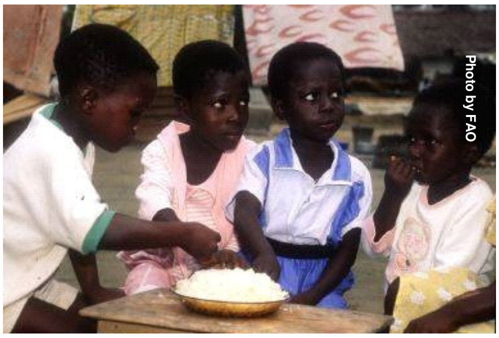
Rice & Climate Change

Global rice production has steadily increased, but there are still 852 million people who are suffering from hunger and malnutrition.

WHAT IS THE LINK BETWEEN RICE PRODUCTION, FOOD SECURITY AND GLOBAL CLIMATE CHANGE?

WHAT ARE THE POTENTIAL OPTIONS FOR THE RICE INDUSTRY SECTOR TO CONTRIBUTE TO THE MITIGATION OF AND ADAPTATION TO CLIMATE CHANGE FOR SUSTAINABLE INCREASE IN RICE PRODUCTION?

These are just some of the questions you will find the answers to in this fact sheet.



EMISSIONS

Flooded rice fields *emit methane* (or CH4), which is second in importance to CO2 as a greenhouse gas. Under anaerobic condition of submerged soils of flooded rice fields, methane is produced and much of it escapes from the soil into the atmosphere via gas spaces in the rice roots and stems, and the remainder CH4 bubbles up from the soil and/or diffuses slowly through the soil and overlying flood water as shown in Figure 1.

SEQUESTRATION

Rice cultivation is both an important *sequester of carbon dioxide from the atmosphere* and an important *source of greenhouse gases* (e.g. methane and nitrite oxide) *emission*. In 2004, for example, the global paddy rice output was 607.3 million tonnes at 14% moisture content. At the grain/straw ratio of 0.9 for most currently planted rice varieties, the global rice straw output in 2004 was about 676 million tonnes at 14% moisture content. This means that in 2004, rice *sequestered about 1.74 billion tonnes of CO2 from the atmosphere* to produce about 1.16 billion tonnes of biomass at 0% moisture content.

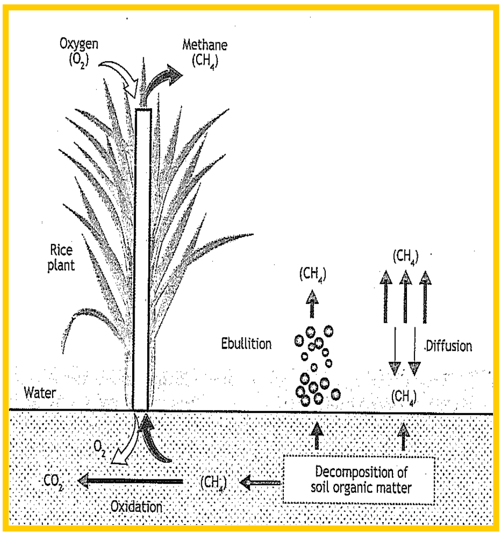


Figure 1 Schematic representation of methane emissions from flooded rice fields. Source: Rice Almanac 3rd Edition, p. 39.

RICE AND FOOD SECURITY IN A CHANGING CLIMATE

When measured against the total greenhouse gas emissions of a country, the amount of methane emitted from rice fields ranges from only 0.1% as in USA in 2005 to about 9.8% as in India in 2006 (Table 1).

The burning of rice residues such as straw and husks also contributes to greenhouse gas emission. Similarly the inefficient application of nitrogen fertilizers in rice production systems promotes the release of nitrous oxide, a potent greenhouse gas, into the atmosphere.

	Total amount of emitted CH4 (Gg CH4)	Contribution of rice methane to total methane emission (%)	Contribution of rice methane to total greenhouse gases emission (%)
USA in 2005	328	1.3	0.1
Italy in 2005	70	3.7	0.3
Japan in 2004	274	24.0	0.4
China in 1994	10182	30.0	5.9
India in 2006	6600	35.0	9.8

Table 1 Methane gas emissions from rice fields in selected countries. Source: Leip, Bocchi, 2007[1]

Rice is the most important staple food crop of the world's population. In 2004 rice was the staple food of about 3.23 billion people, wheat of about 1.55 billion people and maize of about 288 million people.

The immediate impacts of climate change on rice production systems and food security will be felt in the form of adverse effects of extreme weather events on rice production. Floods also cause indirect damage to rice production by destroying the properties and production means of farmers, and infrastructures supporting rice production such as dams, dikes, roads, etc.

Less immediate but possibly even more significant impacts are anticipated due to changes in mean temperatures, increasing weather variability, and sea level rising.

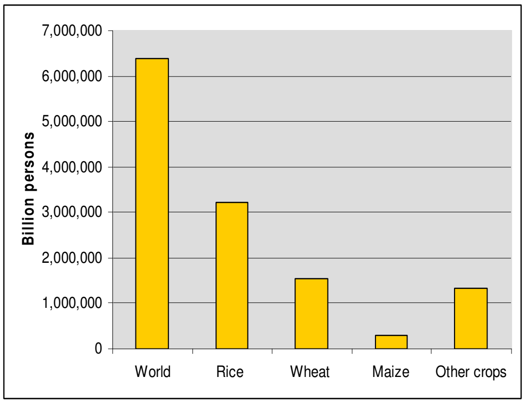


Figure 2 World's population in 2004 based on staple food crops (Calculation based on data in FAOSTAT) – A staple food crop is a crop that provides 700 Kcal/capita/day or more.

FAO RICE PROGRAMME FOR ADAPTATION TO CLIMATE CHANGE

The world's population was about 3.34 billion people in 1965 and it grew steadily to about 6.40 billion people in 2004 (Fig. 3). The trend of population growth did not change significantly between 1965 and 2004 – suggesting that the population is likely to grow steadily in the near future. FAO has estimated that the global population will reach about 9.3 billion people in 2050.[2]

Thanks to the development and adoption of improved production technologies, global rice output had also increased steadily from about 254 million tonnes in 1965 to about 598 million tonnes in 2000. The growth rate of global rice output, however, has declined substantially since 2000 (Fig. 3) – indicating the need for additional support to increase the productivity of rice cultivation for food security in the future. Through its International Rice Commission, FAO has promoted and harmonized international, regional and national actions, aiming at *mitigation of* and *adaption to* climate change for sustainable increase in rice production for food security.

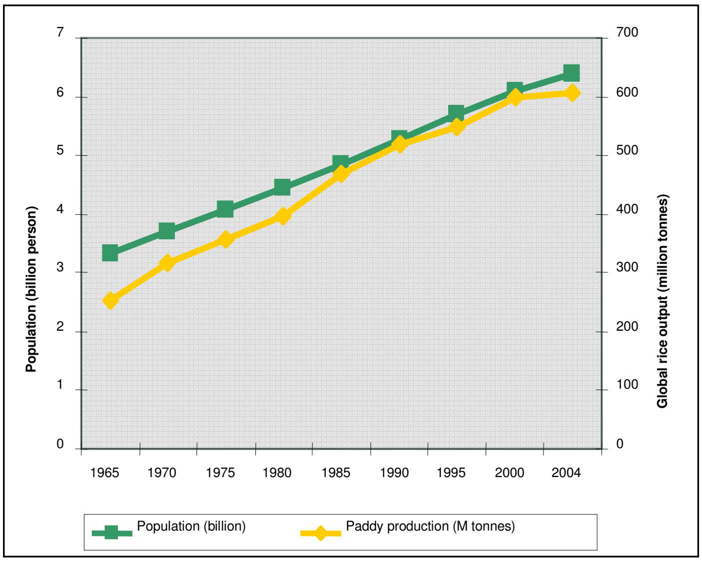


Figure 3 World population and global rice output, 1965 to 2004 (Source of data: FAOSTAT)

ADAPTATION TO CLIMATE CHANGE

In 2001, the Intergovernmental Panel on Climate Change reported that worldwide temperatures have increased more than 0.6°C over the past century and it estimated that by 2100, average temperatures will increase by between 1.4 to 5.8°C. High temperatures decrease yield in tropical climate areas. [3, 4] The changes in pattern of rainfall distribution may lead to more frequent occurrence of intense flooding and drought in different parts of the world.

In 2002, FAO, the West African Rice Development Association, National Agricultural Research systems in sub-Saharan Africa, and other partners supported the establishment of the African Rice Initiative to promote the development and use of **NERICA** (or New Rice for Africa) in upland rice production systems in the region. NERICA varieties generally have better tolerance to drought stresses.

The Intergovernmental Panel on Climate Change reported in 2001 that sea levels have risen by 10-20 cm and estimated that the average sea level would rise by 0.09 – 0.88 metres between 1990-2100.

The rising seas expected under climate change would definitely increase salinity level in the soils of major rice growing areas in low-lying deltas and flood plains of the major river systems such as the Ganges, the Mekong, the Nile, the Yangtze, the Yellow, and others.

Normal rice varieties are severely injured when salinity in soil solution causes the electrical conductivity of soil solution to reach 8-10 mmho/cm at 250 C 5.

FAO, through several emergency projects, promoted the use of **salinity tolerant varieties** to expedite the recovery of rice production in areas affected by tsunami waves in 2004.

FAO – IAEA has collaborated with agricultural research institutes in Vietnam to develop **high yielding rice varieties with good level of tolerance to salinity** such as VND 95-20 and VND 99-3 for planting in saline-affected soils in the Mekong River Delta 6.

NERICA rice field, Guinea. FAO field project

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