




Sustainable Farming Can Cost-effectively Cool down the Earth



FAO/OECD Expert Meeting on Greening the Economy
with Agriculture

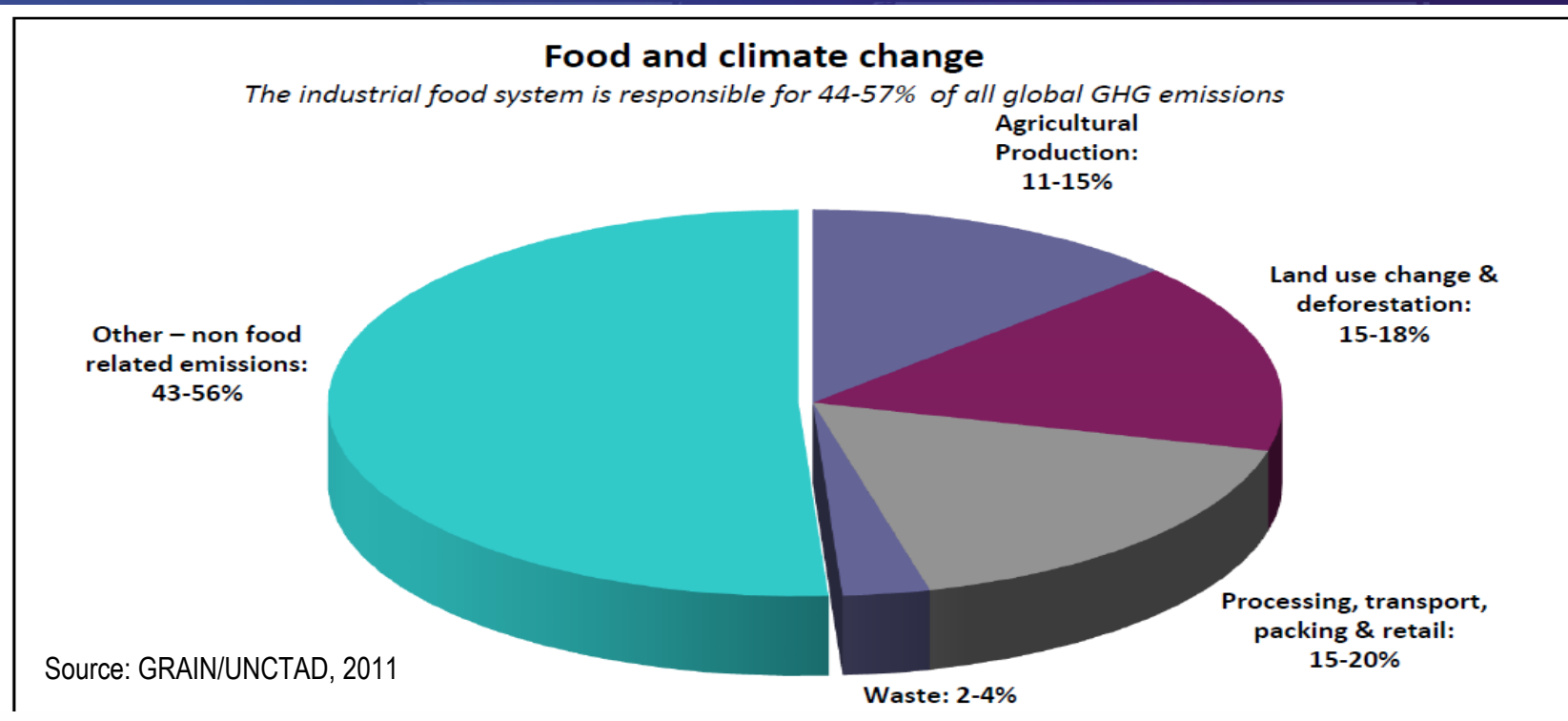
Session one: Green Economy Perspectives

Paris, 5 September 2011

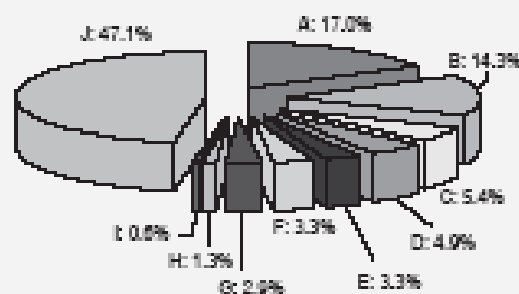
Presented by: Ulrich HOFFMANN, UNCTAD secretariat

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Contribution of Agriculture to Global GHG Emissions ²



Sources		Million tons of CO ₂ -eq
Nitrous oxide emissions from soil	A	2,128
Methane from cattle enteric fermentation	B	1,792
Carbon emissions from biomass incineration	C	672
Methane from rice production	D	616
Methane emissions from manure	E	413
Carbon emissions from fertilizer production	F	410
Carbon emissions from irrigation	G	369
Carbon emissions from farm machinery	H	158
Carbon emissions from pesticide production	I	72
Carbon emissions from land conversion to agriculture ^a	J	5,900
All direct and indirect sources		12,530

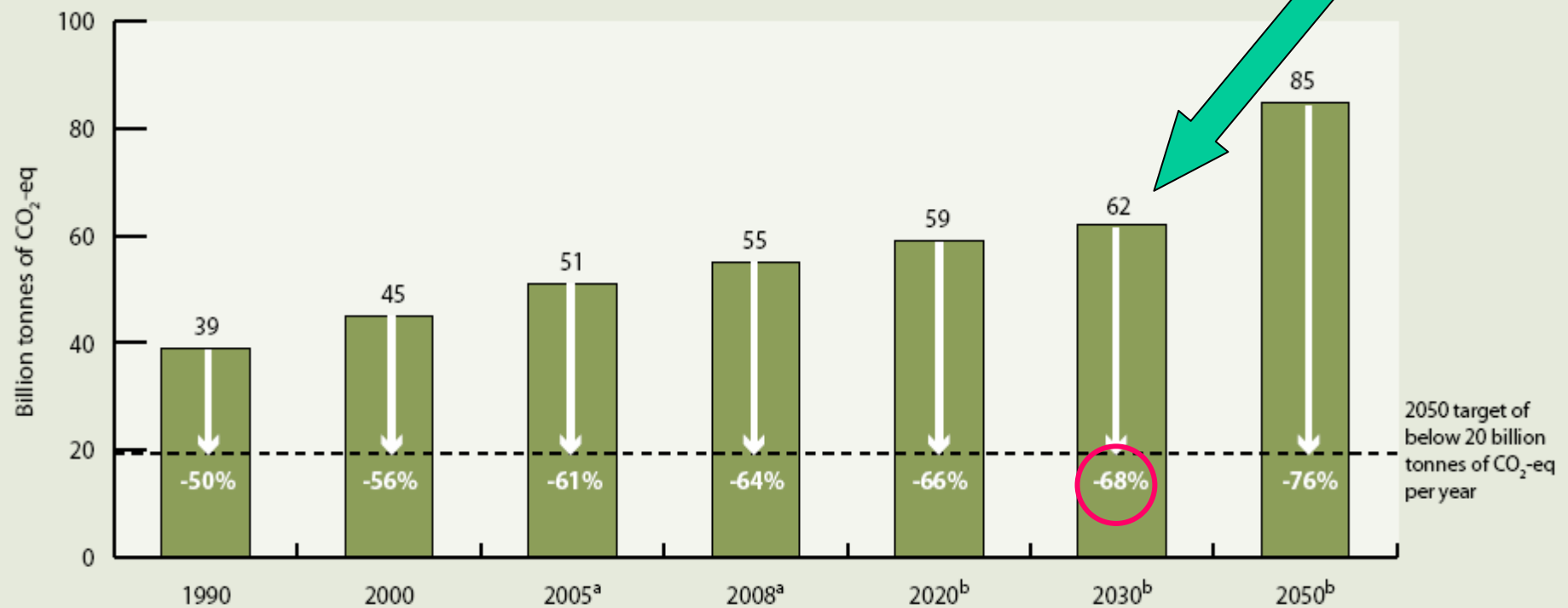


Source: Bellarby et al. (2008)

GHG Emission Dynamics of Agriculture

- Increase of non-CO₂ agricultural GHGs in 1990-2005: **14%**
- Projected increase of non-CO₂ agricultural GHGs in 2010-2030: **30-60%**

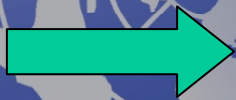
Figure 2. Required global GHG emission cuts for the period 2020–2050



Source: The Climate Group, 2008: 19.

Terrestrial Carbon Sequestration – More than a Silver Lining

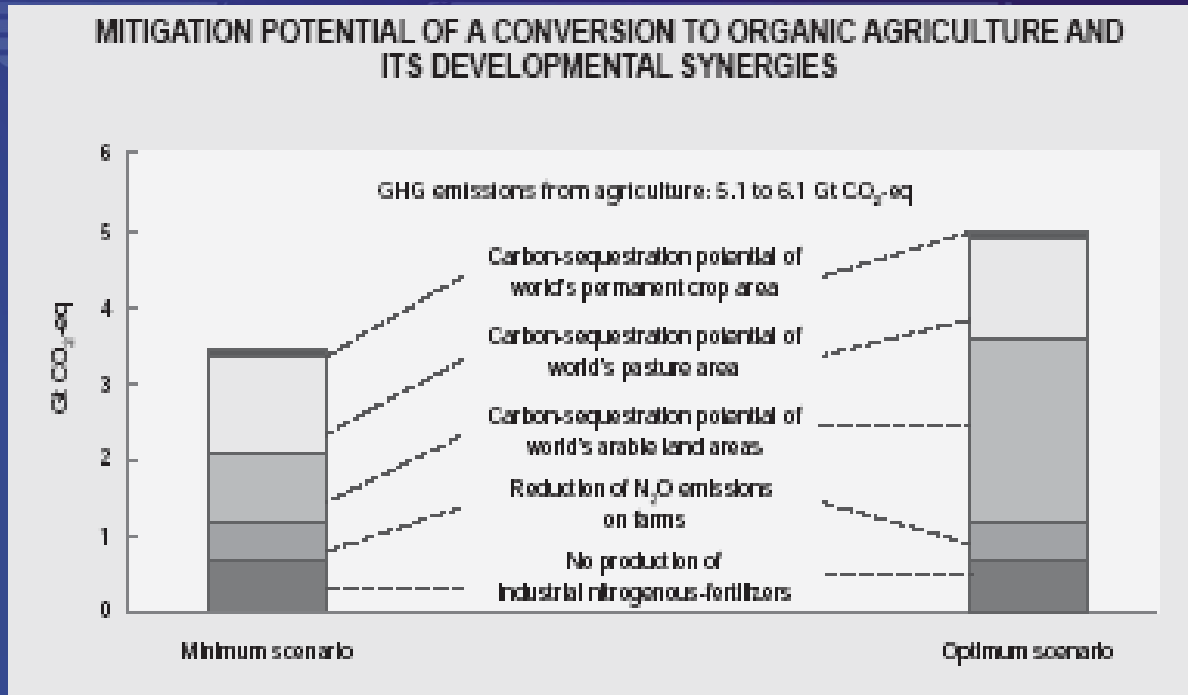
- Land makes up $\frac{1}{4}$ of the Earth's surface, and its soil and plants hold three times as much carbon as the atmosphere.
- Agricultural land: 1.6 bn ha cropland and 3.4 bn ha grassland/savannah (a significant part used for pasture).
- Land/soil degradation: annual loss of about 10 million ha of cropland.
- Estimates suggest that top soil in key agricultural producing countries has lost some 7-10% of its carbon content in the last 50 years.
- Key task: Continuously building up soil organic matter – will result in:
 - Huge carbon sequestration of soils
 - Improving soil fertility
 - Enhancing water-holding capacity
 - Improving soil biodiversity preservation



Thus enhancing resilience of production

Building up Soil Organic Matter through Organic Agriculture

- Results of earlier FAO research assuming carbon sequestration of 0.2-0.5 t/ha/yr.
- Findings: organic agriculture can be “climate neutral”.



- More recent IFOAM and Rodale Institute analyses arrive at considerably higher figures for soil carbon sequestration through building up soil organic matter: 2-30 tons per ha per year.
- Giving also higher importance to carbon uptake by grassland through integrated crop and livestock management (while biomass of forests expands by 10% annually, that of grassland expands by 150%).
- Annual carbon sequestration could be as high as 110-120 Gt CO₂-eq

Conclusions

- Building up soil organic matter is an effective way of removing large amounts of carbon from the atmosphere, effectively checking the growth of global GHG emissions.
- Skills and technology are readily available, but flanking R&D and extension systems required for up-scaling.
- Soil carbon sequestration is one of the most inexpensive sequestration methods.
- No other sector in the global economy has potentially the same weight in climate-change mitigation and has all means readily available.
- Building up soil organic matter will have many catalytic (pro-poor) developmental effects.
- However, this will require a fundamental transformation away from external input dependent and agro-chemical intensive agriculture to biological intensification and integrated forms of sustainable agriculture, fully using the potential of smallholders.

THANK YOU

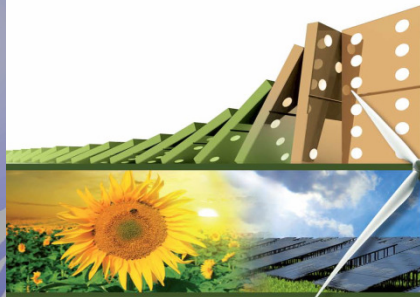
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UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

TRADE AND ENVIRONMENT REVIEW

2009/2010

Promoting poles of clean growth to foster the transition to a more sustainable economy



UNITED NATIONS

UNCTAD
UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

N° 18, December 2010

UNCTAD POLICY BRIEFS

Agriculture at the Crossroads: Guaranteeing Food Security in a Changing Global Climate

For a large number of developing countries, agriculture remains the single most important sector. Climate change has the potential to damage irreversibly the natural resource base on which agriculture depends, with grave consequences for food security in developing countries. However, agriculture is the sector that has the potential to transcend from being a problem to becoming an essential part of the solution to climate change provided there is a more holistic vision of food security, climate change adaptation and mitigation as well as agriculture's pro-poor development contribution. What is required is a rapid and significant shift from conventional, industrial, monoculture-based and high-external-input dependent production towards mosaics of sustainable production systems that also considerably improve the productivity of small-scale farmers. The required transformation is however much more fundamental than simply tweaking the existing industrial agricultural systems.

In most developing countries, agriculture accounts for between 20-25% of GDP and employs up to 65% of the labor force, providing a livelihood for approximately 2.6 billion people globally. Despite increased world food production in the last few decades, the global effort to meet the MDG eradicating hunger by 2015 now appears beyond reach. In fact, the number of people suffering from chronic hunger has increased from under 800 million in 1996 to over one billion recently.

Global warming poses significant threats to agricultural production and trade, and consequently increases the risk of malnutrition and extreme hunger. Preliminary estimates for the period up to 2030 suggest a decline of some 10-30% of agricultural productivity in the most climate change-exposed developing country regions: Sub-Saharan Africa and South Asia. For some countries in these regions, total agricultural production could decline by up to 80%.

GHG emissions in agriculture
Agriculture accounts for about 13-23% of global GHG emissions, the former being confined to direct, the latter including indirect agricultural GHG emissions from agricultural inputs, equipment, food processing, transport, and land-use changes. As agriculture shares the global GDP is just about 4%, this suggests that agriculture is very GHG-emission-intensive. Agricultural emissions of methane and nitrous oxide (collectively accounting for over 90% of agricultural GHG) grew by 17% in the period 1990-2005, about three times up to its productivity increases in global cereal production. For instance, these GHG emissions are predicted to rise by a further 35-50% by 2020 in response to population growth and changing diets in developing countries, in particular towards the greater consumption of ruminant meats and dairy products, as well as the further spread of industrial farming.

Composition of GHG emissions in agriculture
The composition of GHG emissions in agriculture is very different from that of other industries. Carbon emissions account for only about 10%, whereas nitrous oxide (N₂O), mainly from fertilizer use, and methane (CH₄) emissions (related to fermentation

digestion by ruminant livestock, residue/straw management and rice cultivation in flooded conditions) represent 46 and 45%, respectively. In many developing countries, agriculture accounts for the majority or a major share of national GHG emissions.

Key driving forces of GHG emissions in agriculture
Land-use changes, primarily deforestation, mono-crop-based industrial agricultural practices, and industrial livestock production that rely on significant external inputs are the major driving forces of agricultural GHG emissions.

Deforestation has been largely driven by intensified cattle, animal feed, vegetable oil or palm, and large-scale bio-fuel production, mostly in pursuit of increased exports. Deforestation for fuel wood and subsistence agriculture by rural poor and landless has also played a role.

Today's advanced food production systems have become heavily dependent on the continuous investment in and use of energy-intensive machinery and fossil-fuel-based agricultural inputs. At present, industrial agriculture uses 2-3 times more herbicides and 1.5 times more pesticides for the production of 1kg of food than it did 40 years ago. Industrial agriculture uses ten times more energy than ecological agriculture, consuming on average 10 energy calories for every food calorie produced. This imbalance is only possible with cheap energy-based inputs linked to inflated prices.

Promising mitigation and adaptation strategies
Agriculture is a sector that has the potential to move from being part of the problem to becoming an essential part of the solution to climate change. It is however clear that much more fundamental transformation is required than simply tweaking the existing industrial agricultural systems. In essence, the key task is to transform the uniform, high-external-input-dependent model of industrial agriculture into a regenerative agricultural system. Such a system consisting of a mosaic of sustainable production methods collectively recycles the resources it uses and achieves higher productivity and profitability of the

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DISCUSSION PAPERS

ASSURING FOOD SECURITY IN DEVELOPING COUNTRIES UNDER THE CHALLENGES OF CLIMATE CHANGE: KEY TRADE AND DEVELOPMENT ISSUES OF A FUNDAMENTAL TRANSFORMATION OF AGRICULTURE

No. 201
February 2011

UNITED NATIONS

LEAST DEVELOPED COUNTRIES SERIES

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

N° 20/C, May 2011

UNCTAD POLICY BRIEFS

Sustainable agriculture and food security in LDCs

The most critical issues facing LDCs today are poverty and hunger. These issues related to each other and to environmental degradation.

LDCs are primarily agricultural economies with nearly 70% of the population engaged in agriculture. The vast majority of the poor and food insecure are in rural areas. Therefore poverty alleviation and food security must start in these areas.

The outcome of the World Food Summit states that, "food security exists when 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." It requires that food is available locally and that people have the means to acquire it, either by growing it or purchasing it, throughout the entire year.

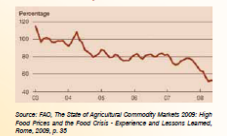
Productivity of LDC agriculture is relatively low. Land degradation is a major problem, due to increasing population pressure, erosion, water scarcity and the breakdown of traditional systems for soil fertility. Farmers have little support from their Governments, with African countries spending only 3% of their budget on agriculture, disproportionate to the size of the sector in terms of employment and economic activity. Twenty years ago most LDCs dismantled marketing boards, extension services and credit support and opened up agricultural markets to subsidized exports from developed countries. This dismantled agricultural sectors and most turned from net food exporters to net food importers within a decade - the LDCs food import bill rose from \$9 billion in 2002 to \$24 billion in 2008.

International finance organizations and bilateral donors advised several LDCs to stop production and export capacity for cash crops. While some countries, such as Tanzania, have been successful in this regard, this focus often distracted political attention and crowded out investment from staple food production and its supportive infrastructure and institutions. In addition, post harvest losses in LDCs are large, with at least one third of food produced being lost before reaching consumers due to spoilage, poor storage and transport facilities. On-site processing of agricultural products is limited by energy poverty: 92% of rural households in sub-Saharan Africa have no electricity.

Environmental degradation contributes to food insecurity. Natural ecosystems provide most of the world's poor with food, fuel, medicine, building materials and cultural identity. These systems are being systematically degraded and destroyed, and their regenerative and strategic productive capacity jeopardized. Unsustainable land management practices lead to scarcity of water for both drinking and agriculture. The changing climate increases extreme weather events (LDCs lack temperature, floods and drought) and unpredictable changes in weather patterns that affect agriculture. Extreme weather events

In LDCs increased fivefold from the period 1970-79 to 2000-10, resulting in over USD 14 billion losses. Land use changes, forestry and agriculture account for over 70% of LDC greenhouse gas emissions. Environmental degradation, low agricultural productivity, high post-harvest losses, limited connections to markets, energy poverty, limited education and non-agricultural opportunities, hunger and thirst lead millions of desperate people to leave rural areas each year for the cities, only to find that life is often no better. For this we need a fundamental transformation, even a revolution, in agriculture. This revolution should not be based on expensive, imported external inputs. Governments spend large amounts of their foreign currency reserves on agrochemicals (synthetic fertilizers, pesticides, herbicides, fungicides). LDCs import over 90% of the agrochemicals used in agriculture. Many of these chemicals are dangerous, with pesticides being a top cause of occupational mortality and morbidity, and they are difficult to provide to rural farmers at the right time. It is problematic that the global seed, agrochemical and biotechnology market is dominated by few companies, with the four biggest controlling 60% of global agro-chemical, a third of seed and almost 40% of biotechnology supply. The prices of oil and agrochemicals are increasing, due to the increasing price of fossil fuels, used in agrochemicals, and mineral phosphorus, used in synthetic fertilizer. The agricultural input index deteriorated just before the food price crisis of 2008. As can be seen in figure 1, the ratio of food prices to input prices fell steadily over the 2004-2008 period. Farmers were not profiting from higher food prices because their input prices were increasing much faster. In the light of the above, going down the high-external-input-dependent, industrial agriculture route places LDCs in a situation of extreme vulnerability.

Figure 1 - Development of the output to input price ratio versus inputs



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