

This brief series was developed in preparation for the Foresight Breakout Session of the Global Conference on Agricultural Research for Development (GCARD 2012) and the Global Foresight Hub¹. The briefs were written to communicate to a wider audience, such as policy makers, civil society organizations, researchers, and funders. The briefs were classified into three categories: Future Studies, Regional Update, and Visioning.

What are the likely developments in world agriculture towards 2050?

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Given what we know today in terms of expected demographic, macro-economic, environmental, technological and policy developments, what are the most likely outcomes for world food and agriculture by 2030 and 2050?

This is the question FAO seeks to answer in a recent outlook study on world agriculture². This study is the latest in a long series of outlook studies FAO has produced since the late 1970s to provide the international community with background information over likely developments in food and agriculture. These studies are not normative or planning exercises, but meant to signal continuing or upcoming problems and bottlenecks to enable national and international entities to formulate corrective policies and measures.

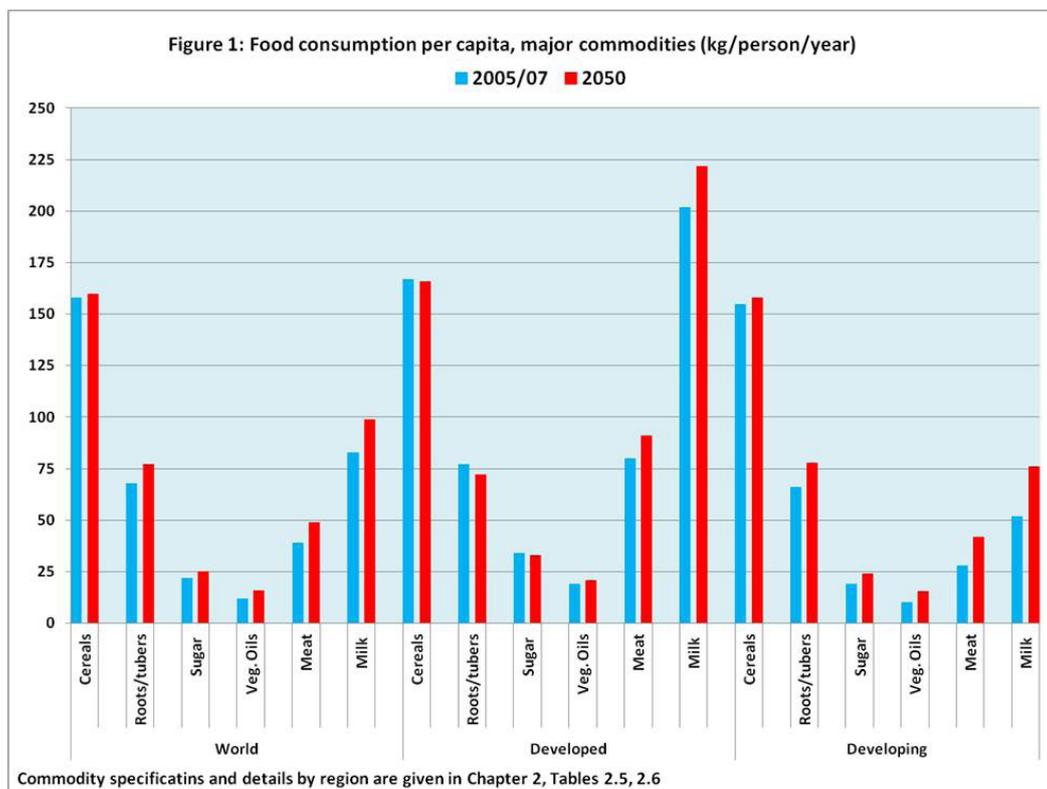
These studies have two distinct characteristics: first, they are truly interdisciplinary in their approach, drawing on all technical expertise available within FAO (experts on nutrition, trade, crop and livestock production, land and water, fisheries and forestry, individual countries, etc.); and second, although only aggregated results are presented, they are based on detailed analyses of over 100 individual countries and more than 30 individual crop and livestock commodities. A mix of formal and informal quantitative methods was applied to assemble all information into a consistent baseline scenario. A small core group of three or four professionals at FAO generates a first set of model-based projections, which are subsequently inspected and modified by the various in-house technical experts. The projections are then adapted in successive rounds to take in expert judgment until an acceptable consistent world picture is obtained. Obviously, the projections are wrought in uncertainty concerning, for example, developments in population, climate change and bio-fuel demand.

What could be the outcome for food and nutrition security by 2050?

Structural change in diets: towards satiety and beyond. Global gross domestic product is projected to grow 2.5-fold by 2050 with per capita income growing 1.8-fold, resulting in a world that is richer and characterized by less pronounced income gaps between developed and developing countries. As a consequence, significant parts of the world could approach saturation in per capita food consumption, a combination of many countries (mainly developed but not only) having completed the transition to higher-value commodity diets (livestock, sugar, vegetable oils, etc.) and many (including large) developing countries progressing more rapidly towards higher consumption levels (figure 1). However, convergence towards developed countries' consumption patterns is not inevitable for all countries, if only for cultural reasons. For example, pig meat consumption will remain non-existent in Muslim countries while meat consumption in South Asia is expected to increase only slowly.

¹<http://www.egfar.org/our-work/shaping-future-together/global-foresight-hub>

²This brief is mainly based on the report: Alexandratos, Nikos and Jelle Bruinsma (2012), "World Agriculture: Towards 2030/2050 - The 2012 Revision", ESA Working Paper No. 12-03, FAO, Rome (in press). Proof copy available at <http://www.fao.org/economic/esa/esag/en/>.



As a result, by 2050, some 52 percent of the world's population may live in countries where average calorie intake is more than 3000 kcal/person/day, while the number of people living in countries with an average calorie intake below 2500 kcal may fall from 2.3 billion to 240 million.

Undernourishment remains a challenge while obesity problems loom large. FAO's latest estimate³ indicates that in the developing countries there were 827 million undernourished people (or 15.9 percent of the population) in 2005/07. This number is expected to fall to about 320 million (or 4.1 percent of the population) by 2050. Progress is expected to be slow because countries with low food consumption and high prevalence of undernourishment in 2005/07 are also often those where population growth is likely to be highest while at the same time facing scarce natural resources.

Food consumption is expected to increase, even in countries where current levels appear adequate and additional growth may cause health concerns. The latter may happen even in countries where undernourishment remains significant as obesity takes hold among the better-off segments of the population. In many cases obesity (and related non-communicable diseases such as for example type-2 diabetes) is already a major problem and its prevalence is expected to increase rapidly.

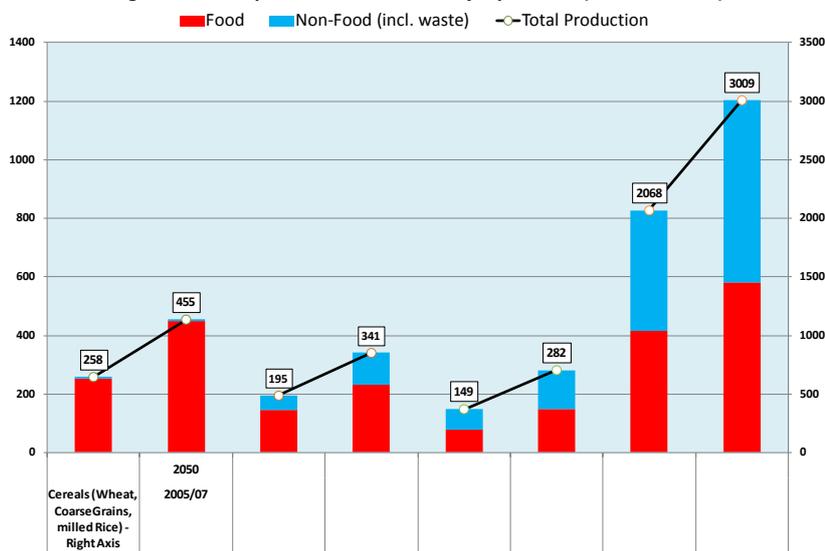
Overall growth in agricultural demand will continue to slow down. UN population projections (2008 Assessment) show that the demographic growth will continue to slow down (from an annual 1.7 percent over the last 40 years to 0.75 percent over the coming 40 years), with the global population reaching 9.15 billion by 2050. This slowdown combined with an ever increasing share of the population attaining medium to high levels of consumption, results in a halving of annual demand growth to 1.1 percent over the period to 2050 (down from 2.2. percent over 1970 to 2007). It should be noted that this slowdown is not a sharp structural break but a gradual process.

How could production respond?

Production growth slows, but absolute increases remain significant. At the global level, developments in production growth mirror growth in demand. Therefore, projected growth rates in production will be smaller than those of the past, but in absolute terms production is expected to rise significantly for the main product groups. For example, cereal production would have to increase by almost 1 billion tonnes and meat production by almost 200 million tonnes. Overall, by 2050 global annual production would be some 60 percent higher than in 2005/07 (24 and 77 percent in developed and developing countries, respectively). Achieving such increases will be more difficult than in the past. Land and water resources are increasingly stressed and are becoming more scarce and diminished in quality due to resource degradation and competition from uses other than for food production.

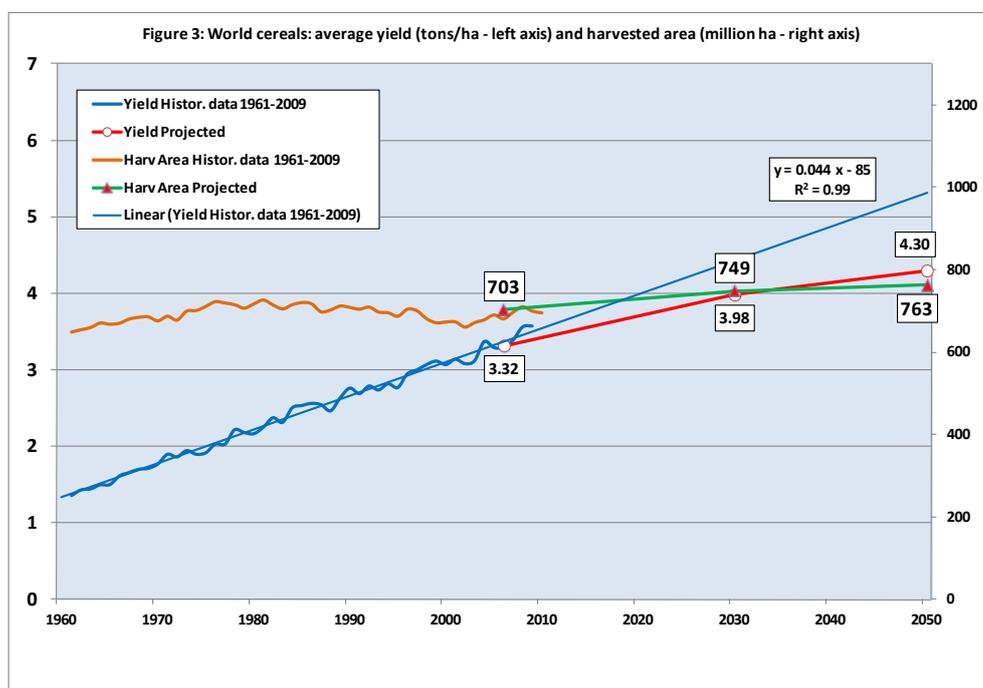
³FAO (2010), "The State of Food Insecurity in the World 2010: Addressing food insecurity in protracted crises". The methodology FAO uses for calculating the prevalence of hunger is currently under revision, and updated estimates will be published in October 2012.

Figure 2: World production and use, major products (million tonnes)



Sources of growth. In aggregate, nearly all (90 percent) of the increase in (crop) production over the next 40 years is expected to derive from improved yields (80 percent) and higher cropping intensities.

Yield growth has been the mainstay of historic production increases and will continue to play this role. Average cereal yields have been growing in a nearly linear fashion for the past five decades (implying a falling growth rate). After accounting for differences among countries, global cereals yields are projected to increase from 3.3 tonnes/hectare in the base year to 4.30 tonnes/hectare in 2050. World average yields for other major crops follow similar patterns. Although there are significant exploitable yield gaps between areas with similar agro-ecological conditions, local constraints to increasing yields remain a major concern in many countries, threatening improvements in local food supplies in countries where they are most needed.



Globally, around 4.5 billion hectares of land has an acceptable potential for rainfed production. After discounting areas already in production, under forest cover or put to other uses, some 1.4 billion hectares of prime and good land remains that could be brought into cultivation. Much of this, however, would come at the expense of pastures, and would require considerable investment.

Spare land is often not readily accessible due to lack of infrastructure, is suitable for only a few crops, or is characterized by high incidence of constraints and disease, making production uneconomical. Globally, land under crops is projected to increase by some 70 million hectares by 2050. As much of the spare land is concentrated in a small number of countries, land scarcity may be very pronounced in other countries and regions, and likely to remain a significant constraint in the quest to achieve food security.

Water is another critical resource. Irrigation has played a strong role in contributing to past growth in yields and production. World area equipped for irrigation has more than doubled since the early 1960s to 300 million hectares (over 40 percent of it in China and India alone), but the potential for further expansion is limited. A net increase of 20 million hectares is expected by 2050, almost all of it in developing countries. To replace obsolete and degraded irrigation schemes, the rehabilitation and development of an additional 150 million ha could be needed over the period to 2050. Water withdrawal for irrigation could increase by some 6 percent (to 2926 km³ in 2050). This increase is somewhat smaller than the increase in irrigated area since the water-intensive area under rice could decrease slightly. While water resources are globally abundant, they are extremely scarce in the Near East and North Africa, parts of South Asia and northern China.

Global gain: no guarantee for alleviating local pain

Evidence cautiously suggests that, at the global level, agricultural production can be increased enough to satisfy the additional demand expected by 2050. However, this is no reason for complacency and certainly no consolation for countries and individuals facing severe constraints and little prospect for development. First, resource availability, income and population growth are very unequally distributed. Food security will remain a challenge at local and household levels, and some countries will need to increase food demand more quickly than in the past through broad-based economic growth if they are to achieve it. Such countries are typically those characterized by persistent poverty and high population growth. Second, the outlook presented is, among other things, implicitly based on the assumption that agricultural policies will be conducive to further development and that the required investments will take place not only to develop resources and infrastructure but above all in agricultural research, without which the foreseen crop yield increases could not occur.

Impact and lessons learned

This particular study was only recently completed, and its impact cannot yet be gauged, but the preceding similar FAO outlook studies have been widely used and quoted by policy makers and staff at ministries and universities. In the context of GFAR and GCARD, the studies were extensively used by the Technical Advisory Committee (TAC, now Science Council) in setting priorities for agricultural research in the CGIAR. At the national level, the studies were used in several countries to formulate national agricultural policies against the global background provided by the FAO outlook studies. The studies also helped planners at ministries of Agriculture and national planning offices to focus on long-term issues (such as designing investments in agriculture, with their long gestation periods).

One of the lessons learned is that many of the issues in agricultural development, including resource use and, more particularly, food and nutrition, are best studied in an economy-wide context. For example, demands on land and water originate in various sectors of the economy, and demand for food is usually determined by a person's income, which is derived mostly by activities outside agriculture.

Furthermore, great uncertainty remains concerning the continued strengthening of the linkages between agriculture and energy, which present opportunities and risks to food security. Higher energy prices could potentially divert commodities and land to renewable energy production, increasing the demands on the agriculture sector. Moreover, the projections are set in a future where the impact of climate change will never be fully understood.

These assumptions contain a source of uncertainty that could alter the ability of the agriculture and food sectors to meet demand and reduce undernourishment. Testing these assumptions through scenario analysis will add significantly to the value of the outlook studies and will therefore be an important feature of future work of the Global Perspectives unit at FAO.

Citation:

Bruinsma, J. 2012. What are the likely developments in world agriculture towards 2050?. *The Futures of Agriculture*. Brief No. 38 - English. Rome: Global Forum on Agricultural Research (GFAR).

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