ANNEX

CLIMATE CHANGE AND FOOD SECURITY

It is generally accepted that climate change is the result of human activity including industrial output, car exhaust, and deforestation. These types of activities increase the concentrations of carbon dioxide, methane, nitrous oxide and other greenhouse gases (GHGs) in the atmosphere (IPCC, 2001). If the current trend in carbon emissions continues, temperatures will rise by about 1° C by the year 2030 and by 2° C by the next century. This increase, however, will probably have different impacts in different regions. Agricultural impacts, for example, will be more adverse in tropical areas than in temperate areas. Developed countries will largely benefit since cereal productivity is projected to rise in Canada, northern Europe and parts of Russia. In contrast, many of today's poorest developing countries are likely to be negatively affected in the next 50 – 100 years, with a reduction in the extent and potential productivity of cropland. Most severely affected will be sub-Saharan Africa due to its inability to adequately adapt through necessary resources or through greater food imports.

Problems facing farmers can be better understood if one considers the impact of climate change on weather or water. Precipitation, temperature and sunlight are the main factors behind agricultural production. Climate change can alter these factors causing essential threats to water availability, reduced agricultural productivity, spread of vector borne diseases to new areas, and increased flooding from sea level rise and even heavier rainfall. Climate variability is already the major cause of year-to-year fluctuations in production in both developed and developing countries. The largest reduction in cereal production will occur in developing countries, averaging about 10 percent, according to an FAO study (1996)._A projected 2 – 3 percent reduction in African cereal production for 2020 is enough to put 10 million people at risk. These impacts would require adaptation efforts that in many cases will be hardly affordable for people living with little access to the necessary resources or savings. In fact, the real impact will be in areas where food production is already often marginal.

Some of the impacts of climate change on food production, which are already visible and seem to be advancing at a higher rate than previously anticipated include:

- Regional temperature rises at high northern latitudes and in the center of some continents;
- Increased heat stress to crop and livestock; e.g. higher night-time temperatures, which could adversely affect grain formation and other aspects of crop development;
- Possible decline in precipitation in some food-insecure areas such as southern Africa and the northern region of Latin America;
- Increased evapo-transpiration rates caused by higher temperatures, and lower soil moisture levels;
- Concentration of rainfall into a smaller number of rainy events with increases in the number of days with heavy rain, increasing erosion and flood risks;
- Changes in seasonal distribution of rainfall, with less falling in the main crop growing season;
- Sea level rise, aggravated by subsidence in parts of some densely populated flood-prone countries, displacing millions;
- Food production and supply disruption through more frequent and severe extreme events.

FOOD INSECURITY

Since food insecurity depends more on socio-economic conditions rather than on agroclimatic ones, the ways in which climate change can affect people's access to adequate food is rather complex. Future food security will mainly depend on the interrelationships between political and socioeconomic stability, technological progress, agricultural policies and prices, growth of per capita and national incomes, poverty reduction, women's education, trade and climate variability._Climate change, however, may affect the physical availability of food production by shifts in temperature and rainfall; people's access to food by lowering their incomes from coastal fishing because of rising sea levels; or lowering a country's foreign exchange earnings by the destruction of its export crops because of the rising frequency and intensity of tropical cyclones.

Some groups are particularly vulnerable to climate change: low-income groups in drought-prone areas with poor infrastructure and market distribution systems; low to medium-income groups in flood-prone areas who may loose stored food or assets; farmers who may have their land damaged or submerged by a rise in sea-level; and fishers who may loose their catch to shifted water currents or through flooded spawning areas. However, it is thought that by 2030 more countries will have improved their economies, infrastructure and institutions, and will be capable of compensating for the impact of climate change on domestic production through food imports from elsewhere.

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AGRICULTURE'S ROLE IN MITIGATING CLIMATE CHANGE

Agriculture is itself responsible for about a third of greenhouse-gas emissions. Activities such as ploughing land and shifting ('slash and burn') cultivation for agricultural expansion release CO_2 into the air. Much of the 40 percent of human caused methane comes from the decomposition of organic matter in flooded rice paddies. About 25 percent of world methane emissions come from livestock. In addition, agriculture is responsible for 80 percent of the human-made nitrous-oxide emissions through breakdown of fertilizer and that of manure and urine from livestock. However, agriculture's GHG emissions can be largely reduced, and much can be done to lessen their effect on production and on the livelihoods of farmers, especially in developing countries.

Farmers can adopt coping mechanisms that withstand climate variability through activities such as the use of drought-resistant or salt-resistant crop varieties, the more efficient use of water resources, and improved pest management. Changes in cultivation patterns can include the reduction of fertilizer use, the better management of rice production, the improvement of livestock diets and the better management of their manure. In addition, national governments have an important role to play in enforcing land use policies which discourage slash and burn expansion and extensive (rather than intensive) livestock rearing, as well as raising the opportunities for rural employment.

Carbon sequestration can also be a means through which agriculture can make a positive contribution towards mitigation, and will be of growing economic and environmental importance in the context of the Kyoto Protocol. It is estimated that for the next 20 to 30 years, cropland contribution to carbon sequestration lies within the range of 450 – 610 million tonnes of carbon per year. By applying improved land management practices (better soil fertility and water management, erosion control, reversion of cropland in industrial countries to permanent managed forests, pastures or ecosystems, biomass cropping, conservation tillage, etc.), the role of agriculture as a major carbon sink and as a compensating mechanism for agriculture's contribution to GHGs can be greatly enhanced.

Agriculture can also play a role in reducing the burning of fossil fuels. Up to 20 percent of fossil fuel consumption could be replaced in the short term by using biomass fuel. In Brazil 6 million cars are running partly on alcohol derived from sugar cane. China already has 10 million dung digesters which provide a clean cooking fuel and an organic fertilizer. Fast-growing grasses, oilseeds and agricultural residues offer great potential as energy alternatives. It is important to note that these bioenergy initiatives also have a positive impact on rural socio-economic development.

Policy response can not only enhance agriculture's mitigating role, but at the same time it can reduce the vulnerability of poor people to food insecurity. New rural employment opportunities can be generated in efforts to replace fossil fuels with bioenergy. In addition, carbon sequestration programmes can help boost agricultural production as well as improve its overall sustainability. Regardless of the approach, technological and institutional changes must take place now before the impact of climate change becomes irreversible. But most importantly, poverty must be addressed and alleviated if the effects of climate change by the end of the next century are truly to be abated.

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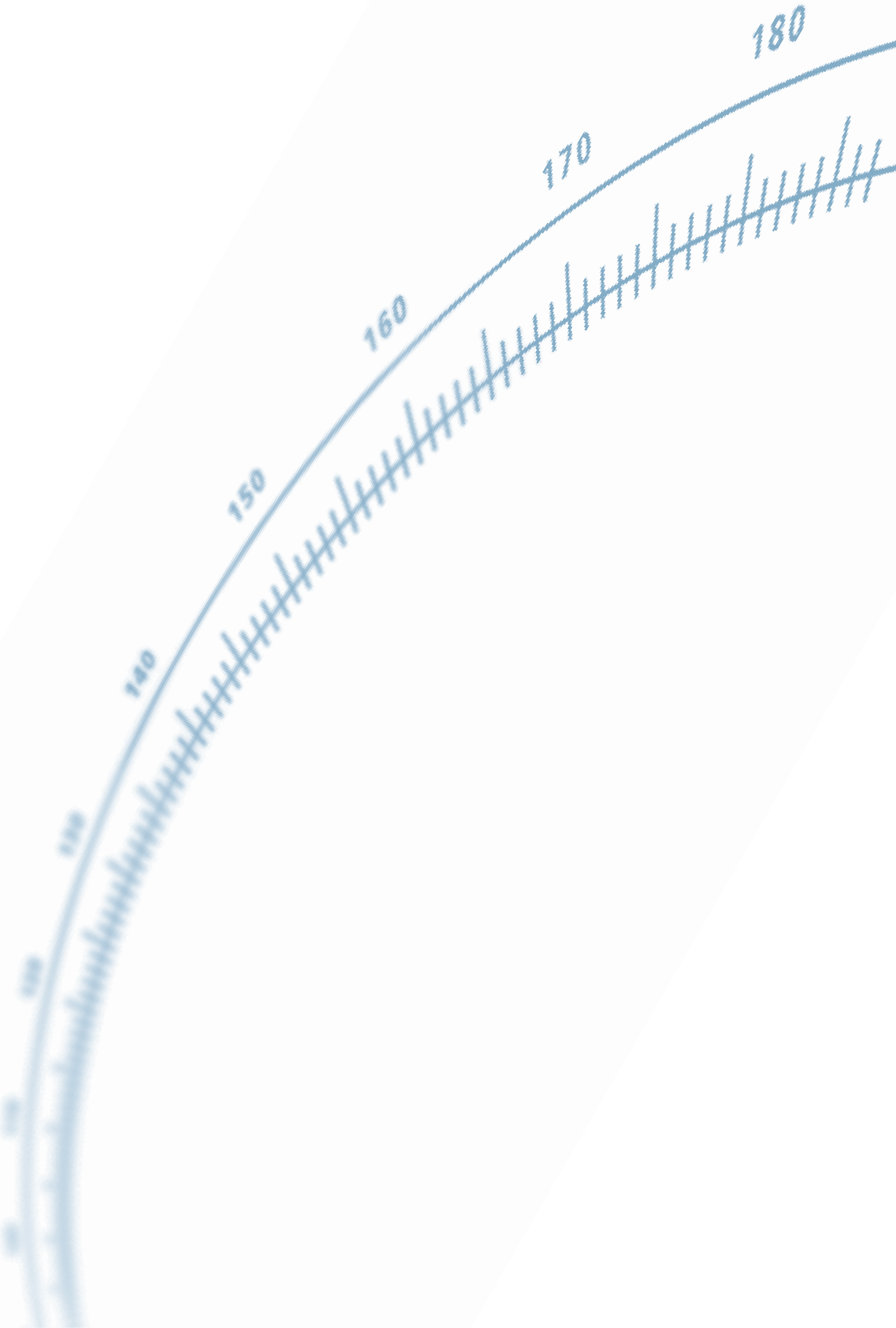
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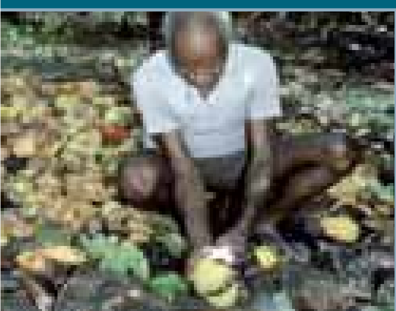
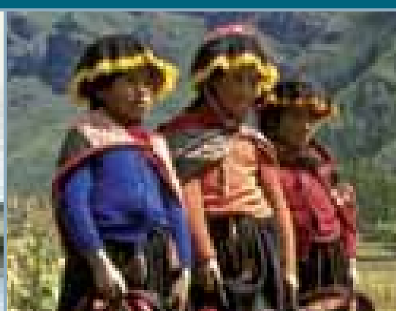
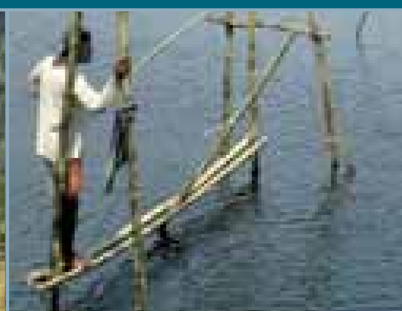
Over a billion people around the world are undernourished today because they lack easy, consistent and reliable access to affordable source of food. Changing climatic conditions and unsustainable bioenergy development are projected to affect food security through their impact on food systems at all scales, from single household to global. It is essential to address the fundamental question of how to increase the resilience of present food production systems to challenges posed by climate change. Policy-makers must render decisions on a variety of issues related to climate change with less than perfect information. This book presents some fundamental issues, challenges and concepts in order to improve policy-makers' understandings of and preparations for coping with both the causes and the impacts of climate change on food security. The book elaborates on the critical considerations including basic ecological principles, assessment of impacts, vulnerabilities, invisible boundaries and suggestions for short-term and long-term policy options, as well as policy-driven strategic thinking for adaptation to and mitigation of climate change.



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