# State of the Planet 2004
# Panel on Food

## *Background Statement*

*What are the highest priority policy interventions now needed for more adequate sustained provision of food on our planet?*

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*Introductory note:*

The purpose of this background statement is to articulate a few facts and principles about public policy which are not widely understood by the public, and yet might be critically important for policy. We know that scientific discovery runs on specialization and dispute. We don't usually spend much time reaching across specialties to identify areas of agreement. But this conference is motivated by the idea that it is imperative to do so now, to ask ourselves what policy actions might be most urgently needed to address emerging threats and seize new opportunities in meeting the world's needs for energy, food, water and health. Our panel does not seek a formal "scientific consensus" on any predefined statement, nor are we seeking only statements on which we can all agree. Instead, our goal is to look for interesting, useful and perhaps unexpected areas of broad agreement, to inform policy-makers and the general public.

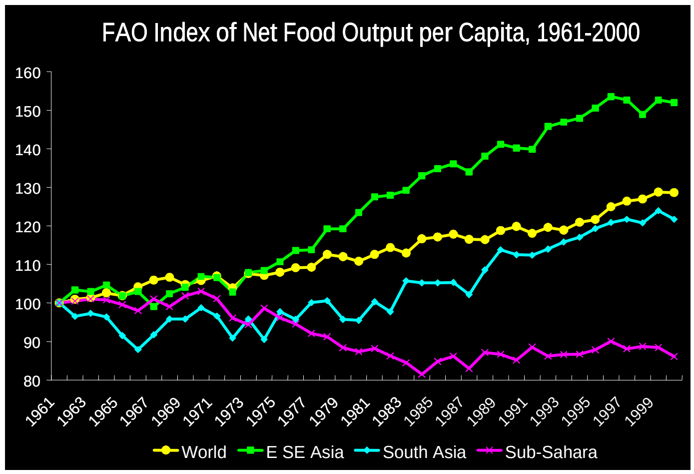
# State of the Planet 2004 – Panel on Food

## *Background Statement*

## SECTION I. THE WORLD FOOD SITUATION: SUCCESSES AND FAILURES

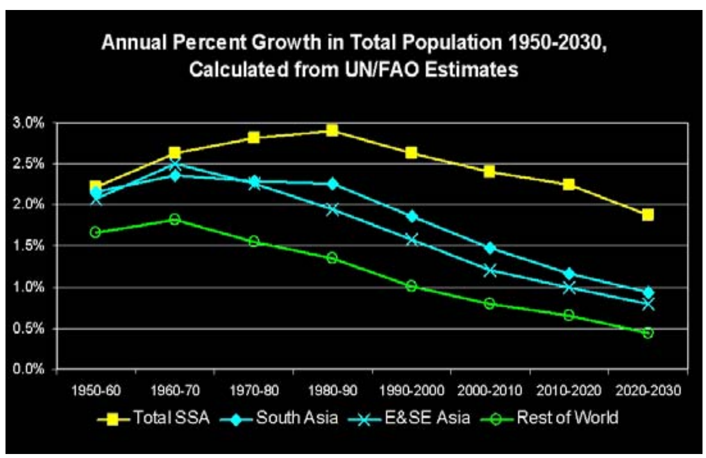
**Food supplies: many of our problems are regional, not global**

The world as a whole has experienced steady growth in its food supply. But for some key regions, food supplies are much lower now than in the past. In particular, there was a steep decline in food production in Africa during the 1970s and early 1980s. Policy reforms and public investment helped stop the decline in the late 1980s, but it was never reversed and Africa remains the only region where food supply is barely keeping up with population growth.

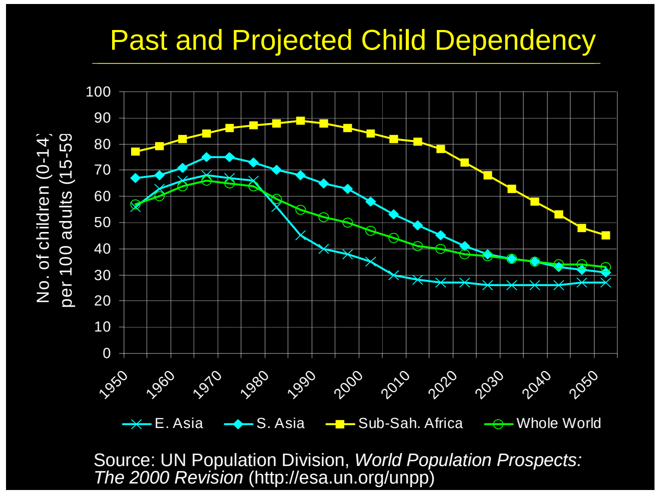



**Food *per person*: many of our problems are transitional, not permanent**

Some of the differences in food supply per person are associated with differences in the demographic transition, which involves a temporary burst of population growth during the shift from high to low rates of mortality and fertility. Food production per person grew in Asia only after population growth rates peaked, and began to decline in the 1970s. In Africa, population growth rates did not begin to decline until the 1990s, and they remain much higher than historical growth rates anywhere else.

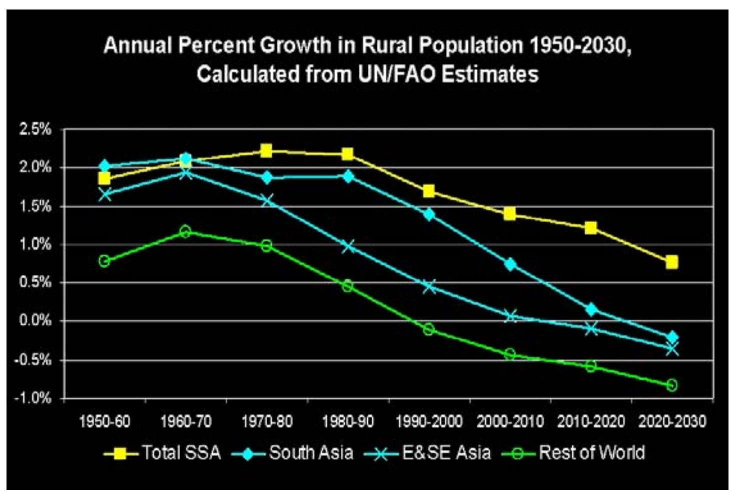


Regional differences in the demographic transition involve the *composition* of the population, not just well as the total number of people. One particularly important transition concerns the proportion of people who are *children*, and are therefore not in the workforce. This fraction first rises when mortality declines, creating a temporary "demographic drag" on output per person, and then it falls when fertility declines, creating an equally temporary "demographic gift" as a growing fraction of the population enters productive adulthood. Regional differences in the pace and timing of this transition have contributed heavily to food availability per person. It is only in the 1990s that Africa entered the demographic-gift phase of the transition, with a declining ratio of children to adults, and even now it is declining more slowly than it did in Asia twenty years earlier.




Source: UN Population Division, *World Population Prospects: The 2000 Revision* (http://esa.un.org/unpp)

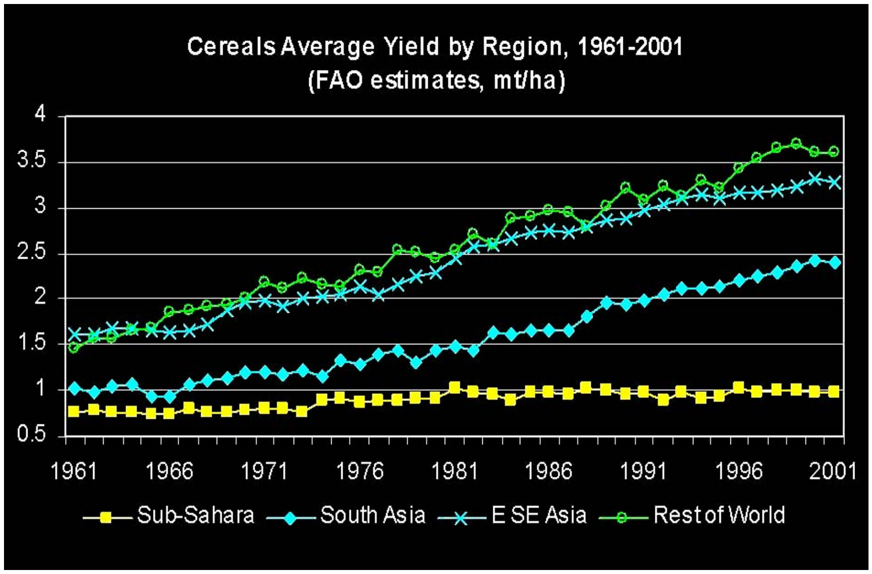
Another important aspect of population composition concerns the rate of change in the *rural* population, who earn their living mainly from farming and the use of natural resources. The urban population, which earns its living mainly from the use of man-made capital, can grow very rapidly. But where urbanization levels are initially small, even the fastest growing cities cannot absorb all of the population increase. The *rural* population must continue to grow, against a fixed supply of land and other natural resources. This occurs at very different rates in different regions. In particular, Africa had an unusually small share of its population already in cities during the 1960s, as a result of which a large fraction of its total population growth has had to be absorbed in rural areas – despite having the world's fastest-growing towns and cities. In fact, Africa's rural population is projected to keep rising, leading to an ever-smaller area of land available per farmer, for at least another generation. The problem of food production against declining land available per farmer is among the most daunting challenges facing the world environment.



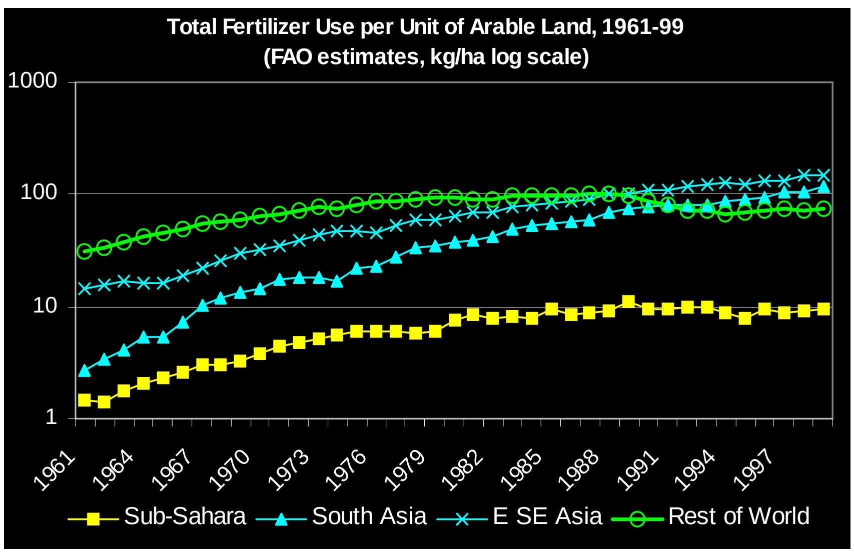
## SECTION II. FOOD PRODUCTION GROWTH: SUCCESSES AND FAILURES

**Raising yields on already-cropped land is possible, but is not guaranteed**

A declining area of land per farmer does not necessarily threaten food supplies, if people can raise output on already-cropped land. In fact this "vertical intensification" on a limited agricultural footprint, as opposed to horizontal expansion of the footprint, is what underlies worldwide growth of food supplies. Africa is the one region that has not seen this kind of sustained yield increase. The continent entered the 1960s with significantly lower yield levels than other regions, and then benefited much less from subsequent yield-increasing innovations.




Intensification on a limited natural-resource base is made possible by the introduction of man-made inputs, most notably the use of inorganic fertilizers to replace soil nutrients taken up by plant growth. African farmers use much less fertilizer than farmers elsewhere, and African soils have unusually low and declining nutrient stocks. The continent's use of fertilizers did grow rapidly in the 1960s and 1970s, but since then it has stabilized at a plateau around 10 kg/ha of arable land, while the rest of the world is applying about ten times as much.



One important factor limiting the profitability of fertilizer use is soil characteristics, most notably low CEC nutrient-exchange capacity, and low moisture holding capacity. These characteristics, together with low and uncertain rainfall, make the physical productivity of fertilizer relatively low. In addition, long distances to market, poor roads and lack of competitive pressures make for unfavourable prices, as farmers must pay high prices for things they buy, and get low prices for what they sell.

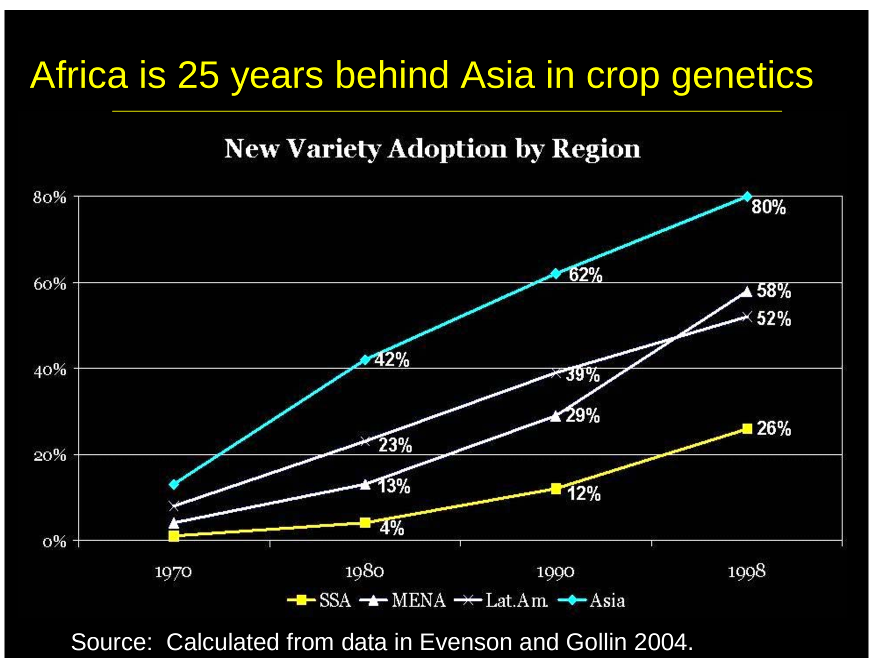
### Africa's soil constraints are worse than Asia's

**Selected Soil Fertility Constraints in Agriculture (as percent of agricultural area)**

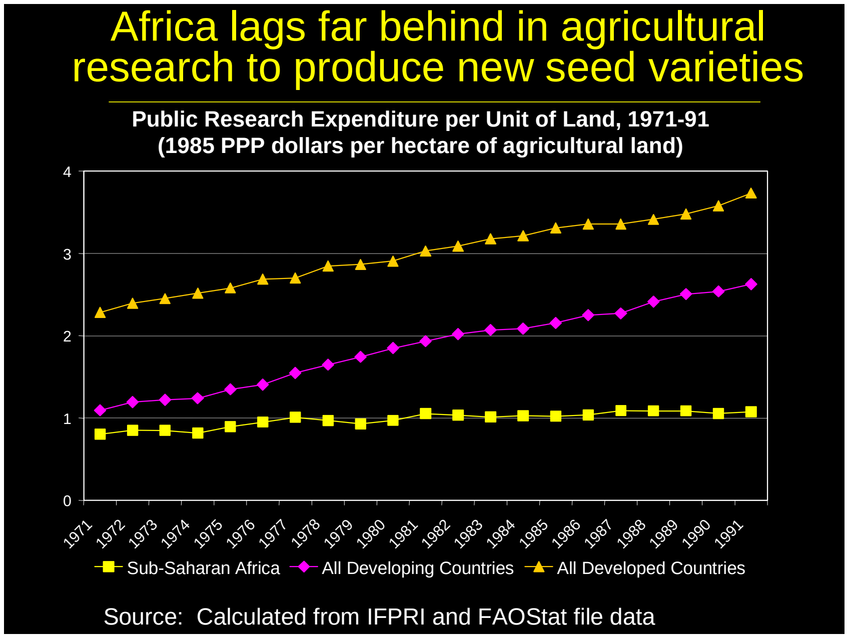
| | Free of Constraints | Low CEC | Low Moisture Holding |
|---|---|---|---|
| *SSA* | *7.0* | *15.9* | *23.2* |
| Southeast Asia | 6.2 | 2.3 | 6.0 |
| South Asia | 13.4 | 0.7 | 7.9 |
| East Asia | 15.7 | 0.1 | 1.8 |
| *Global Total* | *16.2* | *4.2* | *11.3* |

Note: Constraints characterized using the Fertility Capability Classification (Sanchez et al., Smith).
Source: Stanley Wood (2002), IFPRI file data.

A key way to escape from the trap of low physical productivity and unfavourable prices is to have scientists develop plant types and agronomic techniques that are better adapted to farmers' emerging needs. Today's farmers in Africa have much less land than their parents or grandparents did, with much degraded soil fertility, but many of them are still planting the same seed varieties–simply because science has not yet delivered anything significantly better for them to use.



There may be many reasons why some farmers have more improved seed varieties than others. The simplest would be that the public sector has simply done less research for some locations than others. Indeed, total public R&D spending has been substantially lower, and has grown much less quickly, for Africa than for other regions. Another key factor could be that African farmers have less well-functioning seed multiplication systems, to disseminate those new varieties that scientists have developed. Another could be that they have more difficult and more diverse production environments, requiring more research to obtain the same gains.




**Crop Genetic Improvement**

Developing improved crop varieties requires sustained investment in crop breeding programs. Varieties must be developed for every agro-ecological zone (AEZ). This is costly when AEZs are small. Generations of varieties are required. In India, more than 600 modern varieties of rice have been developed. Not all AEZs in India have modern varieties today.

The skill requirements for crop breeding are high. This means PhD training. Long-term program commitments can only be made by governments. Non-Government Organizations (NGOs) cannot make these commitments. NGOs did not produce the Green Revolution.

The Gene Revolution, based on rDNA or genetic engineering techniques, is not presently suited to generational breeding. Generational breeding is based on sexual crosses. Genetically Modified (GM) products can only be "installed" on Green Revolution "platform" varieties. GM products convey static cost reduction gains to farmers. These have been shown to be large in cotton production. GM products contribute very little to landrace (farmer selected) varieties or older traditional varieties.

Training of scientists and plant breeders requires an understanding of modern molecular biology. It is not possible to be trained in "old science." Countries with low crop yields are constrained to mass poverty. Crop varietal improvement is necessary if those countries are to initiate the economic growth processes that can ultimately lead them out of poverty.

The schooling of farmers is important and farmers with more schooling are better farmers. But farmers do not produce the new varieties required to improve crop yields. Many countries today lack the capacity to produce agricultural scientists. Most of them are in Africa. Most Asian and Latin American countries have this capacity and are realizing economic growth. Capacity building programs are essential in Africa.

## SECTION III. STRATEGIES FOR AGRICULTURE IN A STRESSED ECOLOGY

Developing and extending "ecoagriculture" systems is a high priority to meet future food security needs without large-scale environmental degradation. Global demand for food and fiber is expected to grow by at least 50 percent in the next few decades, and much more in low-income developing countries. The need to increase food, forest, range and fisheries production and sustain rural livelihoods increasingly conflicts with the equally important need to protect wild plant and animal species and the natural ecosystem services upon which both human and wildlife depend. Over half of the most species-rich areas contain large human populations who depend on farming, forestry, herding or fisheries for their livelihoods, with many plagued by chronic poverty and hunger. Almost half of the world's 17,000 major protected areas are heavily used for agriculture. Biodiversity has been depleted in ways that threaten agricultural productivity and sustainability, and the wild species upon which low-income, food-insecure people depend for their livelihoods, or as 'safety nets' in time of harvest loss or disasters. Critical watersheds that are home to large and growing human populations must be used for food and fiber production as well as for water services.

In such places, a new land-use approach is needed—"ecoagriculture"--that integrates farm and forest production with the provision of ecosystem functions at a landscape scale. Innovation is already widespread, but much larger-scale development and adoption of ecoagriculture is essential to achieve the Millennium Development Goals on hunger, poverty and conservation in developing countries.

Ecoagriculture is an umbrella term that embraces a wide range of systems and practices that integrate productivity goals (for crops, livestock, fish, trees and forests) with provision of ecosystem services including biodiversity and watershed services at a landscape scale. Technologies and management practices draw from a wide range of approaches, including indigenous technical knowledge, conventional agricultural sciences, agricultural ecology, conservation biology, wildlife biology, holistic management, integrated natural resource management, organic agriculture.

While maintaining or increasing productivity, ecoagriculture systems make more space for wildlife and improve ecosystem functions of productive areas:
1) Creating and expanding wild biodiversity reserves in rural landscapes in ways that also benefit local farming, herding and forest communities;
2) Using unfarmed areas and forest mosaics to develop habitat networks that support or expand the habitat of wild species;
3) Reducing or reversing conversion of wild lands to production agriculture, forestry or aquaculture by increasing the productivity of land under use;
4) Minimizing pollution by reducing and managing agrochemical use and farm wastes;
5) Modifying soil, water and vegetation management to enhance habitat quality in and around farms; and
6) Integrating perennial trees, shrubs and grasses into production systems to mimic natural vegetation and ecological functions.

Ecoagriculture is especially important for rural farming communities living:
• In or around parks and protected areas and other habitats of high biodiversity value or endangered species;
• In critical watersheds serving human and wildlife populations;
• In biologically degraded landscapes where ecosystem services essential for sustainable agriculture and local livelihoods need urgent rehabilitation.

To develop and scale up these approaches will require significant innovation in policy frameworks for both agriculture and conservation, shifting market incentives, strengthening ecosystem planning, research, extension and financing institutions to support ecoagriculture. This will require that environmentalists, agriculturalists and advocates for the poor work much more closely and synergistically together; and that major international resources be invested in pushing the research frontier on ecoagriculture systems (Scherr and McNeely 2002).

## SECTION IV. LIVESTOCK

Global demand for livestock products is increasing rapidly, with the highest proportion of the increase occurring in developing countries and Asia in particular. From the beginning of the 1970s to the mid 1990s, consumption of meat and milk in developing countries increased by 175 million metric tons, more than twice the increase that occurred in developed countries, and over half as large as the increase in consumption of cereals made possible by the "Green Revolution." The market value of the increase in meat and milk consumption over the period in the developing countries was approximately $155 billion (1990 US$), more than twice the market value of increased cereals consumption under the Green Revolution. The livestock revolution is propelled by demand. The population growth, urbanization, and income growth that fueled the increase in meat and milk consumption are expected to continue well in this century creating a veritable Livestock Revolution. Consequently farm income could rise dramatically, but whether that gain will be shared by poor smallholders and landless agricultural workers who need it most is still undetermined. The environmental and public health impact of rapidly rising livestock production in close proximity to population centers is also another concern.

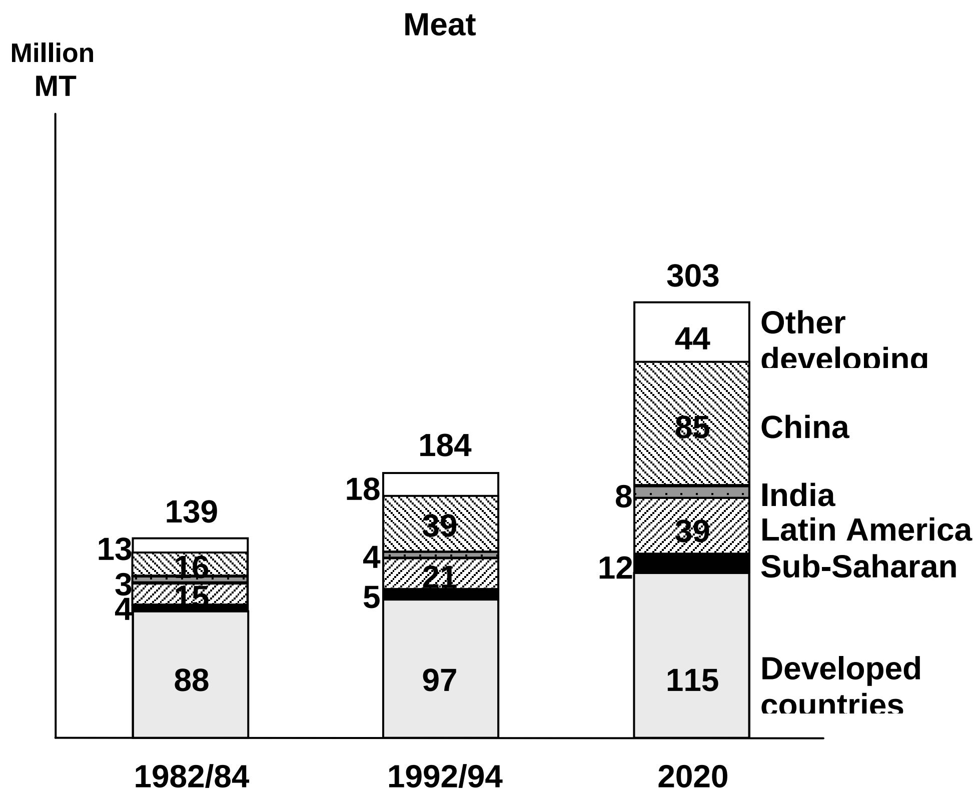
Despite the prevailing potential for growing markets for livestock producers, there are still concerns that the smallholder producers might not be able to benefit from the Livestock Revolution unless specific policy actions are taken. It will be important to:

• link vertically smallholder producers with processors and marketers of livestock and other perishable products;

• eliminate distortions that promote artificial economies of scale, such as credit subsidies to large-scale farmers;

• develop regulatory mechanisms for dealing with health and environmental problems arising from livestock production;

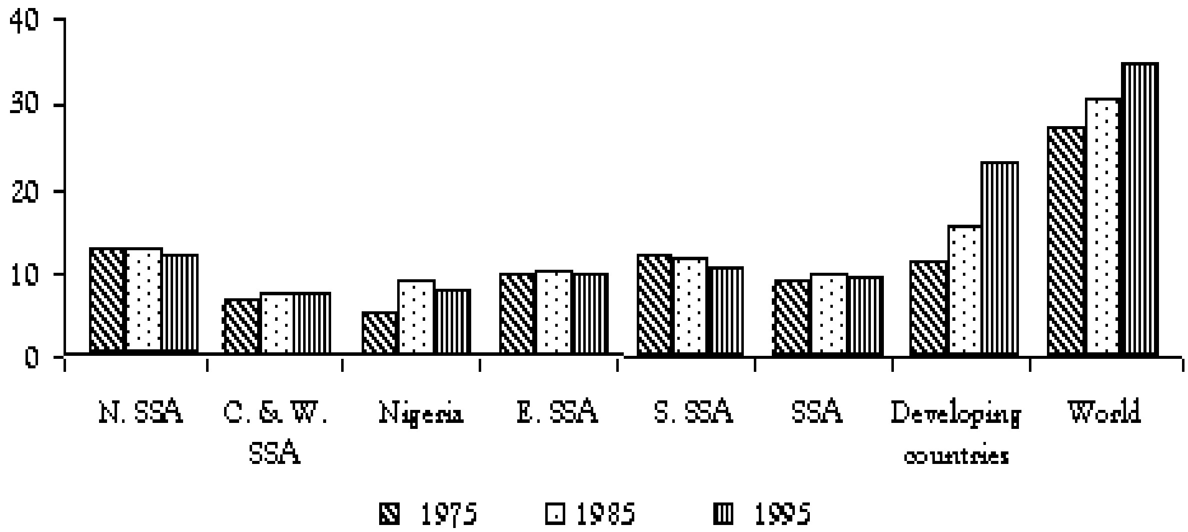
**Figure XX. Total meat consumption 1983, 1993, and 2020**




Sources: Delgado et al. 1999.

Contrary to Asian countries, in sub-Saharan Africa, per capita consumption stagnated or declined , or increased slightly over the same over the past three decades. Per capita consumption of meat, milk and eggs in SSA in 1995 were only 9.5, 23.9 and 1.4 kg, respectively, which were about 27, 31 and 20% of the respective world average. Within SSA, per capita consumption of meat, milk and eggs were the lowest in central and western SSA. Total consumption of meat, milk and eggs in SSA, however, doubled between 1975 and 1995. For example, meat consumption increased from 2.8 million tonnes in 1975 to 5.1 million tonnes in 1995, while milk consumption shot from 6.4 to 12.9 million tonnes. This doubling of demand was fuelled by rapid population growth, similar to the consumption of cereals and roots and tubers, rather than growth in incomes. For example, between 1980 and 1995, the annual rate of population growth was a staggering 2.9%, although gross national product (GNP) per capita declined by 1.3% annually (UNDP 1998, cited in Delgado et al. 1999). Livestock productivity in SSA has also been very low compared to other parts of the world. Beef and milk production per animal declined between 1975 and 1995. In 1995, while production of beef per animal was about 65% of the world average, production of milk per animal was only 14% of the world average. Similar to production of cereals, population outgrew production of both meat and milk. Thus for SSA it seems that improving livestock productivity will be the major challenge. There is substantial evidence demonstrating that major improvements in livestock productivity are possible if appropriate technologies can be generated and adopted by farmers

**Figure YY. Consumption of meat in sub-Saharan Africa (kg/capita), 1975–95.**




Source: Ehui et al. (2003)

SECTION V. STATUS AND TRENDS IN WORLD FISHERIES PRODUCTION

While wild capture marine fisheries were historically viewed as inexhaustible, it is now clear that this premise was incorrect and that in many cases the ocean's limits have already been exceeded. Following sustained growth during much of the 20th Century, world fish landings reached a plateau and declined somewhat during the last decade (see Fig 47 from FAO website below). An increase in world wild fish captures could result from improvements in fisheries management, but gains from this factor have been estimated at a modest 10%. Under more pessimistic projection scenarios, wild fish capture may decline by more than 10% from present levels. While the overall catch levels are of concern, there is increasing evidence that the collateral impacts of fishing have also been severe. Destructive fishing practices have destroyed sensitive and critical habitats, non-target species are threatened by non-selective fishing operations, biodiversity at the community, species, and population levels has diminished, and ecosystems have been durably altered. Recent studies show that the abundance of large apex predators has been reduced by 90%, average fish size has declined by 50%, and the mean trophic level of the catch has declined substantially. Most of ocean life is vulnerable to the direct of indirect effects of fishing, with much less than 1% of the ocean surface set aside in protected areas.

Aquaculture production has increased substantially in the past decade (see Figure 18 from FAO below), and to a large extent, any significant increase in the future production of fish as food will depend upon the potential to sustainably increase aquacultural production (see Fig 47). The limits to aquacultural production are difficult to determine at this stage of development, but several factors indicate the need for caution in projections. An important limit to aquaculture growth is the competing demands for land, particularly in coastal and marine areas, which are also witnessing substantial increases in human population density. Some operations are water-intensive, and again, competing uses of water must be considered. Many aquaculture operations rely upon fish meal and other products for fish feed, and there is concern about the ecological inefficiency in converting one type of fish into another more desired on the human market. The use of non-native species, antibiotics, hormones, etc. are cause for concern of the environmental effects of aquaculture and the safety of the products for consumption.

Sustainable fisheries production for human consumption requires a paradigm shift in the way we view and manage both natural and aquaculture systems. Recognizing that functioning ecosystems are a prerequisite for robust fisheries, maintaining ecosystem integrity must be given highest priority Ultimately, global fisheries may also need to adjust to lower volume or yields to allow for stable recruitment in the future.

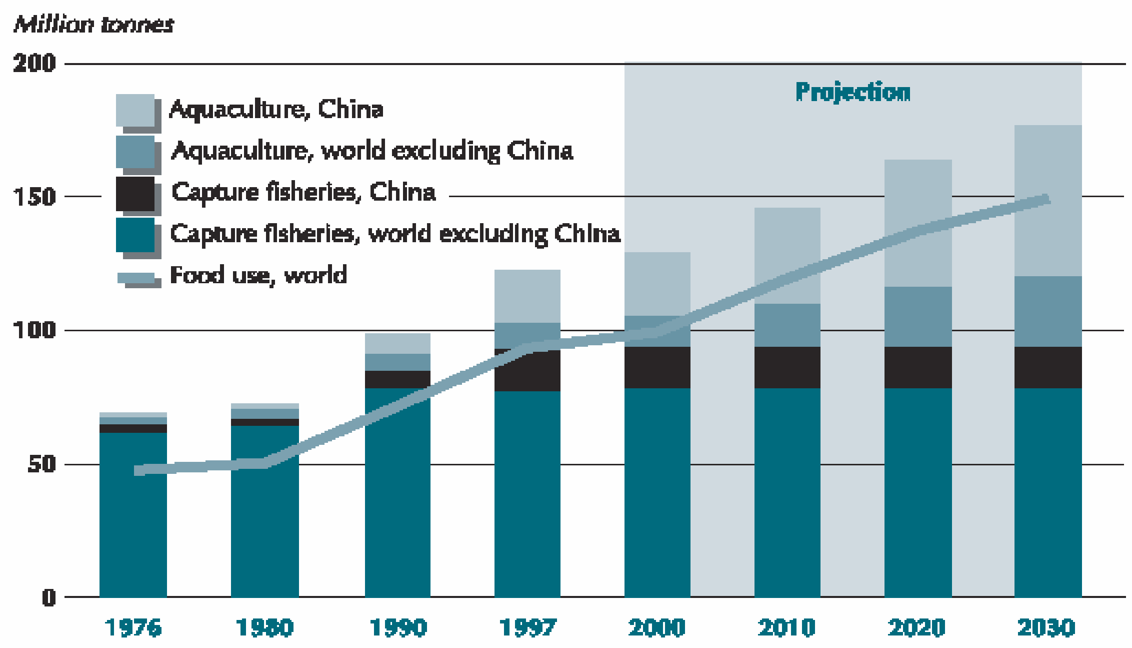
**Box 1. FAO Projection of World Fishery Production in 2010**

***Lower and upper projection levels for 2010 (million tonnes)***

| | Pessimistic scenario | Optimistic scenario |
|---|---|---|
| Capture fisheries | 80 | 105 |
| Aquaculture production | 27 | 39 |
| Total production | 107 | 144 |
| Less fish for non-food uses | 33 | 30 |
| Available for human consumption | 74 | 114 |

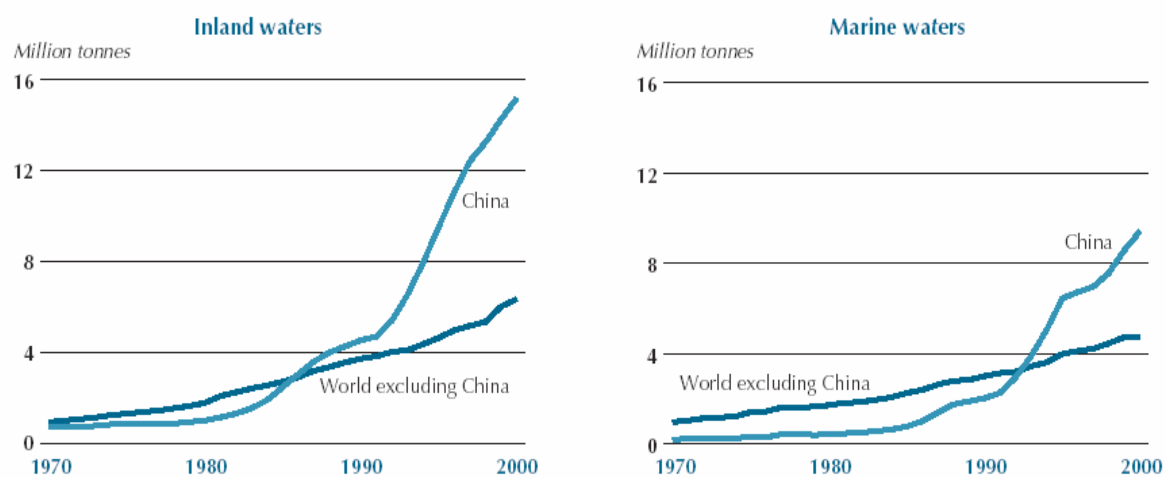
Projections of world fishery production in 201range between 107 and 144 million tonnes, of which about 30 million tonnes will probably be reduced to fish meal and oil for non-food use. Estimated quantities which will be available for human consumption range between 74 million tonnes and 114 million tonnes. Most of the increase in fish production is expected to come from aquaculture which is growing rapidly. The contribution from capture fisheries will depend on some further development and also on the effectiveness of fisheries management. Improved management of currently overfished stocks could provide an increase of between 5 and 10 million tonnes, whereas continued overfishing will lead to declining production, as reflected in the pessimistic scenario in the table.

**FIGURE 47**
**World fish production and food use consumption 1976–2030**




*Note:* Data are from the Global 1 report; in general they are suported by the Global 2 report.

FIGURE 18
Aquaculture production in marine and inland waters




*Note:* Data exclude aquatic plants.

**<u>Recommended policy actions</u>**

***A. To develop sustainable wildcatch fisheries***, it will be necessary to:

**1. Implement ecosystem-based fishery management,** by zoning ocean uses, including establishing marine protected areas and implementing other spatially-based regulations, notably:

a) **for marine protected areas, to determine appropriate sites and establish (networks of) protected areas to maintain marine biodiversity and ecological processes** such as spawning and nursery activity, and to allow for the recruitment and replenishment of target and dependent marine life populations;

b) **for other sensitive areas, to eliminate destructive fishing practices, by establishing regulations banning the use of the most destructive fisheries practices in critical habitats** where effects may be irreversible and may durably alter ecosystem function. Concurrently promote the development and application of selective fishing technologies that allow for targeting particular species, deter entanglement or capture of threatened seabirds, marine mammals and other non-target populations, and enhance escape of unintended bycatch. Establish penalties for the loss or deliberate discarding of gear, which leads to ghost fishing with unnecessary and unrecorded impacts on the marine ecosystem.

**2. Eliminate distorting subsidies**: reconstruct economic incentives to promote sustainable practices in extraction fisheries.

**3. Improve traditional fisheries management** to rebuild depleted fish populations and prevent deterioration of other fisheries. Establish targets and timetables, where possible, based on stock assessments. Ensure proper monitoring of coastal fish stocks at the domestic level and migratory and straddling fish stocks at the international level to allow for proper estimation and management of fisheries resources.

***B. To encourage sustainable aquaculture*** with minimal impact on marine ecosystems, it will be necessary to establish incentives and regulatory measures, and crucially to shift the burden of proof for demonstrating ecologically responsible practices and meeting human health and safety standards.

More generally, looking forward our top priorities must include the protection of coastal fisheries and fishery-dependent populations and the incentives and values they have had that contributed to sustainable fisheries productivity, as opposed to the migratory, transnational fisheries that are often beyond the control of national or even international management regimes, much less local, community-oriented ones.

Challenges to this include long-standing economic and political biases toward production for (a) luxury protein-food markets in the developed world, pricing many of the needy out of the market, and (b) energy-inefficient production systems such as fish meal for fertilizer/animal feed/aquaculture. Both of these are contributing to over-exploitation of major fish stocks and decline of opportunities for work and protein for coastal peoples.

SECTION VI. AGRICULTURE IN INDUSTRIALIZED COUNTRIES

The world is most clearly failing to sustain food provision in the poorest regions, and particularly in Africa. Nonetheless, we cannot ignore the degree to which more advantaged countries are practicing agriculture in a way that provides better food security for them now, but is not sustainable and is not a system necessarily to be emulated. In particular, policy priorities should avoid:
(a) high fertilizer inputs not fully taken up by plants, with consequent runoff causing water pollution and eutrophication;
(b) heavy reliance on pesticides with negative environmental impacts, including health consequences for operators, the evolution of resistant pest strains, and other effects;
(c) failure to account for potential services that could be provided by agro-ecosystems (or agro-natural ecosystems), including soil fertility and carbon sequestration, pest control and pollination, water filtration and flood control, that are instead provided by technologically-based inputs in current industrial agriculture.

<u>Annex: checklist of cross-cutting issues to raise for discussion with other panels</u>

-- Water
- irrigation and water supply
  - variation in scale, management systems
- agronomic management
  - soil-and-water conservation (microcatchments, agroforestry, etc.)

-- Health
- nutrition and productivity, resistance to infectious disease
- anything associated with biotechnology?

-- Energy
- release and sequestration of carbon in organic matter