the living standards of rural population in Africa through development of agricultural production methods in harmony with the environment.
- 2003 Doctor es Science Honoris Causa, Kenyatta University, Nairobi, Kenya
- 2004 Honorary Professor, Hubei University, Wuhan, PRC
- Tyler Prize (2003), The World Prize for Environmental Achievement. Awarded for outstanding contributions to the field of environmental health.
- Member Third World Academy of Sciences (2005).

The Threats of Climate Change on Undernutrition — A Neglected Issue That Requires Further Analysis And Urgent Actions

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Introduction

Maternal and child undernutrition is the underlying cause of 3.5 million deaths each year and 35% of the disease burden in children younger than 5 years (Black et al. 2008). The recent food and economic crises have magnified the challenge of undernutrition (Bloem et al. 2010) — more than one billion people now suffer from hunger (FAO 2009). These crises combine with the growing threat and negative impacts of climate change.

Climate change is happening now and it represents a major threat for the coming decades (Pachauri and Reisinger 2007). Newly emerging scientific evidence suggests that the pace and scale of climate change may now be outstripping even the most sobering predictions of the last report of the Intergovernmental Panel of Climate Change (IPCC) (UNEP 2009) (Allison et al. 2009). Climate change impacts both natural and human systems from the global to the local levels. From the scientific journals to humanitarian reports and grassroots testimonies, much has been written on the socioeconomic and humanitarian implications of climate change — yet it is only in the last few years that the “human face” of climate change has been fully acknowledged (Adapted from OCHA/WFP/IFRC 2009).

Amongst issues comprising this “human face”, undernutrition has not received the attention it merits, considering that determinants of undernutrition, which relate to food, health, sanitation, water and care practices, are directly affected by climate change. In addition, the nutrition sector is poorly linked to the emerging policies and practices in facing climate change. Unless urgent actions are taken, it will not be possible to ensure nutrition security under a changing climate, which poses an unprecedented challenge to the aim of reducing significantly and eradicating undernutrition.

This article highlights how climate change further exacerbates the already-huge problem of undernutrition and suggests orientations for the nutrition sector to face this additional challenge.

The impacts of climate change on undernutrition

A nutrition security conceptual framework

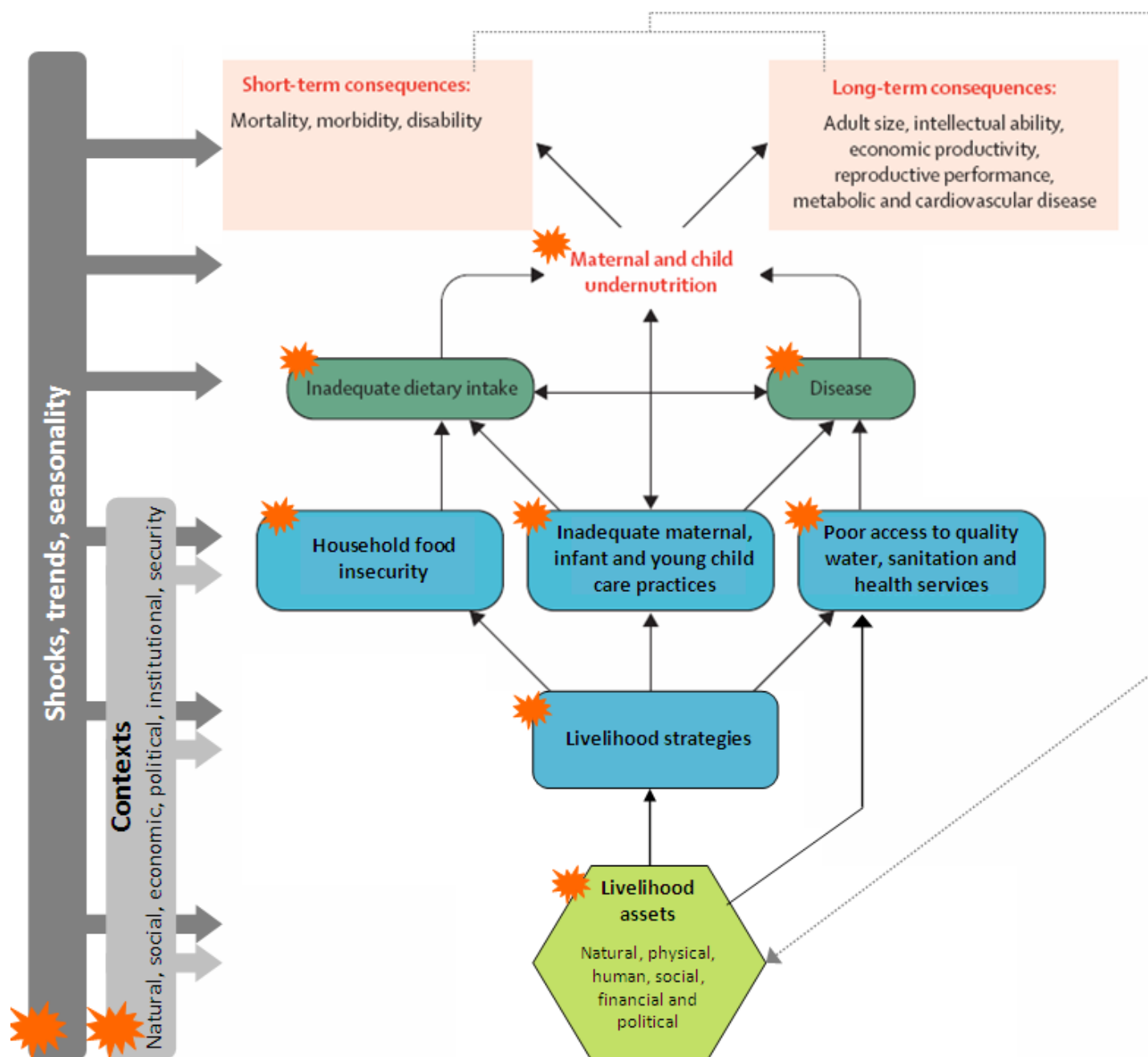
A nutrition security conceptual framework — presented in Figure 1 — is proposed in order to capture the multiple impacts and threats of climate change on undernutrition. This framework is based on three frameworks, respectively the framework presented in Black et al. (2008), the DFID livelihood framework (DFID 1999) and the WFP food and nutrition security framework (WFP 2009).


The framework is a causal analysis that considers the immediate, underlying and basic causes of undernutrition, and their interplay with livelihoods. A livelihood comprises capabilities including assets or capital (natural, physical, human, social, financial) and activities (referred to as livelihood strategies — e.g. cultivation, livestock-rearing, trade, remittances) used by a household for its means of living. A household's livelihood is secure when it can cope with and recover from shocks and stresses, and maintain or enhance its capabilities and productive asset base (based on Chambers and Conway 1992).

Inadequate dietary intake and disease are the immediate causes of undernutrition. Inadequate food consumption heightens vulnerability to infectious diseases, which, in turn, can prevent the body from absorbing adequate food. These immediate causes stem from underlying causes characterized by insufficient access to safe and appropriate food, inadequate maternal, infant and young child care practices, poor access to quality water, sanitation and health services. These underlying causes represent “negative livelihood outcomes”. The immediate and underlying causes make up the determinants of undernutrition.

Livelihoods and the determinants of undernutrition — analyzed at individual, household and community levels — are influenced by local, national, regional and/or global factors. The analysis of these factors focuses respectively (1) on the natural, social, economic, political, institutional and security contexts and (2) on the exposure to shocks and stresses (e.g. drought, food price crisis, negative trends, seasonality).

Figure 1 – Adapted framework on the causes of undernutrition



 = Impacts and/or threats of climate change

The documented impacts and threats of climate change on undernutrition are elaborated in the following section.

Climate change magnifies disaster risks, seasonal stresses and livelihood insecurity

Climate change is already changing the geographic distribution, frequency and intensity of **weather-related hazards** (or “shocks”) such as droughts, floods and storms, magnifying the risk of disasters globally (UNISDR 2008) (CARE/Mapplecroft/OCHA 2009). Climate change also affects disaster risk by increasing the vulnerability of communities to natural hazards (adapted from UNISDR 2008). Each year natural disasters affect the lives and livelihoods of more than 250 million people worldwide, and this number could rise up to 375 million a year by 2015 (Oxfam International 2009). Natural disasters lead to widespread death, injuries, disease, post-traumatic stress and destruction of livelihood assets. They induce or exacerbate insecurities, in terms of livelihoods, access to adequate food and clean water, and work against the gains made in humanitarian and development aid programs. The IPCC notes that undernutrition linked to extreme climatic events may be one of the most important consequences of climate change due to the very large number of people that may be

affected (Confalonieri et al. 2009).

Seasonality represents an important source of stress in the lives and livelihoods of poor rural communities (Devereux et al. 2008). Climate change magnifies these seasonal stresses; for example, rainfall is reported to be more erratic, shorter and more violent (Jennings and Magrath 2009). Smallholder farmers who depend upon rain-fed agriculture as their main livelihood strategy are dependent on the timing of rains and intra-seasonal rainfall patterns, which ultimately determine the success or failure of their crops (in sub-Saharan Africa, rain-fed agriculture covers 96% of all cultivated land (FAO 2007)). Changing seasonality induced by climate change can therefore lead to more livelihood insecurity, seasonal hunger and undernutrition.

Climate change induces or worsens negative trends in the **environment and natural resources** on which populations depend for their lives and livelihoods, including the loss of local biodiversity which provides essential food and medicine. For instance, climate change affects the coastal populations (at least 150 million people live within 1 metre of the high tide level, and 250 million live within 5 metres of the high tide (USAID 2009) in two slow-onset pathways. Firstly, rising sea levels induced by global climate change, amplify coastal erosion and the risk of storm surges in low-lying areas. Secondly, climate change, in synergy with other factors, affects the marine ecosystems and fish population, damaging fishing livelihoods that constitute important sources of food and income for coastal residents (Nicholls et al. 2007).

Increased exposure to natural disasters and seasonal and environmental stresses has profound effects on the socio-economic as well as the political and institutional context. It can force population groups to radically change their livelihoods and/or move to other regions (e.g. urbanization), thus leading to a re-composition of socio-economic and ethnic groups and the relationships between them. It can also create or exacerbate conflict between population groups for access to diminishing resources. These changes can put considerable stress on traditional and modern political institutions and social solidarity mechanisms. These factors directly or indirectly affect the determinants of undernutrition.

Climate change induces multiple risks on all determinants of undernutrition

Climate change undermines current efforts to end the suffering of over 1 billion **food insecure** people and will increase the risk of hunger and undernutrition by an unprecedented scale within the next decades (WFP et al. 2009). Climate change induces various types of stresses on livelihoods, resulting in less food being produced or less money to buy food. Significantly negative impacts of climate change on food security could occur as early as 2030 for several crops and regions, with the most severe effects projected for South Asia and Southern Africa (Lobell et al. 2008). The frequency and severity of production shortfalls are projected to increase due to climate change, thereby increasing food prices even further (DFID 2009).

According to the Lancet (Costello et al. 2009), climate change is the biggest global **health** threat of the 21st century, and is already contributing to the global burden of disease and premature death. Important future trends for human health include an increase in the number of people suffering from death, disease and injury from heatwaves, floods, storms, fires and droughts; changes in the range of infectious disease vectors; and an increase in the burden of diarrhoeal diseases (based on Confalonieri et al., 2007). Climate-related shocks can also have a severe impact on the mental health of those affected (Fritze et al. 2008).

Climate change will also put further strain on the already heavy workload of women (CIDA 2002). For instance, in the Sahel and in the Horn of Africa, men commonly migrate during periods of drought, leaving the women alone to look after their children, work in the fields, tend the herds and manage the home. This can compromise their ability to provide proper **care** to infants, heightening the risk of undernutrition.

Safe and reliable access to **clean water** and good sanitary conditions are essential for good nutrition. Water resources are predicted to be strongly impacted by climate change, with wide-ranging consequences for human societies and ecosystems (Bates et al. 2008). Hundreds of millions of people risk being exposed to a growing scarcity of water (Pachauri and Reisinger 2007). By 2025, 1.8 billion people will live in countries or regions suffering from a shortage of water (FAO 2007). Climate change-related alterations in rainfall, surface water availability and water quality will impact on the incidence of water-related diseases (Confalonieri et al. 2007) (also see the paper of [Lapeque](#) in this issue).

The poor have to face the growing impacts of climate change when their coping strategies are already strained

In the face of difficulties (e.g. a drought, less fish in fishing grounds), households resort to coping strategies – defined here as generally short-term strategies, motivated by a crisis and oriented towards survival – or adaptation strategies – defined here as strategies oriented towards longer-term livelihood security (adapted from Dazé 2009). Some coping or adaptation strategies are successful, in the sense that they do not (further) undermine the livelihood assets of household members, e.g. the diversification of livelihoods. However, some of

these strategies may directly or indirectly undermine the livelihoods and nutrition status of people with the reduction of dietary diversity, the sale of productive assets or the intensive and uncontrolled marketing of firewood and charcoal. Recent crises have already strained the coping strategies of the poor (FAO 2009), decreasing their capacity to withstand current and future food, economic and climate crises and to adapt to climate change. As a consequence, already-vulnerable populations worldwide find themselves fast-tracked along the downward spiral of livelihood insecurity and undernutrition (adapted from Bloem et al. 2010).

What is the extent of the problem?

Quantifying the problem remains a complex exercise, because of the cross-sectoral nature of undernutrition, and only a few studies have attempted this. The International Food Policy Research Institute (IFPRI) has assessed climate change effects on food security and human well-being using two indicators: per capita calorie consumption and child malnutrition numbers, stating that: *by 2050, the decline in calorie availability will increase child malnutrition by 20 % relative to a world with no climate change. Climate change will eliminate much of the improvement in child malnourishment levels that would occur with no climate change* (Nelson et al. 2009). Given the multiple causes of malnutrition, this figure represents a conservative estimate, and thus, a 20 % increase in child malnutrition may be reached much more rapidly, or in other terms, the expected increase in malnutrition in 2050 could be much more considerable (also see the paper of [Butler](#) in this issue).

The links between the nutrition sector and the climate change agenda

Climate change is expected to increasingly re-shape humanitarian and development programming, becoming a transversal challenge to be considered in all analysis and policy development. This section presents an overview of the links between important climate change-related initiatives and the nutrition sector.

Climate change research and undernutrition

Although the links between climate change and undernutrition have been increasingly examined recently, most analyses consider isolated pathways such as those of food insecurity, health or water. Undernutrition is poorly considered in the Fourth Assessment Reports (AR4) of the IPCC. However, the Fifth Assessment Reports (AR5), in the early stages of preparation and due in 2013/2014, represents an opportunity to highlight undernutrition.

The following undernutrition issues require further and urgent attention (based on SCN 2009):

- comprehensive analyses of the multiple climate change-related threats to nutrition;
- setting up and/ or strengthening nutrition early warning and surveillance systems, integrating (further) the climate dimension;
- identifying, validating and budgeting the set of interventions required to protect nutrition from climate-related risks; and
- capitalizing on lessons learnt on the ground.

International climate change-related policies and undernutrition

The United Nations Framework Convention on Climate Change (UNFCCC) manages an intergovernmental framework tackling the challenge posed by climate change. The Fifteenth Conferences of the Parties (COP15), which took place in Copenhagen in December 2009, represented the latest important step of the UNFCCC, whose objective was to establish an ambitious global climate agreement. The negotiations in the frame of the UNFCCC focused on:

- climate change mitigation (the reduction of greenhouse gas concentrations in the atmosphere);
- climate change adaptation (the efforts to assist developing countries to adapt to climate change); and
- the provision of financial resources, technology development and transfer, and capacity-building.

Given that these initiatives relate directly or indirectly to nutrition, the UN Standing Committee of Nutrition (SCN) released an important statement in time for Copenhagen, addressing the implications of climate change on undernutrition (based on SCN 2009).

The outcomes of COP15 are of concern for the nutrition sector but also more globally for the humanitarian and development communities:

- two weeks of intense negotiations at the COP15 led to the Copenhagen "Accord", an unambitious and vague agreement that is not legally binding. Further attempts to reach a real agreement will be fostered throughout 2010, culminating with the Sixteenth Conferences of the Parties (COP16) in Mexico in late 2010.
- the concerns highlighted in the SCN statement (related to climate change mitigation, adaptation and

finances) remain pertinent and urgent to address.

- some climate change-related funding mechanisms – which were originally envisaged as being additional to the Official Development Assistance (ODA) – are recycled from the ODA funds. This might exacerbate the current lack of funds dedicated to addressing the Millennium Development Goals (MDGs), and more specifically, to the already grossly under-financed food security and nutrition sectors.
- the nutrition sector was poorly represented in the frame of the UNFCCC processes, and more specifically, in the frame of the recent COP15.

Climate change adaptation, disaster risk reduction and undernutrition

Climate change adaptation (CCA) and disaster risk reduction (DRR) have been progressively mainstreamed into the humanitarian and development agendas for the past few years, in response to climate change and the increasing risks of disasters. According to the UNFCCC, climate change adaptation is *the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities*. According to the UNISDR (2009), *disaster risk reduction is the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events*. While their scope and specific interests may differ, CCA and DRR have very similar aims in terms of seeking to build resilience in the face of shocks and stresses in the broader objective of sustainable development (adapted from Venton and La Trobe 2008).

The prevention of undernutrition is highly amenable to the policies and practices of DRR and CCA. However, insufficient effort has been made so far by the humanitarian and nutrition communities to consider how these approaches can be integrated and mainstreamed into nutrition programming. A greater exchange between the nutrition sector with those working with DRR and CCA would be synergetic for addressing the future challenges of hunger and undernutrition.

Conclusion and recommendations

Hundreds of millions of people are currently at a degree of risk from the impact of global climate change. This number is likely to increase in the future, not only because of the increasing risk and multiple threats of climate impacts, but also due to the largest consequences and negative impact on livelihood and nutrition security. Climate change amplifies the risk of undernutrition, given that disaster risk, seasonal stresses and livelihood insecurity will be magnified. Climate change is a major threat to all determinants of undernutrition, at a time when coping strategies of poor people are already strained.

Despite the growing threat and incidence of climate change, too little has been done so far in reducing, and adapting to, the impacts of climate change on nutrition and increasing the resilience of poor communities and households to climate change. The nutrition sector remains largely disconnected from key climate change issues and initiatives.

The international community and nutrition stakeholders have recently shown their capacity to mobilize following the recent food and economic crises, and have demonstrated innovation and commitment to address undernutrition, e.g. through the expansion of community-based food security and livelihoods interventions, the development of safety nets (cash and vouchers programmes) and the introduction of Ready-to-Use Therapeutic Food (RUTF) and Community-based Management of Acute Malnutrition (CMAM).

Humanitarian and nutrition policy-makers and practitioners should:

“Do more of the same, and better”:

1. Scale-up coverage of and increase access to interventions to treat acute malnutrition, especially at community level and where possible mainstreamed through existing national healthcare systems.
2. Develop comprehensive and multi-sector programming to face climate change – building upon DRR and CCA approaches – and expand nutrition interventions which successfully and sustainably address the immediate and underlying causes of undernutrition and develop populations’ resilience to the growing impacts of climate change, e.g. small-scale agricultural development, income generation, water and sanitation, nutrition education and hunger safety nets.
3. Mainstream the climate dimension into existing initiatives and nutrition programs dealing with undernutrition, particularly those developed in response to the food and economic crises.
4. Promote good environmental practices in nutrition interventions and humanitarian responses, (fuel-efficient cooking, effective water management, etc.).

Nutrition researchers, experts and IPCC stakeholders should:

1. Build further evidence on the links between climate and undernutrition, on projected effects and on threats that specific climate change mitigation actions pose on nutrition, along with a knowledge base to inform future programming on climate change and nutrition.
2. Ensure the inclusion of nutrition specialists in the process of knowledge-building and the peer review of the IPCC Fifth Assessment Report.

Negotiators and observers involved in UNFCCC-related processes and in COP16 should:

1. Ensure that future agreements on climate change adaptation in the frame of UNFCCC aim at protecting and promoting food and nutritional security, prioritizing actions for the most vulnerable livelihoods groups, households and individuals (particularly nursing and pregnant women, infants and young children) and providing immediate, sufficient and additional ODA funding.
2. Ensure that adaptation and climate change mitigation are equal priorities, and that climate change mitigation actions will not undermine the ability of poor people to feed themselves, to provide adequate care and access adequate public health and safe water.

Multilateral and bilateral donors, the private sector, foundations and charities should:

1. Provide the humanitarian and nutrition sectors with long-term funding to scale up nutrition interventions that successfully address the growing impacts of and threats from climate change.
2. Provide researchers with adequate funding to build further evidence on the links between climate and undernutrition and the required response.
3. Provide sufficient and additional financial resources to support climate change adaptation.

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Call for CVs REACH Roster of Facilitators

The REACH partnership is establishing a roster of CVs of qualified facilitators to support institutional capacity building for improved nutrition and food security governance, strategic planning and analysis, coordination, and monitoring.

Facilitators will be deployed to countries in Africa and Asia for a period of 12-24 months to work in close collaboration with national counterparts and a multi-stakeholder team representing technical staff from relevant ministries, UN agencies, NGOs, and donors. The facilitator must have strong skills in process and organizational change management, multi-stakeholder coordination and conflict resolution or mediation to complement the technical competencies of partners.

For information about the REACH partnership, a detailed job description and application instructions, please visit the REACH website at www.reach-partnership.org

Climate Change Impacts on Food Security and Nutrition

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Introduction

Food security exists when all people in a community or other spatial unit, at all times, have physical and economic access to safe and nutritious food (and food preferences) that is sufficient to meet their dietary needs for an active and healthy life, and is obtained in a socially acceptable and ecologically sustainable manner (WFS 1996). Climate change can affect food security because of the dependence of food systems on the mean and variability of weather. Understanding the potential implications of climate change for food systems requires evaluation of a complex set of climate, environmental, and socioeconomic factors. The interaction of these factors determines the degree to which families, communities, and nations are food secure. We briefly summarize some of the key ways in which climate change could affect food security.

Current burden of food insecurity

The four dimensions of food security are food availability (i.e. production and trade), stability of food supplies, access to food, and food utilization. Food security is often used interchangeably with malnutrition. However, malnutrition indicates various forms of undernutrition that are caused by many factors, including dietary inadequacy, infections, and socio-cultural factors. Undernutrition includes stunting, wasting, and deficiencies of essential vitamins and minerals, as well as obesity or over-consumption of specific nutrients. The worldwide prevalence of undernourishment is 14% (FAO 2006). The prevalence is <2.5% in industrialized countries, 7% in economies in transition, and 17% in developing countries. The prevalence is 16% in Asia and the Pacific (including 22% in South Asia), 10% in Latin America and the Caribbean (including 20% in Central America and 21% in the Caribbean), and 32% in Sub-Saharan Africa (including 56% in Central Africa, and 39% in East and Southern Africa).

Fishman et al. (2004) calculated the impacts of childhood (0-4 years) and maternal undernutrition, as measured by underweight status. Undernutrition in childhood causes nearly 3.6 million deaths, including some of the deaths due to diarrhoea, pneumonia, measles, and malaria. There are an additional 148 400 low birth-weight neonatal deaths associated with low maternal pregnancy weight. These deaths are associated with over 126 million DALYs (Disability Adjusted Life Years lost), with an additional 879 900 DALYs lost due to increased morbidity from undernutrition associated pneumonia, diarrhoea, and malaria. In total, maternal and child undernutrition is the underlying cause of 35% of the annual disease burden in children younger than five years and 11% of DALYs.

Need for increased food production

On the following page, figure 1 shows total agricultural output from 1970-2004, with increasing trends in all regions except Sub-Saharan Africa. Figure 2 summarizes the major impacts of climate change on crop and livestock yields, and forestry production by 2050.

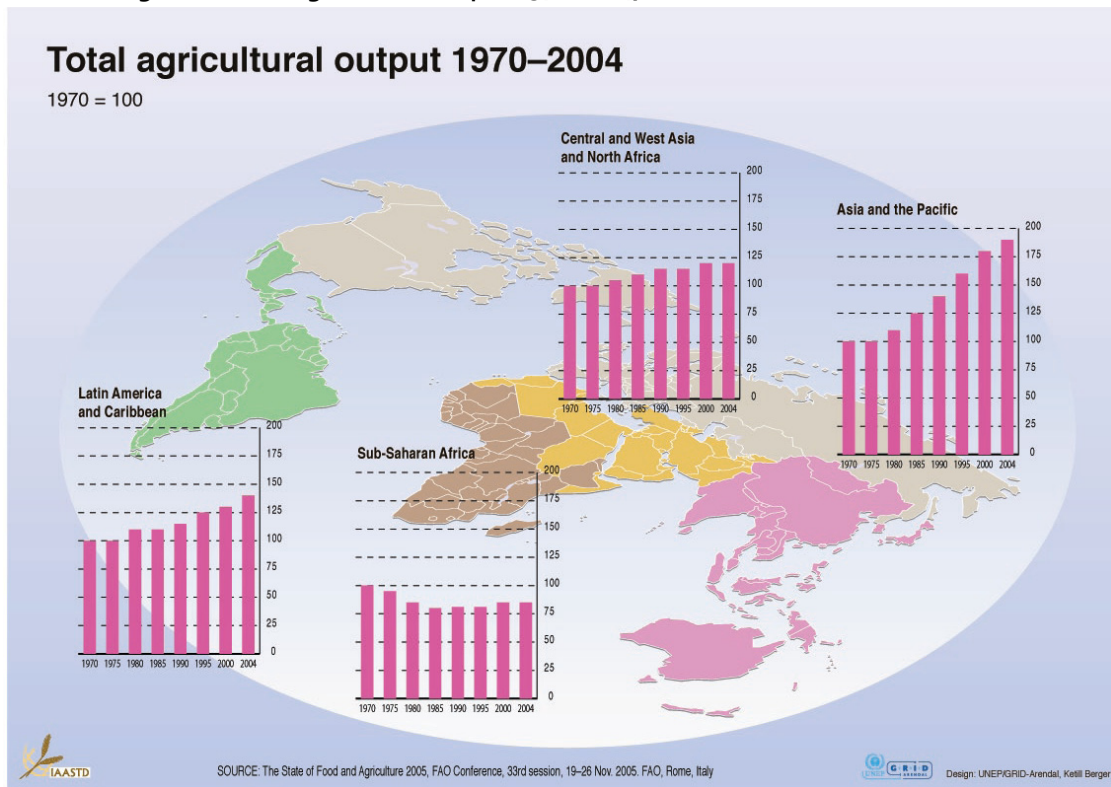
Projections suggest that future population and economic growth will require a doubling of current food production, including an increase from two to four billion tons of grain annually (Easterling et al. 2007). Part of this demand growth reflects a continued shift in global food consumption patterns from crop-based to livestock-based diets. This will put additional pressures on grain production for achieving food security, as illustrated by the calculation that the global food supply in 1993 was adequate to feed 112% of the world population on a near vegetarian diet, 74% on a diet that included 15% animal foods, and 56% on a diet in which 25% of calories were derived from animal products (IAASTD 2008).

Some of the needed increase in grain production will be achieved through land expansion, primarily in sub-Saharan Africa and Latin America, but much of it is expected to come from increases in grain yields (IAASTD 2008).

Sensitivity of food systems to weather and climate

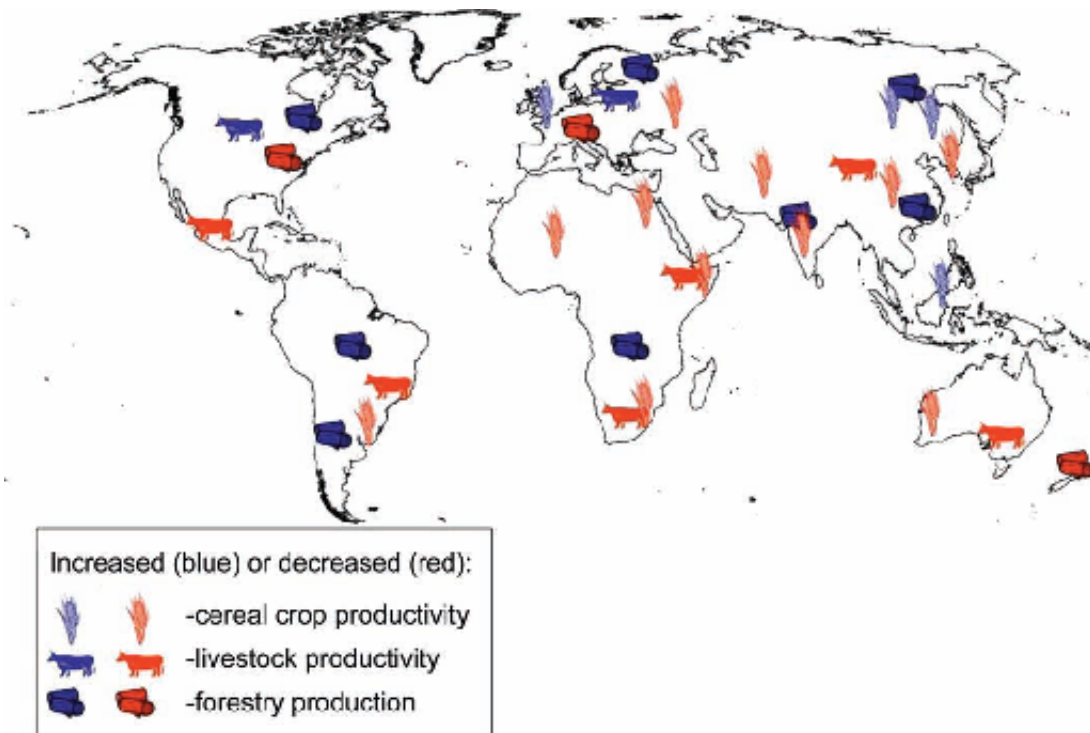
Crop yields depend greatly on weather conditions even in the most highly mechanized systems. Both crop growth and developmental processes are temperature related, and show temperature and precipitation threshold responses that can significantly affect yields (Easterling et al. 2007; IAASTD 2008). Higher temperatures can shorten the period of crop growth, speed loss of water from soil, and directly damage plant cells, all of which tend to reduce yields. With sufficient water and nitrogen, and appropriate weather conditions, additional carbon dioxide (CO₂) can increase plant growth (so-called CO₂ fertilization). Higher CO₂ concentrations also improve the water use efficiency of most crops, which would be beneficial in semi-arid regions.

Figure 1: Total agricultural output 1970-2004; Source: IAASTD 2008



Source: IAASTD 2008

Figure 2: Major impacts of climate change on crop and livestock yields, and forestry production by 2050. Source: Easterling et al. 2007; Source: Easterling et al. 2007



Source: Easterling et al. 2007

C3 crops (including rice, wheat, and soybean) are much more sensitive to CO₂ fertilization than C4 crops (including maize, sugarcane, and sorghum), which routinely show no response to elevated CO₂. The magnitude of CO₂ fertilization will likely be enough to counteract the effects of roughly 2 °C warming on global food supply. Warming beyond 2 °C will require major advances in agricultural technologies, non-farm incomes, and/or social safety nets to avoid pushing tens of millions of people into chronic undernutrition (Easterling et al. 2007).

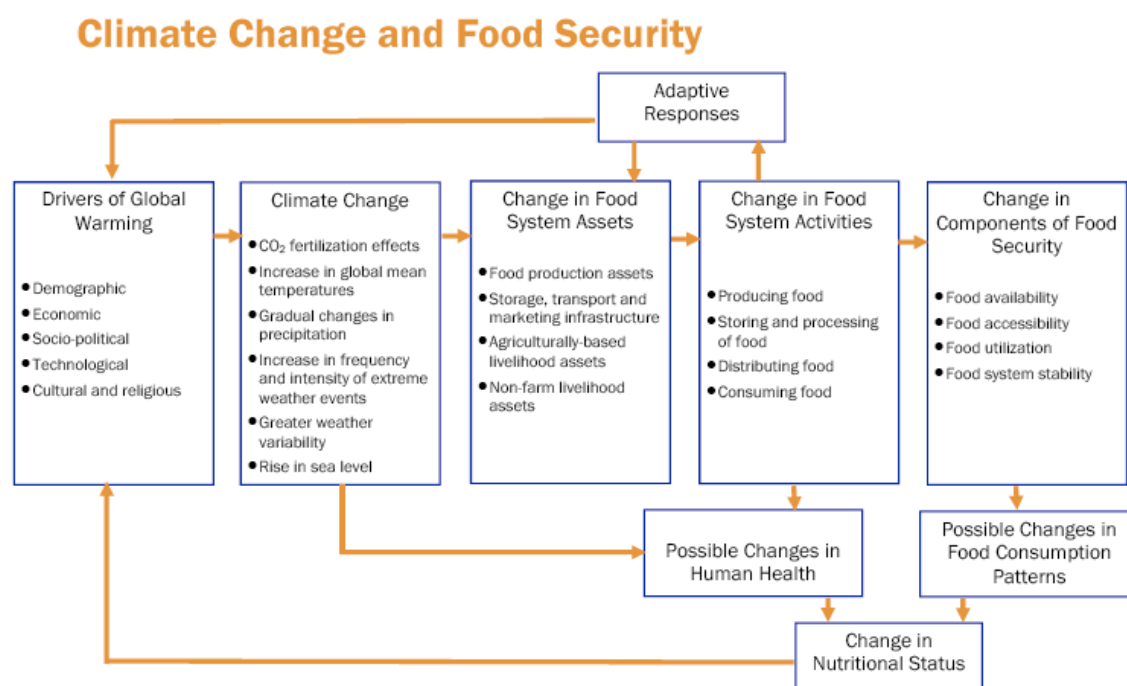
Beyond the primary effects of higher temperatures and CO₂, food production processes and patterns could be affected through:

- Increases in the frequency, intensity, and length of heatwaves;
- Changes in the timing, location, and amounts of rain and snow, and increases in the frequency, intensity, and length of dry spells and droughts;
- Changes in the frequency and intensity of extreme weather events, including storm surges, windstorms, and floods;
- Increasing weather variability;
- Earlier starts to the growing season; and
- Sea level rise, with saltwater intrusions (Easterling et al. 2007).

In addition to effects on food quantity, climate change could alter the nutritional quality of major grains. Recent studies suggest that protein and micronutrient levels are reduced when crops are grown at higher CO₂ concentrations, although the severity of these effects and the potential to ameliorate them with management changes are unclear (also see Burns 2010 in this edition on page 49)

A critical issue will be water availability. Uneven spatial and temporal distribution of fresh water means that only 15% of the world population currently lives with relative water abundance, with the majority experiencing moderate to severe water stress (Kundzewicz et al. 2007). Overall, the negative impacts of climate change on freshwater systems are projected to outweigh its benefits in all regions, with consequences for water availability for crop production.

Figure 3: Climate change and food security; Source: FAO (2007)



Source: FAO (2007)

Projected impacts of climate change on food security

Climate-driven changes in food production processes and patterns could affect food security through impacts on the local and global food supply, and through impacts on livelihoods and access to food (FAO 2007) (Figure 3). Trends of importance when assessing the risks of climate change on food security include declining population growth, increasing urbanization, and fewer people dependent on agriculture.

Food Availability

Climate change impacts on food production will be mixed and vary regionally (Easterling et al. 2007). Globally, the potential for food production is projected to increase with increases of 1 to 3°C in local average temperature, and is projected to decrease above this temperature range. However, there is a significant chance that even 1°C of warming could reduce global average yields, and there is virtual certainty that even with limited global effects there will be damages in selected tropical low-income countries with poor land and water resources (e.g. Hitz and Smith 2004, Fischer et al. 2005, Parry et al. 2005). Changes in the patterns of extreme events, such as increased frequency and intensity of droughts and flooding, will affect the stability of, as well as access to, food supplies. Food insecurity and loss of livelihood can be further exacerbated by the loss of cultivated land and nursery areas for fisheries through inundation and coastal erosion in low-lying areas.

By the 2020s, smallholder farming in low latitudes, especially in East and South Africa, are projected to experience a decline in maize yields, an increased risk of crop failure, and high livestock mortality (Easterling et al. 2007). In South Asia, higher temperatures will decrease crop yields, and early snowmelt is projected to cause spring flooding and potential irrigation shortage (Easterling et al. 2007). Projected impacts increase with increasing temperatures.

Among the challenges in anticipating effects of climate change on food security are uncertainties in how climate will change and how crops will respond to these changes. Results from Lobell et al. (2008) highlight the uncertainties in projecting changes in crop yields. Statistical crop models were developed for 94 crop-region combinations; in only 43 combinations could the model explain more than 14% of the variance in yield or production. Few models were significant in East, Central, and West Africa, where 17.8% of the world's malnourished population lives, perhaps because of poorer data quality. The authors then prioritized the crops into those were more important, important, or less important based on a hunger importance ranking. There were noticeable differences when prioritizing crops based on "most-likely" versus "worst-case" scenarios, highlighting the importance of using multiple models to understand the possible range of changes in crop yields under future scenarios.

Global fisheries are a significant food source for millions of people. Climate change could adversely impact both capture fisheries and aquaculture, but there is low confidence in projections of those impacts because of uncertainties over both future aquatic net primary production and consumption patterns (Brander 2007).

Stability of food supplies

Increasing variability in global and regional weather conditions, including increases in the frequency, intensity, and length of extreme weather events, can adversely affect the stability of crop yields and local food supplies. A gradually warming planet will mean increasing exposure to temperatures that historically were considered extreme, and to which current crops may not be easily adapted (Easterling et al. 2007). Less clear is whether the climate will become more variable in key growing regions, which could have important effects on the stability of food prices.

Access to food

In low-income countries, average expenditure on food, beverages, and tobacco represents 56% of household spending, compared with 35% in middle-income and 17% in high-income countries, suggesting that any increase in the price of food would adversely affect those with the least resilience (IAASTD 2008). Projections of the impacts of climate change on agricultural gross domestic products and prices suggest that the strongest impact will be on sub-Saharan Africa, which means that the poorest and most food insecure region is expected to suffer the largest contraction of agricultural incomes (Schmidhuber and Tubiello 2007). Particularly vulnerable will be urban poor and rural landholders whose income levels do not benefit from higher food prices, as is the case for poor farmers.

Food Utilization

Climate change may affect food utilization by altering the conditions for food safety and changing the geographic range and incidence of infectious diseases (Confalonieri et al. 2007). For example, populations in water-scarce regions are likely to face decreased water availability, particularly in the sub-tropics, with implications for food processing and consumption. In coastal areas, the risk of flooding of human settlements may

increase, from both sea level rise and increased heavy precipitation (Easterling et al. 2007). This is likely to result in an increase in the number of people exposed to vector-borne and water-borne diseases, reducing their ability to utilize food effectively (also see Lapegue 2010 in this edition on page 36).

This increases the risk of undernutrition that, in turn, makes populations more vulnerable to infectious diseases. The net result can be a decline in labour productivity and an increase in poverty and mortality (Schmidhuber and Tubiello 2007).

Projections of the impacts of climate change-related alterations in food security and undernutrition

A number of studies projected the impacts of climate change on food security at regional and global scales (Fischer et al. 2002, Fischer et al. 2005, Parry et al. 2004, Parry et al. 2005, McMichael et al. 2004, Tubiello and Fischer 2006). The main limitation of these projections is that they focused on the impacts of climate change mainly on food availability; they do not cover potential changes in the stability of food supplies, incomes, or the other dimensions of food security that could be affected by climate and/or socioeconomic variability (Easterling et al. 2007). Projections are based on a limited number of crop models and only one economic model that lacks sufficient evaluation against observations (Easterling et al. 2007).

In addition to quantitative models, one can look at expert assessments of future food security, which are generally pessimistic over the medium term (Confalonieri et al. 2007). There are indications that it will take approximately 35 additional years to reach the World Food Summit 2002 target of reducing world hunger by half by 2015 (Rosegrant and Cline 2003, UN Millennium Project 2005). Child malnutrition is projected to persist in regions of low-income countries, although the total global burden is expected to decline without considering the impacts of climate change. Attribution of current and future climate-change-related malnutrition burdens is problematic because of the complex determinants of malnutrition.

Despite limitations and uncertainties, a number of fairly robust findings emerge from studies projecting the impacts of climate change on food security. Climate change is likely to increase the number of people at risk of hunger compared with reference scenarios with no climate change, with impacts strongly dependent on projected socioeconomic developments. For example, using projections from several climate models, Fischer et al. (2002, 2005) estimated that climate change will increase the number of undernourished people in 2080 by 5-26%, relative to no climate change, or by between 5-10 million under a moderate emissions scenario and 120-170 million people under a higher emission scenario.

The magnitude of these climate impacts will be small compared with the impacts of socioeconomic development (Easterling et al. 2007).

Studies suggest the economic growth and slowing population growth projected for the 21st century will, globally, significantly reduce the number of people at risk of hunger in 2080 from current levels. Compared with FAO estimates of 820 million undernourished in developing countries today, Fischer et al. (2002, 2005) and Parry et al. (2004, 2005) estimated reductions of more than 75% by 2080, or by about 560-700 million people, thus projecting a global total of 100-240 million undernourished by 2080 under three emissions scenarios. By contrast, under another scenario, the number of the hungry may decrease only slightly, because of larger population projections (Fischer et al. 2002, 2005; Parry et al. 2004, 2005; Tubiello and Fischer 2006).

Sub-Saharan Africa is likely to surpass Asia as the most food-insecure region, mostly as a result of projected socioeconomic development (Easterling et al. 2007). By 2080, sub-Saharan Africa may account for 40-50% of all undernourished people, compared with about 24% today (Fischer et al. 2002, 2005; Parry et al. 2004, 2005); some estimates are as high as 70-75% under assumptions of slower economic growth (Fischer et al. 2002, Parry et al. 2004, Tubiello and Fischer 2006).

Funk et al. (2008) projected the number of malnourished people in eastern and southern Africa based on three scenarios. In one, recent precipitation and agricultural capacity trends were assumed to persist through 2030, resulting in a 53% increase in the number of malnourished people between 2000 and 2030. In another that considered only the impacts of agricultural capacity trends, undernourishment increases by 23%. The third combined observed rainfall decline with an increase in per-capita agricultural capacity of 2 kg/person per year (equal to a 2% per capita growth rate), and projects that undernourishment declines by 38%.

Global burden of disease study

McMichael et al. (2004) projected global estimates of current and possible future population health burdens attributable to climate change in the years 2000 and 2030. The projected excess deaths from malnutrition due to climate change in the year 2000 were approximately 77 000, with the largest impacts in Southeast Asia and Sub-Saharan Africa. In 2030, the prevalence of malnutrition is projected to increase about 10%, with large variations across regions. The largest increase in malnutrition is projected to occur in the parts of Southeast Asia where malnutrition is currently severe.

Discussion

The impacts of climate change on agriculture in a particular region could be positive or negative, requiring regional assessments of the possible extent, magnitude, and timing of impacts. CO₂ fertilization, increased precipitation, and higher temperatures could lengthen the growing season and improve crop yields in some regions. Elsewhere, impacts will be negative with higher temperatures and more erratic precipitation. In summary:

- Higher temperatures result in lower yields for most crops in most regions. Although there is the potential to adjust crop varieties to high temperatures, this is often a slow and only partially effective strategy.
- Higher CO₂ will increase yields for crops like wheat and rice, but much less for maize. Nutritional quality of crops could be negatively affected by higher CO₂ concentrations, although these effects are less clear.
- Even if global production is not affected in the short term, local shortfalls in tropical regions could have serious implications for food security, especially if incomes are affected at the same time that food prices rise.

The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD 2008) identified key approaches for increasing food security, with no one approach likely to be sufficient. Seeking a diversity of possible actions based, in part, on the history and context of a country or region, would likely be most effective.

- Increase flexibility in national agricultural and trade policy and technology choices to strengthen the domestic small-scale farm sector.
- Adequate remuneration and a minimum level of price stability in the small-scale sector in developing countries.
- Support the collective efforts of farmer organizations to achieve more equal access to and distribution of the benefits of trade.
- Strengthen regionally managed reserves of emergency food stocks.
- Improve tenure and access to resources, credit, and insurance for small-scale producers.
- Address market concentrations, especially in grain markets, at the global level.
- Increase public investment in agriculture (market roads, agricultural knowledge for science and technology, research and development, extension, marketing information and services, postharvest facilities, support for cooperative marketing, etc.) in food insecure developing countries.
- Mobilize the capacities of supermarkets and other public and private actors along value adding chains to offer consumers affordable, safe, healthy, and fair-trade foodstuffs.
- Promote the diversification of production systems through inclusion of locally important species/crops to develop a wide range of marketable natural products that can generate income for the rural and urban poor in the tropics and provide ecosystem services, such as soil and water conservation.
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Climate change, crop yields, and the future

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Introduction

There is growing realization of the immense challenge of feeding the growing human population this century (FAO 2009, Beddington 2010, Godfray et al. 2010). Among the many reasons for this is concern that climate change will affect agricultural productivity, livelihoods, and development prospects (Bloem et al. 2010). In January 2008, the head of the World Food Programme commented “we could now be facing a perfect storm of challenges, including climate change and increasingly severe droughts and floods, soaring food prices and the tightest supplies in recent history” (Sheeran 2008). However, even more environmental and social problems are emerging. These will inevitably interact with climate change. Without extraordinary social and technological improvements, including a Green Revolution for Africa (Ejeta 2010) global nutrition and health appear likely to be inevitable casualties of the future.

Central to these developing problems is a re-awakening of concern about a crucial and disconcerting prospect: limits to growth (Meadows et al. 1972, Turner 2008, Hall and Day 2009, Leder and Shapiro 2009, Butler 2009a, 2009b). This debate is most obviously manifested by the rising price of energy. The likelihood of approaching “peak oil” has recently been given added credibility by a paper co-written by David King, recent Chief Scientific Adviser to the UK Government (Owen et al. in press). Also uncomfortably near are “peak phosphorus” (Cordell et al. 2009) and projected shortages of fifteen elements known collectively as rare Earths, essential for a growing number of electronic devices (Stone, 2009). These scarcities are accelerated by a still growing human population, mainly in the low-income countries. Perversely, the poorest populations in low-income countries contribute little on a per-capita basis to resource demand, yet their limited human and institutional resources make them particularly vulnerable to global stresses. These populations also need to be fed; many are likely to receive even more inadequate nutrition in future. In turn, via several causal pathways, this is likely to increase the risk of insurgency and political instability, outcomes understood, predicted and feared since the birth of the Food and Agricultural Organization of the United Nations (FAO). Concurrently, there is a slowly growing awareness of the dependency of modern agriculture upon cheap and abundant energy, vital for transport, for the manufacture of nitrogenous fertilizer and pesticides (White and Grossman 2010).

At the time that Sheeran warned of a perfect storm, the price of energy, fertilizer and food was rising sharply (von Braun 2008, Piesse and Thirtle 2009) but the global financial crisis had not yet started. As that crisis strengthened, it forced another 100 million into undernourishment, leading to an estimated 1.02 billion in this state by early 2010 (FAO 2009). This catastrophe makes achievement of the Millennium Development Goal on Hunger and the even more ambitious World Food Summit target, set in 1996, seem unachievable (Butler 2009a, FAO 2009), a failure so severe that it is likely to undermine credibility in internationally set targets.

How might climate change impact on food security?

The impact of climate change on food security has been modeled for at least two decades (Adams et al. 1990). Consistent over this period has been the prediction that climate change will bring benefits and harms to agriculture and food security, especially in the short to medium term (e.g. to 2100). Models beyond 2100 are rare, if they exist at all. If they do, the intrusion of sea level rise, likely by then to be at least a metre (Hansen 2007, Allison et al. 2009) on densely populated fertile land, combined with extreme weather effects, would seem likely to result in overwhelmingly negative effects.

Over a shorter period, warmer weather is predicted to allow expansion of croplands to sparsely populated regions of Canada, Scandinavia and Russia, where crops are currently limited due to short growing seasons (Rosenzweig and Parry 1994; Parry et al. 1999, Easterling et al, 2007). At the best case, such new areas for cultivation will compensate for areas which are forecast to decline in productivity, such as many parts of the tropics (Fischer et al. 2001). Farming innovation and adaptations (for example earlier planting) will also reduce the negative impact, particularly in mid and higher latitudes (Cassman et al, in press). However, even if warmer temperatures expand agricultural zones poleward, much of the soil then subject to agriculture is likely to be acidic or in other ways sub-fertile, requiring large fossil-fuel intensive investments, including of fertilizer. It thus does not follow that increased crop production from high latitudes will easily compensate for the

forecast reduction in crops in tropical regions. This task is made even harder by the possibility of increased rural impoverishment in densely populated South Asia, where many agro-climatic models forecast cereal declines by 2080, some by as much as 22% (Tubiello and Fischer 2007). Few if any models forecast improvement there.

Most obviously, climate change will affect agricultural production by altering temperature and precipitation patterns (Zhang et al. 2007, Schmidhuber and Tubiello 2007). Climate change has long been predicted to alter the intensity and distribution of rainfall (Milly et al. 2002). Recent evidence suggests that the rainfall models are conservative. That is, the changes in rainfall intensity may exceed the models' predictions (Allan and Soden 2008). Limited observational data also suggest that moist regions are becoming wetter and dry regions drier (Allan and Soden 2008). Anecdotal evidence from 2009 is consistent with this sobering finding, including from the slow moving Taiwanese typhoon Morakot and the twin typhoons, Ketsarna and Parma, which soon after displaced over 400,000 people in the northern Philippines. Only a few weeks later, a severe drought in the Indian states of Karnataka and Andhra Pradesh was broken by rains, judged as the greatest in a century. At least one million people became temporarily homeless.

Unfortunately, however, the paucity of high quality agricultural, health and meteorological data in these low-income areas make the attribution and measurement of adverse agricultural effects due to climate change extremely difficult. On the other hand, such patterns are consistent with climate change predictions, and undoubtedly cause local adverse effects to food supplies and food security, especially for the poor.

Changes in average rainfall may poorly reflect growing conditions; for example increased rainfall intensity combined with longer dry spells could maintain average rainfall, yet be unfavorable for agriculture, especially for crops (Rosenzweig et al. 2002). Altered precipitation patterns are also likely to lead to increased agricultural variability, reducing livelihood security for landless agricultural laborers, and thus worsening food security. Such vulnerable populations face a double jeopardy – less income in conditions of tightened food supply at increased prices (Schmidhuber and Tubiello 2007).

Carbon fertilization

The carbon fertilization effect (CFE) refers to evidence and theory that because carbon dioxide (CO₂) is essential for photosynthesis, increased levels of this key greenhouse gas will partially offset harm to crop growth due to other climate change consequences. While there is consensus that the CFE exists, doubts persist concerning its strength and importance, especially for C4 plants such as maize, sorghum and sugar cane, where the effect may only occur during drought (Leakey et al. 2008). This controversy arises because of a discrepancy in the earlier, enclosed studies and the more recent open air studies, called Free Air Carbon Enrichment (FACE) (Long 2006; Tubiello et al. 2007). This debate remains unsettled, and unsettling. However, it is possible that there may be systematic differences in the genetic structure of the crops used in the newer studies, for example there may be less down regulation in the presence of increased CO₂ in the older plants. Were this the case, then both sets of observations could be correct, but if so, there may still be a risk that dominant modern strains of plants might be less able to take advantage of higher CO₂. Lower amounts of soil nitrogen, due to higher energy prices and hence more expensive fertilizer, might also impede the full benefit of the CFE.

Increased CO₂ may even cause harm for some crops, including cassava, a staple food today for about 750 million people, most of whom are poor (see more on this in the Burns paper in this issue). Increased CO₂ may also favor some important insect pests (Zavala et al. 2008).

Other agricultural impacts of climate change

The likely effect of climate change upon crops, livestock and fisheries is more complicated than the average temperature during the growing season or the winter, important for pest control and some perennial crops, such as stone fruits. Apart from changes in rainfall intensity, frequency and reliability, also to be considered are altered patterns of winds, hailstorms, forest fires, and other extreme weather events, such as cyclones and hurricanes. Sea level rise is already harming food production in some low-lying islands (Keim 2010), while warmer temperatures are reducing nutrient mixing and fishery productivity in Lake Tanganyika (Tierney et al. 2010). Despite warming, the pattern and even frequency of frosts may change, for example by reduced seasonal rainfall and cloudiness. Indeed, increased frosts have been reported in autumn in parts of southern Australia (due to reduced rainfall and clearer skies at that time), though probably not at a time when crops are vulnerable (Murphy and Timbal 2008).

Large-scale risks, such as weakening in the Indian monsoon (Zickfeld et al. 2005), intensification of the El Niño Southern Oscillation or of other ocean currents and atmospheric oscillations may also occur. Tropospheric ozone is not only an important greenhouse gas, but is also increasingly recognized as having a substantial adverse effects on both current and future crop growth, (Ashmore et al. 2006). It too is currently excluded from agro-climate models.

Other likely effects of climate change upon agriculture include altered crop and animal diseases, such as the expansion of the midge transmitted viral disease, blue tongue, a growing problem for livestock in Europe (Purse et al. 2005). Milder winters are predicted to expand the range of some important pests, such as the corn earworm (Diffenbaugh et al. 2008). The Vietnamese Minister of Agriculture recently warned of increasing plant diseases, a warm winter (harmful to seedlings) and drought, all factors likely to reduce the 2010 rice harvest in the Red River Delta, one of Vietnam's main food bowls (ProMed 2010). It is plausible this is contributed to by climate change.

Ideally, models which try to forecast the effect of climate change on agriculture should consider the soil characteristics of areas which may in future be climatically suitable for crops. Complex effects from climate change upon irrigation are also likely, not only from changed rainfall, but from accelerated glacial melting and reduced summer river flow, including to many of the great rivers springing from central Asia (Kehrwald et al. 2008). Climate change is also predicted to have complex and largely adverse effects on marine fisheries, in the short run by changing the pattern of ocean currents, and in the longer run by increasing ocean acidity. Also in the long run, climate change, unless rapidly mitigated, will lead to sea level rise of a metre or more by 2100, with likely catastrophic impacts for fertile low lying shorelines, including many parts of coastal Bangladesh (Inman 2009) and the Mekong and Nile deltas.

Modeling

The plethora of effects of climate change upon global and regional agriculture thus presents a huge modeling challenge. Models simulate agricultural conditions to reflect altered average temperatures, rainfall and the CFE. Some incorporate models of world trade. Table 1 lists some of the main modeling studies reviewed for this paper.

These modeled studies consistently predict a change in the location of growing areas, with agricultural expansion to areas formerly too cool to consistently grow crops, such as northern Canada and Scandinavia. They also consistently forecast a decline in agricultural productivity in hot regions. An early modeling study noted several limitations, including soil quality in new areas, as well as changes in weeds, pests and diseases, and on altered climatic variability (Adams et al. 1990). Indeed, in vast regions that are likely to become more climatically suitable for crops, such as in the boreal forests of Russia, soil quality is known to be poor (Dronin and Kirilenko 2008). Twenty years later, few if any of these excluded factors are well simulated.

Models omit many factors likely to impact on future food production. These can be classified into climate and non-climatic related effects, (see tables 2 and 3). There are three main reasons that agro-climate models omit both classes of effects. Firstly, few, if any such models are designed to simulate future food security, but only to consider the impact of climate change upon future agricultural production. Few if any agro-climatic modeling teams are likely to feel empowered or motivated to incorporate any comprehensive list of extra-climatic factors. Secondly, many of the climatic factors, such as a sea level rise of 50cm, or a weakening of the Indian monsoon, are either decades away or highly uncertain. It is not surprising that early modelers have focused on temperature and rainfall. Finally, the sheer number of such effects presents a daunting, perhaps intractable computational challenge. Nevertheless, in aggregate, both classes of omitted factors are likely to be negative, particularly from the second half of this century.

One of the most detailed modeling studies to date was recently published by the International Food Policy Research Institute (Nelson et al. 2009). It combines economic, population and trade figures with a sophisticated climate model of two scenarios, incorporating temperature and rainfall for both irrigated and rain fed crops. The models also account for increased water demand caused by higher temperatures. Results are presented with and without a CFE. Other limitations of models, as discussed here above, are not included. The findings of this analysis are sobering, yet also likely to be optimistic.

In developing countries, and in the absence of a strong CFE, the model reports declining yields for most crops, with irrigated wheat and rice especially harmed. On average, yields in developed countries are affected less than those in developing countries.

In China, some crops fare reasonably well, due to the large temperature ranges present in that country.

South Asia, however, is particularly affected, and shows the greatest yield decline for almost all crops. Sub-Saharan Africa sees mixed results, with little change in maize yields but large negative effects on rain fed wheat. The Latin American and Caribbean region also shows mixed yield effects.

The IFPRI study presents an analysis of the number of malnourished children globally under 5 years of age of in 2050. It finds that this increases by about 25 million compared to scenarios without climate change, or by about 20% (from 113 to 138 million). In reality, the increase in the prevalence of undernutrition will be higher, because this result refers only to the cohort of children born between 2045 and 2050. Many children born before (and after) these dates will also be malnourished (due to climate change), and many will still be alive (in, say 2050).

The adverse consequences of undernutrition in the first years of life are often irreversible (Victora et al. 2008). Such effects include reduced cognitive capacity, with a lesser capacity to benefit from schooling, even if available and thus less productive lives as adults. Thus, for the period 2020-2060, at least 100 million additional malnourished children and young adults are likely to be growing up, due to climate change, with millions more succumbing to diseases which have malnutrition as an underlying cause.

Another problem is disguised in the IFPRI model. The report predicts that without climate change the number of malnourished children will fall by 30% between 2000 and 2050, from 147 to 114 million, with a particularly strong decline in South Asia, from 77 to 42 million. These figures are implausible. In India, for example, undernutrition remains a very serious problem, despite many years now of high economic growth (Black et al. 2008). It is clear that the benefits of that growth remain extremely unequally shared, especially in the north and north east. The influence of Maoists (Naxalites) in India is growing, substantially fuelled by the high prevalence of poverty and undernourishment (Chakravarti 2008). In much of the highly fertile irrigated grain belt of parts of north-west India, aquifers are seriously depleted (Rodell et al. 2009). Even without climate change, yields are at risk. Finally, relatively high population growth persists in northern India, especially among the poor. This impedes economic development (Bryant et al. 2009) and adds to the absolute number of undernourished children. In Pakistan, similar problems are likely; indeed the current breakdown in governance in much of Pakistan is arguably in part caused by poor nutrition, consistent with concerns long held by food and development workers, such as Sir John Orr, the first director of the FAO.

Such baseline models, devised before the global financial crisis and the oil shock of 2008, arguably reflect a worldview which is more optimistic than reality. Between 2007 and late 2009 the number of undernourished increased by over 100 million, due not to climate change but to other factors (Butler 2009a). There is thus an urgent need to develop models which are more realistic.

Conclusions and recommendation

The future is rushing nearer, and the daunting task of decarbonising the global energy system, necessary to slow climate change has barely commenced. While the documented effects of climate change on agriculture to date are mixed, few if any studies have looked carefully at the recent effect on agriculture of climate change effects in low-income countries. In any case, these effects seem likely to soon become overwhelmingly negative, especially for poor populations in South Asia and sub-Saharan Africa. Without dramatic and rapid technological breakthroughs, the problem of climate change will soon be exacerbated by a rising price of oil and phosphorus (Butler, 2009b).

Low-income populations can look for support, but by no means “rescue” by high income populations. Low income countries need better and fairer governance, more education, and to accelerate their demographic transitions (Bryant et al. 2009). Their contribution to climate change is still small, and it is rational for them to rely upon fossil fuels for development, which are cheaper. High income countries need to reduce their emphasis on adaptation, which may prove ineffectual if the current policy trajectories persist. Instead, they must awaken to the urgency posed by climate change, limits to growth and their interaction with global security. Alliances perhaps may strengthen between philanthropists and activists in developing countries, in order to facilitate technological “leapfrogging” and to improve the other social and environmental needed to promote resilience, well-being and the endurance of global civilization.

Finally, there is an urgent need to need to develop agro-climatic models which are more realistic. Such models should try to better integrate knowledge from the social and physical sciences, and to also incorporate a range of extra-climatic factors, such as soil quality and the likely price of fertilizer.

If this task proves too computationally intense, then perhaps modelers could explicitly list major factors which are excluded, with an estimation of their likely collective direction and importance. Such caveats would reduce excessively optimistic or uncritical interpretation of models, especially by policy makers.

Study (year)	Scale	CFE	Temp	Rain	Farming adaptation	Other
Adams et al (1990)	US	optimistic	yes	yes		no
Rosenzweig and Parry, (1994)	global	optimistic/no effect	yes	yes		no
IPCC (1996)	global		yes	yes	yes	no
Fischer et al, (2001)	global	optimistic	yes	yes		no
Rosenzweig et al, 2002	US		yes	yes		
Fischer et al, (2005)	global	optimistic	yes	yes		socio-economic, world trade
Thornton et al, 2007	Africa		yes	yes		no
Tubiello & Fischer (2007)	global		yes	yes		no
Easterling et al (2007)	global	Varying strength	yes	yes	yes	
Nelson et al (2009)	global	Optimistic/no effect	yes	yes		

Table 1. This is an incomplete list of key reviews and studies of models of the effect of climate change upon agriculture. All studies consider average temperature, average rainfall and the carbon fertilization effect. Several studies comment explicitly on limitations, such as soil quality, which are excluded from the models.

Climate change effect	Modeled?	Likely food security effect	Timing of effect
Temperature	yes	varies	1950 on
Rainfall	partially	varies	1990 on
Rainfall intensity and distribution	no	varies	2000 on
Irrigation	partially	mostly harmful	1990 on
Glacial melting	no	harmful	2050 on
Carbon fertilization effect (CFE)	yes (earlier studies more optimistic)	beneficial	1950 on
CFE on pests	no	adverse	Uncertain
CFE harm for cassava	no	adverse	Future
Conflict	no	adverse	2050 on
Extreme weather events	no	adverse	Increasing
Fishery effects	no	adverse	2050 on
Frost frequency	no	uncertain	current
Governance disruption	no	adverse	2050 on
Gulf stream weakens	no	adverse	2100 on
Monsoon changes	no	adverse	uncertain
Population dislocation	no	adverse	2050 on
Sea level rise	no	adverse	2050 on
Soil quality	no	adverse	2050 on
Tropospheric ozone	no (not with CC)	adverse	2000 on

Table 2. This is an incomplete list of likely effects of climate change upon agriculture. The impression of whether an effect is modeled derives mainly from the studies referred to in table 1. The timings are approximate and indicative; they refer to substantial effects likely to occur from the date listed. The word "on" (in the timing column) indicates not only the start of an effect, but that the effect is likely to then intensify, because climate change is likely to increase in effect for many decades. The soil effect is important in the future as warmer temperatures allow new areas to be cultivated. Some models do exist for tropospheric ozone, but not for its interaction with climate change.

Non-climate change effect	Modelled?	Direction of agricultural effect	Timing
Conflict (regional)	no	harmful	current
Desalinization (cheap)	no	beneficial	uncertain
Ecosystem decline	no	harmful	1970 on
Energy price increase	no	adverse	2020 on
Fertilizer (N) scarcity	no	adverse	2020 on
Fertilizer (P) scarcity	no	adverse	2050 on
Genetically modified organisms	no	probably beneficial	2020 on
Groundwater depletion	no	harmful	2000 on
Institutional failure	no	harmful	Africa, already
Institutional failure	no	harmful	parts of Asia
Yield increase	yes	beneficial	current
Yield plateau	no	harmful	uncertain

Table 3. This is an incomplete list of predictable non-climatic effects upon agriculture. The timings are approximate and indicative; they refer to substantial effects likely to occur from the date listed. The word "on" indicates not only the start of an effect, but that the effect is likely to then intensify, because climate change is likely to increase in effect. The soil effect is important in the future as warmer temperatures allow new areas to be cultivated. Many non-climatic constraints are also likely to apply to future agriculture, including yield limits, a rising cost of fertilizer and transport costs, and in some places impaired governance. Ecosystem decline is widespread, and is likely to already be harming food production, e.g. via loss of pollinators and insectivorous bats. However, there is little specific literature about this.

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The Implications of Climate Change on Food Security in the Asia-Pacific Region

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There is now sufficient evidence that climate is changing, and that humans are contributing by producing large amounts of greenhouse gas (GHG) (McMichael et al. 2006, Haines et al. 2006). Climate change will not only damage the global environment directly, but will also have major impacts on human security, of which food security is a key although under-researched component (UNDP 1994, Butler 2009b). This in turn has important implications for the international public health agenda (Chiu et al. 2009). Here we argue that climate change will have particularly serious impacts on food security in the Asia-Pacific region. After a short review of the concept of food security we argue that threats to food security vary enormously between regions and countries. In the case of Asia, gradual processes of ecological adaptation in response to climate change will be serious enough, but the region is particularly susceptible to the devastating impacts of natural disasters which will increase in frequency. The rapid growth of Asia's megacities creates particular problems of food supply, cost and reliability. In this setting, the paper examines the policy responses at both global and regional level. The ways in which a number of regional organizations in Asia have addressed some of the issues is looked at in some detail. Finally, a short case study of Taiwan, China's responses to its own food security challenges is presented, something that is particularly pertinent given the devastating typhoon that so recently hit the island.

Defining food security

Two definitions of food security are widely accepted and used. The Food and Agriculture Organization (FAO) of the United Nations definition being that 'all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life' (FAO 1996). For the World Health Organization (WHO) the concept should be seen as 'including both physical and economic access to food that meets people's dietary needs as well as their food preferences' (WHO 2009). Based on these definitions four key dimensions can be identified: (1) food availability- sufficient quantities of food available on a consistent basis; (2) food accessibility- having sufficient resources to obtain appropriate foods for a nutritious diet; (3) stability of food supply; and (4) utilization of food- appropriate use based on knowledge of basic nutrition and care, as well as adequate water and sanitation (FAO 2008a, Wahlqvist 2009b). Importantly, concerns encompass not only food quantity but also food quality (Wahlqvist 2009b). Insecurity in food may cause hunger, malnutrition, eating disorders, chronic non-contagious illnesses, obesity, anemia, micro-nutrient deficiencies and diseases transmitted by food (Chiu et al. 2009). It may also be a prelude to unforeseen changes in food-health relationships.

However, it must be recognized that the precise nature and determinants of food security and insecurity vary considerably from country to country, and that hence it is essential to develop a full understanding of local conditions, environments and institutions. In a recent paper Yu, You and Fang (2010) constructed a detailed classification of developing countries based on different levels of food intake and on the particular elements determining levels of food security. There may also be important variations in food supply reliability within individual countries. For example, while China's overall record in this area is extremely good there are a variety of localities that still face serious problems that must be addressed (Xiao and Nie 2009).

Climate change, natural disasters, and food security

Food insecurity is determined by particular physical, economic, political and other conditions within communities and much of the discussion about the impacts of climate change has been confined to more gradual processes of disruption to existing environmental conditions in specific localities, and the flow-on effects to plants and animals and hence to human communities. But food security is often more drastically undermined by shocks such as natural disasters, extreme climate variability and conflict, all of which are likely to increase as climate change intensifies (Postnote 2006).

Climate change is leading to more frequent natural disasters. In 2005, the executive director of the UN's environment agency, Klaus Töpfer, pointed to the link between the effects of climate change and the natural disasters hitting Europe in the summer of 2005 (EurActiv 2005). A policy study of the European Parliament outlined certain types of climate-related natural disasters, including:

- heat waves;
- storms, such as windstorms and hurricanes;
- high levels of precipitation, and associated flooding; and
- lack of precipitation, and associated drought.

Hurricane intensity has increased by 70% due to climate change in the last 50 years in Europe (European Parliament 2006). In a study of acute weather events across Europe and the Atlantic, a relation between climate change and weather extremes has been recognized (Aalst 2006). Similarly, Oxfam reported that weather-related disasters have quadrupled over the last two decades (Oxfam 2007). Newly recognized by Academia Sinica in Taipei is a link between oceanic warming and earthquake frequency, dependent on atmospheric pressure change, evident in tectonic plate movement (Wahlqvist and Kuo 2009). There is a corresponding conjunction of atmospheric pressure change and typhoon (or cyclone or hurricane) formation. In August 2009, in Taiwan, China, increased earthquake frequency destabilized mountainous areas which then became mud and rock avalanches with the torrential rain of the Morakot typhoon, burying hundreds of people. Agricultural losses were estimated at US\$ 500 million, representing about 20% of the island's agriculture, aquaculture and forestry harvests (Wang 2009).

Extreme weather events have impacts on all components of global, national and local food systems, such as food production, food distribution infrastructure, and the incidence of food emergencies, all exacerbated by increases in population (FAO 2008b).

The impact of climate change and natural disasters on food security in Asia: locality, urbanization and megacities

As has already been noted, the precise nature of threats to food security varies considerably between regions and countries, and in Asia natural disasters appear to pose a particular threat. The Global Assessment Report released by the UN International Strategy for Disaster Reduction (UNISDR) indicates that certain Asian countries are at the top of the list for mortality rates related to natural disasters: notably Bangladesh, China, India, and Indonesia (Rangatia 2009). According to the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), the Asia-Pacific region is the world's disaster hot spot, experiencing 42% of the world's natural disasters between 1999 and 2008. A person living in this region is 4 times more likely to be affected by natural disasters than someone living in Africa, and 25 times more likely than someone living in Europe or North America (Heyzer 2009). The World Bank identifies East and South Asia as being at the greatest risk of loss from the multiple hazards, such as droughts, floods, cyclones, and landslides that climate change may bring (The Earth Institute 2005). A number of island nations in the Pacific and Indian Oceans will probably cease to exist (Fogarty 2004). The Asian Development Bank (ADB) indicates that the Asia-Pacific region will suffer major social and economic turmoil if climate change is ignored, particularly in food shortage and malnutrition (Petty 2009).

Taiwan (China) is particularly vulnerable to natural hazards, with 73% of the land and population exposed to three or more natural hazards, including typhoons, floods, mudslides, rising coastal or delta sea levels and earthquakes (The Earth Institute 2005). The island's vulnerabilities are affecting both rural and urban populations, since there is little scope for further expansion of sustainable food production, and it is serviced by over-stretched energy, water and food supply routes. Its substantial dependence on food supply lines from drought-stricken Australia and rural New Zealand makes its position all the more precarious.

A particular challenge in the Asia-Pacific region is the growth of megacities, often in flood-prone, volcanic or earthquake regions (e.g. Bangladesh, China, Indonesia, the Philippines, Thailand, and Viet Nam) or regions prone to drought (e.g. Northern China, Northern India). Various efforts led by the International Science Council (ICSU) are being made to accelerate earthquake preparedness in several large urban areas (Bendimerad et al. 1999). More recently, the Sciences for Health and Well-Being (SHWB) initiative of ICSU is adopting a "System Analysis Approach to Health and Well-being in the Changing Urban Environment." It has identified:

- various external driving forces (population growth, migration, climate change, economic pressure, and technological development);
- major urban sectors (water, nutrition, health care access, transport, housing, waste disposal and education), and
- risk factors (pollution, poor diet, infection, accidents and overcrowding)

for principal health outcomes (dehydration, poisoning, obesity/diarrhea, infectious diseases, physical disablement, psychological wellbeing) (ICSU Scoping Report 2007). Analyses like these emphasize the

importance of the food and health systems to work in an integrated way to minimize the impact of climate change on food and health security.

With regard to the urban environment, a basic problem at all stages of development is that cities are massive consumers of some of the key inputs relating to climate change and food security, including energy and food. There is now considerable interest in developing ways in which cities can become more productive sources of these inputs through the encouragement of alternative energy systems and local food production in urban areas. At present, urban populations are seen by the wider society as being subsidized and supported by regional areas. Rectification of this longstanding urban bias will require some difficult political choices, such as pricing policies for food from rural areas. The problem here is that as cities become larger and more dominant, their populations exert more political power, with the ever present threat of urban protest and instability.

To be manageable, megacities and urban sprawl will need to be deconstructed into functional units, communities, or neo-villages so that they can work towards appropriate responses to climate change. They may be considered as household aggregates, where a household, by definition, is a place of commensality where food is shared, and responsibility understood for the household food system. This takes us towards a food strategy that is enabled by connected households and communities (CCH-FBS) (Wahlqvist 2009a). Neighborhood, school or home gardens can generate food, increasing diversity and minimizing risks in vulnerable localities. Importantly, the reformatting of a lost local ecosystem re-establishes a level of personal control and mitigates the specter of climate change.

Climate change and Millennium Development Goals (MDGs)

Climate change will make the UN MDGs harder to reach in the nutrition and health area. MDG goal 1 is to reduce by half the proportion of people suffering from hunger by 2015. Currently, over a billion people are affected by hunger (UN 2010) and numbers are not falling quickly enough, particularly in Africa and Southern Asia (Postnote 2006). The impacts of climate change will make the situation even worse. Climate change may increase the incidence of disease such as malaria, dengue fever and diarrhea (also see the paper of Lapegue in this issue), resulting in increases in mortality rates of children and pregnant women in particular (Sari 2008).

A deficiency in the MDGs is their silence on population control- this has been stressed by Roger Short in his essay for the Royal Society (Short 2009, Butler 2009a). The relative effect and efficacy of family planning on planetary sustainability may exceed that of almost any other intervention.

The global responses to climate change on human security: recognition, surveillance, risk management with adaptive responses

Tackling these immense challenges will certainly require the use of sophisticated surveillance and response systems, drawing on a wide range of academic fields in the sciences and social sciences, as well as technologies and policy analyses.

International society has started to take certain essential steps to meet these challenges. For example, in the area of climate change and health security, WHO predicts that if improvements in environmental conditions could be made, more than 25% of the global disease burden might be reduced (Campbell-Lendrum et al. 2007). Several international organizations, including the Intergovernmental Panel on Climate Change (IPCC), WHO, and the European Union (EU), recognize the importance of developing health adaptation policies to face the problems that climate change may bring.

Meanwhile, the United Nations Framework Convention on Climate Change (UNFCCC) recognized that climate change will cause impacts on agriculture and urged all nations to prepare adaptations to the impacts on food security (Su et al. 2009). Key adaptation technologies for agriculture include:

- seed development;
- improved irrigation;
- upgrading long-term weather and short-term climate forecasting;
- changing farming practice by using crop rotation; and
- improving crop distribution networks.

However greater levels of communication and cooperation are necessary for the further development of these technologies and to encourage all parties to develop enhanced adaptation strategies (Su et al. 2009).

Improved surveillance increases our ability to measure, recognize and predict climate trends and events; it will be increasingly valuable allowing more efficient use of the essentials in food production (land, water, seed

or stock and fertilizer). More reliable forecasting and dissemination of information can reduce the impact of a natural disaster markedly, an important factor in disaster-prone areas such as the Bay of Bengal.

In planning and prioritization, agreed indices of food security such as food diversity are useful (Hoddinott et al 2002, Ruel 2003).

The regional responses to climate change and natural disasters on food security in Asia

In order to promote regional cooperation and collaboration in reducing disaster losses and intensifying joint emergency response to disasters in the Association of Southeast Asian Nations (ASEAN) region, the ASEAN Agreement on Disaster Management and Emergency Response (AADMER) came into force at the end of 2009. This legally-binding agreement pushes ASEAN Member States to achieve the goals together. It contains provisions on disaster risk identification, monitoring and early warning, prevention and mitigation, preparedness and response, rehabilitation, technical cooperation and research, mechanisms for coordination, and simplified customs and immigration procedures. Margareta Wahlström, the UN Secretary-General's Special Representative for Disaster Risk Reduction, pointed out that "the AADMER is the first of its kind in the world, an agreement that binds Asian states together to address disaster risk reduction and improve their preparedness for response" (ASEAN 2009).

In March 2009, the Member States of ASEAN adopted a five-year (2008-2013) Strategic Plan of Action on Food Security in the ASEAN Region. This recognized that climate change has important impacts on food security. The ASEAN members are preparing:

- to conduct studies to identify possible impacts of climate change on food security;
- to identify measures to mitigate/adapt impacts of climate change on food security; and
- to develop collaboration with other ASEAN Sectoral Bodies, which address impact mitigation and adaptation of climate change" (ASEAN 2009-2013).

However, implementation might vary in the ASEAN Member States due to specific domestic conditions and political consideration (Su et al. 2009).

Declarations from the Asia-Pacific Economic Cooperation (APEC) leaders' and ministerial meetings tend to deal with climate change and food security issues separately. Statements relating to climate change have mainly dealt with the implications for economic and energy development. However, the relationship between climate change and food security is rarely recognized. Although adaptation strategies for APEC members were discussed in the '2009 APEC Climate Symposium', APEC did not particularly identify climate change as an impact factor in food security (APEC 2009). Since APEC agreements have non-binding commitments for member economies, the development of the adaptation strategies must rely on individual efforts or bilateral agreements (Su et al. 2009). In November 2009, the APEC leaders failed to agree on targets for reducing greenhouse gas emissions, which implies that the APEC leaders tended to view the Copenhagen summit as a 'staging post' rather than an end point (BBC News 2009).

In the meantime, leadership and action is to be found among various food-oriented research institutions, like the World Vegetable Research centre (WVRC) which co-hosts the Food in Health Security (FIHS) Network (Yang et al. 2009, Weinberger et al. 2009).

Implications for food security policies in the Asia Pacific region

The case of Taiwan (China) is particularly instructive here. Advanced planning requires the consideration of land utilization so that farms support food self-sufficiency, through increased productivity and lower production costs for staple foods and for food diversity. Adjustments to policies on food reserves are needed to minimize episodic food shortages and increase strategic food reserves to last more than a couple of months. Local food security should be managed partly through the careful management of trade options and the diversification of food sources.

Improvement of the quality of food security information is also vital, including climate early-warning and related surveillance systems to enhance preparedness (Wang 2009). Data mapping is increasingly sophisticated and integrated and should also include: meteorological and surface and underground water information (Rodell et al. 2009, Wahlquist Å 2009); agricultural and nutritional assessment including the quantities and quality of food available (SCN NEWS 2009, Zapata-Caldaset et al. 2009); the adequacy of key inputs needed for the production of appropriate foods; and related health patterns and systems.

Much more research is needed in this area. The FIHS Network for the Asia Pacific region, established in August 2009, and co-hosted by NHRI and the World Vegetable Research Centre in Taiwan (China) will:

- assist in "building the food and health security promotional capacity" of various academic and

community institutions; and

- develop and make policy options and recommendations (Wahlqvist et al. 2009).

The Asia-Pacific region can cooperate intra-regionally and internationally using this network through sharing information, prevention strategies, and adaptation policies to mitigate climate change and improve food security. It will provide much needed impetus to this effort if food security becomes a more recognized part of the broad security agenda (McKay 2009).

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Climate Change, Nutrition and Food Security in sub-Saharan Africa

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Introduction

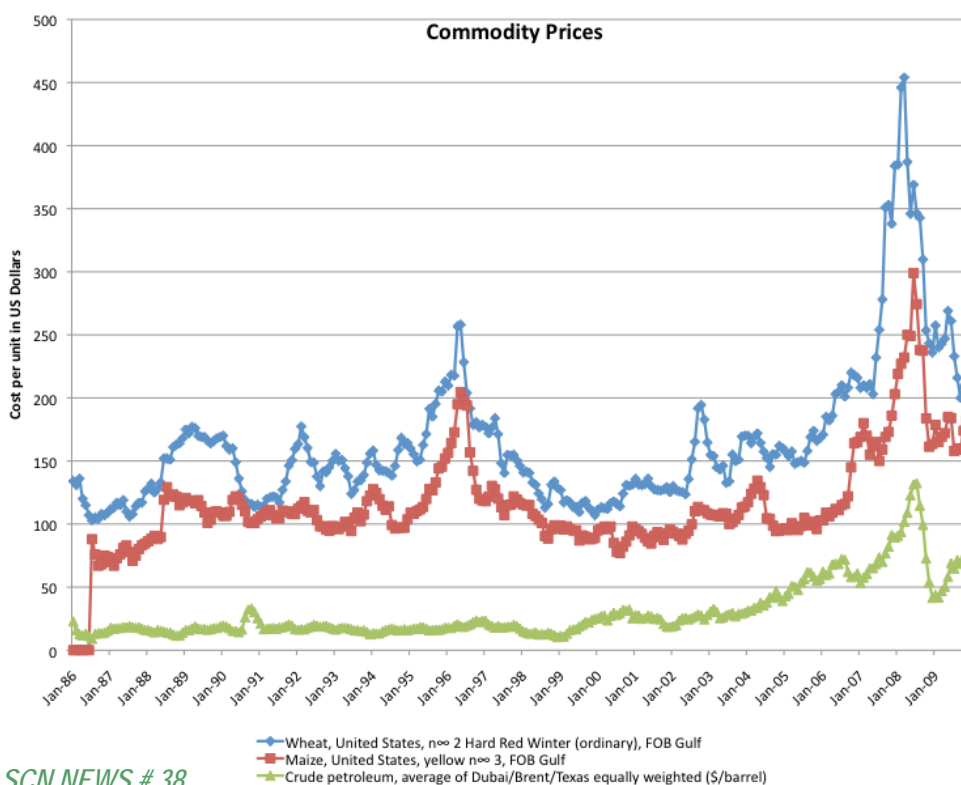
Socio-economic conditions and the adverse impact of unpredictable weather on the agricultural production of communities in sub-Saharan Africa have long been recognized as an important cause of malnutrition in the region. Climate change, with its potential to disrupt weather patterns, change rainfall distribution, and increase temperatures beyond what crops can tolerate, has recently emerged as a critical threat to the long term food security of the region. These changes may reduce overall food production while the population increases, further forcing reliance on an unpredictable global commodity market. New ways of using existing satellite remote sensing data will need to be developed in order to understand, document and respond to the longer-term impact of climate change on food security. New remote sensing measurements are needed to provide for regular, repeated observations of the land surface of the earth at a resolution commensurate with farm decision-making, at around 5 meter resolution. Although the technological capacity to make such measurements exists, the political will to provide free, accessible and sustained measurements for agriculture does not yet exist.

According to the Food and Agriculture Organization of the United Nations (FAO), a billion people will face serious hunger in 2010, while two billion will be malnourished (FAO 2009). Food security, the ability of all people to have enough food for an active and healthy life, has not been attained for all for many reasons, including broad issues of poverty, natural resource disparities, unequal global trading arrangements, and poor or corrupt governments, among others. Human population growth currently exceeds advances in crop yields, and a 14% global decline in per capita cereal production by 2030 appears very likely (Funk and Brown 2009). Future cereal deficits will particularly impact cash-strapped African and South Asian nations, and will likely be exacerbated due to increased demand on the international commodity markets due to bio-fuels and rising meat consumption.

Climate change is likely to further threaten the ability of economically marginalized regions to compete in a global food system. Although the likely impact of climate change on rainfall in many regions is currently unclear, increases in average temperature will undoubtedly reduce yields in tropical countries as well as in many of the key production areas of the world (Lobell et al. 2008).

The global food system is moving from one of abundance, where the primary problem was to find buyers for excess global grain production, to one of scarcity. After an extended period where productivity grew rapidly, this growth is slowing down and thus the era of declining food prices is likely over. Figure 1 shows the variation in global commodity prices for the past two decades, showing the price spike in 2008.

Figure 1. Wheat, maize and crude petroleum prices from the United Nations Conference on Trade and Development (UNCTAD).



In 37 countries throughout every region of the world, this increase in global commodity prices resulted in localized food insecurity, lack of access to food, or shortfalls in food production or supplies.

The combination of declining productivity with increasing demand will put significant pressure on markets that are thus likely to again produce high commodity prices in the near future, aligning them with energy markets to a much greater extent than in previous decades. In this context, strong local food production becomes even more critical, as the value of that food will be far greater than ever before.

Remote Sensing Information

Remote sensing is the observation of surface conditions and calculation of biological parameters that can be used to derive information about rainfall, soil moisture and crop health. The information is global in scale, rapid and can be used to assess the impact of widespread weather variations.

USAID's Famine Early Warning Systems Network collaborates with the US Geological Survey (USGS), the National Aeronautics and Space Administration (NASA), and the National Oceanic and Atmospheric Administration (NOAA) to monitor agricultural growing conditions in the developing world using remote sensing datasets. These agencies collect and process satellite data that are used to monitor the vegetation condition (Normalized Difference Vegetation Index, or NDVI) (Tucker et al. 2005) and rainfall (Rainfall Estimate, or RFE) across the world (Xie and Arkin 1997). Daily, operational rainfall data are used to drive crop models that estimate yields and is the most widely used of the data products FEWS NET produces to monitor agricultural conditions in Africa (Brown 2008). These two datasets are described further below.

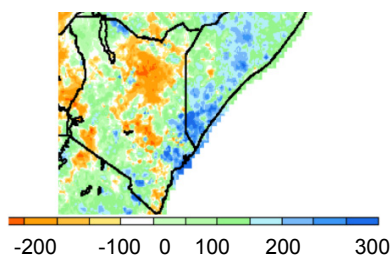
FEWS NET has used remote sensing derived indices and information to estimate inter-annual variations in food production since its founding in 1986.

FEWS NET currently uses a merged satellite-gauge product for its primary source of information on rainfall in the countries where it operates. The Rainfall Estimate (RFE) 2.0 uses several techniques to estimate precipitation while also using traditional cloud top temperature and station rainfall data. The RFE data are particularly useful because it uses daily rainfall observations from the UN's World Meteorological Organization's Global Telecommunication System (GTS) as ground truth in the rainfall model, producing a gridded product which is far closer to the observed rainfall in all locations where observations are taken, than other satellite-derived datasets. This greatly increases its utility and acceptability by local government organizations in Africa (Figure 2A).

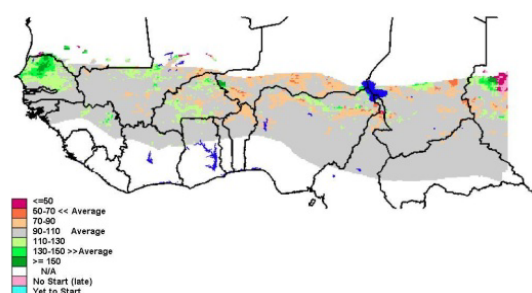
The RFE data are used as an input into a crop yield estimate model called the water requirement satisfaction index (WRSI). The WRSI is an indicator of crop performance based on the availability of water to the crop during a growing season. The WRSI is related to crop yield through estimating the impact of in-season moisture deficits on a specific crop (Senay and Verdin 2001; Verdin and Klaver 2002). Figure 2B portrays

Figure 2. Remote sensing data used to monitor food production in Africa

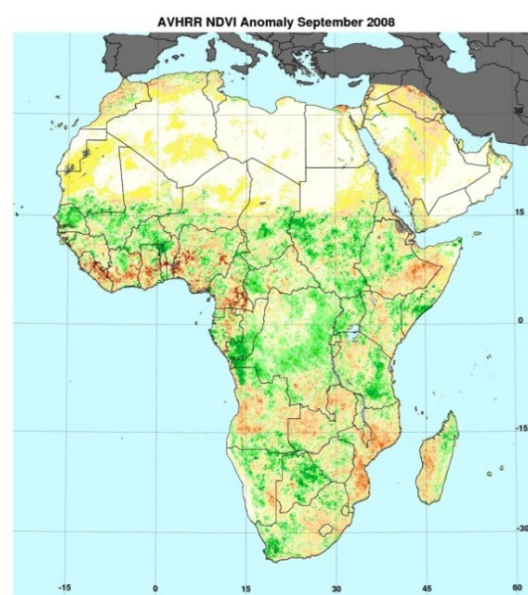
A. Rainfall Anomaly for Kenya, Dec 09



B. Water Requirement Satisfaction Index for maize in August, 2009



C. AVHRR NDVI difference from long term mean for September 2008



values for maize from the start of the growing season in 2009, showing some areas of above average conditions and some below average for West Africa. Decision makers use the WRSI to understand the impact of observed localized, in-season rainfall deficits on ultimate crop yields at the end of the season.

Another, independent way that FEWS NET estimates the health of a rainy season crop is through the satellite estimate of vegetation health or through the normalized difference vegetation index or NDVI data. Vegetation estimates, although available at a higher spatial resolution than most rainfall datasets, do not allow specific estimation of crop yields, as the information from all vegetation, including fallow fields and trees, are combined together into a single observation. However, by comparing a given period of the current year with those from previous years when conditions were known, or with the mean of all previous years, a reasonably reliable estimate of the productivity of the growing season and ultimate yield can be developed (see Figure 2C). In some cases, NDVI-based estimates of production can work better than those derived from rainfall (Funk and Budde 2009) because they include all influences on plant health, including land degradation.

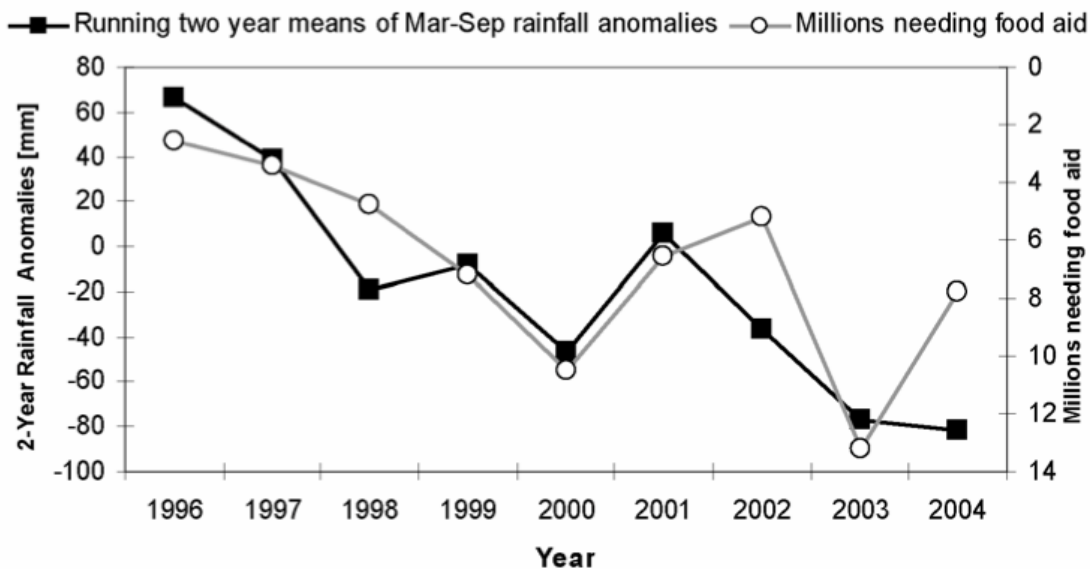
The RFE, NDVI and WRSI are just three of the suite of remote sensing tools that FEWS NET's analysts use to identify and respond to weather-related food crises. These data products were either developed directly by FEWS NET partners for FEWS NET or were adapted to their needs. A more comprehensive description of these and the other datasets used in early warning can be found in Brown (2008).

Climate Change and Food Security

Climate change will affect food security in vulnerable communities across Africa in multiple ways. The first is through changing agricultural growing conditions locally. Comprehensive records of weather and agricultural production strategies are needed in order to understand what the previous conditions were like, and to detect and document change (Brown and Funk 2008). Remote sensing data records such as those derived from the AVHRR sensor are nearing three decades in length, enough to understand and document long-term changes in productivity due to weather (Brown 2008).

One key region where a lot of work has been done, analyzing the potential impact of a changing climate, is the coast of East Africa. In this region, FEWS NET has documented declines in rainfall, which threaten the pastoral livelihoods in the region (Funk et al. 2003) (Figure 3). If these trends continue, no rebuilding of herds

Figure 3. Running 2-year March-September rainfall anomalies (left axis) with millions needing food assistance (right axis, inverted). While the two time series show a good correspondence ($r^2=0.62$) many factors influence food aid needs (from (Funk et al. 2005))



or food aid delivery will help preserve the way of life of its people, since pasture needs a minimum level of moisture to survive. Most food aid programs, even those dealing with complex emergencies with multiple causes, have as their objective to return the affected region to a stable state, similar to how the region functioned from before the crisis. Early warning organizations and the humanitarian aid systems they support, will have to come to terms with the permanently changed ecosystems that may no longer support the kind of agricultural and pastoral systems, as they did before. Effective programs will require the integration of short-term crisis response with longer-term, development-focused assistance.

A second major impact of climate change is on the global food system. According to a highly interdisciplinary international assessment of agriculture (IAASTD 2008), demand for food will almost double by 2030 due to rising population and shifting food preferences to meat and dairy. It is also clear that rising temperatures and changing rainfall patterns will negatively affect global crop yields (Challinor et al. 2007; Funk and Brown 2009; Godfrey et al. 2010). Only through increasing production in regions that currently have yields that are less than half of the highest producing areas, can we hope to meet the growing demand for food. This is particularly true for regions that are currently food insecure, as these are usually the same countries that have the smallest purchasing power and thus are likely to be unable to compete on the global market, resulting in widespread food availability and access problems (Brown et al. 2009).

Finally, climate change is occurring with many other large-scale processes that will impact food production as much or more than rising temperatures and changing weather patterns. These include expanding urban areas, an aging agricultural workforce, declining fresh water supplies, increased invasive species penetration into ecosystems and the emergence of new or previously eradicated crop diseases such as wheat rust. These problems will further erode yield gains globally, tightening global food supply while demand rises.

Conclusions

To track global food production in a way that can ensure that tightening supply does not result in widespread price fluctuations, efforts must be made to integrate information on type of crop planted, information on cultivar and agricultural practices with remote sensing estimates of weather and growing conditions. There are several major efforts underway that seek to do just this - e.g. integration of fine scale remote sensing data with extensive databases of agricultural statistical information, the most notable being from the US Department of Agriculture's National Agricultural Statistics Service (West et al. 2010). These approaches can be coupled with creative financial instruments such as index insurance which can provide funds for small scale farmers to boost yields through fertilizer and improved seeds in good years and provide both the means to repay loans and income support in bad years (Barnett et al. 2008; Skees and Barnett 2006). Index insurance is far less expensive than traditional agricultural insurance because farmers do not have to provide farm-level historic yield data and is thus triggered by a weather or productivity index, not a farm or field survey. By leveraging improved information, longer-term investments can be made that can boost non-agricultural incomes and increase the productivity of the agriculture sector, something that is essential in regions that are already food insecure.

Agriculture and nutrition are intimately linked, particularly in rural areas of sub-Saharan Africa where agriculture is both a source of food as well as the primary source of income. Multiple stressors that affect agriculture will therefore affect community health and the ability of individuals to combat chronic diseases, vector-borne diseases such as malaria and malnutrition. Robust agricultural, public health, surveillance, monitoring and response systems can help identify the true burden of ill health and cost-effective strategies for reducing the impact of climate change and the resulting weather patterns on populations (IAASTD 2008).

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Hosted on the UNSCN website www.unscn.org

IASC Global Nutrition Cluster Harmonized Training Package (HTP)

The UNSCN website now hosts the Harmonized Training Package (HTP) of the Global Nutrition Cluster. The HTP is a unique resource bringing together all aspects of Nutrition in Emergencies (NiE) for trainers, practitioners and decision makers. It is now being used by different agencies and institutions in many different regions and in different contexts.

What is the HTP ? The HTP focuses on key areas in nutrition in various emergencies and protracted crisis situations. It is divided into 4 sections; Introduction and Concepts (5 modules), Nutrition needs assessment and analysis (5 modules), Interventions to prevent and treat malnutrition (9 modules) and Monitoring, evaluation and accountability (2 modules). The HTP is a unique resource, comprised of 21 modules. Each module contains four parts: i) a *Fact Sheet* providing an overview of the module's topic, ii) *Technical Notes* for trainers and trainees that provide guidance on current practice, iii) a *Trainer's Guide* to help trainers develop a training course, and iv) a *Resources* Document which lists relevant available resources.

HTP hosted on the UNSCN website The HTP is a living document: it is reviewed and revised on a regular basis. The website allows you to [download all modules](#) in either WORD or PDF format. Furthermore, you are invited to leave your comments and experiences of using the HTP and these will be taken into account during the updating process.

Nutrition in Emergency Repository Also on the UNSCN website, you will find the [Nutrition in Emergency Repository](#) which is a special sub-section of the [SCN Food & Nutrition Resource Portal](#). It contains all relevant key documents referred to in part 4 of the HTP modules and many more relevant resources and links.

Who developed the HTP? The need to develop harmonized training materials for nutrition in emergencies was first recognized in 2006. Following a side meeting of the SCN in March 2006 the five UN agencies WHO, UNICEF, WFP, UNHCR and FAO developed a joint concept paper. In July 2006 during the first Inter Agency Standing Committee (IASC) Nutrition Cluster meeting, the Global Nutrition Cluster (GNC) took responsibility and a Capacity Development Working Group (CDWG) of the GNC comprising the five UN agencies as well as NGOs, academia and individuals was formed and tasked with overseeing the project. NutritionWorks (NW), a UK based partnership of public nutritionists, was commissioned to undertake the work between 2006-2008. The HTP was rigorously peer reviewed before being piloted in five countries: Tunisia, Sri Lanka, Somalia, Uganda and Zimbabwe and finalized in October 2008. The current version, which dates from September 2009, is now being reviewed and revised under the coordination of NW. The aim is to make updated modules available by the end of 2010.

Opportunities for Action: Linking Climate Change Adaptation to Nutrition and Food Security Programs and Policies¹

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Worse outcomes for the most vulnerable

New evidence that climate change is accelerating continues to come to light. Based on the latest survey of Arctic ice, which is melting at an accelerated rate due to thinning as well as higher average temperatures, the Arctic is expected to be ice-free by 2030; 20 years earlier than previously anticipated (Stevenson 2009). Just one factor in climate change, this alone will result in ecosystems and food and nutrition security being negatively impacted faster than previously thought, making adaptive strategies and cross-sectoral solutions ever more urgent. More severe weather events, and shifts in precipitation and temperature patterns create havoc with agriculture, and increase the vulnerability of ecosystems and populations alike, especially in areas where livelihoods are highly dependent upon the local natural resource base. Food availability is expected to decrease significantly, driving the push for increased investment in productivity. The importance of community-based adaptation approaches is increasingly acknowledged, including the need for locally appropriate crop varieties, and sustainable and efficient use of water resources (Nelson 2009).

There is little question that those with the fewest resources, and who rely most on their local natural environments, are most vulnerable to significant changes in that environment. The 75% of the world's food insecure (FAO 2005) who live in rural areas, particularly in those countries with the highest rates of malnutrition in Africa, Asia, and Central America, will be under even greater stress in the coming years.

The Intergovernmental Panel on Climate Change (IPCC) reports that the majority of models (acknowledging significant uncertainties) indicate that southern Africa, the Caribbean and Mediterranean regions, southern Latin America and parts of Brazil, are all expected to face reduced freshwater availability over the next 100 years. These areas are also expected to see the highest rates of temperature increase. Conversely, increased precipitation (over 20%) is projected for most northern latitudes, as well as in eastern Africa, central Asia and the equatorial Pacific Ocean (IUCN 2008 in IPCC 2007). Food insecure farmers in many countries already experience increased unpredictability in rainfall. Increased intensity of droughts and floods are expected in the future. Local variations and expected unpredictability of rainfall is likely to mean that rural households will continue to face challenges in food availability and access.

Dramatic changes in habitat, disease vectors, global food supply and threats to biodiversity are all possible scenarios that are being predicted over longer time horizons. In the short and medium term, increasing variability and unpredictability of rainfall and therefore of droughts and floods will continue to challenge populations already vulnerable to food and nutrition security. IFPRI's latest analysis of climate change impact argues that agriculture and human well-being will be negatively affected by climate change, predicting:

- Yield declines in developing countries for the most important crops, especially in South Asia;
- Varying effects on irrigated yields will be experienced across regions, but large declines in South Asia;
- Additional price increases for the most important agricultural crops (rice, wheat, maize, and soybeans). Higher feed prices will result in higher meat prices, thus reducing the meat consumption growth slightly and creating a bigger fall in cereal consumption;
- Reduced calorie availability in 2050 relative to 2000 levels throughout the developing world;
- By 2050, child malnutrition will be 20% higher than without climate change, thus eliminating much of the expected improvement in child malnutrition rates (Nelson 2009).

The impacts of climate change on health and nutrition are expected to exacerbate inequities between the rich and poor, and are laid out in detail by the recent Lancet Commission Report, which calls for new advocacy and public health movement to support climate change adaptation along with primary strategies to mitigate climate change itself (i.e., reducing green-house gas emissions) (Costello et al. 2009). Nutrition and health interactions themselves are well documented, for example, with disease burdens (e.g., diarrhoeal disease, malaria) contributing to poor nutrition outcomes, and undernutrition contributing to child morbidity and

1. Content for this article was adapted with permission from several IUCN publications: IUCN (2008) *Indigenous and Traditional Peoples and Climate Change: Vulnerability and Adaptation*; IUCN, Bangladesh (2005) *Baira: the Floating Gardens for Sustainable Livelihood*, Dhaka, Bangladesh <http://data.iucn.org/dbtw-wpd/edocs/2005-090.pdf>; and IUCN (2009) *Ecosystem-based Adaptation: A Natural Response to Climate Change*, Gland, Switzerland. <http://data.iucn.org/dbtw-wpd/edocs/2009-049.pdf>.

mortality² (Black et al. 2008).

Mitigation of climate change impacts - sourcing local knowledge for adaptation

A multi-pronged approach will be essential to success in combating malnutrition in the context of climate change. Donor planning documents emphasize the need to fund the long-term research needed to address projected food shortages, utilizing new and traditional methods for advancing crop research, and some acknowledge the importance of retaining and tapping global bio-diversity to these ends³. Finding local solutions appropriate to local and changing conditions will be critical. This means not just developing shorter maturing and drought-resistant staple crop varieties, but finding ways to better address the diverse range of food and nutrition needs of local populations. Just as important as technology-driven approaches, food insecure communities will need multiple strategies to identify, understand, and develop accessible solutions to reduce their own vulnerability.

There is no question that national governments in food insecure countries recognize the most immediate and critical social impacts of climate change related to food and nutrition security. Ethiopia, which continues to experience among the highest malnutrition rates globally⁴, prioritized food and nutrition related climate change adaptation strategies, in eight of the top ten priority actions:

- Promoting drought/crop insurance;
- Strengthening/enhancing drought and flood early warning systems;
- Development of small-scale irrigation and water harvesting schemes;
- Improving/enhancing rangeland resource management practices;
- Community-based sustainable utilization and management of wet lands;
- Realizing food security through a multi-purpose large-scale water development project;
- Strengthening the malaria containment program; and
- Promotion of on-farm and homestead forestry and agro-forestry practices (Government of Ethiopia 2007).

Policymakers, technical experts, and implementing agencies can work together to create stronger linkages that reflect this basic understanding, and achieve better cross-sectoral coordination. The following three sections describe approaches to creating synergy between food and nutrition security and climate change:

1. a site specific intervention: 'floating gardens' of Bangladesh;
2. a community based planning and solutions development tool: community based vulnerability analysis which links climate change, livelihoods, and food/nutrition security;
3. a conceptual approach that links social and environmental policy and planning, for sustainable outcomes for both food and nutrition security as well as the underlying resource base on which rural livelihoods depend: ecosystems-based adaptation.

'Floating Gardens' of Bangladesh

In its national climate change Adaptation Programme for Action, Bangladesh has included as one of its top ten proposed actions: the development of eco-specific adaptive knowledge (including indigenous knowledge) on adaptation to climate variability to enhance adaptive capacity for future climate change (Government of Bangladesh 2007). A specific example is presented by traditional "floating gardens," which provide a strategy with potential to support short and medium term adaptation in flood prone areas, and also can support stronger impacts when linked with nutrition promotion programs such as efforts to promote essential nutrition actions, as well as food security initiatives such as marketing and other technical/financial services.

'Floating gardening' or '*baira*' cultivation is a traditional hydroponic technique known to a variety of ancient cultures (Chinese, Babylonian, Aztec) and applied by Bangladeshi farmers primarily in the southern wetlands of the country. Aquatic plants (generally Water Hyacinth) are used to construct floating platforms during the

2. 35% of deaths and 11% of global disease burden in children under 5 years of age can be attributed to maternal and child undernutrition. Meanwhile, an estimated 3.7% of stunting in children under 1 year of age could be averted by disease control interventions.

3. The following documents all place heavy emphasis on agricultural research and productivity: DFID White Paper (6 July, 2009), *Building our Common Future*, London, ([online](#)) ; US Government (October 2009) *Global Hunger and Food Security Consultation Document*, Washington, DC ([online](#)); FAO (2009) *How to Feed the World 2050*, Rome,

4. Up to 38% of Ethiopia's children under the age of 5 are estimated to be underweight, and 47% stunted. This represents the sixth highest rate of stunting globally, and is well above the average for Sub-Saharan Africa of 38%. UNICEF (2009) *State of the World's Children*, New York. [online](#)

rainy season, on which cultivation of seedlings, vegetables and other crops is possible, and frequently with shorter maturation cycles than traditional planting. Up to three crop cycles are reported as possible in Bangladesh. In the following season, the platform is dismantled and the residue is used to make winter vegetable gardens. The extension of the growing season, and the ability to grow crops in flooded or waterlogged areas can provide a critical expansion of food production capacity for poor farmers and even landless households (IUCN 2005). (See video clip on *baira* cultivation available at: http://www.youtube.com/watch?v=bWGRX_cH3oM)

Baira cultivation's potential contribution to improving food security has been recognized by a number of organizations, and as a result has recently been expanded in other regions: in northern Bangladesh by Practical Action (also see the paper of [Berger](#) in this issue), and northeastern Bangladesh by IUCN/CARE. With increased flooding experienced in recent years, it is being explored as a climate change adaptation strategy in coastal regions by CARE (IUCN, UNEP, UNU 2009).

Opportunities exist to both promote low-tech hydroponic cultivation in Bangladesh and potentially other countries where flooding is expected to be regular and on the increase, as well as to link support for specific dietary and infant and young child feeding practices. These measures could help to increase the quantity and quality of foods available all year at the household level and enhance impacts on nutrition.

Enhancing and scaling up community-based vulnerability and planning processes (Riche 2009)

Like other parts of the world, eastern and southern Africa are already being affected by climate change, and will feel its impacts on agriculture, water availability and quality, ecosystem services, biodiversity, and health, all of which will impact local livelihoods and food and nutrition security among the poorest segments of the population, particularly in rural areas.

IUCN's Climate Change and Development project provides some experience in analyzing livelihood and climatic risk factors to help identify community priorities for adaptation. It is being implemented in sample agro-ecological zones in Mozambique, Tanzania and Zambia, to ensure that climate change-related policies and strategies lead to adaptation activities by taking actions to reflect learning from community assessments in national planning and prioritization processes. This three-year project has focused on risk screening and scoping of adaptation activities at the community level. It uses participatory approaches to conduct vulnerability assessments using CRiSTAL (Community-based Risk Screening Tool – Adaptation and Livelihoods)⁵. The tool was developed by IUCN, the International Institute for Sustainable Development, the Stockholm Environment Institute and Inter-Cooperation, to help integrate risk reduction and climate change adaptation into community-level projects, and continues to be adapted.

Assessments have been carried out in the context of different livelihood systems (farmers, agro-pastoralists, fishermen), and in different ecological zones (e.g., arid, coastal and sub-humid). Each zone experiences extreme climatic events (droughts, floods and hurricanes) which are increasing in frequency and intensity. In Zambia, testing of CRiSTAL's community-based vulnerability assessments revealed that farming and human health and nutrition were particularly vulnerable to drought, variability in rainfall, and periodic intense rainstorms. The analysis allowed the community to identify feasible coping strategies such as water harvesting, conservation farming, and the need for better access to meteorological information and improved sanitation (Riche 2007). The communities will determine the priority of potential adaptation measure, helping to improve their adaptive capacity to the impacts of climate change, through both improved analytical capacities and specific interventions.

As a result, activities that will both help to mitigate climate impacts and to improve food and nutrition security include re-vegetation and reforestation of coastal dunes (Mozambique), tree enrichment in flood-prone zones (Tanzania), and sustainable exploitation of non-timber forest products (Zambia). Good management and restoration of ecosystems can go a long way to reducing community vulnerability to climate-based stress. Similarly, policies and development interventions that secure the local natural resource base can, in many cases, increase community resilience to a range of threats, including climate change and disaster risk reduction.

These impacts support nutritional outcomes through improved and more resilient livelihoods. However, they could be made even more directly relevant. Opportunity exists to expand vulnerability and climate change adaptation analyses and community-based planning processes in rural areas where malnutrition rates are high, households are food insecure, and vulnerability factors to climate change are significant. Refining analytical processes to include malnutrition data, where available, and to differentiate between those

5. CRiSTAL is a vulnerability assessment technique adapted by IUCN for use at the community level, and which specifically examines potential impacts of climate change. It was initially developed by IUCN, IISD (International Institute for Sustainable Development), the Stockholm Environment Institute, and Inter-Cooperation. For original version of CRiSTAL developed for project managers see: [\(online\)](#)

strategies that benefit the most food insecure and those that can be accessed by and/or benefit households with young children, would increase potential for impact on nutritional outcomes.

Protecting sustainability of food and nutrition security to climate change through ecosystem-based adaptation⁶

Food and nutrition security programs can be improved, especially with regards to sustainability, by paying greater attention to the underlying natural resource base as a whole. In the face of climate change, understanding the dynamics of the local environment, or ecosystem⁷ as a whole becomes increasingly important.

Healthy ecosystems are essential to the sustainable provision of drinking water, food, habitat, shelter, natural resources, and serve as a barrier against disasters. They provide the critical natural assets for livelihoods, and may need protection or restoration to ensure sustainable support for food and nutrition security. In fact, human adaptation to climate change may well depend on the local ecosystem itself, having characteristics of sustainability (not subject to depletion, such as deforestation or biodiversity loss), resilient (able to recover from drought and extreme weather events), and adaptable (able to adapt to long-term climate change). An ecosystem-based approach to addressing water issues would not focus simply on the provision of wells or irrigation systems. Instead it would more broadly examine and address the entire water system and watershed management in an effort to ensure sufficient quantity and quality of water and equitable access for all, as well as to mitigate water borne diseases such as malaria and dengue fever.

Ecosystem-based Adaptation involves a range of ecosystem management activities to increase resilience and reduce the vulnerability of people and the environments in which they live to climate change. These activities may be carried out within an agricultural, environmental or climate change adaptation program with sensitivity to food security concerns, and are also common to many integrated food and nutrition security programs, and may include:

- Sustainable water management, where river basins, aquifers, flood plains, and their associated vegetation are managed to provide water storage and flood regulation services;
- Disaster risk reduction, where restoration of coastal habitats such as mangroves can be a particularly effective measure against storm-surges, saline intrusion and coastal erosion;
- Sustainable management of grasslands and rangelands, to enhance pastoral livelihoods and increase resilience to drought and flooding;
- Establishment of diversified agricultural systems, where using indigenous knowledge of specific crop and livestock varieties, maintaining genetic diversity of crops and livestock, and conserving diverse agricultural landscapes secure food provision in changing local climatic conditions;
- Strategic management of shrub lands and forests to limit the frequency and size of uncontrolled forest fires; and
- Establishment and effective management of protected area systems to ensure the continued delivery of ecosystem services that increase resilience to climate change.

Ecosystem-based Adaptation is now being recognized as a cost-effective, accessible way of reducing poverty and climate risk. A number of Least Developed Countries (LDCs) have included *Ecosystem-based Adaptation* activities within their National Action Plans for Adaptation, including:

- watershed restoration in Haiti;
- community-based coastal afforestation in Bangladesh;
- the conservation and rehabilitation of degraded wetlands in Lesotho; and
- a range of practices in Ethiopia, including: improvement and enhancement of rangeland resource management; community based sustainable utilization and management of wetlands, and the promotion of on farm and homestead forestry and agro forestry practices; and community based carbon sequestration (Government of Ethiopia 2007).

Established approaches for ecosystem management of drylands, wetlands, forests, and coastal areas will be useful in confronting some of the new challenges posed by climate change. *Ecosystem-based Adaptation* strategies can enhance their relevance to local and national priorities through explicit linkage with policies and programs on food and agriculture; nutrition and public health; and disaster risk reduction. This will also

6. This section adapted from: IUCN (2009) *Ecosystem-based Adaptation: A natural response to climate change*, Gland, Switzerland. ([online](#))

7. Very general characterization could include: drylands, wetlands, forests, and coastal regions.

increase the likelihood of sustainable impact of all programs. Success in *Ecosystem-based Adaptation* is increased by the following better practices:

- **Involving local communities:** Community participation in both planning and implementation is a critical element to success and sustainability. Establishing linkages between risk reduction, resource sustainability and food and nutrition security helps develop locally appropriate solutions.
- **Including multiple partners/stakeholders:** Multi-partner funding and cooperation has characterized successful programs, and provides the opportunity to align food and nutrition security with conservation. Planning and programs will benefit from collaboration between indigenous and local communities, technical agencies/experts, relevant private sector stakeholders, and policy-makers in the areas of nutrition, food and agriculture, conservation, and humanitarian response.
- **Adopting flexible ecosystem management approaches:** Programs should allow for changes in technical interventions or institutional arrangements as needed to achieve desirable outcomes or to better account for changing circumstances, to facilitate and accelerate learning about appropriate adaptation options for the future. Climate impacts and related programs should be monitored carefully so that management actions can be appropriately adjusted in response to changing conditions and challenges.
- **Integrating Ecosystem-based Adaptation with wider adaptation strategies:** Successful ecosystem and community adaptation to climate change relies upon integrating initiatives with other risk management components, such as comprehensive early-warning systems and awareness-raising.
- **Communicating and educating:** Knowledge transfer, capacity building, integrating scientific knowledge with local knowledge are important factors. In addition, raising awareness among all stakeholders about climate change impacts, the potential for linkage and synergy with food and nutrition programming, and the benefits of doing so (IUCN 2009).

Ecosystem-based adaptation measures have the advantage of being immediately and easily implemented, nevertheless, ecosystem-based and linked adaptation initiatives will have limitations. *Ecosystem-based adaptation* strategies may be successful primarily as an interim measure over the coming decades, as more drastic responses, such as population movement and/or more significantly changed livelihood responses may be essential in a more radically changed local environment over the longer term. Nevertheless, increased integration of multi-sectoral approaches will increase success and sustainability of food and nutrition security outcomes.

Linking program and policy

Climate change adaptation strategies can and should be linked to food and nutrition strategies and programs. Linked-up policy and program planning at the national, regional and international levels will be important to create synergies and reduce competition for resources and profiling. Climate change planning at the country level addresses food and nutrition security, although food and nutrition security policies also need to consider climate change as key vulnerability factor, and ensure that policies, programs, and measurement include points of linkage. A few specific opportunities are laid out in the table below.

Initiative	Actors
Committee on food security reform efforts	FAO – UN
High level task force on food security	UN
'Food Facility' programme and funding	EC
Hunger and food security strategy	US State Dept.
Food and nutrition security policy (under development)	African Union
Regional and national planning monitoring and coordination processes for food and nutrition security, agriculture, disaster risk reduction and climate change adaptation	National level processes as well as regionally, e.g., in Africa: CADAAP, NEPAD, SADC, ECOWAS, African Union, and National

Even more importantly, action can be initiated immediately, and capacities built at the local level, through community-based activities that build upon existing local knowledge, and complement behavioral and service-oriented nutrition programs. This experience should then be used to support policy and programme priorities.

Moving from policy to programming will necessitate more innovative partnerships between government ministries at the national and local level, and leveraging volunteer networks such as those provided by local civil society agencies, national Red Cross/Red Crescent Societies, and international nongovernmental organizations to increase reach and effective coordination. Communications technologies and marketing expertise and networks have also opened up new opportunities for creative solutions that harness the private sector to achieve broader reach and scale. Planning and policy processes can be enhanced by including all potential actors, but must be focused on clear objectives and outcomes.

Opportunities for Action

Moving beyond words to actions that will link climate change adaptation strategies to food and nutrition security strategies and programs will require action at several levels: in terms of

1. **SUPPLE SOLUTIONS: Practitioners and projects should share and adopt promising practices and interventions which can support nutritional improvements in the face of climate change.** Traditional hydroponics may be one such solution for contexts where increased flooding is an important factor. The availability of project information and interventions through the internet makes information access increasingly possible, especially through practitioner networks. Although efficient knowledge management and targeted dissemination systems are important, as is access to technical assistance for quality implementation and optimal impact (e.g., sector technical details as well as standard targeting, monitoring, gender, and other issues), existing inter- and intra- agency networks should commit to identify, document and share promising practices and interventions, reaching beyond the nutrition community.
2. **GO LOCAL: Tap local knowledge and recognize the need for solutions that are locally adapted, as communities will need multiple strategies to sustainably combat malnutrition in the context of climate change.** Underlying this essential understanding is the fact that climate change will bring greater unpredictability to weather patterns, and in the need for communities to become more resilient by increasing their ability to adapt. This will mean increasing skills in adopting solutions to their own capacities and contexts, be they institutional, environmental, or driven by access to natural resources and local infrastructure. Approaches such as community-based risk assessments and planning processes that link issues of food and nutrition security with natural hazards (including climate change) are one way to support increased resiliency and create a base for sustainable impacts on food and nutrition security. Paying greater attention to the underlying natural resource base as a whole (i.e., the local ecosystem), provides a holistic and practical approach to increasing the sustainability of food and nutrition security and related investments.
3. **REQUIRE REAL POLICY LINKS: National governments and donors must require sectoral interests and planning processes to not just coordinate or identify complementary actions, but move beyond lip service to actual joint planning.** Identifying measures of success that use nutritional data to measure success of agricultural and food security programs, will help to ensure accountability and increase incentives to link program targeting and approaches for better results. Food and nutrition security budgeting parameters and technical guidance require attention to long-term sustainability. This can be achieved by including consideration of, and methods to maximize the resiliency of the natural resource environment. Early-warning systems could be made more sensitive to longer-term changes by the inclusion of selective local biodiversity data. Stronger cross-sectoral participation should be ensured at global policy fora on nutrition, food security, climate change, and disaster risk reduction. Stronger cross-sectoral participation by Ministry and agency staff is even more important.
4. **PROMOTE PARTNERSHIP: Effective cross-sectoral planning and solutions will be facilitated by joint effort among different actors, and developing creative partnerships for national level reach of key interventions and monitoring mechanisms.** Many innovative solutions are developed at pilot level, without sufficient attention to cost and what it takes in terms of administration and technical support to achieve and sustain change at scale. Developing national level coalitions of actors across sectors will be important, as will individual partnerships for initiatives. Partnerships must be practical, leveraging mutual interest, with clear roles and objectives. These should be comprised of government, local civil society, and international organizations, so as to provide the mandate, the reach, and the technical support necessary to develop appropriate policies and programs to influence food and nutrition security in the face of a changing environment.

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[back to contents](#) *SCN NEWS # 38*

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How is the Water Sanitation and Hygiene Sector Implicated in the Link between Undernutrition and Climate Change?

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Action Contre la Faim, one of the key nongovernmental actors in the field of treating and preventing undernutrition, contributed recently to a [United Nations Standing Committee on Nutrition statement](#), entitled "Implications of Climate Change on Undernutrition". The statement mentioned that "Climate change constitutes a major health threat, and already contributes to the global burden of disease and premature death – hundreds of millions of people are at risk of being exposed to increased water stress. It will increase the burden of water-related diseases".

The current paper aims to describe how climate change already has an impact on undernutrition, and will increasingly continue to do so. Climate change leads to an extension of the pandemic areas of water-related pathogens and thwarts Water, Sanitation and Hygiene (WASH) strategies to control infections. Climate change also adds a new challenge to already struggling funding mechanisms. This paper will first review the relationship between undernutrition and WASH-related infections and explain how climate change impacts on classical WASH strategies to control or minimize infections; it will then propose a number of recommendations.

This paper focuses on the link between undernutrition, infection and WASH although climate change also has an impact on food and livelihood aspects (food availability, accessibility, stability and utilization). By putting further strain on women, climate change, compromises their ability to provide proper care to infants. Women and girls are the ones mainly responsible for fetching water: if less available, more time will be spent on fetching water and less time will be available for child care. In addition, climate change will impact the basic causes of malnutrition, namely the national and international strategies – including the allocation of funding which already causes controversies.

Undernutrition, health status, environment and WASH-related infections

The World Health Organisation (WHO 2005) states that the cause of 17% of deaths of children under 5 years of age is diarrhoea (19% are related to acute respiratory infections and 8% to malaria). Diarrhoea and malaria are also major immediate causes of acute malnutrition. On the other hand, malnutrition leads to decreased immunity as well as impaired barrier protection, and thus increases the frequency and the duration of diarrhoeal episodes, thereby creating a vicious circle, exacerbated if the patient suffers from AIDS or any other immune deficiency.

According to Bos (personal communication), an inadequate sanitary environment is the cause of more than 3 million deaths each year of which 2.2 million (including 1.8 million children) deaths are due to diarrhoea and 1.2 million to malaria. Additionally, nearly one third of humanity is affected by parasitic worms.

Several types of pathogens transmitted with contaminated food or water, or through unhygienic contact, can be responsible for diarrhoeal disease; most frequently *Campylobacter*, *Salmonella*, *Shigella* and *Escherichia coli*. Viruses such as *rotavirus* are known since long to be responsible for 20% of the diarrhoea-related deaths of children under 5 years of age (Zoysa and Feachem 1985). In endemic zones, parasitic colonisation of the intestine is the norm. Since malnutrition compromises the immune system, parasitic diarrhoea is frequent and acute among malnourished children, whereas well-fed children may more likely be healthy carriers.

The WHO (2000) has already estimated the contribution of climate-related stress to the global disease burden. This represents a total of 5.5 million disability - adjusted life years (DALYs) annually: 2 572 000 in South-East Asia, 1 894 000 in Africa and 768 000 in the Eastern Mediterranean region. The effects of climate change are likely to exacerbate these numbers in the coming years.

Traditional strategies to control WASH-related infections

Regardless of climate change, the causes of WASH-related infections are multiple and linked: low quality of and access to water, inadequate sanitary environment, and poor hygiene practices. The underlying causes of infections spreading can be related to the environment (uncontrolled human excreta disposal, stagnating water, uncontrolled dumping areas, high temperature and humidity), and/or related to poverty (less access to mosquito nets or to proper sanitation, hygiene and medical knowledge, less financial capacity to put this knowledge into practice). But the successful implementation of WASH interventions also depends on local and international strategies (e.g. what are the priorities of duty bearers, relative allocation of funds through international programmes, etc.).

Most cases of endemic diarrhoea are not only due to the transmission of pathogens by water, but are also transmitted from individual to individual due to unsafe sanitation and a lack of hygiene (Fewtrell et al. 2005). Therefore, to enhance public health, improving access to drinkable water (especially through the point of use water treatment) must be accompanied by increasing the availability of sanitation and raising hygiene (handwashing) awareness among the population.

Additionally, exclusive breastfeeding highly increases the child's immunity as well as limits the risk for infection by avoiding polluted water given to the child. The way the mother understands the origin of their children's diarrhoea must also be taken into consideration (Nielsen et al. 2003).

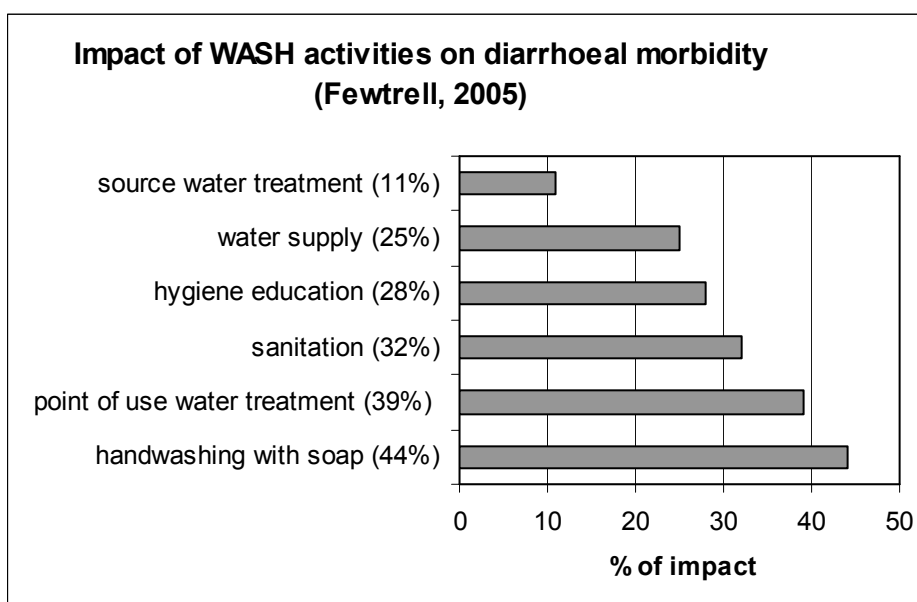
Neglected tropical diseases such as trachoma, schistosomiasis and nematode infections, which affect over one billion people, can also be prevented by proper sanitation and hygiene practices, as their transmission routes are mainly fecal-oral and water-washed (WHO 2006).

To reduce infection risks, and therefore also to reduce the risk of undernutrition, especially in children under 5 years of age, there is a need to focus on¹:

- improving drinking water quality by establishing a safe water chain;
- increasing access to domestic water by improving physical infrastructure and/or by making it cheaper to break both the water-borne and water-washed transmission modes;
- improving human excreta disposal to break faecal-oral transmission modes;
- improving hygiene practices through increased access to facilities, knowledge, time, and funds (to regularly buy soap for improved hand washing, food hygiene, and clothes and body washing); and
- improving the sanitary environment (reducing areas of stagnating water, controlling processes of solid and liquid waste disposal, and developing vector-control strategies in the home to prevent either water-based and water-related diseases).

The prioritization of those five strategic axes is obviously contextual. It depends not only on the mode of transmission in a given situation, but also on the local capacity to support the intervention and to sustainability concerns. Figure 1 shows the impact of the different technical WASH strategies - noting that the

Figure 1: Impact of different technical WASH strategies



different strategic axes are interconnected - to prevent and reduce diarrhoeal morbidity (Fewtrell et al. 2005)

Impact of climate change on the WASH sector

Unfortunately, traditional WASH strategies can be, and already are, affected by the adverse impacts of climate change. As such, climate change represents a key risk factor challenging the prevention of undernutrition as it will hamper classical strategies to prevent infections and increase the infection hazard. The impact of climate change is felt through:

- a change in environmental parameters (global temperatures, rainfall and air humidity) having a direct impact on the distribution of disease pathogens and pests. Climate change will promote the spread of

1. Adapted out of the 'F' diagram, Almedom et al. 1997 in Tabiri, 2005

diseases into previously unaffected areas (Dow & E. Downing 2007). Climate change will increase the burden of water-related diseases, especially in terms of extending the area of major pandemics (IPCC 2007);

- hundreds of millions of people² (WHO, UNICEF 2008) at risk of being exposed to increased water stress in the coming years. Less water means poorer hygiene and a reduced capacity to run sanitation plants and human excreta disposals;
- less water available meaning that mainly women and children will have to walk increasingly long distances to collect water, with less time to spend on productive activities including working on the farm, which has a potential follow-on effect of less food availability;
- an unbalanced water resource, with some areas prone to a regression of water tables and others prone to regular flooding and stagnating water, will have an impact on water availability and will increase the risk of the spread of pests and parasites;
- an increase in both the frequency and the intensity of meteorological events (rain patterns): increased risk of flooding and drought will push more people into poverty, due to the loss of property and income, reduced production capacity, decapitalisation, and finally climate-related forced migrations (e.g. into slums and peri urban areas);
- an increased competition for Official Development Assistance (ODA) funds adds to the already existing challenge of the under-funded Millennium Development Goals (MDGs) – especially for MDG4 (child health) and MDG 7 (environmental sustainability);
- rising sea levels lead to an increase of saline intrusions in coastal areas, reducing availability of fresh groundwater; and
- massive displacement of populations to already overcrowded urban settlements and slums, lacking appropriate sanitary infrastructure.

Specific impact of climate change on WASH pathogen transmission modes

Climate change also directly impacts the different modes of pathogen transmission (Thompson 2001). Climate change will increase risks for **faecal-oral transmitted diseases** (cholera, typhoid, amoebic dysentery, ascariasis, gastroenteritis, hepatitis, paratyphoid) through:

- modified environmental parameters which can have severe consequences, such as seasonal variations for parasitic diarrhoea (Bradbury 2003). Environmental studies showed that there was an increase in mice populations, responsible for transmitting the tick-borne Lyme disease to humans, the year food availability increased (due to El Nino climate events);
- climate change may induce the appearance, or the re-appearance, of water-borne pathogens. WHO (2003) stated that studies showed several micro-organisms (including *Cryptosporidium*, *Escherichia coli* O157, *Norovirus*) had become pathogenic;
- floods having a dramatic impact on water quality, especially in terms of contaminating water sources with faecal and biological material;
- floods, by destroying latrines or solid waste disposal, and therefore on one hand not allowing people to defecate or process their waste in safe conditions and on the other hand often spreading faeces and garbage material stored in pits thus further contaminating drinking water, fields, vegetables, etc. ;
- floods and droughts affecting water accessibility through the destruction of water points and water networks, regression of the water tables, and the reduction of yields. This impacts both the capacity to properly manage domestic sanitation (e.g. pour-flushed latrines) and the possibility of maintaining suitable hygiene standards;
- recurrent floods and droughts, being a major cause of poverty (destruction of assets, forced displacement);
- reluctance to respond to additional financial requests in order to adapt to climate change, for deepening water-points in the case of new drought-prone areas (e.g. in central Afghanistan), or endlessly investing funds for reconstruction after recurrent cyclones in South-East Asia.

Water-washed transmitted diseases (skin or eye infections such as trachoma, abscesses and ulcers, scabies, conjunctivitis, yaws - a tropical form of treponematosis, typhus transmitted by insects or spiders) are essentially linked to hygiene practices. A reduction in water access (e.g. due to drought) or an increase in

poverty (e.g. less ability to purchase soap), both direct consequences of climate change, will impact this specific mode of transmission.

Water-based transmitted diseases, through the skin or through ingestion (due to unsafe water supply), are specifically prevented by proper human excreta disposal. An example is schistosomiasis, where urine or faeces infected with eggs contaminates ponds, and then penetrates the skin when people enter into the infested waters. Guinea worm is transmitted by drinking infected water. Climate change, through reduced access to water and increased poverty, compromises sustainable access to proper domestic excreta disposal, safe water use and household water treatment.

Climate change may increase risks of contracting **water-related transmitted diseases** (malaria, onchocercosis, yellow fever, filariasis, dengue, and several infections due to *Arboviruses* and trypanosomiasis) involving insects either breeding in water or those biting near water:

- a change of an environmental parameter directly impacts the vector's (parasites and insects) biotope, and therefore increases the risk for transmitting diseases. For example, it is predicted that malaria can spread into northern and mountainous regions, if other ecological factors permit it (Earthscan 2007). This risk is exacerbated by the fact that a pathogen appearing in a new geographical area 'benefits' from national institutions lacking strategies, funding, and contingency plans to respond adequately;
- wastewater treatment plants and sewage, as well as drainage systems in peri-urban areas, can be destroyed by floods and new stagnating water areas can appear due to a change in rainfall patterns. As stagnant water is a breeding ground for disease-carrying organisms such as mosquitoes, this represents a major risk for the spread of parasitic infections; and
- a proper control of water-related diseases requires both important investments and political prioritization. This depends on the governments' resources and understanding of the consequences of climate change on human health.

Recommendations

In terms of strategic planning, climate change will not fundamentally alter the existing link between undernutrition, public health and WASH. It will mainly increase the current technical and financial challenges. Climate change has both a catalytic and magnifying effect on the existing link between, the death of 7 children every minute from undernutrition, and the lack of proper access to water, sanitation, and hygiene practices. The necessary adaptation and/or mitigation measures will therefore be more a matter of capacity and volume of traditional interventions than implementing innovative or pilot approaches.

Agencies and donors should:

- *focus on reducing vulnerability*: a highly vulnerable system such as a community, an individual, a sanitary environment, is one that is highly sensitive to even modest changes in climate, and one for which the ability to adapt is severely constrained (IPCC 2007);
- *scale-up community-based adaptation programmes*: community-led processes, based on communities' priorities, needs, knowledge and capacities with the aim of empowering people to cope with the effects of climate change (Reid et al. 2009). For the WASH sector, management of the sanitary environment, as well as promotion of hygiene practices, is a community and household matter. Some positive experiences like the Community-led Total Sanitation (CLTS) (Wateraid 2006) and its local versions, have demonstrated the effectiveness of both high coverage, community-led and low cost initiatives. This 'low-cost' option particularly makes sense as the most affected communities to climate change are likely to also be the poorest ones. These types of programmes focus on enhancing the adaptation capacity of populations (IPCC 2007);
- *ensure the development and systematic implementation of Disaster Risk Management programmes*. This means using administrative directives, organizations, operational skills and capacities to implement national WASH policies and strategies to reduce the adverse impacts of hazards (UNISDR 2009). It also means improving coping capacities as well as mitigation strategies, such as elevated latrines or boreholes to cope with floods;
- *promote Disaster Risk Reduction Programmes* as well as Early Warning Systems;
- *work at community level on practices or traditional beliefs* that (could) increase vulnerability to climate change (Burton 1998); and
- *promote the resilience of communities*, increasing their ability to resist, absorb, accommodate and recover from the effects of a hazard (UNISDR 2009). This includes preservation and reconstruction of

WASH facilities.

Institutions and local communities should:

- support national governments in preparing *National Adaptation Programmes of Action* (NAPAs); these should essentially include sectoral strategies for the Health and WASH sectors; and
- *advocate for funding and priority setting*. This remains a double challenge: firstly, the creation of a new financial envelope specifically dedicated to tackling or preventing the effects of climate change, which will not affect the existing and under-funded MDG priorities. Secondly, the prioritization of adaptation funds over mitigation ones, as mitigation presupposes the existence of basic institutional infrastructures. This has been strongly advocated for by aid agencies and the poorest countries during the Conference of the Parties in Copenhagen (COP15).

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Effects of Increasing Carbon Dioxide Emissions and Climate Change on Nutritional Quality of Food Crops: a Case Study on Cassava

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CO₂, plant chemistry and food nutrition

Double the food with half the resources by 2050 – that is what we need to aim for if we are to provide food security for all 8.5 billion people by then (The Royal Society 2009). Climate change will make the job harder: droughts and floods make for poor yields. But there is another challenge yet to make it onto the radar screen. Rising carbon dioxide levels will almost certainly decrease the nutritional value of most staple crops, and some are likely to become more toxic as well.

Rising carbon dioxide emission has the potential to boost plant growth and crop yields. However, the increase in yield will not be as great as first thought (17% compared to original estimates of 28 to 35%, Ainsworth and Long 2005). Plants acclimate to the higher levels of CO₂ by adjusting their whole metabolism when grown in air consistent with a range of emissions scenarios (Ainsworth and Long 2005 and references therein). As a result, the chemical composition of plant tissue is likely to change in the coming century. Protein content of cereals such as wheat and rice, for example, is likely to decrease 10 to 15% and, indeed, may have already decreased as a result of atmospheric changes during the past century (Taub, Miller and Allen 2008). For those who rely on grains this could be a big problem. Lower protein content is also likely to have a negative impact on baking quality of wheat (Wieser et al. 2010). Leaves too will contain up to 20% less protein, with direct nutritional consequences for grazing animals (e.g. Drake, Gonzalez-Meler and Long 1997; Gleadow, Foley and Woodrow 1998). Some of the reduction in protein is just a dilution effect from the accumulation of carbohydrates, but most of it is a genuine reduction in protein production (Ainsworth and Long 2005).

As well as protein and carbohydrate, plants contain all sorts of other chemicals, which act to protect plants from herbivores and disease-causing pathogens. Some easily recognised examples are phenolics (e.g. vanilla, cinnamon), alkaloids (e.g. nicotine, caffeine and morphine), glucosinolates (e.g. mustards) and cyanide-releasing compounds (i.e. cyanogenic glucosides). The ability to tolerate these natural toxins depends on several factors including the amount ingested at one time, a person's health, age and weight, and in some cases, the amount of protein ingested along with them. For example, sulphur-containing amino acids, which are abundant in fish, help detoxify cyanogenic compounds.

Atmospheric concentrations of carbon dioxide directly affect plant growth and the nutritional quality of plant products as a result of improved efficiencies (Drake, Gonzalez-Meler and Long 1997; Taub, Miller and Allen 2008). CO₂ (input) is converted to chemical energy (sugars, outputs) in the process of photosynthesis using solar energy (sunlight) and water. At higher CO₂ concentrations, the amount of 'infrastructure' (photosynthetic enzyme) required to power the whole process is reduced (Drake, Gonzalez-Meler and Long 1997). Since most leaf protein is actually photosynthetic enzyme, any reduction in that one enzyme affects the overall protein content of the leaves. Moreover, resources that might have gone towards photosynthesis are instead allocated to defence chemicals such as cyanogens or phenolics (Gleadow, Foley and Woodrow 1998). This is good for the plants, but bad for the humans or animals that eat them. While anti-nutritional factors are not normally a problem in human food, some are, and it is important to know what will happen under future climate scenarios.

Cyanogenic plants

Around 10% of all plants and 60% of crop species are cyanogenic (Jones 1998). The cyanogenic glucosides in these plants break down to release toxic cyanide gas (HCN) when plant tissue is crushed or chewed (i.e. the process of cyanogenesis). The cyanogenic glucosides and the enzyme involved in breaking them down to release cyanide are kept in different compartments of plant cells to prevent auto-toxicity. Cyanogens are effective defensive agents against generalist herbivores, including humans. The main toxic action of cyanide is inhibition of cellular respiration (McMahon, White and Sayre 1995). The acute lethal dose of HCN for humans is 0.5–3.5 mg per kg body weight (Halstrom and Moller 1945 in Jones 1998). The toxic effect of cyanide also depends on the time duration over which the toxic product is consumed, and the amount of sulphur-containing amino acids in the diet (Jones 1998). Despite the fact that most crops produce these defence compounds, which have the potential to be toxic to humans, very few studies have examined the effect of elevated CO₂ on them (but see Gleadow et al. 1998, 2009a, b).

Cassava (*Manihot esculenta* Crantz, also known as manioc, mandioca or tapioca) is a food crop that naturally contains cyanogenic compounds. It is a staple food source for over a billion people in Africa, Asia and Latin America, with the greatest per capita daily consumption in African countries (FAO/IFAD 2000; Nhassico et al. 2008). In fact, it is the world's fourth most important food source (after rice, wheat and maize) and third most important source of calories in the tropics (after rice and maize, FAO/IFAD 2000, [FAO 2010](#)). Cassava roots (or tubers), which look a bit like sweet potatoes, are high in starch (up to 90% dry weight), but relatively low in protein and certain minerals and vitamins (Montagnac, Davis and Tanumihardjo 2009). Cassava leaves are higher in protein, minerals and vitamins than the roots and are also consumed in several countries. Cassava is sometimes called the 'drought, war and famine' crop of the developing world because it grows fast on poor soils with little water and requires relatively little cultivation. The downside is that cassava plants can contain high levels of cyanogens in the roots, leaves and stems (up to 1500 ppm, Cardoso et al. 2005). If not correctly prepared, consumption of cassava products can lead to illness or death. Too much cyanide and insufficient protein in the diet can

Picture 1: Cassava tubers (long storage roots) at a market in Mozambique.



Photo: Ros Gleadow.

Picture 2: Children with *konzo* as a result of toxins produced in their food. Faces have been blurred.



Photo: Julie Cliff.

lead to outbreaks of the paralyzing disease, *konzo* (Nhassico et al. 2008). *Konzo* is the result of ingesting high concentrations of cyanogens over a short time interval, causing irreversible paralysis of the legs or even death. Children and women of childbearing age are particularly at risk. *Konzo* is widespread and persistent in southern and eastern Africa, especially in times of drought, war and social upheaval. The chronic neurological disease, tropical ataxic neuropathy (TAN), is also associated with eating cassava high in cyanogenic glucosides over the long term, and is seen in adults. Goitre may be another result of a diet high in cyanogenic glucosides (Montagnac et al. 2009 and references therein).

Processing cassava is usually a role of women and children. Most of the cyanogens are in the peel of the cassava tubers, so that is removed first. Then the tubers are chopped or grated and sun-dried, soaked or fermented, before being pounded into flour or roasted to produce *gari*, *rale* or *farinha* (depending on the location). Processing can involve a combination of these methods and can take up to a week before the flour is ready for consumption. Sun drying and heap fermentation remove 60 to 85% of the cyanogens in the tubers, but grating removes 97 to 99% (Nhassico et al. 2008; Howard Bradbury personal communication). Grating is particularly effective as it mixes the cyanogens with the enzymes in the tubers, which releases the cyanide, but it is very time-consuming and exposes the people grating to cyanide poisoning. In a collaborative research project between Australia and Mozambique, scientists found that more cyanide gas can escape from the cassava flour if it is wetted, spread thinly in a tray and left for up to 5 hours before consumption (Bradbury 2006). However, the final amount of cyanogens in the flour depends on the initial levels of cyanide compounds in the cassava plants. The World Health Organization's recommended safe level of total hydrogen cyanide in cassava flour is 10 ppm (i.e. 10 mg cyanide equivalents/kg DM: FAO/WHO 1991 in Montagnac et al. 2009).

Picture 3: Cassava flour needs to be prepared carefully to remove cyanide toxins from the roots.



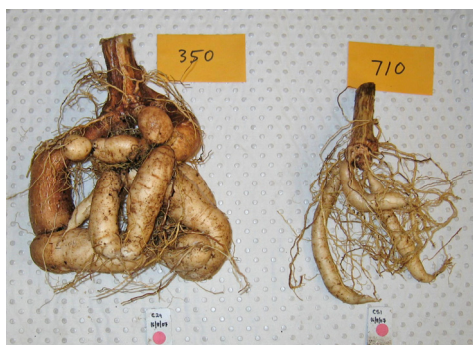
Photo: Natalie O'Donnell.

Impacts of CO₂ on cassava

Despite its vital importance to human health, little is known about how cyanide production in plants will be affected by climate change. If cassava is to help meet global food demands in a changing climate then a number of questions need to be answered:

- Will cassava be safe to consume?
- Will growth rates be maintained?
- Will there be any interaction between increasing carbon dioxide levels with temperature and drought?

Picture 4: Cassava tubers of plants grown at elevated carbon dioxide concentrations (right, 710ppm) were about half the size of those grown at ambient CO₂ (left, 350 ppm). Source: Gleadow et al. 2009, *Plant Biology* 11, (Suppl.1) 76–82.



Other staple crops commonly grown in the Asia Pacific (e.g. taro, yam, and forage sorghum) also contain cyanide-producing compounds and nothing is known about how their nutritional value or yield will change in a high CO₂ world.

A recently conducted a glasshouse trial, tested the effect of different CO₂ emission scenarios on the nutritional value and toxicity of cassava (Gleadow et al. 2009). The plants were cultivated at three different CO₂ emission scenarios: slightly lower than today's air (360ppm, i.e. controls), approximately one-and-a-half times (550 ppm), and twice (710 ppm) the concentration of carbon dioxide as today's air. This represents the concentrations of atmospheric CO₂ we can expect in about 30 and 60 years time, given the current worst-case scenario that the world is following (IPCC 2007a,b). Two important results were discovered when cassava plants were grown under elevated CO₂ concentrations: (1) cyanide levels doubled in the edible leaves (up to 1500 ppm), but not the tubers, and (2) the tuber yield decreased by up to half (compared to control plants).

Similar results were found for the leaves of clover, an important pasture crop (Gleadow, Edwards and Evans 2009a).

So these results represent both good and bad news. The good news was that the starchy core of the tubers did not show any increase in cyanogen levels. The peel was more toxic (Gleadow, Evans and Cavagnaro, unpublished data) but that is not a problem for human consumption because the peel is removed. However, the peel is often fed to animals on subsistence farms, so that would definitely reduce animal production in the future. The bad news for human consumption was that the leaves were significantly more toxic, with a higher proportion of cyanogens compared to leaf protein. This is of concern for people who eat the leaves as a salad in Indonesia and Brazil. In the future it would be better to pound and cook the leaves before consumption, as is done in Africa.

But food toxicity is only one of the effects of increased CO₂ emissions. More worryingly, it was found that the cassava plants in the elevated CO₂ glasshouses did not grow as well. In fact, the tuber mass of plants was reduced by more than half in one of the nutrient treatments, which is a substantial decrease. If this would occur globally, there could be widespread increase of hunger and consequently flow-on social and political effects. The question why the two cassava cultivars responded to the higher concentration of atmospheric CO₂ in this way is currently being looked at.

These findings also need to be tested in a field setting, similar to other crops that have been tested in free-air CO₂ enrichment (FACE) facilities (Ainsworth and Long 2005). As a first step, baseline information will be collected about the cyanogenic potential of cassava varieties grown in Mozambique, through a project funded by the Australian Agency for International Development (AusAID).

Drought impacts on food quality

In addition to the direct effects of elevated CO₂ emissions on plants, there are indirect effects associated with global climate change (which result from the increasing atmospheric concentrations of CO₂ and other greenhouse gases). Global surface temperatures, sea levels and the frequency and intensity of droughts, floods and other extreme weather events are predicted to increase in the future (IPCC 2007a). These phenomena will directly affect crop production and the nutritional value of food products. For example, cyanogen levels are known to increase in the whole cassava plant as a result of drought. Monitoring of cassava toxicity in Mozambique by Cliff and colleagues has revealed that cyanogen levels in cassava flour triples in drought years compared to normal years. An average of 40 ppm cyanide concentration has been recorded in cassava flour in 'normal' rainfall years, compared to about 120 ppm in a drought year (at the same locations in Nampula district: Ernesto et al. 2002; Nhassico et al. 2008), which is well above the World Health Organization's safe level of 10 ppm (DM: FAO/WHO 1991 in Montagnac et al. 2009).

Coupled with the fact that protein intake is also lower in times of drought, these results explain why outbreaks of *konzo* coincide with droughts. Not only is this a problem for human nutrition, but for animal production as well, since cassava is used as an animal feed in many countries (Lebot 2009). Growing-season rainfall in eastern and southern Africa has declined by approximately 15% in the last 30 years, and droughts have seemed to be more severe (Funk et al. 2008). In the future, Mozambique and other cassava-growing areas are expected to become drier and warmer, leading to more incidences of drought (IPCC 2007a). Combined with declining per-capita agricultural capacity in these regions, these factors are exacerbating rural poverty.

Priorities and a way forward

Increasing greenhouse gas emissions and associated climate change pose a very real threat to food security. There is no doubt that grains and plant foliage will have less protein in them under future atmospheric conditions. Many plants will also produce more of the natural chemicals that defend them against herbivores. The impact of elevated CO₂ on the nutritional quality of cassava is one such example where attention should be focused on. Thus, with AusAID funding, the authors are now making further assessments of the impacts of climate change on cassava nutrition and yields. The case study is situated in Mozambique, in collaboration with experienced cassava breeders to address how the cyanogenic potential of cassava plants is correlated with yield and environmental factors such as moisture availability, temperature, soil nutrients and plant-microbe associations.

Recommendations to reduce or eliminate cyanide poisoning from cassava now and in the future:

- diversification of the diet of cassava-dependent communities, e.g. introduction of other vegetables, pulses and fruit (with support from government agricultural departments and nongovernmental organizations; Cardoso et al. 1998);
- improved processing of cassava products, e.g. further implementation of the wetting method for cassava flour, in *konzo*-prone areas of Africa (Bradbury 2006);
- monitoring of the cyanogenic potential of cassava products, with the use of simple test kits available free to agricultural and health workers in developing countries (Howard.Bradbury@anu.edu.au, <http://online.anu.edu.au/BoZo/CCDN/>);
- development and cultivation of high-yielding, pest-resistant, low-cyanide varieties of cassava; and
- global reduction of greenhouse gas emissions.

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Epigenetic Epidemiology and Food Availability

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Introduction

An understanding of consequences in the long perspective of famines and feast, might influence future relief programs. Apart from selection by higher mortality among people at the extremes, and besides reproductive fitness, long-lasting modulation of gene expression mediates nutritional- nurture effects. These genomic or metabolic imprintings and other mechanisms occur without alterations in the DNA sequence. They are called epigenetic (on genetics) and reappear in the cell divisions. One observation after the Dutch Hunger Winter from 1944 to 1945 was that individuals, who were periconceptionally exposed to the hunger, had six decades later, a changed imprinting of a growth factor gene (Heijmans et al. 2008).

Modulation of gene expression also has responses in following generations. This has been demonstrated in plants and lower organisms. In mammals, it is complicated by erasures before implantation and the normal resets as differentiation progresses (Chong and Whitelaw 2004, Reik et al. 2001). Despite what was previously thought, environmentally induced epigenetic marks sometimes reappear in plants, lower animals, and the offspring of mammals (Waterland et al. 2007). In humans there is one observation of a gametic epigenetic inheritance of a genomic change (Amor et al. 2004) which might be the first evidence at the molecular level (Whitelaw and Whitelaw 2006).

Epidemiological findings

Early growth and development can be grossly divided into an intrauterine-infancy-toddler growth phase, a slow growth phase (SGP), a prepubertal peak in growth velocity, and adolescence. Nutrition, hormones, and other growth factors during the early life have an influence on the oogenesis (Bromfield et al. 2008). For the spermatocyte, a reprogramming of DNA-methylation begins at the SGP (Pembrey 2002). Transmission, through the male germ line in particular, suggests gametic epigenetic inheritance (Skinner 2008).

Three-generational data have revealed an association between 19th century grand-parental and parental early life nutrition and their 20th century descendants' health. Their longevity and their decease caused by cardiovascular diseases or diabetes varied with parents' and grandparents' exposure to food crises or good availability of food. The transgenerational response was different if the exposures had occurred during the ancestors' embryogenesis-fetal-toddler age or during the slow growth period in mid-childhood or during adolescence. When ancestors' availability of food was good during the very early life, the influence was positive for the descendants: they suffered less from cardiovascular disease. When the ancestors lived through very good years during their slow growth phase in mid-childhood, the trans-generational response was the opposite: their descendants had a high mortality in cardiovascular disease.

The availability of food during ancestors' early life was defined with the help of the agricultural statistical tables, the price statistics, and general historical facts. Variables controlled for were: selection, reproductive fitness, parents' socio-economic status, size and literacy of the family, and the descendants' own socio-economic circumstances (Kaati et al. 2007).

Selection had not diminished the outcome variation over the generations; the reproductive fitness was not affected by ancestors' childhood experience. Soft inheritance in a similar cohort has been reported (Modin et al. 2008) and the mothers' literacy had an influence on the future longevity of her children (Kaati et al. 2007), but over the three generations gametic epigenetic response was the proposed dominating explanation (Bygren et al. 2001, Kaati et al. 2002, 2007, Pembrey et al. 2006). There are now proposals to couple the epidemiological level with the molecular level (Foley et al. 2009, Sasaki and Matsui 2008).

Famines and feasts have surprising and very long-term repercussions. Famines are hopefully rare in the future and the famine relief systems hopefully improve. From the presently described studies, we can learn that, during such crises, long-term sequels are best counteracted by good care of pregnant mothers, infants, and toddlers.

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- outline some frequently used methods for measuring food security
- describe the main considerations when planning an anthropometric nutrition survey
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Health Co-Benefits of Climate Change Mitigation Policies: the Role of Food Production

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Introduction

In the definition of national and international food-based dietary guidelines, the strong and direct links between diet and several nutrition-related chronic diseases such as cardiovascular disease, cancer and obesity, remain the primary consideration (WHO 2003, World Cancer Research Fund 2007, WHO 2004). The features of a healthy diet generally include: maintenance of a healthy weight, limiting energy intake from fat and a shift from saturated to unsaturated fats, increased fruit and vegetable consumption, and limiting the intake of free sugars and salt (WHO 2004, WHO 2003).

It is however becoming increasingly clear that research and policy directed at defining healthy diets must now have a considerably wider remit. The dietary consumption by populations should also be seen within the context of sustainable development. Climate change and population growth pose threats to food security for poor populations and require that researchers from across academic disciplines work together with policy-makers to identify strategies to ensure that populations have access to both a healthy and an environmentally-sustainable diet. For too long there has been separation of academic disciplines and government departments involved in agriculture, environment, food and health which has resulted in research silos that fail to address important cross-cutting issues, and a lack of joined-up government policies. Researchers and policy makers must reach across traditional boundaries to find solutions that will tackle the over-arching impacts of climate change.

Greenhouse gas emissions from food production

The food system contributes significantly to global greenhouse-gas emissions. Greenhouse gases are produced at all stages in the system, from farming and its inputs through to food distribution, consumption and the disposal of waste (Garnett 2008). Recent estimates suggest that the agriculture sector contributes between 10 and 12% of total global greenhouse-gas emissions (Smith et al. 2007). Significant additional emissions arise from agriculture-related changes in land use such as deforestation, overgrazing and conversion of pasture to arable land, and emissions from the agriculture sector are expected to increase by half again by 2030 (Smith et al. 2007).

Approximately half of all food-related greenhouse-gas emissions are produced during the farming process. Farm-stage emissions include nitrous oxide (N₂O), methane (CH₄), and carbon dioxide (CO₂). The latter arises predominantly from agriculturally-induced land use change, especially deforestation (McAlpine et al. 2009, UN Food and Agriculture Organisation 2006). Within the agriculture sector, it is livestock production, which gives rise to N₂O (both from pasture land and from arable land used to grow feed crops), and CH₄ (from the digestive processes of ruminant animals such as cows and sheep), that accounts for the vast majority – nearly 80% – of all greenhouse-gas emissions (UN Food and Agriculture Organisation 2006). Rising demand for animal source food products, especially in middle-income transition economies is likely to drive up the production of livestock by 85% by 2030 from levels in 2000 (World Bank 2008) and this will further significantly affect sector emissions.

Health co-benefits of climate change mitigation

An important earlier review suggested that in high-income countries, there would be both environmental and health benefits from reducing the consumption of meat, while in low-income countries, meat consumption could be increased to ensure adequate consumption of essential nutrients especially in early childhood and to increase global equity of food supply and consumption (McMichael et al. 2007). This so-called contraction and convergence approach suggested that globally, meat consumption should be restricted to around 90g per capita per day if it was desired to avoid future increases in greenhouse-gas emissions from the food and agriculture sector.

In early 2009, a collaborative programme of work, co-ordinated by the London School of Hygiene & Tropical Medicine, on the public health effects of strategies to reduce greenhouse-gas emissions in a range of sectors was initiated. As part of this programme an international group of scientists from multiple disciplinary backgrounds set out to look across the climate change, agriculture, food and health disciplines to quantify the possible benefits to health of meeting agriculture-related greenhouse-gas emissions targets. It was assumed that to meet global targets for greenhouse-gas emissions, all sectors i.e. transport, electricity generation, built environment and agriculture would need to reduce emissions by the same magnitude, and the estimates were based on existing data from the UK on emissions (AEA 2009) and dietary intake among adults (Finch et al. 1998, Henderson et al. 2003). While efficiencies may be possible in all parts of agricultural production,

and for example result from actions to reduce waste, the production of livestock was identified as the primary focus of the strategies given its predominant role within the agriculture sector as a source of greenhouse gases (UN Food and Agriculture Organization 2006).

First, potential strategies for the food and agriculture sector were identified that could meet the necessary reductions in greenhouse-gas emissions by 2030 for a high emission country such as the UK proposed by the UK Committee on Climate Change (HM Government 2009) with the ultimate objective of reducing greenhouse-gas emissions by 80% by 2050 from levels recorded in 1990 – the target agreed by the UK government. The agriculture sector has for many years been working to improve efficiencies and reduce greenhouse-gas emissions in the livestock sector, and some important advances have been made. However, the latest estimates suggest that these existing strategies, such as feed modifications, breeding, manure processing and carbon capture through management of land use, will fall well short of UK government emission targets (ADAS 2009). It was therefore estimated that in addition to the existing strategies it would be necessary to cut overall livestock production in the UK by 30% to meet the greenhouse-gas emission target for the livestock sector in the UK. For illustrative purposes it was assumed that a 30% cut in livestock production would result in a commensurate fall in the consumption of livestock products and especially of animal source saturated fat. In these models the focus was on UK livestock production and consumption although it was acknowledged that livestock products, and their associated emissions, are globally traded.

Next, the impact this change in food production would have on population-level food consumption was estimated. Finally, the effects these changes would potentially have on population health, were estimated (Friel et al. 2009). This work was designed to provide an indication of the approximate magnitude of co-benefits to health of policies that were primarily aimed at reducing greenhouse-gas emissions.

As well as the adverse environmental impacts of livestock production, excessive consumption of livestock products is also associated with a number of adverse health outcomes in adults. For example, animal products are a major contributor of saturated fat in the human diet, and high intake of saturated fat is consistently associated with increased risk of heart disease (Hu et al. 2001, WHO 2003). Similarly, there is also strong evidence that high red and processed meat consumption is associated with increased risk of certain types of cancer (World Cancer Research Fund 2007).

For modelling purposes, existing data on the association of consumption of saturated fat with risk of ischaemic heart disease in adults (Jakobsen et al. 2009) were utilised. The WHO Global Burden of Disease ranks ischaemic heart disease as the most common cause of death in high-income countries, and the second most common cause in low-income countries. Globally ischaemic heart disease is the cause of more than 7 million deaths per year. The estimated 30% cut in consumption of animal source saturated fat would result in a substantial decrease of the order of about 17% in the number of premature deaths from heart disease among adults in the UK – equivalent to 18 000 premature deaths averted in one year, or 3% of all deaths in the UK (Friel et al. 2009).

For comparison, the UK strategy for greenhouse-gas reduction was also applied to data on dietary intake in Sao Paulo city in Brazil. This was a necessary simplification given the lack of data from Brazil on sector-specific emissions and nationally-representative dietary intake. In the Brazilian context, it was estimated that a 30% reduction in consumption of saturated fat would also result in a 17% reduction in the number of premature deaths from heart disease among adults in Sao Paulo city – equivalent to 1 000 premature deaths averted in one year (Friel et al. 2009).

To summarize, using data from two countries which consume large amounts of animal source products, if a strategy to meet greenhouse-gas emission targets for the agriculture sector, namely to cut livestock production, also led to a fall in the consumption of animal source saturated fat, it would have a substantial benefit to population health. This is a good news story – a policy that is good for the environment and good for public health. Furthermore, only one diet and health association was examined. There may also be additional benefits to health associated with decreased consumption of livestock products such as reduced incidence of certain types of cancer.

Caveats and uncertainties

Clearly, there are uncertainties in these estimates and they should only be seen as indicative of the sorts of health benefits that might accrue from strategies that primarily set out to tackle greenhouse-gas emissions. And of course there are numerous caveats. First, these estimates are based on UK data only and greater availability of emissions and dietary intake data from around the world would enhance the current analysis. Second, different forms of livestock rearing, such as up-land extensive farming and intensive grain-fed animal-rearing, contribute differently to greenhouse-gas emissions but also to food production. These complexities were not included in the calculations. Third, the estimates only relate to countries which consume large

quantities of animal source foods and for millions of poor people in low-income countries, animals are a crucial source of livelihoods. It is important to remember that the proposal is to reduce livestock production in countries that consume large amounts of livestock products. The elimination of all animal source food consumption is not proposed. Fourth, the estimates did not allow for the environmental costs of producing substitute foods, although substituting livestock products for vegetable source foods would make a relatively small contribution to green-house gas emissions. Certainly in countries consuming large amounts of livestock products, where total calorie consumption is likely to be in excess of requirements, no substitution is probably necessary. And fifth, simple substitution of livestock products with other less environmentally harmful foods may not be realistic. If, for example, saturated fat from animal products was not isocalorically replaced by polyunsaturated fats from plant sources, the benefits would be less than estimated. Equally, the estimates did not take into account that if livestock products were replaced by healthy alternatives such as fruit and vegetables, additional benefits to health would accrue. These caveats are identified as important areas for future research.

Changing population consumption patterns

How possible is it to shift population consumption patterns? In the UK, adult males are estimated to eat over 1kg of meat and meat products a week (Henderson et al. 2003) which is an amount well in excess of national dietary recommendations. Indeed, it has recently been estimated that 70 000 premature deaths in the UK could be prevented each year if diets matched nutritional guidelines. The health benefits of meeting the national nutritional guidelines have been estimated to be as high as £20 billion each year in the UK (HM Government 2008). The WHO Global Strategy on Diet, Physical Activity and Health provides a comprehensive action plan for improving dietary intake at the global, national and individual level (WHO 2004). Potential strategies include both demand side alternatives, such as interventions on education, marketing, labelling and health claims, and supply side alternatives such as defining agricultural policies that would result in enhanced national diets and could benefit public health.

Several nations have already taken up the challenge of reducing consumption of animal source foods in their populations, not only for health reasons, but also for the good of the environment. In May 2009, civil servants and elected councillors in the Belgian city of Ghent committed to go meat free one day a week with school-children following suit later in the year (Mason 2009). While in Sweden, dietary guidelines explicitly recommend that meat consumption should be reduced because of the associated greenhouse-gas emissions, and Swedish food products also now state their carbon footprint (Swedish National Food Administration and Swedish Environmental Protection Agency 2009).

These are brave and crucially important first steps towards tackling the impending climate crisis. A greater awareness of the climate costs of all our actions, including our choices about what we eat, is urgently needed. Governments and consumers face tough choices. But surely cooling our love-affair with animal source foods is a very small price to pay for moving towards a more sustainable pattern of dietary consumption especially in high-income countries.

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Further reading: Humanitarian implications of climate change

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Human Rights and Climate Change¹.

FIAN International www.fian.org

Impacts of climate change on implementation of human rights to food and water

Already today, climate change has visible and predominantly negative impacts on global crop yields and the availability of potable water. The situation will further deteriorate in the future. Climate change therefore poses substantial challenges for the implementation of the human rights to food and water.

The increase in temperature will reduce the production of many food products, for some it will become completely impossible to grow in their traditional production areas. Furthermore, climate change will shift rainfall patterns, leading to many areas with low rainfall to experience a further decline in precipitation in the future. As a consequence, the productivity of rain-fed agriculture will significantly decrease in some regions of the world.

Changing rainfall patterns will also substantially affect the availability of drinking water. The natural seasonal melting of snow in summer, the driest season of the year, supplies water to many rivers which are central to freshwater supply. However, the melting of glaciers caused by global warming will lead to the disappearance of these natural water reservoirs and therefore to water shortages. In addition, the sea-level rise increases the salinity of groundwater and soils in coastal regions and small islands.

The impacts of climate change will be much more severe in the tropical and sub-tropical climate zones, where the majority of developing countries are located, than in the temperate zone, where there are mostly developed countries. This implies that precisely those people who have contributed least to global warming will be most strongly affected by its impacts.

Furthermore, many people who live in those regions lack the physical, social, economic and technological resources necessary to adapt to the changes that will be brought about by climate change. Especially vulnerable are people and segments of population who are socially disadvantaged and already suffer from hunger and poverty due to their gender, age, disease or belonging to a minority group. These are predominantly rural communities, of which small family farmers, landless peasants, day-workers and nomads are most vulnerable. If gender-specific differences are taken into account, it is women and girls who are particularly exposed to the adverse impacts of climate change.

Foundations and principles of international environmental and human rights law

The foundations of international climate change law were laid at the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992. One of its results was the United Nations Framework Convention on Climate Change (UNFCCC), which can be regarded as the “constitution” of international climate policy. Further documents produced at the “Earth Summit” were the Rio Declaration on Environment and Development, Agenda 21 and the Convention on Biological Diversity.

International environmental law is based inter alia on the following principles:

- The *polluter pays principle*, stating that the polluter should, in principle, bear the cost of pollution (Rio Declaration on Environment and Development, Principle 16).
- The *principle of limited territorial sovereignty*, according to which States parties have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction (Preamble of the UN Framework Convention on Climate Change; Rio Declaration on Environment and Development, Principle 2).
- The *principle of common but differentiated responsibilities*, stating that industrialized countries should assume the leadership of the fight against climate change and its negative effects (UN Framework Convention on Climate Change, Art. 3 [1]).

The *precautionary principle*, according to which lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation (UN Framework Convention on Climate Change, Art. 3 [3]).

The main pillar of the human rights system is the International Bill of Human Rights of the United Nations, which consists of the Universal Declaration of Human Rights adopted by the General Assembly in 1948, the International Covenant on Civil and Political Rights (ICCPR) and the International Covenant on Economic, Social and Cultural Rights (ICESCR), both adopted in 1966.

1. Summary from the report “Menschenrechte im Klimawandel. Anforderungen an die deutsche und internationale Klimapolitik. Schwerpunkt: Menschenrecht auf Nahrung und Wasser”, FIAN Germany, November 2009 ([online](#)), written by Teresa Schulze, Hanna Wang-Helmreich, Wolfgang Sterk. Summary translated by María Alejandra Morena

The resulting obligations of States are explicitly stipulated in the treaties and result from the further work of the organs of the United Nations human rights system.

In essence, there are three main levels of obligations:

- The obligation to respect means that States must refrain from undertaking measures, as for example displacements, which curtail the enjoyment of human rights (Committee on Economic, Social and Cultural Rights –CESCR– 1999; 2002).
- The obligation to protect requires States to take steps in order to prevent both corporations and individuals from abusing human rights (CESCR 1999; 2002).
- The obligation to fulfill means that States must take positive action to achieve progressively the full realization of human rights. For instance, they have the duty to facilitate people's access to water and other resources necessary to assure their livelihood. If an individual or a group of people are not able to realize their rights to adequate food and water with their available means, due to causes they cannot influence, then States are obliged to take immediate action to correct such situations (CESCR 1999; 2002).

Further relevant key obligations of States are:

- The obligation to take steps, individually and through international assistance and co-operation, especially economic and technical, to the maximum of its available resources, with a view to achieving progressively the full realization of the rights recognized in the International Covenant on Economic, Social and Cultural Rights (ICESCR, Art. 2, para. 1).
- The obligation to act promptly and expeditiously, making an efficient use of the available resources, in order to undertake specific and purposeful measures to ensure the enjoyment of human rights (CESCR 1990).
- The obligation to guarantee, regardless of the extent of available resources, that the rights to food and water can be exercised without discrimination (prohibition of discrimination). In addition, special attention must be given to members of vulnerable and disadvantaged segments of population (CESCR 1990).
- The obligation of States to guarantee the access to at least minimum levels of food and water to all people under their jurisdiction (CESCR 1990).
- The obligation to facilitate the participation in the political decision-making process of those people who are affected in their rights by the adopted policies (CESCR 1999).

It should be noted that the obligation to co-operate internationally is usually given a subsidiary role. In the first instance, States are bound to implement international human rights on their own territories. However, it can be argued that due to their global scale, some problems require from the outset joint action of the international community with a view to protecting human rights.

The task of the international community is to make the climate regime consistent with the existing human rights obligations of States.

Emissions reduction and human rights

Climate change is caused by human activities and has extensive negative impacts on the fulfillment of human rights. International human rights therefore constitute an obligation of States to promptly undertake measures to reduce greenhouse gas emissions so as to prevent further negative impacts of global warming on the international protection of human rights (*do no harm* approach). Furthermore, the human rights perspective requires state actions to focus on those who are most vulnerable to human rights abuses. Thus, international environmental law must mandate and realize emissions reductions of a magnitude that is adequate to protect the rights of these people from climatic changes.

The need for large emissions reductions prompts fundamental questions about distributive justice, given that hundreds of millions of people in developing countries are still affected by hunger, poverty and lack of access to proper sanitation, among others. Although it will hardly be possible to fulfill their basic needs without an expansion of their energy consumption, it would not be sustainable to satisfy their growing energy demand by using fossil energy sources. In order to fulfill the human rights of people in poor countries, it is therefore indispensable to build a system of green energy supply. Most Southern States, nevertheless, will not be able to do this fully on their own.

According to the *principle of common but differentiated responsibilities* stipulated in the UN Framework Convention on Climate Change and to the obligation to co-operate internationally recognized in the ICESCR,

it is the duty of industrialized countries to take the lead in the reduction of emissions, as well as to assist developing countries to reduce their emissions, through financial aid and the transfer of low-carbon technologies.

Specific mechanisms and measures to reduce emissions must respect human rights, too. Resulting from their obligation to respect and protect, States must ensure that such measures – as for instance the expansion of agrofuels, the construction of dams or the utilization of forests as carbon stores – do not curtail or infringe the enjoyment of human rights of people both on their own national territories and beyond. Measures to protect the environment shall not lead to people losing their means of existence; they rather must recognize and respect the traditional rights of indigenous people and local communities to land and other resources. When affected by such measures, these groups shall be fully and effectively involved in all levels of decision-making processes. In addition, a mechanism to settle potential conflicts should be established.

Obligations of States to protect human rights from the impacts of climate change

In addition to minimizing the impacts of climate change, States must protect people living on their territory from these impacts and ensure the realization of minimum essential levels of the rights recognized in the ICESCR, also under changing climatic conditions. Each State must therefore conduct studies on the regional impacts of climate change. States must then on this basis take steps to improve their possibilities to adapt better to climate change, giving special attention to the vulnerable segments of population. Furthermore, States are obliged to ensure access to information on short-term and long-term climatic changes to all people (establishment of an early-warning system), as well as to facilitate their participation in the political process in which the adaptation measures are developed and decided. Finally, States must also guarantee that all persons whose individual rights are being affected by the impacts of climate change are protected by the law, i.e. that they are able to assert their rights before a court.

Given that many developing countries are particularly hit by the negative impacts of climate change and that the costs of adaptation greatly exceed their financial means, they depend on international co-operation to fulfill their human rights obligations. States committed themselves to engage in such co-operation in Article 2 of the ICESCR. The human rights obligation of industrialized countries to help developing countries, through financial aid and technical co-operation, to protect their citizens from the impacts of climate change is supported by the environmental law *principle of common but differentiated responsibilities*, enshrined in the UN Framework Convention on Climate Change. Measures undertaken by the international community to increase the adaptive capacity of people to climate change must be oriented towards human rights standards.

Finally, the international community must find a solution to the issue of climate refugees. More and more people are forced to leave their homes as a result of extreme weather events and floods. However, according to present international law these people currently do not have a legal status and are not under the responsibility of the Office of the United Nations High Commissioner for Refugees. This gap in international law must be closed without delay.

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FIAN International www.fian.org was founded in 1986 and is the international human rights organization that advocates the realization of the right to adequate food. It is a non-political, not-profit organization with consultative status to the United Nations and sections and members in more than 50 countries. FIAN Germany is one of its national sections.

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[back to contents](#) *SCN NEWS # 38*

Indigenous Peoples, rainforests protection and climate change

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The protection of tropical forests is now high on the international climate agenda. Upcoming strategies to reduce deforestation and forest degradation could benefit the global climate while protecting the livelihoods and rights of forest dwellers. However, poorly managed, these strategies may end up marginalizing those who are the custodians of natural forests and who depend on them the most for their food security and livelihood.

Forest dependent indigenous peoples in the context of climate change

Indigenous peoples tend to be vulnerable to climate change. This is partly due to their dependence on natural resources, but also to their marginal position in political and economic terms, giving them little influence and bargaining power. Climate change undermines their traditional livelihoods and makes them more food insecure (OHCHR 2009; UNPFII, 2008).

About 60 million indigenous individuals live in the rainforests of South America, Southeast Asia and Central Africa. A further 350 million people live in, or next to, dense forests and rely on them for subsistence or income (World Bank, 2004; Mayers and Vermeulen, 2002). Indigenous peoples living in and depending on rainforests have so far not been hardest hit by climate change, but, as shown in the Amazon, temperatures are rising. In combination with deforestation, this leads to a cycle of less rainfall and greater frequency of draughts (UNEP/GRID Arendal 2009) which may dramatically change the biodiversity and carrying capacity of the areas they depend on.

The food crisis is likely to increase the pressure on indigenous territories. When food prices rise, food production becomes more profitable. This increases the value of agricultural land, and makes it more profitable to expand the agricultural border. Forest is cut down to provide grazing land for cattle and food crops.

Land inhabited by indigenous peoples is often perceived as 'unused', underutilized, and up for grabs, even if indigenous communities living there have legal land title. More often their land rights are not acknowledged, as states consider indigenous territories to be 'State land'.

A human rights-based approach

A human rights-based approach (HRBA) aims towards ensuring all human rights for everyone. This necessitates placing a special focus on inequalities and on the most vulnerable, here specifically on indigenous peoples. Human rights provide overarching frameworks for national laws, regulations, government planning and policies. Development processes and goal setting should be a process towards fulfilling human right norms and standards as expressed in human right declarations and treaties, guided by principles like human dignity, equality and non-discrimination, participation and inclusion, accountability and the rule of law (UN, 2003). The emerging HRBA is versatile and may be applied to all policy sectors and development planning, including agriculture, forest and development policies.

The practice of gradually diminishing indigenous territories is disputed with basis in international human rights law; especially the Convention on the rights of indigenous and tribal peoples (ILO 169) and the United Nations declaration on the rights of indigenous peoples (UNDRIP). According to these human right instruments, indigenous peoples have a collective right to the territories they depend on for their livelihoods. They also have the right, as peoples, to make their own development strategies within these areas. According to the UNDRIP, which was adopted by the large majority of the world's countries at the UN General Assembly in September 2007, indigenous peoples have a right to self determination, and also a right to (and the government a duty to seek their) free, prior and informed consent (FPIC) if laws, policies, or activities are planned that may affect them and their interests. The void between rights and realities provides them with a political space that should be, and gradually is, used to its fullest.

The international human rights have their origin in the UN, and it is under the auspices of the UN that these international standards are discussed and state conduct evaluated. It is disappointing that human rights norms and standards, and the situation of vulnerable groups and individuals, were marginal topics at the recent UN-based negotiations on climate change in Copenhagen 2009, and also at the Summit on food security in Rome (November 2009). The issues were mostly brought up by nongovernmental organizations and indigenous peoples.

This is in contrast with the intention of the UN and its Charter, which in Article 55 charges the United Nations to promote respect for and observance of universal human rights for all (UN, 1945). According to the Conference of human rights in Vienna 1993 (Art. 4)

'The promotion and protection of all human rights and fundamental freedoms must be considered as a priority objective of the United Nations in accordance with its purposes and principles, in particular the purpose of international cooperation' (UNGA 1993).

The World Food Summit in Rome in November 2009 and the climate negotiations of the UNFCCC (COP 15) in Copenhagen in December 2009 seemed to take place in relative isolation from each other, in spite of overlapping challenges. The separate processes are seen as a testimony to compartmentalized processes and the failure of states to provide a common framework for global governance (The Cordoba Declaration, 2009). It is also proof of the failure of states and the United Nations to apply an integrated HRBA.

A HRBA commands a holistic and integrated strategy¹ and calls for the adoption of appropriate policies at both national and international levels, oriented to the eradication of poverty and the fulfilment of all human rights for all (UN, 2003). It provides a framework for analysis and action through which adverse effects on marginalized populations can be identified and counteracted. In this approach, in the case of traditional peoples depending on land, territories and natural resources for their livelihoods, the right to food² should be understood as overlapping with the right to land. The right to food would also need to be understood in context with the special rights of indigenous peoples' self determination and to free, prior and informed consent with regard to laws, policies and measures that are likely to affect them.

Under the right to food, as described in the paper by FIAN in this issue (page 52), states should respect what people already do and protect them against harm imposed on them by non state actors. State obligations build first and foremost on respect for and protection of the food acquiring strategies and coping strategies the population use. When needed, the state must also proactively engage in facilitating and strengthening people in their efforts to maintain a livelihood and thus food security. Finally, whenever individuals or groups are unable, for reasons beyond their control, to enjoy the right to adequate food by the means at their disposal, states have the obligation to fulfil (provide) that right directly (Eide 1987, Oshaug et al. 1994). Thus, the right to food is a right to a set of conditions that makes one able to feed oneself (and one's dependents) in dignity. According to the General Comment 12 (UN/ECOSOC 1999), '...specially disadvantaged groups may need special attention and sometimes priority consideration with respect to accessibility of food. A particular vulnerability is that of many indigenous population groups whose access to their ancestral lands may be threatened.'

Forest protection under REDD

The anthropogenic causes of climate change include the emission of greenhouse gasses from the burning of fossil fuels and the loss of forests (IPCC, 2007). Measures to reduce greenhouse gas emissions would thereby include the reduction of the global dependency on fossil fuels, in addition to measures to reduce deforestation and the burning of forests.

State leaders gathered at the United Nations climate negotiations have so far failed to achieve agreement on how to address climate change, with one possible exception. Industrialized countries have signalled willingness to provide economic incentives to rainforest countries that reduce deforestation. Reduced deforestation would be a substantial, although not sufficient achievement, as an estimated 15% of greenhouse gasses stem from forest loss (UCS, 2009). The new initiative, called 'REDD' ('Reduced emissions from deforestation and forest degradation') is also welcomed by tropical forest countries. If they are paid for protecting forests against logging, they will be able to uphold their development paths without sacrificing their forests.

To assist countries developing adequate national REDD plans, the UN is working with a group of countries through the UN-REDD initiative, and the World Bank through the FCPF (Forest Carbon Partnership Facility) with some overlap. While there have been serious concerns over inadequate consultation with indigenous peoples and local communities nationally, the UN and World Bank initiatives have still not led to tangible REDD initiatives on the ground. In parallel to these initiatives however, bilateral development assistance and various sub-national REDD projects are already in place in some forest countries. In a parallel vein, 'carbon trading' is taking place through the voluntary market. Experiences from project based REDD initiatives indicate reason for concern. There are many challenges ahead both with regard to actual climate impact, the quality of consultation processes and the consequences of these projects for people depending on these forests.

The Stern (2006) and Eliasch (2008) Reviews were instrumental in creating interest in REDD. The Stern Review suggested that setting up a system in which rainforest countries are compensated for reducing deforestation and forest degradation is a cost-effective way of reducing 'carbon emissions', while also preserving bio-

1. According to the Vienna Declaration and Programme of Action (World Conference on Human Rights) 1993 Article 5: 'All human rights are universal, indivisible and interdependent and interrelated. ...'

2. From the International Covenant on Economic, Social and Cultural Rights (1966)

diversity and local livelihoods. This has influenced the REDD discussions under the United Nations climate initiative (UNFCCC: UN Framework Convention for Climate Change) and other UN and World Bank related initiatives.

There is no doubt that compensation for 'carbon' stored in tropical forests may become a substantial source of income for states and other forest owners. Properly managed, REDD could benefit the global climate and humankind while contributing to poverty alleviation. By protecting these forests, and by compensating forest owners, one may at the same time protect the livelihoods and the food security of forest dependent communities. There are vast additional known and probably unknown benefits linked to protecting forests. Forests play an important role in regulating groundwater and rainfall, and thereby influence climate and food security far outside the forests themselves. Forests also lessen the impact of natural disasters. They provide a physical barrier against heavy winds and waves, and root systems protect against landslides and erosion. Intact natural forests also provide critical resources for communities adapting to the negative impacts of climate change. In addition, forests are the home of a wide range of plants, birds and animals, including insects that provide a crucial 'service' in the pollination of domesticated plants (UNEP/GRID Arendal, 2009).

While the Stern and Eliasch Reports have been important in creating a momentum for forest protection, they have also, by focussing on economic incentives and the 'carbon equivalents' of forests biomass, contributed to a potentially problematic and rather simplistic view on forests. If REDD+ leads to reduced forest destruction, without changing the forest ecosystems or threatening the user rights and self governance for forest dependent people, REDD will secure their livelihoods and food security. If poorly managed, REDD schemes may further marginalize these groups and threaten their food systems.

It is expected that the economic compensation payed to countries will be used to compensate forest owners, including indigenous peoples and other forest dependent communities with land titles, for reducing deforestation. The incentives may however tempt powerful actors to find ways of acquiring ownership over indigenous land and even remove them from their territories and homes to stop the use of wood for domestic purposes. This threat accentuates the need to establish indisputable land rights for forest dependent communities, and also laws, regulations and practices that protect their tenure.

Some countries and companies argue that REDD schemes should allow for a certain amount of logging. Due to the new value of trees, tree plantations are also promoted, including the conversion of natural forest to tree plantations, as this would maximize income opportunities. As a consequence it is debated internationally how depleted a forest can be and still be defined as forest, and whether plantations are in fact forests. If their land rights are not secured, and these creative initiatives win through, REDD will end up financing tree monocultures and include so called sustainable logging. The depletion of forest peoples' food base would then continue, in the name of forest protection, and forest peoples may have to watch their forests gradually being replaced by plantations.

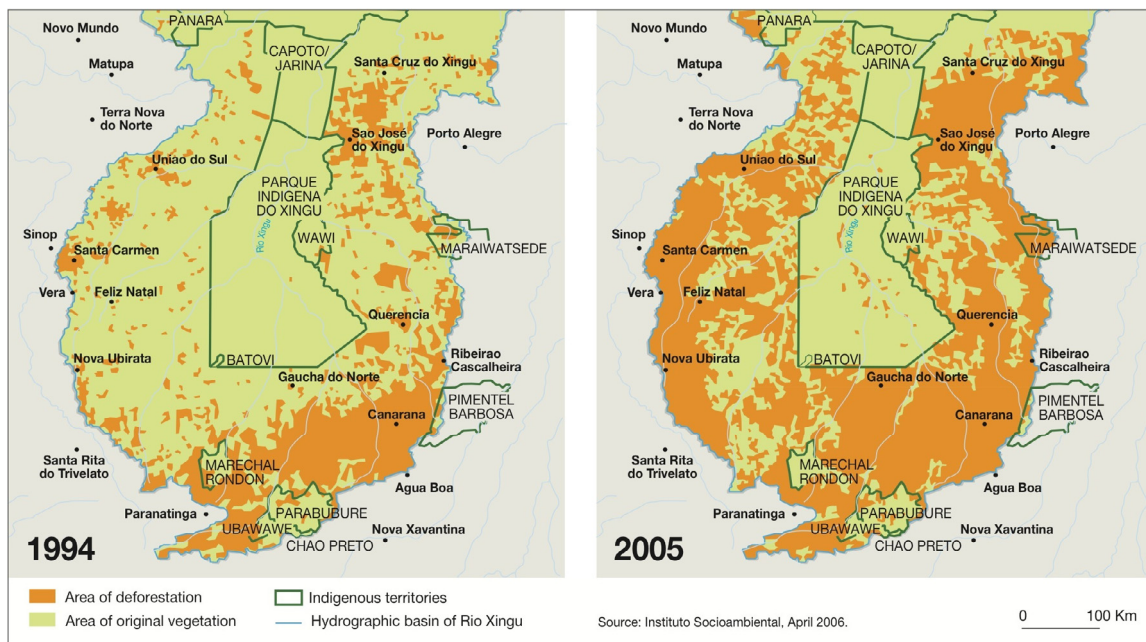
During the last years, civil society and indigenous peoples have mobilized and increased the attention to forest dependent peoples and their rights. Their territorial rights and their right to self determination and to freely give or withhold their consent in matters of concern to them and their land and resources³ have so far been poorly understood and inadequately respected by powerful stakeholders in REDD. Various reports have also highlighted the role of forest people in protecting forests against deforestation.

Forest protection- experiences: Brazil

Although the REDD agenda is new, the forest protection agenda is not. Conservation efforts and sustainable management of forests have been motivated by biodiversity and livelihood concerns for decades (CIFOR, 2009). Recent studies strongly indicate that ensuring the land rights of indigenous peoples and local communities is beneficial to forest conservation. A recent World Bank study finds that areas under indigenous self-governance are most effectively protected against deforestation, followed by protected areas (Nelson and Chomitz, 2009). This is clearly demonstrated in the Xingu indigenous territory in Brazil. Here the indigenous inhabitants patrol and protect their area against loggers and other intruders. The almost complete forest cover in their territory is starkly contrasted by the surrounding areas.

As shown in Figure 1, the area outside the indigenous territory of Xingu was almost completely deforested and turned into agricultural land in the period 1994-2005 while the forest cover in the indigenous territory remained almost intact (UNEP/GRID Arendal, 2009).

3. As defined in the United Nation Declaration on the Rights of Indigenous Peoples, from Sept. 2007, and also reflected in ILO Convention No. 169 (1989) concerning Indigenous and Tribal Peoples in Independent Countries (ILO 169)

Figure 1: Trends in Deforestation in the Xingu River Basin Brazil⁴

REDD- a double edged sword

It is becoming increasingly clear that REDD is a 'double-edged sword'. If well designed and managed wisely, it may represent an unprecedented historic opportunity to address climate change while stopping deforestation and ensuring indigenous peoples' rights. Indigenous peoples have consistently called for climate change policy and law to comply with indigenous peoples' rights as outlined in the Declaration on the rights of indigenous peoples (IIPFCC, 2009).

On the other hand, combined with weak management, the monetization of the carbon stored in tropical forests may make REDD an incentive for land grabbing and fraud (IIED, 2009). Indigenous peoples may see halted the ongoing processes of having territorial rights recognized, while speculators or the state position themselves as lawful forest owners. The decentralization of forest management may be reversed as the state and local governments want to achieve control over carbon funds (Phelps et al. 2010). Furthermore, there might be no sufficient political commitment in rainforest countries:

- to consult with forest dependent communities;
- to apply social safeguards;
- to respect and protect rights; and
- to address the main drivers of deforestation through political and legal measures.

This may result in the selection of a strategy, which at any given time, generates the most income for the state and other powerful actors. This will be to the detriment of forest dwellers. Lobbyists are already seeking to influence the UNFCCC negotiations to ensure that REDD can be combined with logging, bio-fuel plantations or monoculture tree plantations, and that plantations will be eligible for REDD funding (Griffiths 2008). Such a development would seriously harm those depending on forests for their livelihoods.

It still remains to be seen what effect REDD will have on the food security and nutrition situation of forest-based communities, and whether REDD funding will reach these. Many indigenous peoples are sceptical to REDD. This is mainly because of distrust in their governments due to former negative experiences, and also a distrust in market-based solutions to the climate problem (ICP, 2010).

There is little doubt that climate change will affect us all, but not all to the same degree. It is thought-provoking that those who have contributed the least to climate change and thus has the smallest ecological footprint are those who may be most harmed by it (UNPFII 2008). The human rights-based approach would be a suitable framework for integrated actions spanning ministries. In order to take effective measures against climate change, governments need to agree on a common and bold global approach and take concerted action in all relevant sectors, including transport, agriculture, energy and forests. It seems obvious that measures to alleviate food insecurity should not contribute to climate change. However, the production of food crops is a real threat to forests.

4. Data: Instituto Socioambiental, Brazil, April 2006. Graphics: Philippe Rekacewicz assisted by Cecile Marin, Agnes Stienne, Guilio Frigieri, Riccardo Pravettoni, Laura Margueritte and Marion Lecoquierre. <http://maps.grida.no/go/graphic/trends-in-deforestation-in-the-xingu-river-basin-brazil>

It also remains to be seen if states manage to unite in the determination to confront these global challenges in a manner that benefit the global ecosystem as well as the human rights of present and future generations, including those depending most on the forests we need to protect. Climate change will most likely widen the gap between the powerful and the disempowered, and contribute to increasing poverty and food insecurity. A human rights-based approach is therefore long overdue. A global REDD agreement among states should be rights-based, and include a mechanism for conflict resolution; it should also be accessible by forest dwellers. Nationally REDD+ plans will have to be developed in consultation with forest-based communities. The rights to their land territories and natural resources should be formalized. So should the rights of indigenous peoples to self-determination and to decide whether to give their free prior and informed consent to REDD+. Forest owners, including indigenous peoples and local communities, should receive their share of the REDD+ compensation. This would allow them to improve their situation with regard for instance to schooling, health and food security, according to the needs they perceive. This would help build trust and could contribute to future collaboration between states and local communities in protecting forests.

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Climate Change, AIDS and Nutrition Security: Responding to Long-Wave Processes

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After a decade of work investigating the interactions of sub-Saharan Africa's AIDS epidemics with food and nutrition security, the Regional Network on AIDS, Livelihoods and Food Security (RENEWAL) recently started to consider the additional implications of ongoing climate change for these interactions. This led us to ask questions about how to anticipate and effectively respond to complex multi-faceted problems that play out over different spans of time.

Much has been learnt in recent years about the ways that food insecurity and malnutrition may contribute to the spread of HIV – as well as themselves being consequences of the downstream impacts of AIDS on individuals and households. Such vicious cycles play out against a backdrop of the longer-wave dynamics of climate change and the short-wave cycles of seasonality – both of which can exacerbate vulnerability. Superimposed on these different "timescapes", periodic shocks – such as the soaring food prices of 2008 – will further threaten resilience of households and communities.

Let us first go back to the southern African food crisis of 2002. Given that the drought was less severe than the one that hit the region in 1992, why did household impoverishment increase much more rapidly? During the nineties, food and nutrition security had been progressively squeezed by a silent, progressive build-up of political, socio-economic and environmental vulnerability along with a burgeoning AIDS epidemic. Against this backdrop, a modest external threat such as an unexceptional drought, was all that was needed to trigger widespread suffering (Drimie and Casale, 2009).

This situation led de Waal and Whiteside (2003) at that time to hypothesise that the coexistence and interaction between acute food insecurity and pervasive high HIV prevalence could precipitate a downward spiral of households and communities into destitution, thus precipitating famine. The "new variant famine" (NVF) hypothesis posited that not only does AIDS interact with and worsen other livelihood shocks but it selectively undermines the very strategies that historically were employed to respond to such shocks. A new variant famine would be qualitatively and quantitatively quite different to a 'normal' famine, demanding qualitatively and quantitatively different responses. Several papers have since provided empirical backing for many of the NVF tenets and outcomes (Mason et al, 2007; Naysmith et al, 2009; Arrehag and de Waal 2006; Ansell et al, 2009; Loevinsohn, 2009).

Nutrition insecurity may be chronic for many people, seasonal for others, and for many it is both. AIDS epidemics, on the other hand, are long-wave phenomena. In fact there are several waves – the first wave of HIV infection is followed by increased incidence of opportunistic infections and, several years later, by the AIDS death wave (now being attenuated to some extent by the roll-out of antiretroviral drugs which can turn AIDS into a chronic disease). Beyond this, depending on a host of variables, there lies a stream of economic and social impacts at household, community and national levels. Such impacts – especially when considering the future of children living through this period in southern Africa – are likely to endure for decades, spanning generations.

If we consider the dual long-wave dynamics of AIDS epidemic and the climate change together we can see important similarities, and real possibilities for a more united response. Populations with high rates of HIV (most southern African countries, where HIV is now considered to be "hyperendemic") are the most vulnerable to a worsening or prolongation of the epidemic due to climate change. The maximum impact of climate change is in the future, many years beyond the peak incidence of HIV. The severity will largely be determined by the temporal and spatial overlap of these long wave processes, both of which are physically and socially differentiated. Yet these links have received little analysis (UNAIDS & UNEP, 2008).

A recent paper by Chazan et al (2009) draws important comparisons in the evolution of AIDS and climate change discourses. Three key parallel trends in research include: i) the tendency toward globalized discourses and the masking of uneven vulnerabilities; ii) the dominance of scientific perspectives and continued grasping for "techno-fixes" and iii) the polarized debates and resulting diversion away from equitable and comprehensive responses. Examining these parallels together we can begin to see why the task of understanding the *root causes* of the *uneven* impacts of AIDS (and of climate change) has not been at the forefront of dominant research or development agendas.

Finally, let's consider the effects of the soaring food prices in 2007/8. In regional assessments in late 2008, food price shocks were found to intensify the vicious cycles between HIV and nutrition insecurity - rendering it simultaneously more difficult, as well as more important, to integrate responses to HIV and hunger (Gillespie et al 2009). As the financial crisis then supplanted the food price shock, households and communities continued to struggle. Acute shocks and chronic stresses – social, economic, political, environmental, and health-related – combined to push livelihoods to the brink.

Looking back, the soaring food prices of 2008 can be seen as a dramatic spike in a longstanding and deep-rooted livelihoods crisis in southern and eastern Africa. Spikes in food prices were reflected in spikes in international interest in food and nutrition, and in their possible relationships with AIDS epidemics. Though opportunities were seized for making the case for nutrition at this time, “business as usual” is now returning. The chronic, long-wave dimensions of enduring hunger have never been as media-friendly -- nor as likely to cause rioting in the streets -- as a food price crisis.

Viewing these multiple “waves within waves”, we can see how concurrent long wave processes of AIDS epidemics and climate change have the potential to interact directly – with consequences for food and nutrition insecurity. Slow burning deleterious effects of climate change on food and nutrition security – in addition to other stresses – could a) place people at greater risk of being exposed to HIV (as livelihoods are undermined, and riskier options taken up), b) threaten the access of people living with HIV to a diverse and adequate diet (potentially undermining adherence to, and effectiveness of treatment regimes) and c) reduce resilience of HIV-affected households to the downstream impacts of AIDS, as agriculture’s ability to support livelihoods is progressively threatened.

The foundations of nutrition security for many poor households may thus become progressively eroded. Households and communities that used to be resilient to seasonality, may be increasingly hit by seasonal nutrition insecurity, assuming they fail to adapt. Those communities which historically have struggled with seasonality will suffer more severe effects, perhaps precipitating destitution. If resilience is undermined, droughts may be more severe, for more people. Seasonality of food and nutrition security may also lead to seasonal spikes in HIV-related vulnerability – especially for poor women who may be driven to high-risk livelihood strategies including transactional sex (Bryceson and Fonseca 2006).

Responding to long-wave dynamics

To what extent, if at all, is the AIDS epidemic taken into account by agencies and governments seeking to facilitate climate change adaptation – and vice versa? Little is being done to actually assess and strengthen the organisational capacity of institutions to adapt to a changing climate. Long wave shocks are complex and difficult in policy terms – as they involve dealing with multiple dislocations, diverse agencies and a much longer time horizon than governments or international bodies are accustomed (or willing) to (Standing 2005). Unfortunately there is not much evidence that agencies and governments are proactively responding *at large-scale* to the interactions between HIV and nutrition insecurity, let alone anticipate additional interactions with climate change.

This once again highlights the need for a multisectoral approach. In the medium/longer term, there is an urgent need to build bridges between agriculture and health sectors to ensure longer term support to livelihoods where HIV and hunger coexist, often overlaid by climate change. The majority of people affected by AIDS epidemics globally are primarily dependent on agriculture for their livelihoods. Creative ways of fostering convergence of social and health services with agricultural support should be explored. The regeneration of small-scale agriculture (e.g. homestead food production) could be linked with health and education services, so that produce may be used as food assistance in HIV treatment programs and/or school feeding to improve school retention, and reduce child hunger. The private sector too could, for example, develop local food fortification initiatives that generate income and build capacity to immediately link to treatment interventions and also serve to mitigate the impacts of AIDS in the longer term.

Agriculture and development policy could reduce distress migration by incentivizing adoption of local livelihood strategies in and around the community, extending the growing season through developing small-scale irrigation, subsidizing agricultural inputs, product diversification, agro-processing, strengthening existing, and creating new, market linkages, and developing the farm input supply chain. Policy reform could help overcome barriers experienced by affected households in participating in agricultural production and marketing, such as their depleted resource base, their need to be close to home to tend to the sick, loss of key skills and their inability to take on risk.

Overriding such shifts, there is a need for a major, sustained capacity strengthening drive. AIDS has reduced capacity in many development spheres, especially agricultural extension. Organizations (governments, NGOs, and donors) need to invest not just in programmes and activities directly aimed at reducing risk but also at general capacity strengthening. Adaptation to climate change must explicitly factor in the existing and long-wave effects of the AIDS epidemic as it cuts through household and community level capacity. Policies, programmes and services need to be progressively steered toward strengthening people’s own adaptive capacity in the face of the multiple stressors of AIDS, climate change, chronic and seasonal hunger.

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Addressing Undernutrition and Climate Change in the Millennium Villages: Enhancing Resilience of Rural Communities

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Need for integrated nutrition and climate approaches

Climate change is a defining challenge of our time. Its impact and implications will be global, far-reaching and largely irreversible. Climate change is already increasing the risk of exposure to hunger, malnutrition and food insecurity among the poorest and most vulnerable people (Nelson et al. 2009, Parry et al. 2009, WHO 2009). Natural disasters are becoming more frequent and intense, land and water are becoming more scarce and difficult to access, and increases in agricultural productivity are becoming more difficult to achieve (Nelson et al. 2009, Parry et al. 2009). By 2050, the number of people at risk of hunger as a result of climate change is expected to increase by 10 to 20% more than would be expected without climate change; and the number of malnourished children is expected to increase by 24 million – 21% more than without climate change (Parry et al. 2009). Sub-Saharan Africa is likely to be one of the worst affected regions, especially the semi-arid regions north and south of the equator. This is mainly because of projected increases in aridity resulting from climate change and because of high vulnerability consequent on low levels of income. Without drastic changes in our global food system complemented with large-scale strategies to address malnutrition, taking into account the ongoing demographic and epidemiological shifts and the nutrition transition, it is predicted that climate change will eliminate much of the improvement in child malnourishment levels that would occur with no climate change (Nelson et al. 2009, Parry et al. 2009).

We are already in a state of emergency with more than one billion people hungry (an increase of 250 million over the previous five years), 195 million children stunted, and more than one billion people suffering from overweight or obesity, diabetes or other food-related health issues (WHO 2006, Popkin 2008, FAO 2009). At the same time, agricultural practices and food systems are pushing our ecosystems beyond sustainable boundaries and are important factors contributing to climate change (IPCC 2007, Rockstrom et al. 2009). Almost 15% of global anthropogenic greenhouse gas emissions are due to deforestation much of which is attributed to agriculture conversion, while another 14% of the emissions are directly attributed to agricultural practices (Morton et al. 2006, IPCC 2007). Food prices continue to rise as energy and other inputs drive up production costs (FAO 2009, OECD-FAO 2009). Biofuel has caused controversy during a time in which the world food system is under siege (Searchinger et al. 2008, Tilman et al. 2009). High meat demand adds pressure because it requires more energy and landmass to produce (Weber and Matthews 2008) with global inventories of grain at all time low levels (FAO 2009, OECD-FAO 2009).

There is an urgent need for integrated nutrition approaches that are able to address nutrition insecurity and climate change simultaneously and thereby tackle tradeoffs and enhance synergies between nutrition and climate change adaptation and mitigation strategies. To fully address undernutrition, it is crucial not to limit actions to short-term treatment tools but to simultaneously address the long-term determinants that impact nutrition, i.e. poverty, food production and supply systems, population growth, gender, health care, education, infrastructure, environment and this, in the face of a changing climate.

The Millennium Villages

The Millennium Villages (MVs) (Sanchez et al. 2007) was launched to establish a “proof of concept” for broad-based, community-led development strategies to achieve the Millennium Development Goals (MDGs) in rural Africa, including MDG 1, to eradicate extreme poverty and hunger, and MDG 7, to ensure environmental sustainability. Drawn from the UN Millennium Project’s recommendations to scale-up efforts to address development challenges using proven technologies, the project works with communities to deliver integrated, science-based interventions in health, education, agriculture, environment and infrastructure (UN Millennium Project 2005, Sanchez et al. 2007). The range of interventions adheres to a cost ceiling of \$110 per capita sustained over a period of 5 to 10 years, reflecting the full value of contributions from government, external donors, local communities, and the project itself (Sanchez et al. 2007).

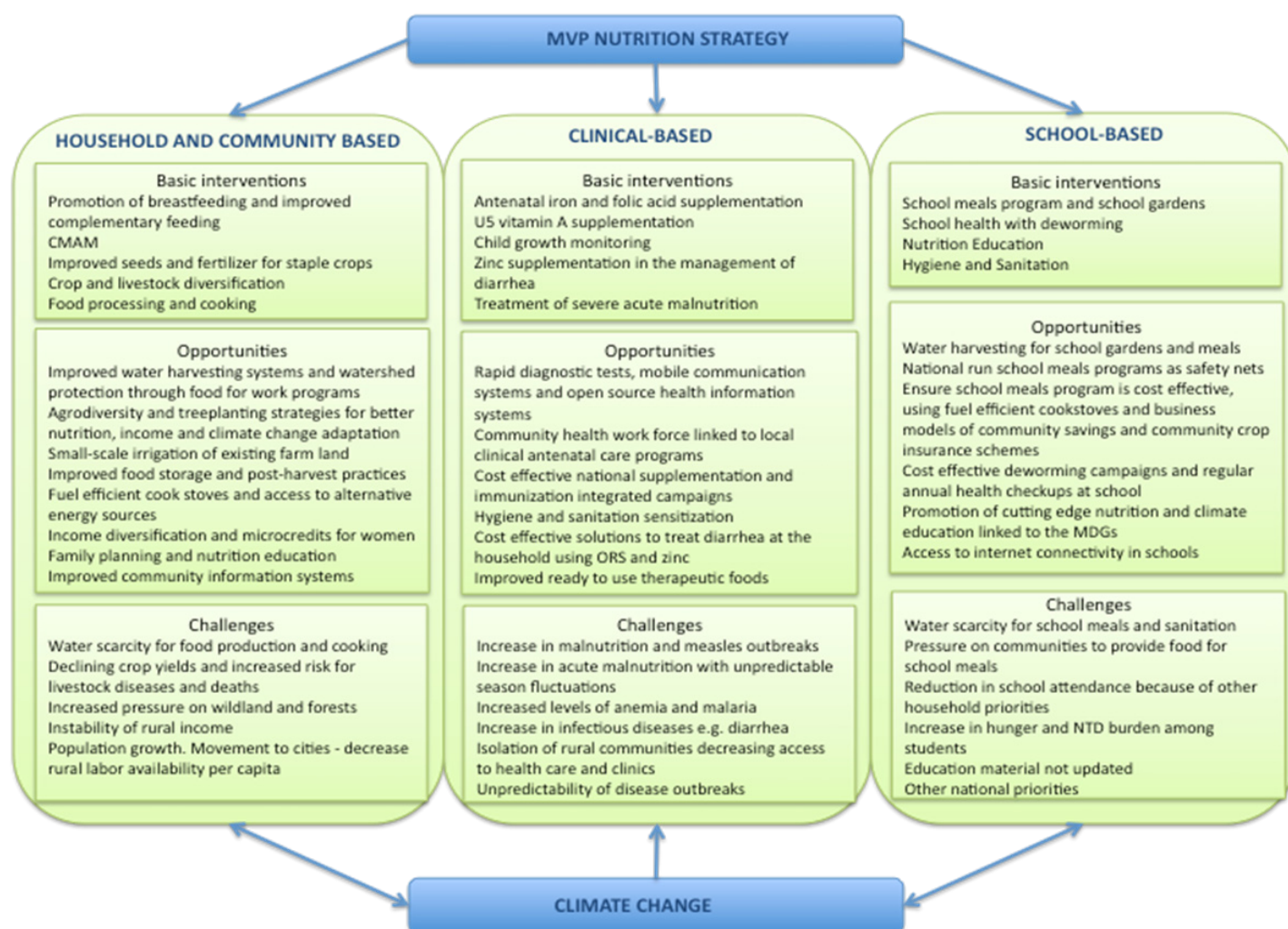
The MVs are situated in ‘hunger hotspots’, where at least 20% of children are malnourished and where severe poverty is endemic (Sanchez et al. 2007). The MVs were chosen to reflect a diversity of agro-ecological zones, representing the farming systems found in over 90% of sub-Saharan Africa. Sites range from slash-and-burn in rainforest margins to pastoralism in deserts, reflecting varied levels of population density, soil conditions, climate instability, water access, disease profiles, environmental degradation,

nutritional deficiencies and food availability, market access, education levels, cultural traditions and religious norms.

The nutrition strategy adopted within the Millennium Villages is cross-disciplinary and multi-sectoral in nature and centers upon an integrated food- and livelihood-based approach. The strategy has three main components (Figure 1). First, household, community- and livelihood-based interventions engage longer-term realities of food and livelihood security. These consist of subsidized seed, fertilizer, livestock vaccination and treatment to increase agricultural productivity; the introduction of high-value crops for both income generation and improved household diet quality; the promotion of livestock marketing; agro-processing initiatives and microfinance programs to stimulate small-business development. This approach is complimented by a community health worker (CHW) program to promote exclusive breastfeeding, family planning and improved complementary feeding practices and foods, home-based fortification, food preparation, hygiene and sanitation, and proper food storage techniques. Second, clinical interventions focus on persistent macro and micronutrient deficiencies in children, including vitamin A supplementation, treatment of severe acute malnutrition and regular growth monitoring. For cases of moderate malnutrition, families receive nutritionally improved food commodities. In addition, basic maternal health interventions such as basic antenatal care and institutional delivery are supported by efforts to promote adequate weight gain and improve coverage with iron and folic acid supplementation. Third, school- and education- based interventions include homegrown school meals programs, school gardens, and nutrition activities after school, along with deworming campaigns. School meals not only serve to decrease hunger among primary-age school children, but have been demonstrated to increase school enrollment and attendance. Adult education, especially for women, is also a critical intervention addressed.

Taken together, these efforts are an attempt to enhance nutritional intake and diet diversity, while affording households the additional income required to address nutritional needs in a sustainable way. Each of these three components faces particular challenges related to climate change but also offers unique opportunities to address challenges of malnutrition and climate change simultaneously (Figure 1). Several examples within

Figure 1. Nutrition strategy of the Millennium Villages Project: Three key components, their particular challenges related to climate change and opportunities to address malnutrition and climate change simultaneously.



the villages clearly illustrate some of these challenges and opportunities.

School meals in Koraro, northern Ethiopia

Until July 2008, the Koraro MVP School Meal Program (SMP) was feeding a meal consisting of 100 g of wheat, maize and pulses to 15 500 children in 22 schools. The World Food Programme (WFP) has supported two other schools in the Koraro MV cluster. All primary school children received a meal for 220 schooldays per year. The cost of the program was US\$ 0.08 per child per day in recurring costs. The community contributed 70% of the US\$0.08 per day mainly in direct contributions from food inputs. In June - September of 2008, the Koraro community was hit by a drought, resulting in low crop yields and leaving the community with minimal food reserves at the household level, and no community cereal banks, as it is not widely practiced. The household grain reserves had been sold to finance the SMP in previous years (teff was sold to purchase maize and wheat). As a result, the community and the MVP team had to make the difficult decision to downscale the SMP, leaving only two schools in the program and providing meals to only 1 860 children. Despite considerable community support for the SMP, households were simply unable to contribute to the cereal bank as food security at the household was a greater priority.

While SMPs are promoted as social safety nets (WFP 2009, Bundy et al. 2009), the SMP in Koraro was the first program that the community discontinued under drought conditions. How can these community-led SMPs become more resilient to climate shocks? The Koraro community and MVP team act in three major ways to enhance SMP resilience. First, by strengthening the community's own safety net program. This includes investments in improved water harvesting systems, school gardens, promoting savings in village level microfinance schemes and more efficient post-harvest storage and processing. Implementation of a system of 'saving' during periods when food supply is high, stabilizes supply and allows the community to accumulate grain in peak periods. These reserves can be sold when food prices are high and cash reserves can be used to buy food for the SMP during times of shortage. Initially there was resistance to grain banking and saving. Most savings and credit facilities are avoided by farmers who prefer to use traditional 'asset' acquisition as a way of preserving wealth – buying cattle for instance. But community sensitization, mobilization and ownership helped initiate savings at household level. Establishing communities own safety net program is not a quick fix solution but requires a holistic approach to community resilience and development. Second, a recent partnership between MVP and WFP has been established, which will provide the opportunity for exploring new implementation models and "best practices" of home-grown school meals programs. Third, crop insurance schemes (Hellmuth et al. 2009) are being developed to reduce risks of future crop failures caused by drought.

Mobile technology for health, business and climate

A key challenge in climate change adaptation is a lack of knowledge for communities to be proactive or rapidly change course. This is particularly true for isolated rural communities such as the sites where MVP is implemented. Climate change is predicted to increase the risk of acute malnutrition, to reduce the reliability of water resources and increase the risk of some infectious diseases such as diarrhea (Parry et al. 2009, WHO 2009). Moreover, climate change reduces the predictability of seasonal fluctuations of malnutrition and infectious diseases, and therefore urges efficient early-warning systems and rapid response kits. If a community can detect and respond rapidly and appropriately to increasing rates of malnutrition or infectious disease, many lives can be saved and major outbreaks prevented.

Mobile technology offers unique opportunities for community-based, inexpensive early- warning and response systems to tackle malnutrition and disease in the community. An example of an early-warning system based on mobile technology can be found in ChildCount (www.childcount.org), piloted in the Millennium Villages. ChildCount is an mHealth platform developed by the Earth Institute to improve child survival and health by providing support to community-based nutrition screening programs (Berg 2009). Community Health workers monitor mid - upper-arm circumference measurements (MUACs) and oedema checks to diagnose children with severe acute malnutrition simultaneously with diarrhoea screening. ChildCount uses SMS text messages to coordinate the activities of the CHWs and refer children rapidly for treatment. Using any standard mobile phone, CHWs are able to use text messages to register patients and report their health status to a central web dashboard that provides a real - time view of a community's health. Powerful messaging features help facilitate communication between the members of the health system and an automated alert system helps reduce gaps in treatment. ChildCount has been piloted in the Millennium Village of Sauri, Kenya. In its first three months, ChildCount was used by 100 CHWs to register over 9 500 of the 10 000 estimated children under five living in the community. This forms the basis of a "living" registry that helps the CHW to closely monitor and track the children's health status and rapidly detect trends in malnutrition or diarrhoea incidence.

Another example of a mobile technology application in the MVs which increases community knowledge to adapt to climate change, is the addition of weather monitoring devices on community cellular communication towers, providing a whole new source of data to enhance the MVP's climate science, information and adaptation efforts.

Livestock management in Dertu, northern Kenya

Semi-arid pastoral areas are particularly susceptible to climate variability and change with household alternatively vulnerable to droughts and floods. In the Dertu Millennium Village in the nomadic region of northern Kenya, rains have failed since December 2006. This has led to deteriorating pasture forage and grasses and water supplies for both humans and livestock. With another failure of the rains in April/May 2009, the distance to pasture and water increased, as open water surfaces and pastures dried up. A few thousands bales of hay, which had been made locally, and pods stored by the community in early 2007 were already gone by September 2008. Responses to the drought included the slaughter of calves and lambs, rare evergreen trees were lopped for animal feed, and livestock migrated to far, isolated pastures. Over 30% of the goats, sheep, cattle and donkeys in surrounding villages were lost. Even camels, the most drought tolerant animals, died during this drought period. As the animals became weak, diseases started to spread among the livestock. This was further aggravated by the salinity of the water from the few reliable boreholes. The value of animals dropped by more than 70% compared to the usual market prices because of the cost and challenge to keep animals alive. Human undernutrition was evident, particularly amongst the vulnerable members of the community (children under five years of age, pregnant and lactating mothers and the elderly).

To overcome recurrent droughts, the MV of Dertu commenced mass treatment and vaccination of livestock within the community and neighboring villages with support of the Ministry of Livestock. A total of over 100 000 heads of livestock were treated or vaccinated in the past three years to prepare them to overcome drought and unexpected floods that causes the emergence of the contagious Rift Valley Fever (RVF). The project has also established monthly mobile integrated health outreach services to reach the most marginalized pastoralists with immunization and treatment services. In the Dertu clinic, the project is providing free medical services and essential drugs. As drought intensity increases, a local disaster response committee, formed by the community and the MVP team and ready to act whenever needed, mobilized emergency response kits. This committee identified nomadic drought response sites, deep in the hinterland where support in the form of water, food, human medicine, livestock drugs and animal feeds are to be delivered to the vulnerable and their livestock. Additionally, pit latrines are dug and access to water is improved through piping and the establishment of water kiosks close to the settled parts of the community.

In addition, multiple long-term initiatives are being implemented in Dertu to increase community food and livelihood security under climate change. Mobile communication technology including a cell tower, mobile phones and internet in the mobile schools, now connects the Dertu community with the outside world and provides information on weather, health, security, education, market prices, status of boreholes and water surface availability, which allows the community to act more pro-actively to droughts. Further, the Dertu Renewable Energy Project was launched which will bring biogas (starting from livestock manure) and solar energy to the community. This offers opportunities for new sources of income (e.g. selling green energy, charging radio and cell phones, internet kiosks) that are less risky to the threats of climate change such as livestock and grassland production. Simultaneously, biogas and solar installations provide alternative energy for cooking, boreholes and efficient food storage (e.g. refrigeration) and thereby reduce the demand for fuel and firewood, which poses high pressure on the environment. Kenya is facing an imminent power shortage related to unreliable rainfall and decrease in the volume and reliability of hydropower; along with this is an anticipated increase in the cost of energy. Alternative energy sources such as biogas and solar energy will become increasingly important. The new energy project in Dertu is a unique pilot project illustrating potential synergies between food- and livelihood and climate change adaptation strategies in vulnerable areas like northern Kenya. However, regardless of these long-term development strategies, an emergency response kit should always be an integral part of any development and research activity within the arid and pastoral land use system. The international community has a role to contribute to such kits in order to overcome the impact of climate change.

Improved cook stoves

The landscape of the MV of Ruhiira in Uganda is dominated by banana plantations with few remaining indigenous trees. Women in Ruhiira have commented that they regularly lack firewood to prepare harvested beans which require prolonged cooking. Diet diversity and quality in Ruhiira is directly impacted by firewood shortage. In this environment, fuel scarcity is an important energy challenge for households which rely primarily on collected wood. Fuel wood collection represents a potential pressure on an already stressed

environment. Also, reduced indoor air quality due to smoke from cooking fires poses a major health risk to women and their families. The World Health Organization (WHO) estimates that indoor air pollution from solid fuel use is responsible for 1.6 million deaths due to pneumonia, chronic respiratory disease and lung cancers and is responsible for 2.7% of the global burden of disease.

The MVP team introduced fuel efficient improved cook stoves of the “rocket” design, which have demonstrated fuel wood savings of 30 to 40% in field testing (Modi et al. *in preparation*). The improved cook stoves were introduced with the aims of reducing the household burden of fuel wood collection (particularly on women and children), local environmental pressure due to use of non-renewable biomass as fuel, and emissions of harmful pollutants indoors. Additionally, improved stoves may, by reducing overall fuel wood demands, help reduce barriers to cooking food items with high fuel wood requirements, such as beans. Fuel savings may also translate into reduced overall energy costs allowing additional expenditures in other areas (education, nutrition, and health).

In Ruhira, 400 fuel-efficient stoves have been purchased by households (Modi et al., *in preparation*). Meanwhile, institutional stoves have been installed and tested in other MV sites (notably Sauri, Kenya) to reduce the collection burden and costs of fuel wood usage for the School Meals Program. In some MV sites, mud/clay stoves, made from local materials, have also been constructed, most often in homes. Fuel wood savings from these stoves is still being tested. In Sauri for example, testing of mud/clay household rocket stoves has been undertaken, with preliminary results of 10 to 20% fuel savings, though these data are under review. In Koraro, Ethiopia, household *injera* cookers have been installed in 1 950 homes under a program with technical support from the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). The project is also exploring how financing through carbon credits may offer a means of support for subsidy schemes for household cookstoves.

Further, across the MVs, investments in solar and grid expansions aim to provide improved access to alternative energies and are expected to reduce the heavy dependency on firewood, an important cause of environmental degradation. The Millennium Village Project currently prioritized solar and grid extension of schools, health facilities, farmer training and community centers. Demand for energy will definitely grow as households income increases as a result of improved production of crops and livestock and production of high value crops using small-scale irrigation.

Crop and livestock diversification and tree planting

Increased crop production during the Asian Green Revolution prevented mass starvation in many countries. The focus, however, was primarily on cereal crops (rice, wheat, and maize), consisting mainly of carbohydrates, modest amounts of protein and a few other nutrients essential to meet human nutritional requirements. The change in agricultural production from diversified cropping systems towards ecologically more simple cereal -based systems may have contributed to poor diet diversity, significant micronutrient deficiencies and resulting malnutrition (Frison et al. 2006, Graham et al. 2007). Moreover, ecosystems low in biodiversity are more vulnerable to environmental shocks (Elmqvist et al. 2003). The importance of nutrient diversity for human well-being as well as the importance of biodiversity for resilience to climate change calls for diversification in food production systems.

Agrobiodiversity provides a key resource for nutrient diversity and adaptation to climate change. Agrobiodiversity is systematically maintained and used by rural communities (PAR 2009). It is part of traditional knowledge systems and seed networks with respect to key traits and responses of diverse crop species and varieties to changing production environments and needs. For example, in the Sauri MV (Kenya), 53 different edible crop species were identified with an average of 15 edible species per farm. In the Ruhira MV (Uganda), 34 different varieties of banana were identified with an average of 10 varieties per farm. The management of this agricultural biodiversity plays a central role in providing different nutrients for human well-being and adaptation to climate change. Diversity helps coping with the increasing frequency of extreme weather events, both through the provision of some buffering and enabling farmers to respond after droughts, floods, hurricanes and other disasters. Over the last 20 years the cultivar diversity of millet and sorghum for example has been maintained by farmers who require an extended range of maturation dates to meet early or late onset of rains and increasing frequency of droughts (PAR 2009).

Two diversity management strategies (PAR 2009) to adapt to climate change and improved nutrition are implemented by the MVP with local communities. One strategy is to restore or maintain high levels of local diversity to ensure adaptability at the local level and to improve resilience in local production systems. A second strategy involves the adaptation of new varieties and crops with new and different characteristics that fit the new conditions, e.g. drought resistant varieties, bio-fortified crops like orange flesh sweet potatoes. Change is happening so fast that traditional knowledge systems and seed supply or breeding stock cannot

evolve quickly enough to meet local needs. Investment in small-scale irrigation projects of existing farmland supports these diversification efforts.

Additionally, special efforts are made to maintain and increase the number and diversity of trees in the MV landscape. Tree species are often selected for the variety of ecosystem services they provide, e.g. fruits for human nutrition, firewood, income generation, animal feed, shade for social meetings, soil fertility, watershed protection and carbon sequestration, thereby providing smart and simple solutions for nutrition security and climate mitigation. In the Sauri MV, groups of farmers are sponsored for tree-planting business, and farmers have planted more than 2.3 million trees in two years. In the same period, youth groups have planted 172 000 trees and schools have planted 55 000. The total number of trees planted in the Sauri cluster is an estimated four million.

It is beyond the scope of the paper to evaluate the economic returns to these interventions, however some observations can be made. The Millennium Villages Project itself is designed to meet the criteria of sustainability over time and potential for replication over locations. The total cost of the combined interventions is budgeted at US\$ 120 per capita per year for the first five years, with US\$ 60 per year provided by outside donors, US\$ 30 per year by government and the local community, and US\$ 20 per year by nongovernmental and corporate partners. The US\$ 60 per capita per year from outside donors is, by design, within the envelope of 0.7% of GNP in official development assistance committed by donor nations to developing countries to support the Millennium Development Goals (UN Millennium Project 2005), and well within the G8 Gleneagles Commitments on aid to Africa, adopted in 2005 for the year 2010, which are on the order of US\$ 80 per person per year. The project aims to unleash self-sustaining economic growth over a ten-year period, by promoting business development (including commercial agriculture) alongside the social interventions with a climate adaptation lens. By investing in the elimination of the poverty trap, the MVP anticipates a benefit-to-cost ratio far above one.

Conclusion

Malnutrition and climate change pose significant risks to the development of poor rural communities, particularly in sub-Saharan Africa. Integrated development approaches such as the MVP create opportunities to address malnutrition and climate change simultaneously and enhance synergies between various strategies. The cross-sectoral MVP nutrition model, represented by the examples provided here, illustrates how to translate such opportunities into on the ground solutions. Alongside the interventions, the MVP is underpinned by a monitoring and evaluation platform that involves detailed socio-economic, agriculture, nutrition, infrastructure, environment and health surveys complimented with biological data collection. Cross-site and cross-sectoral analysis using this research platform will further enhance the understanding of climate – nutrition interactions in the MVs.

From the MVP experience, some key components to tackle malnutrition and climate change simultaneously can be identified, all related to resilience of rural communities, including i) strengthen rural information, knowledge and communication systems; ii) diversify food production, income and diet; iii) combine new technologies and local knowledge to improve management of natural resources key for local food systems, i.e. biodiversity, water, soil and energy; iv) empower women; v) utilize technology and tools to be more proactive, less reactive. In addition, more cross-sectoral, multiple scale and cross-site research is needed to identify and tackle potential tradeoffs between nutrition and climate change. Now, more than ever, we need to apply our knowledge on the interactions between social, economic and environmental sustainability, into on the ground action.

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Increasing food security for marginal farmers in the face of climate change: programme experience and policy recommendations

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Introduction

It is now accepted by most scientists and development professionals that the current increased climate variability and global temperature increases are human-induced through the burning of fossil fuels, deforestation, and land use changes. Global temperature is already around 0.7°C above pre-industrial levels, and there is enough lag in the climate system to lead to a further 0.6°C rise even if emissions ceased tomorrow. This article will not discuss in detail the different scenarios. The Intergovernmental Panel on Climate Change (IPCC) in its fourth Assessment Report (IPCC 2007) produced indications of what the impact of climate change would mean for water resources, for agriculture and food production, and this for a number of different future global temperature increases. The broad findings are that climate change will cause yield declines for the most important crops in developing countries, with bigger reductions than in industrialized countries. South Asia and Sub-Saharan Africa will be hardest hit. In developing countries as a whole, without modifications to production technologies, climate change will reduce average irrigated wheat yields in 2050 by around 30 percent, and irrigated rice yields will fall by 15 percent compared to current levels. In the absence of a strong commitment to reduce emissions and adopt low carbon development pathways, these impacts could be felt sooner. The impact of food shortages (leading to higher prices) will be worse on poorer households and those already suffering from malnutrition, because they spend a larger share of their income on food.

The failure of the Copenhagen summit to reach a binding agreement on the emissions reductions necessary to stabilise temperatures at a maximum of 2 degrees above pre-industrial levels, is potentially catastrophic for humanity. The political impasse that caused this failure is unlikely to be resolved in 2010. Further delay in curbing greenhouse gas emissions means there is an increasing likelihood that we are on a trajectory towards a temperature rise globally of 3.5 to 4°C by 2100 (IPCC Fourth Assessment Report, [Summary for Policy Makers](#)). The [report](#) (Climate change 2007) of the IPCC Working Group highlights the risks for food production. This means that a global temperature rise of 2°C (which implies a significantly higher temperature rise in Africa) could be reached within a few decades – well within the lifetime of today's young adults.

Pressures on land and impacts on vulnerable populations

While changing temperature and rainfall patterns have a direct impact on food production, agriculture is also part of the problem: greenhouse gas emissions from agriculture account globally for around 30% of the total, including emissions from conversion of land from forests to plantations and agriculture, methane from ruminants and wet rice production systems. Pressures to reduce emissions from fossil fuels is raising demand in the United States of America (USA) and Europe for biofuels, leading to increasing pressure on land, with conversion of tropical forest to oil palm, and diversion of maize for food or fodder to ethanol production. Financial opportunities for using certain large-scale technologies that may lead to reduced emissions from agriculture, such as no till cultivation systems (often tied in with herbicide resistant genetically modified crops), pose further threats to small holder farming and food security.

Practical approaches to adaptation in the face of climate change

With these multiple pressures, the long term outlook for improving food security for the one billion hungry people in the world today may look bleak. However, Practical Action is adopting a two-pronged approach to address the challenges. First and foremost, Practical Action is actively working to help some of the poorest communities already facing increasing climate variability, to adapt to their current reality, and to cope with expected future changes. Secondly, the organization works to influence policy, drawing on its experience, to advocate for greater support for proven technologies that increase food production from small scale farming systems. At the same time, enhancing the health of the ecosystems, which underpins all agriculture - soil, insect fauna, and groundwater - needs to be taken into account. This article will focus on our work in Bangladesh and Nepal. Before discussing the details of the programme work, it is important to explain the underpinning framework of these programmes.

Climate change, uncertainty and adaptation: key concepts

Two broad categories of climate change impact can be identified. First, *discrete hazards* such as flash flooding, droughts or storms. These phenomena develop rapidly and have the potential to damage or destroy crops, livestock and infrastructure. The second kind of impact brings slower changes to the average conditions, such as warmer winters, wetter summers, earlier seasonal changes or rising sea levels. These *continuous hazards* may have a profound effect on agriculture, altering the location, timing and rate of growth of

plant, animal and fish species, the spread of diseases, and the availability of coastal land. But for each category of hazard, the particular impact will depend on the current condition of the environment. Heavy rains, for example, may either wash away degraded top soil, or be absorbed and stored within a healthy soil structure, so that water is available to support plant growth during dry periods.

Adaptation is the process through which communities adjust to the impacts of climate change. Rather than just reacting to climate change, adaptation can be forward looking, aided by forecasting information and climate predictions. However, effective adaptation requires an appreciation of the uncertainty that is inherent in climate change predictions. While climate models are able to establish with high confidence that global average temperatures will continue to increase, more detailed changes, such as the impact of warming on wet and dry seasons, remain unclear.

Adaptation must address the challenge of uncertainty by ensuring that altered livelihood strategies do not only bring benefit if climate change plays out as predicted. For example, if a climate model anticipated that there will be less rain in a particular area, the large scale introduction of a type of drought resistant crop could lead to the collapse of livelihoods if rainfall actually remains similar to current levels.

Reduction of vulnerability and strengthening of resilience

People's vulnerability to climate change is related to the particular hazard they are likely to face. For example, in their locality, populations may be experiencing reduced rainfall, more frequent flooding or, in most places, more unpredictable weather. Vulnerability reduction measures are targeted to meet short term needs (such as increasing food security, or reducing the risk of flooding) while taking account of potential future impacts of climate change.

Resilience is the ability to cope with shocks and stresses of many kinds, including economic, environmental and social shocks. In relation to climate change, these could include crop failure, drying up of a local water source, flooding of farmland, or even the forced relocation of a village. Resilience reduces vulnerability to a wide range of hazards and can be strengthened by enabling people to develop or obtain a diversity of assets (both tangible, such as livestock or tools, and intangible, such as new skills and knowledge) and livelihood strategies. When people's resilience is increased, they are better able to cope with change. To effectively increase resilience, it is vital to draw on local knowledge – people's experience of climate variability, their coping mechanisms that have worked in the past – so that strategies are relevant and fit in with the social and cultural context of the communities. Development non governmental organizations can bring useful new knowledge and technologies and can cross-check with scientific data so that local knowledge and experience is validated and strengthened.

Building adaptive capacity

Adaptive capacity encompasses the ability of individuals or communities to make changes to their livelihoods or livelihood strategies in response to changing conditions. It is the combination of skills and resources that enable resilience building or vulnerability reducing measures to be employed at any given time, in response to what the situation demands. It involves the opportunity and ability to make an assessment of the current context (in the light of adequate information), and requires the opportunity and readiness to learn and acquire new knowledge, and the ability to make and act on decisions. In order to do this, people need to be connected to each other and to the outside world. This can be achieved through informal contacts, through local farmers' groups, or through more formal relationships e.g. those between communities and local government organized for consultation on different themes. Linking communities and government or other service providers offers opportunities to influence decision makers and access information, resources and support, e.g. when cooperative actions can be arranged between marginalized farmers and local research stations.

What this means for programme design

The design of an adaptation programme will reflect the level of uncertainty over climate change in a particular location over a particular time period. There is greater certainty for the near future, and the kind of action necessary to reduce vulnerability and increase resilience is clear. Thus, where a flood or drought can be expected with a high degree of certainty over a short time period, an adaptation programme would focus on vulnerability reduction and disaster preparedness. Over a longer period, where there is much less certainty over the future climatic conditions, a focus on improving knowledge, building adaptive capacity and increasing resilience would be required.

It is important and relevant for all programmes to build and strengthen institutions at all levels of society, to ensure active citizen participation and local governance of resources. This will build adaptive capacity and empower communities to shape their future. Institutions will range from community-based organizations that focus around local needs, to networks of such organizations at district level, up to national stakeholder fo-

rums enabling a wide spectrum of civil society interests, to engage in decision making on resource allocation and prioritization.

The interventions to improve food security described below may appear to be merely improved agricultural techniques to increase food production under difficult climatic conditions. In the context of adaptation to climate change, they are also examples of interventions that enable adaptation to climate change in the specific circumstances of geography, culture and socio-economics faced by that community. The activities described here are therefore not blueprints to be implemented wherever similar circumstances arise, since adaptation is context specific: it must be related to the local climatic, geographical, social and cultural environment. In designing and implementing adaptation programmes, Practical Action aims to start with the knowledge and experience of the communities: the challenges they face, their current coping strategies, and the cultural and socio-economic context that determines the social networks and institutions which can be drawn in to support them.

Adaptation in flood prone riverine communities in Bangladesh

Practical Action has been working with communities affected by river erosion. Many families have repeatedly lost their homes and land to erosion over decades. Factors other than climate change are behind the increasing erosive power of the fast-flowing rivers in Bangladesh – including deforestation in the Himalayas and glacial melting. What is certain is, that flooding and river erosion will become a more frequent threat to livelihoods and agriculture in Bangladesh. Given that people are either landless, or have tiny parcels to cultivate, Practical Action has focused on activities that require little land, and which can take place during the monsoon season. At the same time, consensus building processes have been followed to enable the most marginalized people to access some natural resources. During the monsoon season, river fishing is not safe because of the fast flow. Access to seasonal ponds has been negotiated in some communities, and training given to households for the rearing of fish, both in ponds and in cages tethered in the ponds. People were trained to build the fish cages – one cubic metre in size (see photo.) The initial design involved metal rods; however, communities found that this was too costly, so the design was modified using bamboo and local low-cost netting. Poultry rearing, which is a women's activity in Bangladesh, is encouraged, specifically duck rearing – since ducks can swim and therefore cope better than chicken with a flooded environment. The eggs are mostly sold for income and have proved popular; being larger than hens' eggs they also sell for a higher price.

The floating vegetable gardens have become quite well known, almost iconic as an adaptation strategy. Originally developed in the Bangladesh coastal area, Practical Action has successfully introduced a modified design, using freely available materials such as banana trunks for the frame, and water hyacinth (allowed to rot) making the base of the raft, onto which soil is placed. Participatory technology development such as these two examples are key to building adaptive capacity and ensuring that people will have the skills and confidence to continue adapting to future changes as they occur. The raft-gardens have been used both for growing vegetables for household consumption and for sale, and for growing rice seedlings so that when the floodwater recedes, transplanting can take place immediately. In other areas, government-owned road embankments have been made available to landless people to use for planting trees for fruit and fodder.

The introduction of earlier maturing rice varieties, developed at the national rice research institute, resulted in crops that can be harvested before the start of the monsoon. This is of direct benefit to the better-off households which own rice fields, but also indirectly to day labourers whose income depends on land suitable for cultivation and on a successful harvest of affordable rice. The variety, initially introduced as a trial has proved popular and many farmers have begun cultivating it.

Women with their fish cage in a seasonal pond, Bangladesh (© Practical Action)



Farmer with her floating vegetable garden, Gaibanda District, Bangladesh (© Practical Action)



Rearing livestock (usually goats), is an important livelihood activity for women, even if they own little land. Improving local breeds and producing dried fodder for use during flood periods has helped people to increase their asset base and the resilience of the livestock during the monsoon season.

Adaptive food production strategies are just one part of a broader strategy on climate-related disaster preparedness. One of the most basic requirements is to prevent, or at least reduce, the extent of flooding within homes. Building houses on plinths is a key strategy in this regard as well as installing a shelf within the roof space, for the store of key valuables: e.g. identification papers stored in plastic pouches, seeds for the next planting season, dried food and fodder. Groups of community volunteers trained on evacuation strategies and provision of a community boat are other key elements. Strengthening the local disaster preparedness capacities builds confidence within communities; this in turn enables people to cope better during a disaster. It also builds trust that people can and will be able to cope with the challenges in the longer term. Ultimately, it is this sustainable capacity building that will be more relevant than the interventions which Practical Action have introduced.

Adaptation within the Terai region of Nepal

Practical Action has been working on disaster preparedness for many years in Chitwan district in the middle hills of Nepal. This region is prone to flooding when rivers fed by melting glacier water overtop their banks. Heavy monsoon rain often leads to local landslides in a region where overgrazing and deforestation has destabilised the hillside land. Changing patterns of rainfall and temperature have been observed in the district. Rainfall is becoming less seasonally predictable, more intense in some months, and scarce in others; summer temperatures have increased over recent decades (Ensor and Berger 2009). A strategy to help communities adapt has been implemented in a number of villages within the district since 2005, aiming to build capacity for increased food production. Besides specific agricultural activities, this has evolved in building linkages with local government and local offices of the ministries: this increases awareness of these officials on local issues, and their understanding of climate change impacts within their district. Linkages such as these help to ensure that communities will be able to access information and support, beyond the life of the project.

In the communities where Practical Action works, topsoil loss was affecting productivity and restoring eroded hillsides was a major challenge. A variety of interventions was implemented: creating terraces, planting grasses and trees along contour lines, and introduction of zero grazing for goats. The latter involves bringing leafy fodder from the forests to the penned animals to prevent damage to seedlings that free grazing and browsing caused. As in Bangladesh, cross breeding of local with more productive breeds has improved income. A scheme of goat sharing has been introduced, whereby the poorest households (selected by the community) were given a couple of goats. They were allowed to keep the first offspring, and then had to give the second to another selected family. An insurance scheme run by a community-based organization gave compensation where, despite reasonable care, a family's goat had died.

Reduced rainfall at critical periods during the growing season has led to reduced yields from maize, one of the staple food crops. Cash crop diversification, which can be marketed locally, has helped to increase food security. After receiving training, many households are now growing vegetables (including tomatoes, cucumbers and beans) for consumption and sale during the off-season, instead of leaving land fallow. Other households prefer to grow fruit trees, particularly bananas, for increasing their income.

For the longer term, it is as important to support a process of local level planning and consensus building within and between villages in order to present clearly expressed views on local priorities to the local government for inclusion in district plans.

Conclusions

Practical Action aims to follow a process of testing interventions, and then replicating them to gain further evidence of effectiveness. Beyond that, scaling up is sought through influencing other organizations and government institutions to adopt proven approaches. Influencing policy however is never just a matter of providing evidence: many other factors come into play. In the field of food and agriculture policy, vested interests are a key factor. These range from professional interests that may, for example, lead agriculturists to reject approaches that are seen as traditional or backward, in favour of promoting modern hybrid varieties and high applications of fertilizer and pesticides – an approach mostly beyond the means of poor farmers. More powerful still are the multinational corporations, which now have a very concentrated hold on the global seed industry, and where vertical integration means that seeds, fertilizers and herbicides are all under the same control. The promotion of biodiverse systems based on farmers' own seed breeding and using local compost and biological pest control promoted by organizations such as Practical Action and small scale farmers organizations worldwide, faces strong opposition from these corporations. However, the International Assessment of Agricultural Science and Technology for Development (IAASTD 2009), a four year international study funded by the World Bank, concluded in 2007 that future food security in the face of a changing climate would require a

more knowledge-based biodiverse approach, drawing on technologies of soil conservation and nutrient management already practised by small scale farmers. Greater support for these farmers, bringing new knowledge to supplement their traditional wisdom and experience, could lead to significant and sustainable increases in food production. The challenge is that while many countries took part in the research, and more than 58 have endorsed the findings, key countries including the USA, Canada, Australia and New Zealand have not yet done so.

Shifting agricultural policy requires wide-ranging changes in national policy: changes to agricultural education, abolishing legislation that restricts farmers' seed saving, and investment in agricultural research towards meeting the needs of small scale farmers rather than large scale commercial agriculture. Internationally, it requires a major commitment from donors towards agriculture, and possibly changes in rules of the World Trade Organization relating to intellectual property rights for plant genetic material. These are major challenges, but a growing number of international development organizations are aligning with a worldwide movement of small scale farmers to fight for these changes.

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Special Feature

Summary report on the high level meeting on nutrition organized by the United Nations System Standing Committee on Nutrition and hosted by the European Commission

23 and 24 November 2009, Royal Windsor Hotel, Brussels

The meeting was a joint Standing Committee on Nutrition (SCN), European Commission (EC) high level meeting on "Recapturing Malnutrition Reduction" with support from the Institute of Development Studies, Save the Children, and the Institut de Recherche pour le Développement. It constituted a unique opportunity to discuss policy coherence and nutrition architecture during a time of increasing global attention to nutrition. During the two days, participants reflected on ways and means to put nutrition higher on the agenda of high burden and donor countries. A clear commitment for nutrition was obtained and basic guiding nutrition principles were reflected upon which hopefully will be translated into action through the joint preparation of a roadmap for the development of country level action plans.

The main objectives of the meeting were: 1) to put nutrition higher on the agenda of both high burden and donor countries; 2) to initiate the development of a roadmap for country level action plans; and 3) to develop basic guiding nutrition principles for nutrition programming and planning. It was expected to obtain: 1) a set of agreed basic guiding nutrition principles; 2) recognition by donor countries and high burden countries of the urgency to act at international, regional and national levels; and 3) concrete steps towards better governance on nutrition at global and country level (including an agreement on the initiation of the roadmap).

The first day of the meeting was dedicated to "highlighting nutrition governance issues at national levels, needs and current practices". A rich set of experiences from ten countries ([Lao](#), [Malawi](#), [Benin](#), [Brazil](#), [Cambodia](#), [Peru](#), [Guatemala](#), [Madagascar](#), [China](#), [Bolivia](#)) were presented and discussed. The second day of the meeting dealt with "strengthening global level nutrition governance to better support countries". The [full report](#), agenda, all the presentations and participants list can be accessed on the [Brussels meeting webpage](#) of the [SCN website](#).

A set of common challenges in terms of trying to get nutrition on the political agenda at national level were raised by the country representatives. These included:

- a low level of recognition of the malnutrition problem. It is referred to as a 'silent crisis' as it is invisible to decision makers, at local and national level;
- a failure of leadership in many countries. The challenge is to get some of the top political leaders to take nutrition on their agenda;
- problems with nutrition resources, particularly human resources. Many countries have an insufficient number of people with training and experience in nutrition, therefore nutrition posts are vacant. But also financial resources are insufficient for scaling-up relevant nutrition services into national programmes;
- existing confusion around the terminology on hunger, food security and nutrition: on how they are related and how to conceptualise the problem and address it in government policies;
- the need to transform economic growth into positive effects for the most vulnerable people.

Ingredients for successfully raising nutrition up the national political agenda were:

- existing leadership, often at the top level of government, particularly at presidential level or at the prime minister's office. Existence of legal frameworks as back up strategies to ensure permanence despite government or personnel changes;
- improved governance at local level, decentralization policy and participation at community level has to go hand in hand with strong national leadership;
- a strong emphasis on mechanisms for cross-sectoral / cross-ministerial coordination, where different groups, councils and other bodies work together;
- accountability, monitoring and the ability to track progress and hold various players accountable are essential;
- a preparedness across countries to use multiple entry points for nutrition;
- the importance of funding through national budgets, as well as donor flexibility;
- the development of strategic elements and priorities based on data from (policy) research for integrating nutrition in the national development plan.

However, open questions remained, most notably:

- what really triggered governments to take leadership on nutrition?
- what role did the international community play in assisting governments to alleviate nutrition and accelerate progress?
- what kind of institutions would be needed at national and regional level to keep the momentum and to initiate new ideas in dealing with the double burden of malnutrition?
- how are factors such as natural resources and their degradation (e.g. water scarcity, plant degradation) linked to nutrition?
- how can the terms hunger, health and nutrition be repackaged so that they are more generally understood? Which indicators are needed to measure progress?
- how to measure the readiness score to accelerate action in nutrition (ref. [Landscape Analysis](#)) for countries in conflict situations?

Progress at national level was contrasted by a failure of international leadership. It was repeatedly mentioned that there are gaps at international level and extremely weak nutrition coordination. The fact that this problem at the international level exists, strongly underlines the need to reinvigorate the Standing Committee on Nutrition (SCN). It was emphasized that if the SCN did not exist, the global nutrition players would have to invent it.

The second day of the meeting, the UN Agency representatives and the Special Representative on Food Security and Nutrition shared their ideas and reflections on global governance; these are summarized as follows:

- there is commitment of all UN Agencies, including the World Bank and the Special Representative on Food Security and Nutrition to work together to take the lead on nutrition. Collaboration should be daily business and agencies should be monitored on it;
- good governance includes: 1) harmonization of efforts, 2) policy guidance, 3) identification of new risks and generation of new knowledge, and 4) awareness raising;
- the SCN Reform process must be transparent, inclusive and always considering what it means for the people on the ground.

The [key guiding principles](#) for nutrition policies and programming were presented and discussed: what they are, why they are needed, and how they can be translated into operations. Two additional principles were

A Global Action Plan ([GAP](#)) was presented and commented: it is a nutrition framework for action including what should be done, where it should be done and how it should be done; it is not meant to be a vertical initiative and it has a price tag (10.3 billion US\$ per year); by design the GAP does not deal with governance. Comments on the GAP were varied and although there was no consensus on the document, there was a wide appreciation of the content and the leadership shown in GAP. At the same time it became clear that a substantial, deep consultative process needs to be adopted for further progress. Clarification is needed on the linkage of GAP with SCN and other structures/initiatives (the Committee on World Food Security ([CFS](#)), The Secretary General's High Level Task Force on the Global Food Security Crisis ([HLTF](#)), the Ending Child Hunger and Undernutrition ([REACH](#)) partnership, etc.)

The representative of the European Commission (EC) summarized a number of key issues as seen from the EC perspective:

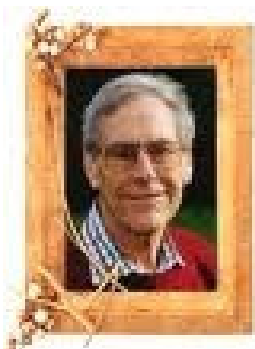
- to endeavour to place nutrition higher on the political agenda with a clear road map;
- the need for a clear and recognized global leadership in nutrition to coordinate global initiatives; partner countries, international NGOs, civil society, and the private sector will need to be properly involved;
- the need for clearer and more readable coordination modalities between the different nutrition stakeholders, notably, the linkages between the SCN, CFS, and HLTF must be clarified;
- the need for a clear division of responsibilities and roles between UN agencies and the World Bank;
- more attention should be given to make global sectoral initiatives become more nutrition-friendly;
- facilitate “South-South” exchanges of experiences between partner countries to ensure that countries that are lagging behind can use the lessons learned to catch up;

while the assessment of the impact of climate change on nutrition still needs to be better defined, adaptation strategies must also be “nutrition-friendly” and nutrition must not be forgotten during the discussions taking place in Copenhagen.

Obituaries

Professor Emeritus David C. Morley, CBE 15th June 1923 – 2nd July 2009

Tribute from the World Alliance for Breastfeeding Action, WABA, Penang



We were all deeply saddened to hear of the sudden death of David Morley, who has been such an inspiration to us all, and a delightful friend to so many.

David was one of the earliest pioneers promoting child health in the 1960's, through Under Five Clinics, and the use of the Road-to-Health growth chart. One of the main pillars of his work was to call for a new approach to halt the decline in breastfeeding, then at its worst. His renowned book, *Paediatric Priorities in the Developing World*, published in 1973, contains a chapter on practical aspects of breastfeeding, which influenced a generation of paediatricians all over the world.

For those of us associated with WABA, it is interesting to recall that David did his National Service in Malaysia, and this provided his introduction to the inequalities of health in the developing world. After a time working in Australia and then in Newcastle-upon-Tyne in the UK, he went to Imesi, in rural Nigeria, where he transformed the approach to health care of children. He showed that infant mortality could be reduced by over 80%, not by hospital medicine, but by education and village clinics run by local people. Health workers in the area still lead the way in supporting breastfeeding mothers.

Back in England, David took over a UNICEF sponsored course at the Institute of Child Health for senior teachers in child health from developing countries, which led to the foundation of the Tropical Child Health Unit, of which he became the professor. Many of the participants on this course have become fervent and practical advocates for breastfeeding. Notable among them was the late Professor Natividad Relucio-Clavano of Baguio General Hospital, in the Philippines, who in the 1970s dramatically reduced neonatal mortality in her unit by the simple expedients of giving the babies to their mothers immediately after birth, and banning infant formula. Her experience was one of the foundation stones of the Baby-friendly Hospital Initiative.

While teaching in London, David realised how little of the vast resource of knowledge and publications in the West becomes available to the rest of the world, where the need is far greater, and even those books and materials written specifically for developing countries scarcely penetrate to the schools where so many health workers are trained. To help overcome this problem, David formed the charity Teaching-aids At Low Cost, known as TALC, which for the last 40 years has developed and distributed books and visual aids – firstly slide sets, and now CDs – all over the world. Two sets of slides on breastfeeding were among the most popular and widely used, and a recent CD contained some WABA material. David also developed a number of educational tools, such as a simple weighing scale that can be used in villages, and even by mothers themselves, to encourage interest in their children's growth.

David travelled widely and visited many people in remote and isolated places – always bringing encouragement and stimulating ideas for their work. He took great trouble to keep in contact with colleagues and students to support them, in the days before e-mail, and when postal and telephone services were erratic. Among his many gifts was a remarkable academic generosity – he empowered people, and made sure that what they did was fully recognised. His work continued throughout his retirement. He played an important part in helping to establish the flourishing UK Baby Friendly Initiative, and fully supported the foundation of the course "Breastfeeding: Practice and Policy" now in its eighteenth year at the ICH. Outreach adaptations of this course have now been conducted in other countries, two of them with WABA in Penang.

To quote from the poem *A Final Thought*, read at his funeral:

*You can remember him and only that he's gone
Or you can cherish his memory and let it live on.*

There is no doubt that his work will live on. The fact that WABA was only founded four years after David retired, and yet from its inception has owed so much to his legacy, shows that he is still very much with us.

Felicity Savage King, Chairperson of WABA Steering Committee, Former colleague at ICH and contributor to TALC.

ADIEU MWALIMU DAVID (Professor David Morley)

Tribute from: T.N. MALETNLEMA, For many in Africa

I received the news through email from friends and it was stunning. I last saw him about 4yrs ago at his home in London, looking young and cheerful as ever.

Meeting David for the first time in his famous village, Ilesha, Nigeria, it was a pleasure having to work with someone deeply committed to saving the children in Africa; a quality I rarely found. He had a vision that many lives of children and their parents could be saved and he set out to do just that. While treating and curing many children, David gathered and trained teams of the would be experts and workers in nutrition cum pediatrics. They are scattered from West Africa to east, south and north, we all knew and admired him. Many of us will recall him as a great teacher at the Great Ormond

Street, London, Children Hospital where he worked and taught many.

Most of us in Africa will remember David as a great friend and teacher. He always put friendship before being a teacher to his students. Learned and experienced in the health problems of the developing world, and equipped always with simple practical ideas of solving problems, few could rival him. From Ilesha he developed the Growth chart for the under fives in the 60s and it is in use in many countries today. And in order to reach even more people with vivid and relatively cheap teaching material all over, he founded the now well established Teaching Aids at Low Cost (TALC) organization, with small books, teaching aids – charts and slides gathered from all over the developing world. The slides clarified a lot of diagnostic arguments. More recently the now widely distributed e-TALC Health Development CD-ROM were launched.

I remember with gratitude his role together with the late Prof. Jelliffe, how they handled the Baby Killer Scandal with scientific facts and determination to save breast feeding and the children in the developing world. Many youths and children are alive and well today because David and colleagues fought and won that battle.

We, and many future generations, inherit a heap of precious knowledge in books (eg. Nutrition in Developing Countries, 1972; Paediatric Priorities in the Developing World, 1973; See how they Grow, 1979 to mention only the ones in my possession), many journal articles and speeches, etc. from David. As Christians and I am sure many others will say to our God that "We are grateful and it was an honour to have him among us. He lived to a good and honourable old age, the children and parents in the developing world will remember him with thanks. Adieu David, Adieu Professor.

Dr. José María Bengoa Lecanda (1913 – 2010)



José María Bengoa Lecanda was born on April 20, 1913 and passed on January 16, 2010 at the age of 97 years in Bilbao, Basque Country, northern Spain. Dr. Bengoa received his medical degree in the Faculty of Valladolid just before the Spanish Civil War in 1936. During the war he cooperated with the Basque government in the organization of the military health services which allowed getting the knowledge to become an expert in catastrophes which he later applied in many places he worked. When the civil war finished, he went into exile to Venezuela since 1938.

He worked as rural physician in Sanare, Lara state, Venezuela. He applied experiences and knowledge he acquired during wartimes to improve the health status of the population under his jurisdiction. The sanitary conditions, hygiene and undernutrition in children were the focus of a book he wrote about his experiences entitled: "Social medicine in the Venezuela rural milieu" edited in 1940. After years in the field he returned to Caracas, the capital city to develop the nutrition section at the Ministry of Health and Social Assistance. He studied the living conditions, food habits and nutritional status of the populations living in the Caracas slums which he described in other publications (El Guarataro; Alimentación de las clases obrera y media de Caracas; Dietas normales). He worked also in the countryside organizing medical services for natural disasters. In 1945 he founded the School of Nutrition and Dietetics (National Institute of Nutrition) and Archivos Venezolanos de Nutricion, a scientific journal in nutrition.

In 1955, after organizing the Latin America International Conference of Nutrition he was called to work in the Nutrition unit at the World Health Organization (WHO) in Geneva, Switzerland where he was in charge of evaluating the nutritional problems of the third world countries. He led this unit from 1963 until his retirement in 1974 when he decided to return to Venezuela. The publication "Nutrition in Preventive Medicine" (WHO 1975) describes his career in international nutrition.

Dr. Bengoa was named head of the Planning Department of the Venezuelan Council for Scientific Research (CONICIT), advisor to the Polar Foundation, professor of Food and Nutrition Planning at Central University of Venezuela and visiting professor at Massachusetts Institute of Technology (MIT), in Boston, USA. For three years he was advisor to the Health Commissioner of the first Basque government in the democratic Spain. In 1983 he was named Executive Director of CAVENDES Foundation dedicated to the study of nutritional problems in Latin America, where he worked for 13 years publishing numerous monographs, founding two nutrition journals and establishing concrete nutrition programs for the population.

The Bengoa Foundation was created to honour his professional career and the spirit for helping the neediest and his work in social nutrition. Until his later days, he continued collaborating with passion in the fight against hunger, collaborating with the Bengoa Foundation and writing books such as "Hunger when there is bread for everyone" ("Hambre cuando hay Pan para Todos" (2000) and After the Hunger path ("Tras la Ruta del Hambre" (2006)). Dr Bengoa received numerous awards including the "Heroe of Public Health" from the Pan American Health organization, Medal Andre Bello in Venezuela, and Doctor Honoris Causa from Universidad de Alicante, and the Sabino Arada award in the Basque country.

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Programme News

Food Security, Adequate Care And Environment Quality: Development And Testing Of Eco- Nutrition Guidelines For Community Actions In The Context Of Climate Change **Sokoine University**

Production, consumption, and biological utilization of food are linked by a complex chain of events that if interrupted at any number of points lead to significant consequences. Consequently, nutrition interventions that ignore the larger context in which these components are delivered are much less likely to succeed, and there is a growing appreciation for more holistic approaches.

The project team recognised that there is no clear knowledge on the link between environment quality, food security and adequate care and now climate change. There is an understanding of the three thematic areas mentioned above as individual themes, but little research on the intersection of these themes, particularly in the context of climate change.

The overall goal of the project is to build capacity in rural communities, in the context of climate change, to implement participatory, sustainable interventions aimed at enhancing food security, improving environmental quality, and supporting adequate maternal and child care. This project will be implemented in Malawi and Tanzania.

This project recognises that indigenous scientific knowledge needs to be reviewed in the light of climate change and the food security and care challenges, but capacity is needed for communities to be able to respond to the challenges and for policies to support the necessary action. Historically separate disciplines, such as nutrition, environmental studies and agriculture need to join forces to address these urgent problems in a way that makes sense to communities and addresses their needs. However, there is insufficient guidance for communities to carry out activities to benefit all areas and help to feed into policy formulation.

We therefore propose to develop and test guidelines, termed Eco-Nutrition guidelines, to enable communities to best respond to these challenges with support from various stakeholders. We have taken an Eco-Nutrition approach that focuses on the idea that the effectiveness of community led interventions to improve nutrition will be enhanced when they explicitly account for three key areas: **environmental quality, food security, and caring practices**.

As part of the project we will develop and test the guidelines for community actions in Malawi and Tanzania for future roll-out and feed into policy formulation. The guidelines will be evaluated using a randomised study design with intervention and control areas at different phases.

The project is being led by a Nutritionist Associate Professor Joyce Kinabo of Sokoine University of Agriculture. The team includes scientists from Universities of Malawi and Leeds (UK).

This project has recently been awarded support by IDRC (The Canadian International Development Research Centre) in response to their call for proposals on 'Food, Health, and Adaptation to Climate Change in East and Southern Africa'

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Biofortified Wheat Improves Zinc Absorption in Adult Women

HarvestPlus

Biofortification of staple food crops with micronutrients could prove to be a cost-effective way to reduce micronutrient malnutrition. HarvestPlus is breeding wheat varieties with higher levels of zinc to reduce zinc deficiency, a major cause of early childhood morbidity and mortality, especially in developing countries.

Recent research has shown that absorption of zinc from zinc-biofortified wheat is greater than from non-biofortified control wheat when fed to adult women as their primary food source. Under the research scenario presented, 300g of biofortified wheat flour could provide about two-thirds the physiological zinc requirements of adult women.

The study compared zinc absorption from zinc-biofortified wheat and nonbiofortified wheat. Biofortified wheat flour outperformed control wheat at both a 95% and 80% extraction when fed to adult women over a two-day period. (The extraction percentage expresses the quantity of wheat bran and germ that remains after the milling process, i.e., a 100% extraction would be whole-wheat flour.) Although an 80% extraction contains considerably less zinc than a 95% extraction, the disparity in zinc absorption is subtle because more phytates are removed in the milling process for 80% extraction wheat. (Phytates are a phosphorus compound found naturally in wheat that can inhibit the absorption of zinc). This data suggests that phytate intake should also be considered when setting zinc target levels.

For populations that rely on wheat flour for the bulk of their daily caloric intake, biofortified wheat could greatly improve the nutritional value of this staple food, thus combating micronutrient malnutrition by improving zinc intake.

For more information on this research please visit the Harvestplus Newsroom online or contact us at harvestplus@cgiar.org

SOURCE: Jorge L. Rosado, K. Michael Hambidge, Leland V. Miller, Olga P. Garcia, Jamie Westcott, Karla Gonzalez, Jennifer Conde, Christine Hotz, Wolfgang Pfeiffer, Ivan Ortiz-Monasterio and Nancy F. Krebs. 2009. [The Quantity of Zinc Absorbed from Wheat in Adult Women Is Enhanced by Biofortification](#). Journal of Nutrition Oct 139 (10) 1920-5

WHO

Mapping The Health Impacts Of Climate Change Action On Agricultural Systems

Submitted by Dr C Dora, M. Pfeiffer, and E. Marshall.

The choices made by policy-makers to mitigate and adapt to climate change in the agricultural sector inevitably affect human health. To help ensure that the impact of these policy choices on health is positive, there is a need to inform decision-makers of health risks and opportunities associated with different policy choices, and furthermore, provide them with tools and information to enable them to select options that can benefit both health and the environment.

The Public Health and Environment Department of WHO is implementing a project to identify the health impacts of climate change actions proposed for the agriculture sector. A key aim of this project is to support the integration of health concerns into climate change decision-making by outlining intervention options that benefit both climate and health.

Given the vastly complex nature of agricultural systems, a life cycle approach was selected to help conceptualize and assess human health issues associated with the different stages of four production systems: crop, livestock, forestry and fisheries. The majority of options, or recommendations, for climate change action with relevance to the agriculture sector, are focused on modifying elements of these specific practices (e.g. tillage, fertiliser use, etc). As such, this approach also allows for a more comprehensive evaluation of the wider health implications of a decision in the sector, as opposed to examining an individual issue or risk.

The results of this analysis will be used to develop a decision-support tool to help estimate the potential health co-benefits/implications of different climate change policy scenarios, across different agricultural systems. The results will be generated based on an analysis of the expected health impacts that could result from changes made at different stages of the production cycle. For example, estimating the potential health co-benefits that might result from the use of organic rather than fossil fuel based inorganic fertilisers. It is also intended that the tool would allow for the identification of vulnerable population groups, for example migrant workers, that might be more affected by different policy adjustments, and if so, would permit an assessment of the extent and coverage of such predicted impacts.

To date, the preliminary mapping of health impacts across the life-cycle of the four agricultural production systems has been completed and is currently undergoing expert/peer review. An analysis of climate change options or recommendations, relevant to the agriculture sector has also been completed, and methodological discussions are under way to develop the decision-support tool.

If you have expertise related to agriculture and health or climate change and agriculture, and you would like to learn more about this project and how you can get involved, please send an email to HIA@who.int with cc, agriculture and health in the subject line.

WHO

Joint FAO/WHO Expert Consultation on fats and fatty acids in human nutrition

A Joint FAO/WHO Expert Consultation on Fats and Fatty Acids in Human Nutrition was held in Geneva, 10–14 November, 2008. The Consultation placed more emphasis on the role of certain fatty acid categories, an example being the convincing role played by long-chain polyunsaturated fatty acids in neonatal and infant growth and development, as well as a beneficial role in the maintenance of long-term health and prevention of some chronic diseases. There was strong evidence to recommend a reduction in *trans* fatty acids due to an increased risk of developing coronary heart disease and adverse blood lipid changes, including increasing LDL concentrations and adverse changes in the total/LDL cholesterol ratio. The timeliness of this expert consultation is also tied to the clear recognition of the increasing global burden of chronic disease. Interim summary of conclusions and dietary recommendations on total fat and fatty acids have been posted on the websites of both [FAO](http://www.fao.org) and [WHO](http://www.who.int) while the final report of the 2008 Joint FAO/WHO Consultation is being finalized. The background papers prepared for the Consultation have been published in a special issue of the [Annals of Nutrition & Metabolism](http://www.annals-nutrition.com) [55(1-3) 1-308 (2009)].

WHO Nutrition Guidance Expert Advisory Group (NUGAG)

As part of WHO's efforts in strengthening its role in providing scientific advice and developing evidence-based policy and programme guidance, WHO has established the **WHO Nutrition Guidance Expert Advisory Group (NUGAG)** in February 2010 in accordance with the new WHO guideline development process developed in response to a need expressed at the 58th World Health Assembly for more rigorous processes to develop evidence-based guidelines. NUGAG has three sub-groups covering **Micronutrients**, **Diet and health**, and **Nutrition in lifecourse and undernutrition**.

NUGAG meets twice yearly to implement biannual programme of work. The first meeting was held in Geneva, Switzerland on 22-25 February 2010 and the second meeting is scheduled to take place in Amman, Jordan on 15-19 November 2010. The programme for 2010 include the development of nutrition guidelines in the areas of micronutrients for iron supplementation, food fortification and multiple micronutrient powders, of diet and health for sugars, total fat, nutrient profiling and sodium, and of nutrition in the life course and undernutrition guidelines for severe and moderate malnutrition, nutrition support for TB patients and for HIV patients.

Simultaneously, WHO is developing the **WHO E-Library of Evidence for Nutrition Action (E-LENA)** whose goal is to provide comprehensive programme guidance and support to WHO Member States and their partners for the successful implementation of safe and effective nutrition interventions. This way, WHO E-LENA will become a single, exhaustive resource for finding the most current nutrition related guidelines and other information available.

REACH Partnership To Explore Links Between Agricultural Development And Nutrition Improvement.

REACH

The REACH: Ending Child Hunger and Undernutrition Partnership (www.reach-partnership.org) develops models in several countries in West Africa and Asia to strengthen the capacity of governments in improving nutrition and food security governance, in policy planning and analysis, and multi-sector coordination.

The REACH Partnership will expand its efforts to help countries reduce child hunger and malnutrition. REACH is launching a new project to reinforce its approach by further exploring the linkages between small-scale farmers' livelihoods, local value chain opportunities and child nutrition. An operational research component will identify and document good practices and lessons learned from interventions linking agricultural development to nutrition improvement. The project is funded by a grant from the Bill & Melinda Gates Foundation to the United Nations World Food Programme, the host agency of this joint UN initiative.

The initiative will provide a platform for experts and practitioners from both agriculture and nutrition communities at all levels to identify practical ways to link (i) the promotion of diversified households' food production and diets for better nutrition; (ii) the support to local food production suitable for nutrition rehabilitation, supplementation and fortification and (iii) the scaling up of these activities to link them with market food supply chains and institutional programmes such as school feeding programmes. The key elements are to leverage families' food production for self-consumption and income generating potential, as well as to provide additional markets for local production by promoting institutional food assistance based on locally produced foods.

The critical role of women – both producers, primary caregivers for children – will be taken as a specific entry point to develop new programming models and guidelines.

A toolkit and guidelines will be developed to help governments and field practitioners in other countries adapt the model to country-specific contexts. This multiplier effect will be further amplified through the establishment of a knowledge-sharing system to disseminate case studies of successful practices.

Initial research and testing of the model will be conducted in Sierra Leone. The First Lady of Sierra Leone, Mrs. Sia Koroma, expressed her support for the initiative and committed to making nutrition a cornerstone of her agenda to improve the lives of women and children in Sierra Leone. "Nutrition is essential to maternal health and reducing child mortality. Healthy children make healthy adults, with strong minds and bodies."

Contact: Grace Funnell grace.funnell@wfp.org or Senoe Torgerson senoe.torgerson@wfp.org

The Global Breastfeeding Initiative For Child Survival

Gbičs

Optimal breastfeeding not only saves the lives of more than one million children under five, but also improves the quality of life of these children who do survive. Undernutrition is a major factor in preventing those children from reaching their full developmental potential. Breastfeeding can help prevent this waste of life and health.

During the 126th session of WHO's Executive Board, Board Members reiterated the unequivocal statement in the WHO Secretariat Report: "Breastfeeding is today the single most effective preventive intervention for improving the survival and health of children. It is estimated that more than one million deaths in children under the age of five could be prevented every year with the improvement of breastfeeding practices. Additionally, the deaths of more than half a million children can be prevented annually by adequate and timely complementary feeding."¹

EB Members insisted with WHO that "Scaling up of interventions is urgently required." The NGO community has already noted the urgency of the call for action: at the end of 2009, the global Breastfeeding Initiative for Child Survival (Gbičs) was launched first in Geneva and then in the United Arab Emirates. The International Baby Food Action Network, IBFAN, and its partner the World Alliance for Breastfeeding Action, WABA, aim to intensify coordinated efforts to attain the health-related Millennium Development Goals.

We launched an appeal to government authorities, the health profession and academia to join forces with us, the public-interest civil society groups, in an effort to improve interventions by targeting work where it is most needed, which can only be known after a proper assessment of the state of infant feeding policies and programmes is done at the national level.

In a recent article signed by the heads of eight global health agencies², the need for data that "accurately track health progress and performance, evaluate the impact of health programs and policies, and increase accountability at country and global levels" is presented as an urgent need.

Aware of the importance of improving the quality and availability of data, the International Baby Food Action Network (IBFAN), under the leadership of the Breastfeeding Promotion Network of India (BPNI), put together a participatory, action oriented tool using indicators developed by the World Health Organization and UNICEF to assess infant feeding policies and programmes at country level³.

1. Report EB 126/9

2. Chan, Margaret et al. "Meeting the Demand for Results and Accountability : a Call for Action on Health Data from Eight Global Health Agencies" in *PLoS Medicine*, Volume 7, Issue 1, January 2010

3. WHO, "Infant and Young Child Feeding: A tool for assessing national practices, policies and programmes" published in 2003, available at <http://www.who.int/nutrition/publications/infantfeeding/en/index.html> and the Global Strategy for Infant and Young Child Feeding, available at <http://www.who.int/nutrition/publications/infantfeeding/9241562218/en/index.html>

Gbiċs

In application of IBFAN's philosophy, data collection and analysis is performed by multiple stakeholders that combine the knowledge, the interest and the capacity to influence infant feeding policies and programmes. The purpose is to combine technical knowledge with political commitment for improvement. The picture that emerges is processed into the parameters of information of the World Breastfeeding Trends initiative (WBTi)⁴ and published in the web portal www.worldbreastfeedingtrends.org

Using the WBTi as a magnifying glass to get data about the state of infant feeding in countries showing slow or no-progress on attaining the health Millennium Development Goals, IBFAN and WABA propose the global Breastfeeding Initiative for Child Survival as a means to identify priorities and channel actions where they can be more effective.

The Gbiċs can be summarized as an enticing invitation to build a house that protects, promotes and supports breastfeeding, using the architectural elements furnished by the Global Strategy for Infant and Young Child Feeding in a wise manner. For more information please contact gbics@gifa.org

4. The WBTi is a trade-mark of BPNI. For more information please address your queries to info@ibfanasia.org and gbics@gifa.org

Alive & Thrive**Alive & Thrive Launches Country Programs, Grants, Website, and Series of Technical Updates**

Alive & Thrive (A&T) is a 5-year initiative (2009-2013), supported by the Bill & Melinda Gates Foundation, to improve infant and young child nutrition by increasing rates of exclusive breastfeeding and improving complementary feeding practices. A&T aims to reach more than 16 million children under 2 years old in Bangladesh, Ethiopia, and Viet Nam. In 2009 A&T conducted assessments and formative research in these countries to guide program design. The design includes policy dialogue, community-based and media activities, strategies to increase access to and use of affordable fortified complementary foods and related products, and monitoring and evaluation.

The different models for delivering IYCF services in the three program countries can inform policies and practices worldwide. In Bangladesh A&T is delivering IYCF services through BRAC, a large NGO with multiple program platforms, and is discussing with the government how to best support the national IYCF strategy. By December 2010, more than 30,000 of BRAC's frontline workers will be implementing A&T interventions in rural areas and Dhaka slums.

In Viet Nam Alive & Thrive plans to harness the media and introduce a franchise model for IYCF counseling services in public health facilities that combines one-on-one counseling services and group activities. In food secure areas of Ethiopia, A&T will strengthen the ability of the government's health extension workers and community volunteers to mobilize their communities and deliver IYCF preventive messages and counseling. In Ethiopia A&T will also issue small grants to test interventions to prevent malnutrition by integrating IYCF practices into safety net and nutrition rehabilitation programs.

M&E plans in the three countries include baseline surveys in early 2010, operations research, cost studies, and mixed-method impact evaluations for major community, media, and private sector interventions. A&T also supports a small grants program to test innovative ideas for scaling up effective IYCF interventions. A&T received more than 400 responses to its Call for Letters of Interest, invited 20 applicants to submit full proposals, and awarded eight grants. Another Call will be issued in late 2010.

More information on A&T is available at www.aliveandthrive.org. The website reports on program developments and features IYCF technical updates, news articles, and an abstract research digest. The first technical update focuses on the Impact of Early Initiation of Exclusive Breastfeeding on Newborn Deaths. A&T consortium members are AED, BRAC, GMMB, IFPRI, Save the Children, UC-Davis, and World Vision.

WHO**Development of the Guidance on Nutrient Profiling**

WHO has initiated the work on nutrient profiling in 2009 in collaboration and involvement of various partners. This is part of WHO's efforts in implementing the recommendations of the Organization's Nutrition Programme Review undertaken early 2009. The development of an internationally recognised method (or set of methods) of nutrient profiling is clearly beneficial for a wide range of applications in commercial, international, governmental policy and health promotion strategies. WHO is responding to this challenge through developing an evidence-based framework and guiding principles for the nutrient profiling of food, based on international dietary recommendations established by FAO/WHO. The work has 5 phases: 1) Production of a systematic review of existing nutrient profiling systems; 2) Production of methodological guidance and manual on guiding principles for developing and implementing nutrient profiling; 3) Validation of guiding principles and methodological guidance at least in 6 countries in each Region; 4) Holding of a technical consultation to review the outcome of the validation work with a view to assess the feasibility of a single international nutrient profiling system and the key elements that such a system should contain; 5) Development of a WHO framework and manual for the country level development of nutrient profiling.

Speaker's Corner

A scathing critique of Landscape Analysis: where has the Right to Nutrition gone?

Claudio Schuftan, People's Health Movement, contact: cschuftan@phmovement.org

1. For those of us who have been around long enough, the feature articles on Landscape Analysis in the Standing Committee of Nutrition News, issue No.37, early 2009 (SCNN37), bring back a bitter taste of déjà-vu.
2. Although the initiative is all about *willingness to act*, *policy intent* and *political commitment*, I am afraid it perpetuates the same old top-down approach of 30 years --thus the déjà vu.
3. As it happens, the Landscape Analysis initiative does not come unprecedented. It comes after the 'Nutrition Planning and Systems Analysis era' of the late 70s, the 'Post-ICN era' of the mid-90s and other minor 'post-eras'. Because of that, all of what this latest initiative brings rings a bell to me: It comes as the 'Post-Lancet Series era'.
4. As for the articles, I see a big discrepancy between the text presented to us under Methodology on pp.17 and 18 where the human rights-based approach (HRBA) is highlighted and what is said in Box 1 on page 18 - on the actual five phases to be used in the Landscape Analysis country assessments. I (and I do not know if you) fail to see how the methodology "highly inspired" (p.17) those five country assessments to consider the HRBA as a core methodology.
5. In the conclusion of the same article by M. Chopra et al (pp.19 and 22), the HRBA is not even mentioned anymore (between pp. 17 and 22 it simply fell into oblivion); and we are left to assume that rights holders were not even considered to take part in the consensus-building workshop held to consolidate the assessment methodology. This flagrantly violates the "highly participatory HRBA to programming" needed as mentioned in the methodology in the same article (p.17).
6. I further read with interest (p.16) that, still this year, WHO is planning to undertake a "Comprehensive Global Nutrition Policy Review". One can only hope that it better centres on the HRBA to the Right to Nutrition this time...after all, WHO is a UN agency and is thus bound to apply the HRBA.
7. The issue of assessing the "level of commitment and budget support" proposed by the Landscape Analysis we also found in the post-post efforts of the late 70s and mid 90s. As in the Landscape Analysis, at those times, we also found "multiple initiatives that remained inconsistent, disjointed and ineffective"; we also then "assessed gaps and constraints, and identified opportunities"; "we further established baselines, assessed readiness and the level of commitment in countries covered in an effort to scale up interest in nutrition"; and we also vied (or coerced?) local partners to come up with "national action plans" (pp. 4 and 5). So, you see? There is not much new under the sun. And what came out of all of it? Little. [Note that, as WHO points out elsewhere in SCNN37: "Moderate malnutrition has remained virtually unchanged for the past 30 years" (p.70)]. Then as today, we further looked at "major nutrition problems, budgets, nutrition objectives, resource allocations, coordination mechanisms, training opportunities and women's nutritional status" (p.7) And what came out of all of that? Little. At that time, we may not have called what we aimed at bringing about "readiness to accelerate progress and capacity or ability to act", but we also did "critique the lack of commitment" we found (pp. 6 and 7).
8. I contend we go through these now repeated exercises or initiatives, because we have periodic prangs of guilt (post ICN, post Lancet Series). But we still do not seem to get it right!, i.e., seeing undernutrition as a human rights violation and applying the corresponding methodology SCNN37 so rightly pays lip service to on pp.17 and 18.
9. So, you see? the effort is not new, but it is still wrong --this time with a bucolic new name given to it: Landscape Analysis.
10. I remember in those earlier days we spoke of applying systems analysis, food chain analysis, National Nutrition Plans of Action. They all were or contained in-depth country assessments, but one-after-the-other, the recommendations made were top-down -- again-and-again.
11. Also in those earlier all-out-efforts we thought we left several countries "on track" (p.13), only to harvest disappointment...already in the short term. It all somehow fizzled away and fell into oblivion (...our well known nutrition pendulum swinging away once again, or perhaps the landscape had a bad crop, or a drought).
12. I do not know if the times have changed, but those previous efforts ended up in failures; will this one? Or more pointedly: Is it their or our failure? (Schuftan, C., 1978, 1985 and 1994) Why do I ask this? Because

- chronic malnutrition was then --and still is today-- not seen as a human rights violation! (Schuftan, C., 2005)
13. Yet later in this long saga, we fell into a reductionistic phase in which we considered chronic malnutrition to be too intractable (too politically messy?) and we concentrated our efforts overwhelmingly on micronutrient malnutrition (the 'hidden hunger' that became so popular with donors...because it was much less politically messy?). (Schuftan, C., 1999; Schuftan, C. Ramalingaswami, V. and Levinson, J., 2005)
14. The question I ask at this point is: Is Landscape Analysis seeing the chronic malnutrition problem as a human right problem beyond lip service? What I read in SCNN37 tells me: No.
15. The mixed bag of results in Table 3 (p.15) is revealing. Despite massive funding, neither PRSPs nor UNDAFs have had a real clear-cut predictable value to tell us if a country is "on track" for MDG1. Only 2/10 PRSPs, 2/10 UNDAFs and 4/10 Nutrition Governance indices correlated with a "strong" (though top-down) country commitment to nutrition; yet those ten countries made it to the "on track" category. [By the way, One can only wonder about the accuracy of the data that shows Afghanistan being "on track"...].
16. Heaver, in 2005 (as presented in Table 1, p.11) probably had it partially right: when he (she?) points out that "adequate nutrition is seldom treated as a human right with the concomitant fact that the malnourished have little voice" But he (she?) places these 2/10 "reasons for weak commitment" in 6th and 7th place respectively in his list when, for me, these two reasons explain reasons 8, 9 and 10 in the list. (I say he/she is only partially right, because his first five reasons all explain top-down failures which can be eventually mitigated if the malnourished gather together a big voice...)
17. Let me now turn to Table 2 in the Chopra et al article, the one on "indicators for the assessment of willingness and of ability to act" to be used in the country assessments (pp. 20-21). As a matter of fact, all the indicators in the table could not be more top-down even if the authors tried. The table does not mention rights holders by name, elegantly hiding them under the rubric of "stakeholders" where we do not know if it refers to them or to duty bearers. (The private food industry gets mentioned by name though...). [To be honest, "community groups" and "clients" are mentioned in the table as "links" for the willingness to act (p.20)]. The point I here highlight begs the question: If this extensive list of top-down-biased indicators (or supply-side indicators if you prefer) in Table 2 are flawed (or utterly one-sided), what can we expect from the results of the Landscape Analysis country assessments?: Doomed from the outset, we are bound to get more of the same...
18. I think all this is at the core of a flawed focus --very much consistent with the Lancet Series which many of us severely critiqued at the time it appeared for pretty much the same reasons given here. [But then, again, the REACH "Ending Child Hunger and Undernutrition Partnership" with its four expected outcomes (p.69 under Programme News in SCNN37) does not seem to do much better than Landscape Analysis on its (non) human rights focus]. (See Schuftan, 2000) The closest Table 2 gets to rights holders is in the demand side factors section (p.21) where it speaks a) about "clients' knowledge and satisfaction"...a far cry from rights holders (!), b) about "mobilization of civil society groups/community based organizations around nutrition activities and about systematic outreach activities to community organizations"... yet nothing there is found about them getting mobilized to claim their right to nutrition (!), and c) about "direct funding available to community based organizations for nutrition activities" ...one wonders funding for what...for more of the same? (!).[The last indicator in the table is the most intriguing; it reads: "focus on community interventions on prioritised nutrition interventions ...whatever that means. (!?)].
19. All we read in Table 2 is a far cry from the social mobilization of rights holders needed for them to demand their right to nutrition as the HRBA calls for. I wonder if the authors of the article realize this.
20. To see if I still could be wrong in this, my scathing critique, I proceeded to check the country reports in the same issue of SCNN. Here is what I found:
- Burkina Faso** created a "thematic group on nutrition and community participation to strengthen community involvement" (p.29) ...with no mention whatsoever of what type of participation or of the right to nutrition.*
- Ghana** proposes "counselling and education as an effective tool to reduce stunting" (!?) (do we still think this works?) and "scaling-up community based activities to improve access to services and reinforce and expand volunteerism" (!?) (volunteerism?) (p.36) ...with no mention whatsoever of the right to nutrition.*
- Guatemala** will "develop a social participation strategy to raise awareness and ownership" (p.41). It also explicitly recommends following the Lancet Series recommended interventions ...with no mention whatsoever of what type of social participation or of the right to nutrition.*
- Madagascar** also recommends following the Lancet Series recommendations and, not surprisingly, goes on to recommend "strengthening public-private partnerships for improved nutrition in the areas of iodine and ...nutrient dense foods" (to be used in what?) (!?) (p.48) ...with no mention whatsoever of the right to nutrition.*

Peru does say “a sustainable programme is difficult to build if the communities benefiting from it do not see the program as serving their own interests and needs...they have to understand the main aspects of the causes and solutions (of stunting)”. But then, it goes on to add they will “use user-friendly communication materials based on the Lancet Series for cost-effective interventions” (cost-effective interventions? Are we still speaking of this?) (!?) (p.53). Surprisingly, no mention is made of CARE Peru’s successful use of the HRBA in health and nutrition.*

*: To me this comes as no surprise. In all fairness, one has reason to wonder: Were all or most of these colleagues carrying out the country assessments ‘HRBA-literate’?

21. After reading all these country reports, I can guarantee nothing, or little, will happen medium term. Mark my word and hold me accountable for this statement in 3 to 4 years time.

22. You think this critique is too harsh?

Contrast the Landscape Analysis papers with the conclusions in Roger Shrimpton’s piece on the food crisis (pp.64-66) of the same issue. There, he unambiguously speaks of “empowering individuals to resolve their problems and demand services, collective community action, building from the bottom-up to identify state obligations, rights holders to find their own solutions where the state has a duty”. In the same vein, the Speakers’ Corner piece on Brazil is also to be praised: it attributes “spectacular drops in child undernutrition in the country to strong support from workers’ unions and grassroots movements, as well as vigorous income redistribution policies” (p.73). Yes, dear readers, all this in the same issue of SCNN.

Bottom line --one can only conclude one thing, Elemental Watson: You find what you look for!

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The Landscape Analysis and human rights-based approaches

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There is a global consensus that malnutrition levels remain unacceptably high and the reduction of malnutrition in all its forms needs to be accelerated. The rationale behind the Landscape Analysis is the right of all children to grow and develop according to their full potential. Chronic malnutrition witnesses a violation of multiple human rights at various levels. Clearly, the stunted child does not enjoy his/her rights to adequate food, health and care and to development. This is likely linked to his/ her mother's rights to adequate nutrition before pregnancy and during pregnancy and lactation not being met, along with her non-enjoyment of other related rights such as adequate care and protection during motherhood. These factors in turn, are often linked at deeper levels to gender imbalance, poverty, poor access to basic infrastructure and especially inadequate support and service delivery in connection with motherhood, although the underlying causes may vary from one country to another. This is where the Landscape Analysis seeks to provide guidance on how and where to invest to scale-up nutrition action in order to address stunting in the 36 high-burden countries which are home to 90% of child stunting which are home to 90% of child stunting.

The Landscape Analysis, however, does not provide a top-down blueprint to fit all countries in contrast to many previous efforts in the 1970s - 1990s. Recognizing that there is not one solution that fits all 36 countries, the Landscape Analysis project was developed as a follow-up to the Lancet Nutrition Series in order to link the findings and evidence presented in the Series to information on what action would be appropriate in different typologies of countries.

To this end, the Landscape Analysis investigates the extent to which different stakeholders, or duty-bearers, are ready to take action against maternal and child undernutrition. The Landscape Analysis has three components: a desk analysis of secondary data to define country typologies at various stages of readiness to scale-up nutrition action, in-depth country assessments and the online Nutrition Landscape Information System (NLIS). The definition and approach used, in which being *ready* is equated to being *willing and able*, is highly inspired by the human rights-based approach (HRBA) which recognizes that duty-bearers themselves may not be able to meet their duties unless they have a certain capacity. Furthermore, the in-depth country assessments do follow the step-wise approach of HRBA.

The desk analysis links nutrition outcome data with indicators for underlying factors, including nutrition governance, health system capacity and expenditure, and socioeconomic and social factors. By design, the desk analysis considers secondary data and no new data are collected.

The methodology for the in-depth country assessments in particular has been highly inspired by the HRBA methodology. The country teams and partner agencies who have participated in a Landscape Analysis country assessment would be able to confirm that there has been a great team effort, with multi-agency, multisectoral teams under the leadership of national authorities that have interviewed a wide range of stakeholders and service providers at national and sub-national level. This has fostered ownership of results and accountability towards action recommendations. The respective approach taken in each country is evident from how the resulting recommendations are different from country to country. We agree that community empowerment and participation are crucial, but we also recognize that unless the duty-bearers are motivated, committed and possess the necessary capacity, programmes are deemed to failure.

In the country assessment process, the four HRBA key steps have been incorporated as follows. Steps 1 and 2, the causality analysis and role or pattern analysis, have largely been done by the national team as part of the preparations for the assessment. It includes creating a country profile looking at the underlying factors for malnutrition and a mapping of nutrition policies, programmes and stakeholders. As part of the preparatory actions, the national team also modifies the assessment tools to ensure that they are appropriate for their national setting and priorities. Based on experience from these country assessments, the global tools have been updated and further improved. One of the latest inclusions into the national level questionnaire is whether the stakeholders have been using the Convention of the Rights of the Child in advocacy and partnership-building. Step 3, the capacity analysis, has been realized through a series of interviews with stakeholders at national and sub-national level to assess their commitment and capacity to accelerate stunting reduction. The interviews seek to get the perceptions and views of the stakeholders, including how they may contribute to working together to scale-up the response to chronic malnutrition.

The interviews touch upon mandates (acceptance of responsibility and authority), resources and coordination systems including budget support (which is an important part of the picture) (economic, human and organizational resources), and advocacy and information system (capability to communicate and capability for rational decision-making). Step 4, the drafting of candidate strategies, is done through a participatory analysis phase where field teams get together and discuss observed strengths and weaknesses and draft recommendations

that contribute to capacity development of duty-bearers at all levels and empowerment of individuals and communities. Guatemala for example recommended the development of a social participation strategy. These recommendations are subsequently presented to and discussed in a larger consensus meeting. While the right-holders themselves (children under five and their mothers) have not been interviewed or participated in the consensus meeting, the country assessments always seek to involve their representatives in terms of relevant NGOs, women's organizations or similar organizations. Moreover, a next step is to develop an assessment tool for interviews with mothers to obtain the user or right-holder point of view.

The third component of the Landscape Analysis, the [Nutrition Landscape Information System \(NLIS\)](#), could be a powerful tool in the hands of human rights advocates as it shows a variety of nutrition outcome indicators along with indicators for selected underlying factors including food security, health services, caring practices, national commitment and capacity, and contextual meta-indicators such as education and gender issues. The country profiles, available as a 2-pager printout, can be used to draw political attention to malnutrition.

It will be difficult to measure a direct impact on nutrition outcome or even any indirect impact of the Landscape Analysis particularly in such short time, especially since the project was initiated in late 2007 and country assessments in mid 2008. The difficulties of measuring direct or indirect impacts are also due to many confounding factors influencing the nutritional outcomes as the UNICEF conceptual model delineates. Concerning process indicators however, the Landscape Analysis country assessments can report several successes in terms of development of joint country action, increased awareness of the need to strengthen nutrition at decentralized sub-national levels, preparation of successful funding proposals and new input to national nutrition policy and strategy development processes. Much of this has already been reported in SCN News 37 country papers, and we are pleased to announce the following country updates:

- Burkina Faso has further reinforced the monitoring of coordination of nutrition activities in regions through an initiative by the Ministry of Health to ask every regional directorate of health to appoint nutrition focal points.
- Comoros (which undertook its country assessment in April 2009) has already established a multi-sectoral committee for advocacy and follow-up of recommendations with representation of the national director of health, the chief of agro-alimentary department of the Ministry of Production, the responsible of the nutrition programme within the Ministry of Health, the director of exterior commerce, the chief of sectoral policies, and the chief of planning and statistics. The Committee has held three advocacy meetings with the Ministries of Health and of Agriculture. Moreover, there is updated national information on the nutrition status of under-fives, which was another of the eleven recommendations coming out of the Landscape Analysis.
- In Ghana, the Ghana Health Service is taking the lead in developing a national Nutrition Policy, the outcomes of the Landscape Analysis country assessment being one important input. WHO has been a partner in the process and the World Bank providing the major part of the funds under the Malaria and Nutrition for Child Survival Project. The terms of reference have been drafted, and the policy is expected to be finalized this year.
- Guatemala successfully applied for Spanish MDG Funds that incorporated the outcomes and recommendations of the Landscape Analysis. A Joint Programming for food and nutrition by the national government and UN country group was launched. More recently, the UN System has also implemented a CERF (Central Emergency Response Fund) project, to support and strengthen national capacities to prevent and attend severe malnutrition and food insecurity and improve nutritional surveillance. Advocacy materials regarding the National Strategy for the Reduction of Malnutrition have been prepared and are being distributed.
- Peru also successfully applied for Spanish MDG Funds that incorporated the outcomes and recommendations of the Landscape Analysis. The Landscape Analysis has further resulted in a number of follow-up actions designed to strengthen nutrition actions for pregnant women and young children.
- South Africa, which scaled up the Landscape Analysis country assessment to all nine provinces covering a total of 240 sites with almost 1000 completed questionnaires, has used the findings of the Landscape Analysis to identify key priority nutrition actions. The Landscape Analysis also served as an opportunity for the Department of Health to develop a nutrition strategy for the implementation of key nutritional interventions to address maternal and child undernutrition, guided by the broader National Department of Health strategic framework.
- In Mozambique the outcomes of the country assessment in January 2010 fed into a high-level national seminar on 3-4 March 2010, and the development of a new national action plan for reducing chronic malnutrition.
- In March and April 2010, Côte d'Ivoire, Ethiopia and Indonesia have been undertaking the Landscape Analysis country assessments, and Mali is currently in the process of planning its assessment.

Read more at http://www.who.int/nutrition/topics/landscape_analysis

Visit NLIS at <http://www.who.int/entity/nutrition/nlis>

[back to contents](#) SCN NEWS # 38

Conservation Agriculture And Climate Change

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'Conservation Agriculture' (CA) is a term encompassing farming practices which show three key characteristics: (a) maintenance of a mulch of carbon-rich organic matter (e.g. straw and/or other crop residues including cover crops) over the soil surface; (b) no tillage, with planting done through the mulch; (c) rotations or sequences and associations of crops which include nitrogen-fixing legumes. There are currently ca. 105 million hectares in such systems worldwide, increasing by about 5 million ha. per year (Kassam 2009).

Maintenance of a mulch layer provides a substrate for soil-inhabiting micro-organisms which have significant mutually beneficial inter-relations with plants with respect to improving and maintaining plant-available supplies of water and nutrients (Uphoff 2006). This also contributes to net increase of soil organic matter - derived from carbon dioxide captured by photosynthesis in plants, whose residues above and below the surface are subsequently transformed by soil biota. Avoidance of tillage minimises occurrence of net losses of carbon dioxide by microbial respiration and oxidation of the soil organic matter. Rotations and crop associations that include legumes are capable of hosting nitrogen-fixing bacteria in their roots which provide both temporal diversity of crop plants and free acquisition from the atmosphere of nitrogen, as an important factor commonly limiting optimum plant growth.

Well-managed CA results in: (i) protection of the soil surface from extremes of temperature-variation and rainfall intensity; (ii) improved and self-sustaining porosity of the soil, accompanied by significant increase in rainfall infiltration and, thus, diminution of erosion and improvement in stream-flow characteristics; (iii) regular provision of energy-rich substrate for the soil biota; (iv) improved timing and duration of availability of plant nutrients over the life-cycle of the crops; (v) much-reduced mechanical damage to the physical characteristics of the soil as an environment for both roots and their attendant soil organisms. (vi)

soil health is thus improved, with benefits to sustainability of the plant-soil systems, in rotations during which yields of crops and pasture-species become more stable, and often raised on a sustainable basis. As consequences, efficiencies of resource-use – of labour, purchased inputs, fuel, rain- and irrigation-water – increase, and unit costs of production decrease, offering better return to producers and improved affordability to consumers. Through improved functioning of CA agro-ecosystems, problems of weeds, diseases and insect pests become more easily regulated.

From the viewpoint of human nutrition, CA may be considered capable of (a) improving quantity of food produced per unit area; (b) improving security of food-supplies from a given area over time; (c) improving regularity and usable volumes of water-supply from the catchments which feed the groundwater, and thence streams and rivers; (d) reducing quantities of applied fertilizers, herbicides and pesticides while yet maintaining yield levels, thus reducing risks of environmental pollution. The increased diversity of organisms above and below ground under CA systems – by comparison with those of less-varied character – might provide further benefits in terms of better nutritional value of harvested products, a subject which merits further investigation.

The several merits of well-managed CA suggest that its spread should be encouraged in all situations, because humanity is increasingly pressured by rising populations and associated demands for affordable nutritious food, clean water and other products from land, and by the destabilising effects of climate change.

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For more information please consult our website <http://www.taa.org.uk> or write to fshaxson@gotadsl.co.uk.

WHO's work on salt / sodium reduction

Chizuru Nishida, nishidac@who.int

As part of the implementation of the Global Strategy on Diet, Physical Activity and Health (DPAS) and the Noncommunicable Diseases Action Plan, WHO is planning to convene three **Population Salt Reduction Strategy Platforms**, objectives of which are to discuss:

- How to **create an enabling environment** to facilitate behaviour change of consumers to make appropriate food choices reduce the total sodium content of their diet through consumer education and reformulation of foods by industry.
- How to **evaluate and monitor** dietary salt intake through Identifying the best instruments and tools to be used for determining population salt consumption levels and identify food items that contribute mostly to sodium consumption.
- **Salt as a vehicle for fortification** to prevent Iodine deficiency disorders (IDD) through identifying the way two public health strategies (salt reduction and universal salt iodization) can efficiently and effectively work together. The review and analysis of evidence on the most appropriate levels of iodine for salt fortification has started in February 2010 under the advise of the *WHO Nutrition Guidance Expert Advisory Group (NUGAG)*.

These platforms will involve experts, professional associations, private sector, nongovernmental organizations (NGOs), other UN agencies and interested Member States. For each of the platforms, literature reviews of the evidence will be undertaken to serve as the basis for discussion and the conclusions of the platforms will be used to develop WHO guidelines for reducing population salt intake, provide tools and protocols for evaluating the effectiveness of population salt reduction programmes, provide information on how to adapt and adopt protocols for low- and middle-income countries and provide guidance on the most appropriate levels of iodine for salt fortification, considering the salt consumption patterns.

In addition, there are a number of on-going regional efforts and initiatives that are being implemented by the WHO Regional Offices. The **WHO Regional Office for the Americas (PAHO/AMRO)** established a **Regional Expert Group (EG) for reducing dietary salt intake in the Americas** as a population based approach to cardiovascular disease prevention. The main objectives of EG are to: 1) explore the current epidemiological situation regarding cardiovascular disease and its link to excessive salt consumption in the Americas; 2) review existing policies, interventions and programs aimed at reducing dietary salt and issue evidence-based recommendations for salt reduction in the Region; 3) review, discuss and agree with relevant partners' adjustments necessary for use of salt as vehicle for micronutrient fortification; 4) foster or initiate public and private partnerships. The EG will work for a span of two years focusing on 4 areas of work (i.e. Advocacy, Surveillance, Salt Fortification and Liaison with Industry). The positions which EG promotes include mandatory declaration of sodium/salt on nutrition labelling whether labelling is voluntary or mandatory and how such declaration be effectively communicated to consumers. Please see www.paho.org/cncd_cvd/salt for further information on the work of EG.

As a follow-up of recommendations for action described in the Second WHO European Action Plan on Food and Nutrition endorsed by the Regional Committee in September 2007 as well as of the implementation of 2008 - 2013 Action Plan for the Global Strategy for the Prevention and Control of Non-communicable Diseases (WHA61.14), the **WHO Regional Office for Europe (EURO)** facilitated the establishment of a European Salt Action Network on reducing population salt intake levels, hosted by the UK. The objectives of the Network are to: 1) establish a network of countries within the WHO European Region that are committed to salt reduction and to build an international action on salt reduction; 2) provide opportunities for an exchange of information on the implementation of salt reduction strategies and the sorts of activities these could include and their achievements; 3) provide opportunities for the exchange of information about technological advances and processing developments in relation to salt reduction and 4) develop guidance and provide technical expertise on the different aspects of a salt reduction strategy, such as the setting of salt targets, monitoring intakes and product levels, and communication with the public to Member States who wish to develop salt reduction strategies, as well as the WHO (Europe) and the European Commission.

The **WHO Regional Office for the Western Pacific Region (WPRO)** is holding a "Regional Consultation on Strategies to Reduce Salt Intake" in Singapore on 2 - 3 June 2010 as part of the efforts in implementing the Western Pacific Regional Action Plan for Noncommunicable Diseases (NCD). The consultation will be hosted by the Singapore Health Promotion Board (SHPB), a WHO Collaborating Centre for Health Promotion and Disease Prevention, and the objective are to: 1) review the current best practices for reducing salt intake in relation to data requirements, governmental actions and consumer awareness; and 2) identify strategies and approaches for salt reduction in the Region.

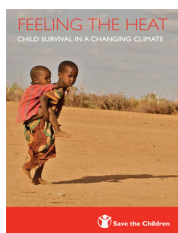
Publications

How the Global Food Crisis is Hurting Children: The impact of the Food Price Hike on a rural community in Northern Bangladesh. Save the Children UK ([online](#))



The report provides one of the most in-depth analysis of the impact of soaring prices on households, highlighting in particular the crucial impact of higher prices on poor households' incomes and their ability to feed themselves. One of the most striking findings of the report is that between 32% and 50% of poor households in the community surveyed had a lower disposable income in 2008 than before the crisis.

Feeling the Heat: Child Survival in a Changing Climate Save the Children UK ([online](#))



Tackling the issues children face as a result of climate change must be made a priority. Save the Children's report, *Feeling the Heat*, illustrates the effects climate change will have on children. Today, nearly nine million children die before their fifth birthdays due to a small number of preventable diseases, such as diarrhoea, malaria and pneumonia. Climate change is set to worsen the conditions which contribute to the prevalence of these diseases, placing children at greater risk. The effects of climate change will reduce poor communities' access to clean water, reduce their ability to grow nutritious food, increase food price fluctuations and allow malaria mosquitoes to spread. Because the effects of climate change on children are so significant, Save the Children is urging national governments and the international community to work together to forge a way forward. It is imperative that world leaders put children first when they meet at the Copenhagen summit in December.

How cash transfers can improve the nutrition of the poorest children Save the Children UK ([online](#))



Evaluation of a pilot seasonal safety net project in southern Niger provides evidence of the impact of social cash transfers on household food security, food expenditure and nutrition in the context of high food prices in 2008.

Impact of Climate Change and Bioenergy on Nutrition IFPRI, FAO ([online](#))



This paper, prepared for the High Level Conference on World Food Security: The Challenge of Climate Change and Bioenergy (Rome, 3-5 June 2008), explores the implications of climate change and rising bioenergy demand for nutrition. It examines the direct nutrition effects of rising bioenergy demand, as well as its contribution to rising food prices. The paper begins by describing the current state of global food insecurity and malnutrition and the causes, consequences and costs of food insecurity and malnutrition. A number of factors besides climate change, bioenergy and rising prices that can contribute to malnutrition in the future are also discussed. Finally, a chapter on policy implications provides several options for improving food security and nutrition, as well as for addressing the links between climate change and bioenergy demand and nutrition."

Addressing the Challenges of Climate Change and Biofuel Production on Food and Nutrition Security Tirado MC, Cohen MJ, Aberman N, Meerman J, Thompson B

Tirado MC, Cohen MJ, Aberman N, Meerman J, Thompson B

This new article soon to be published in *Food Research International*, a journal of the Canadian Institute of Food Science and Technology, provides the latest up to date information on this subject. The article observes that more than one billion of people are suffering hunger and malnutrition in 2009. Food security has deteriorated since 1995 and reductions in child malnutrition are proceeding too slowly to meet the Millennium Development Goal (MDG) target for halving hunger by 2015. Three major challenges threaten current and future efforts to overcome food insecurity and malnutrition: climate and global environmental change and the consequent loss of ecosystems' services, the growing use of food crops as a source of fuel, and the food and financial crises. This paper reviews and analyses the current and projected effects of these issues on nutrition and proposes policy recommendations to address these challenges. The first section of the review lays out the public health and socio-economic consequences of malnutrition and explores causes and costs. The paper then analyses the implications of climate and global environmental change and biofuel production for food security and nutrition addressing strategies for adaptation and mitigation. This analysis includes a number of important socio-economic factors, besides climate change and biofuel production, that are currently impacting food security and nutrition, and that will likely contribute to future effects. The paper concludes with a series of policy proposals and recommendations to adapt to and mitigate the impacts of climate and global environmental change placing human rights in the centre of decision making, including a number of options for improving sustainability, food security and nutrition while addressing the links between climate change and bioenergy demand.

Climate Change, Bioenergy and Nutrition: Challenges and Opportunities for adaptation and mitigation Tirado MC, Cohen MJ, Aberman N, Meerman J, Thompson B

Tirado MC, Cohen MJ, Aberman N, Meerman J, Thompson B

This book reflects the substantial work that has been done in the area of climate change and food and nutrition security since the author's wrote the paper. It will make reference to all the efforts and progress in the area of climate change and will focus on solutions not just on impacts. The book outlines and analyses current and projected effects of climate change and biofuels on nutrition and the opportunities for adaptation and mitigation. Major topics include (1) the impact of climate change on food and water security and nutrition and adaptation and mitigation strategies (2) the consequences of biofuel demand on nutrition, such as reduced food availability and associated price effects, describing how rising bioenergy demand (driven in part by higher petroleum prices) affected global cereal prices. The final section of the book presents policy proposals and recommendations to mitigate the negative impacts outlined in previous chapters.

Scaling Up Nutrition: A Framework For Action

This policy brief, 'Scaling up Nutrition: A Framework for Action' is based on a collaborative effort of the World Bank, UNICEF, WHO, WFP, FAO and a wide range of developing country partners, CSOs and bilateral agencies. The principal aim of the brief is to catalyze actions to redress the serious neglect of nutrition in development efforts. It is not an action plan, but rather an enabling framework, with broad and representative endorsement. There are no proprietary rights to the policy brief. It has been prepared as a public good, available to all for whom it may be helpful in advancing the cause of improved global nutrition. You can download it from the [SCN website](#).

Policy Brief: Breastfeeding Save the Children UK [\(online\)](#)



There is overwhelming evidence that breastfeeding is good for the health of infants and young children [\(online\)](#). In poor countries, using powdered milk or other foods and drinks in unhygienic environments, rather than breastfeeding, can be a death sentence for children [\(online\)](#). It's estimated that more than a million babies die each year as a result. But breastfeeding rates are declining in many countries. The policy brief explores why women don't breastfeed and what can be done to help support them, as a critical part of reducing infant mortality and boosting children's health. It also highlights the benefits of breastfeeding, and breastfeeding trends.

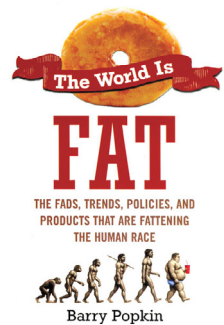
The Cost of the Diet - A novel tool for understanding the barriers to improving child nutrition Save the Children UK [\(online\)](#)



The CoD calculates the cost of the cheapest diet that meets the nutritional requirements of families using just the foods available locally. It provides a unique perspective on seasonal changes in nutrition security and can be used to highlight which vitamins and minerals are lacking in the diets of poor families. The CoD is intended to be used to inform programme design, as part of baseline assessments and alongside nutrition/food security surveillance. We envisage that the CoD will continue to be developed and improved based on the experiences of those who use it.

The World Is Fat- The Fads, Trends, Policies, and Products that are Fattening the Human Race

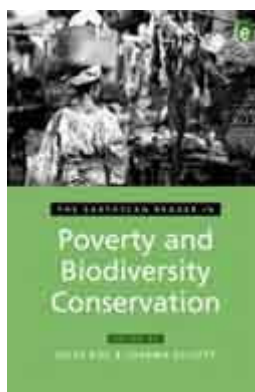
Barry Popkin



With over 1.6 billion people and an additional 100 million per year, the explosion of obesity across the world is complex and it cannot be solved by 1.6 billion treadmills. This is instead the result of an unprecedented collision of technology, globalization, government policies, and food industry practices with human biology developed over tens of thousands of years. One prime example is the clash between our drinking habits and our biology. As a result of evolution, we can drink hundreds of calories and not feel any less hungry. Food and beverage companies aggressively market an ever-increasing range of high-calorie sodas, sweetened teas and waters, lattes, and energy drinks and we increasingly replace water with these caloric beverages. Combined with large declines in physical activity, the replacing of key elements of traditional cuisines—such as noodles in China and the tortilla in Mexico—with processed versions, a powerful food industry that uncompromisingly fights change, and obesity has become a full-blown global public-health crisis in a few short decades. Ultimately, Popkin shows that widespread obesity is less an effect of poor individual choices than the consequence of a high-tech, interconnected world in which governments and multinational corporations have extraordinary power to shape our lives.

www.theworldisfat.org

The Earthscan Reader in Poverty and Biodiversity Conservation



Edited by: Dilys Roe and Joanna Elliott

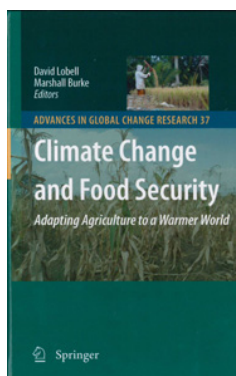
In the last decade biodiversity loss and persistent poverty in developing countries have been recognised as major international problems that require urgent attention. However, the nature and scale of the links between these two problems, and between efforts to address them, has been the subject of much heated debate. Understanding the different elements of this debate is critical if we are to move towards constructive solutions.

This Reader provides a guide to, and commentary on, the different strands of the current conservation-poverty debate through a selection of key readings from both the conservation and development literature including policy documents, journal articles and reports. The breadth of material will help readers, including both students and professionals, to locate current debates within their wider contexts.

Among the areas of debate covered are:

- The lack of attention to biodiversity concerns in international development policy
- The social implications of protectionist conservation policy
- The roles and responsibilities of conservation NGOs towards local communities
- The links between climate change, biodiversity and poverty reduction, and in particular the implication of discussions around reduced emissions from deforestation (REDD) as a climate change mitigation strategy.

Climate Change and Food Security : Adapting Agriculture to a Warmer World



Lobell, David B.; Burke, Marshall

Roughly a billion people around the world continue to live in state of chronic hunger and food insecurity. Unfortunately, efforts to improve their livelihoods must now unfold in the context of a rapidly changing climate, in which warming temperatures and changing rainfall regimes could threaten the basic productivity of the agricultural systems on which most of the world's poor directly depend. But whether climate change represents a minor impediment or an existential threat to development is an area of substantial controversy, with different conclusions wrought from different methodologies and based on different data. This book aims to resolve some of the controversy by exploring and comparing the different methodologies and data that scientists use to understand climate's effects on food security. It explains the nature of the climate threat, the ways in which crops and farmers might respond, and the potential role for public and private investment to help agriculture adapt to a warmer world. This broader understanding should prove useful to both scientists charged with quantifying climate threats, and policy-makers responsible for crucial decisions about how to respond. The book is especially suitable as a companion to an interdisciplinary undergraduate or graduate level class.

Empower people to become resilient

Jaspreet Kindra - [IRIN](mailto:jaspreet@irinnews.org) Contact: jaspreet@irinnews.org

Two recent shocks - high food prices and the recession - one of which was partly fuelled by droughts which have left a billion people chronically hungry (FAO 2009) have illustrated that people nor governments are prepared for what lies ahead. Overstretched aid agencies are struggling to raise money for the 20 million people in need of food aid in the Horn of Africa, parts of which are in their sixth year of drought (WFP 2009).

The reality is most governments in developing countries who face the brunt of harsh climate change impact either don't have the money, the capacity or the political will to respond to crises.

The only pragmatic solution is to empower people with information to help them become hardy enough to handle the fallout of climate change which will see more intense and frequent natural events such as hurricanes and droughts affecting people's access to water and food.

It can be done. Villages in parched Sudan's North Kordofan region have been recording hotter days and sparse rainfall for some years. In the late 1990s as part of a project to help them adapt to climate change, the villages learnt of ways to cope with an increasing shortage of water. In a conflict-torn country where government institutions particularly at the local level are unable to function properly the villages learnt how to draw up project proposals and seek funds to take care of their needs.

Each village set up a development committee to raise money from international nongovernmental development organizations to establish a water supply. The committees also organized community gardens around the water supply - wells in most instances that were leased out to the residents to help them grow food for their families and for sale. The money from renting out plots was used for maintenance of the water supply. The success was infectious. Soon villages not part of the initiative also wanted to learn to draw up project proposals.

In countries with conflicts, such as the Sudan, helping communities to develop their own initiatives and seek sources to fund them is an option. Donors might not always be generous. But for several thousands of people tucked away in villages seemingly forgotten, there are no alternatives to make themselves resilient.

It can begin with educating people. Shidhulai Swanirvar Sangstha (meaning a self-dependant organization), an NGO has begun preparing communities living on the banks of rivers in the marshlands in Northwestern Bangladesh to adapt to a permanently flooded future. Mohammed Rezwan, an architect and a resident of the community, who as a child, could not go to school, as roads would often get flooded, set up the NGO. "Nothing had changed when I grew up, children in my village could still not get to school during monsoons - in fact floods had become worse over the years and climate change threatens the entire community which lives near the rivers with increased flooding as rains become more intense."

Various climate change forecast models have predicted that one-fifth of Bangladesh could be under water by 2050.

"What if the schools came to children?" reasoned Rezwan. Using some of his own money and funds raised from friends Rezwan turned boats into schools. The boat schools (picture 1) pick up children from various villages every morning. Classes are held on board. Rezwan designed several other boats converting them into libraries and healthcare centers. Agriculture extension classes are also held on other boats. Adults and children also learn about climate change on these boats through specially prepared documentation. Villagers in the area are now knowledgeable about climate change and have begun experimenting with crop varieties, which are able to flourish in high water levels.

Along with Rezwan's NGO, the villagers are working on creating house boats which will be able to provide permanent homes for communities in the future.

Prodding communities into self-help with a little bit of guidance is our best shot towards resilience.

Picture 1: Classes on board



Photo: Jaspreet Kindra/IRIN

References

Food and Agriculture Organization (2009) One sixth of humanity undernourished - more than ever before. FAO Media Centre. Accessed 19 June 2009 ([online](#))

World Food Programme (2009) Spain doubles aid to WFP to help fight hunger in Horn of Africa, WFP press release. Accessed 19 November 2009 ([online](#))

Bulletin Board

Miscellaneous:

• Rainer Gross Award

The memory and outstanding career contributions of Rainer Gross, a former stalwart of the SCN, through his work in GTZ projects in Brazil, Indonesia and Peru, and at the UNICEF Nutrition Unit in NYC, are being honored with the first, biennial, RAINER GROSS PRIZE: RECENT INNOVATION IN NUTRITION AND HEALTH IN DEVELOPING SOCIETIES. This \$2500 USD award from the Hildegard Grunow Foundation will be given to the winning applicant with the most outstanding innovation (research or applied), which represents the creativity for nutritional health solutions that typified the "Rainer way of doing things." The lecture and prize ceremony will be held on Saturday, September 25, 2010, at the II World Congress Public Health Nutrition in Oporto, Portugal: <http://www.skyros-congressos.com>. Information on the Award itself, application and awarding, is available on-line at: <http://hgrunowfoundation.org/rainer-gross-award>.

• Journal of Nutrition special supplement—impact of climate change, the economic crisis and the increase in food prices on malnutrition

The economic crisis, related crisis and climate change means that the global food supply system is facing serious new challenges that directly affect the nutritional well-being of the poor. As diet quality and quantity decline, the vulnerability of the already vulnerable is exacerbated and the downward spiral of malnutrition and poverty is fast-tracked. Following a meeting hosted by SIGHT AND LIFE in 2009, a set of 17 papers on this topic was published as a supplement to the January 2010, Volume 140, Issue 1 edition of the Journal of Nutrition. The abstracts are available on <http://jn.nutrition.org/content/vol140/issue1/>. This unique supplement is the first to address the impact of the triple crisis on malnutrition. Hardcopies are available from SIGHT AND LIFE.

• AgroSalud Gallery of Maps: Nutrition, agriculture and socioeconomic maps for 11 Latin American countries:

The AgroSalud Gallery of Maps contains maps that summarize nutrition, agriculture and socioeconomic information for Bolivia, Brazil, Colombia, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, and Peru. The maps can be downloaded from the AgroSalud website www.AgroSalud.org under "Biblioteca en Línea" and "Galería de Mapas". These maps have been used to identify in each country candidate sites for an agriculture-nutrition intervention with biofortified crops; these sites are highlighted in the Gallery of Maps. For more information, contact <agrosalud@cgiar.org>.

New websites:

- **Alive & Thrive (A&T)** is a new project funded by the Bill & Melinda Gates Foundation. A&T is a 5-year initiative (2009-2013) to improve infant and young child nutrition by increasing rates of exclusive breastfeeding and improving complementary feeding practices. The project aims to reach more than 16 million children under 2 years old in Bangladesh, Ethiopia, and Viet Nam. This month, A&T launched its website, www.aliveandthrive.org. The website offers details on A&T programs and results, news on infant and young child feeding, resources, including technical briefs, program tools, and research abstracts, and updates on our small grants program.

• Link to global Breastfeeding Initiative for Child Survival on websites of IBFAN and WABA

The 30th anniversary of the International Baby Food Action network, IBFAN, saw the launch of the global Breastfeeding Initiative for Child Survival. The gBICS is a worldwide civil society-driven initiative aiming to accelerate progress in attaining the health-related Millennium Development Goals (MDGs) by 2015, especially Goal 4, reduction of child mortality, by scaling up early, exclusive and continued breastfeeding. We invite you to view the videoclip of the gBICS in <http://www.ibfan.org/index-ibfan.html>. The two largest breastfeeding advocacy networks IBFAN and its organizational partner WABA, the World Alliance for Breastfeeding Action, have joined forces to strengthen the adoption of the rule of law to protect, promote and support breastfeeding. <http://www.waba.org.my/concerningyou/foradvocates/index.htm> http://www.ibfan.org/art/2009%20October%2012%20event%20Press%20release%202_.pdf

Training and Courses:

- **Nutrition in Emergencies** 28 June — 2 July 2010, London, UK
For more information see announcement p.55

Meetings and Conferences:

Improving Governance for Food Security and Nutrition

9 to 11 June 2010, Berlin, Germany

www.policies-against-hunger.de/en/

[II World Congress in Public Health Nutrition](#)

23 - 25 September, 2010, Porto, Portugal

www.nutrition2010.com.pt/

[II International Conference of Nutritional Oncology \(ICNO\)](#)

June 16 - 17, 2010, at Centro Fecomercio de Eventos, in Sao Paulo city, Brazil

www.icnobrazil.com

[20th IUHPE World Conference on Health Promotion](#)

11-15 July 2010, Geneva, Switzerland

www.iuhpeconference.net

[International Academy on Nutrition and Aging 2010](#)

Albuquerque July 26-27, 2010 at the Hyatt Regency Tamaya, Santa Ana Pueblo, New Mexico, USA

<http://www.healthandage.com/html/min/iananda>

[15th International Congress on Clinical Nutrition - Egypt](#)

19-22 September 2010, Sokhna Resort, Egypt

egcairouw@yahoo.com

[Pre-announcement: Conference on Alcohol and Health](#)

23 September 2010, Amsterdam, the Netherlands

www.stap.nl

[Third International Rice Congress \(IRC2010\)](#)

8 - 12 November 2010, Hanoi, Vietnam

www.ricecongress.com

[First Global Conference on Biofortification](#)

November 9-11, 2010, Washington, D.C.

[IV Congress of the International Society of Nutrigenetics/Nutrigenomics \(ISNN\)](#)

18 - 20 November 2010, Pamplona (Spain)

www.isnn2010navarra.com

Vacancies:

Call for CVs

REACH Roster of Facilitators (see p.10)

SCN EMail Update

Receive news and updates by email on a monthly basis! Ask us to add you to our contact list, at scn@who.int

UNITED NATIONS SYSTEM

**STANDING COMMITTEE
ON NUTRITION**

The Administrative Committee on Coordination (ACC), which was comprised of the heads of the UN Agencies, recommended the establishment of the Sub-Committee on Nutrition in 1976, following the World Food Conference and with particular reference to Resolution V on food and nutrition. This was approved by the Economic and Social Council of the UN (ECOSOC) by resolution in July 1977. Following the reform of the ACC in 2001, the ACC/SCN was renamed the United Nations System Standing Committee on Nutrition or simply “the SCN”. The SCN reports to the Chief Executives Board of the UN, the successor of the ACC. The UN members of the SCN are ECA, FAO, IAEA, IFAD, ILO, UN, UNAIDS, UNDP, UNEP, UNESCO, UNFPA, UNHCHR, UNHCR, UNICEF, UNRISD, UNU, WFP, WHO and the World Bank. Bioversity International, IFPRI and the ADB are also members. From the outset, representatives of bilateral donor agencies have participated actively in SCN activities as do nongovernmental organizations (NGOs). The SCN Secretariat is hosted by WHO in Geneva.

The *mandate of the SCN* is to serve as the UN focal point for promoting harmonized nutrition policies and strategies throughout the UN system, and to strengthen collaboration with other partners for accelerated and more effective action against malnutrition. The *aim of the SCN* is to raise awareness of and concern for nutrition problems at global, regional and national levels; to refine the direction, increase the scale and strengthen the coherence and impact of actions against malnutrition worldwide; and to promote cooperation among UN agencies and partner organizations. The SCN’s annual meetings have representation from UN agencies, donor agencies and NGOs; these meetings begin with symposia on subjects of current importance for policy. The SCN brings such matters to the attention of the UN Secretary General and convenes working groups on specialized areas of nutrition. Initiatives are taken to promote coordinated activities—interagency programmes, meetings, publications—aimed at reducing malnutrition, reflecting the shared views of the agencies concerned. Regular reports on the world nutrition situation are issued. *Nutrition Policy Papers* are produced to summarize current knowledge on selected topics. *SCN News* is published twice a year, and the *NICS* (formerly *RNIS*) is published quarterly. As decided by the SCN, initiatives are taken to promote coordinated activities—interagency programmes, meetings, publications aimed at reducing malnutrition, primarily in developing countries.

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