

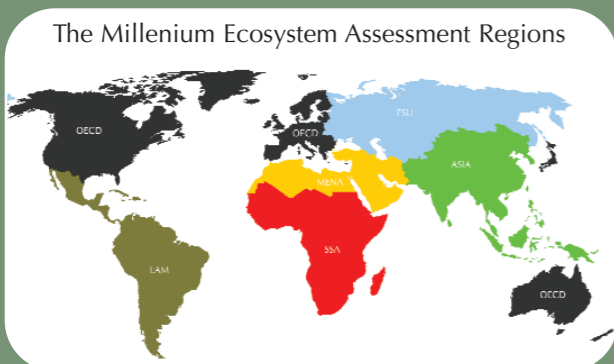
Paths and Limits of Agricultural Growth

How a decreasing share of the active population can provide food for an increasing number of people on a limited land and without adverse impacts on environmental resources ?

Global trends

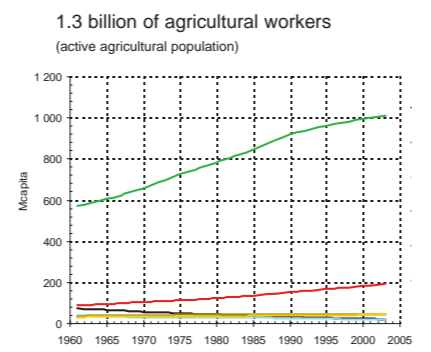
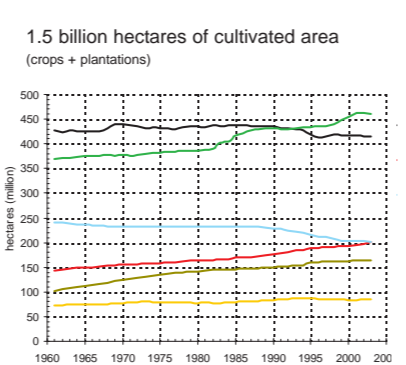
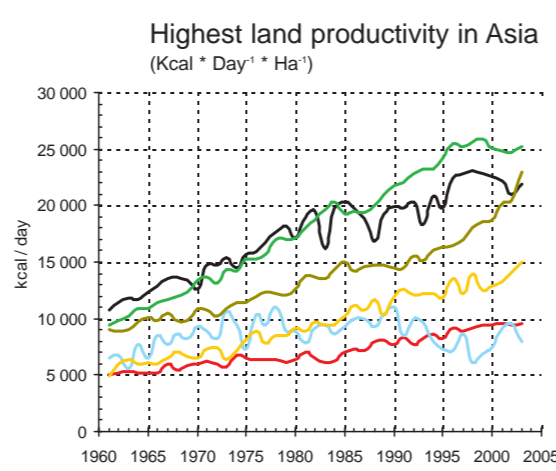
Between 1961 and 2003, the world population has been multiplied by 2 and the urban one by 3, whereas active people involved in agriculture has increased by only 60%. Consequently, the number of persons nourished by an agricultural worker has increased from 3.6 to 4.7 on average (+31%). This was made possible thanks to an increase of production per worker (+53%) as well as per cultivated hectare (+123%), while the cultivated area per worker has fallen from 1.45 ha to around 1 ha.

Regional agricultural productivities

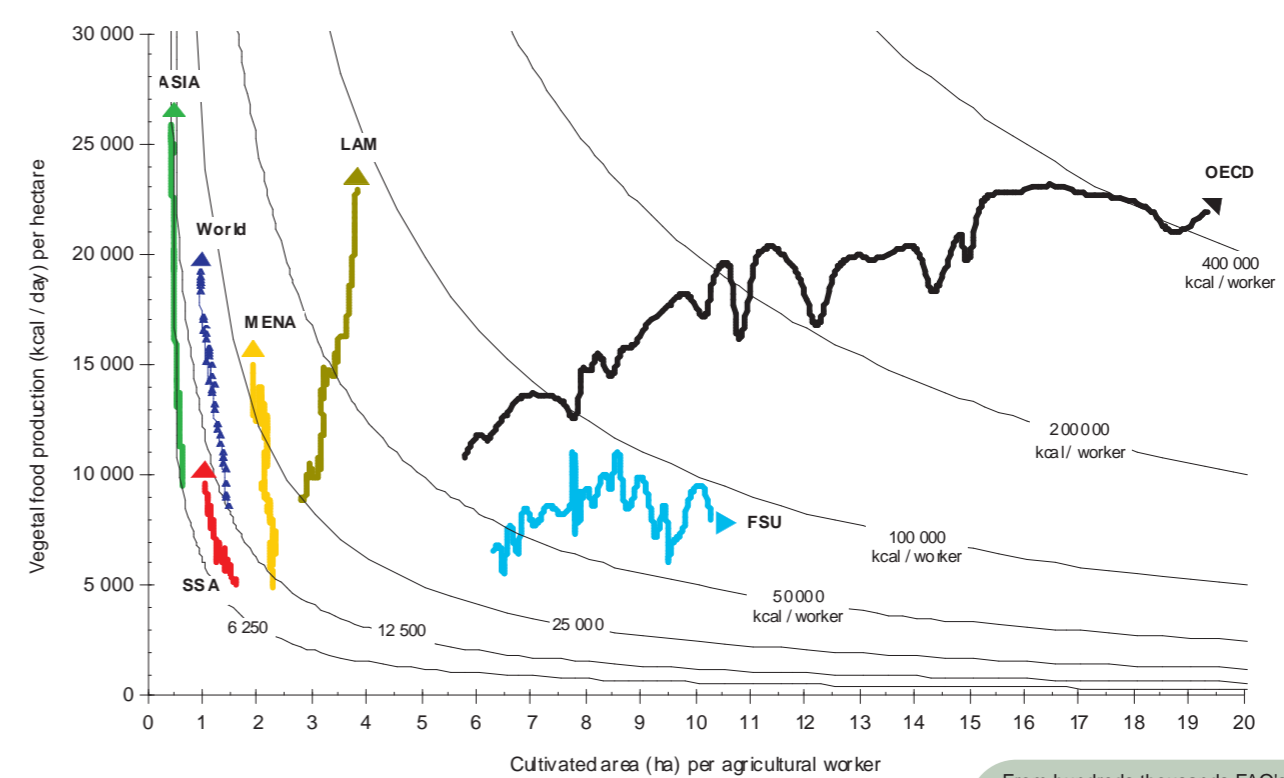


$$\text{Labour productivity} = \text{Land productivity} \times \text{Land availability}$$

$$\text{Kcal/Worker} = \text{Kcal/Ha} \times \text{Ha/Worker}$$

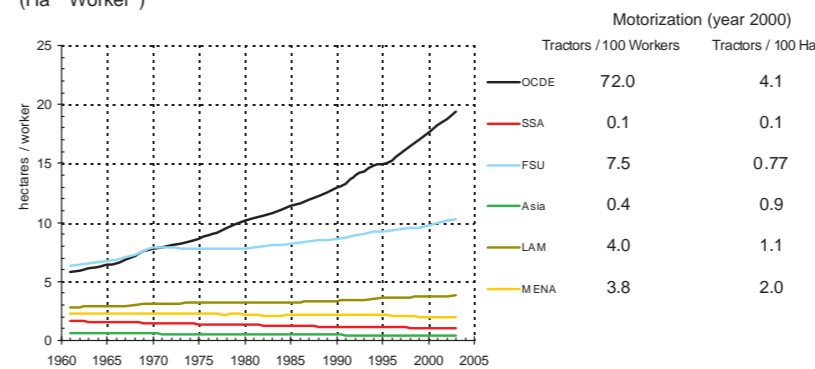


Regional Agricultural Productivity Paths (1961-2003)



From hundreds thousands FAO's data, we provide a new synthetic view of the past 40-years agricultural productivity paths for 6 macro-regions and for the world. Each of these specific paths, results from limitations in land availability (X axis) and ability to increase land yields (Y axis).

A per worker land availability boom in OECD (Ha * Worker')



The contrast between OECD and non-OECD countries is very impressive as far as the per-worker productivity is concerned. This "North-South agricultural divider" is due to huge differences in motorization (and related uses of fossil resources for ploughing, seeding, applying fertilizers and pesticides, irrigating, harvesting, drying...), as our proxy "number of tractors" (per hectare or per agricultural worker) suggests it.

Data and methodology

Faostat1 country-level statistical series (FAO 2006) on land-uses, populations and agricultural productions were bulk-downloaded, merged and harmonized on more than 40 years (1961 to 2003). The output database kept 156 geographical entities representing 99% of the 2000 world population and 98% of the world land area without Antarctica and Western Sahara. An aggregated vegetal food production (AP) has been estimated as follow: $AP_r = \sum_i (P_{i,r} * C_i)$, where r is a region, i a non-processed product of the 80 lines of vegetal food products (cereals, oilseeds, pulses, fruit, vegetables, etc.) listed in the statistical series "Commodity Balances". P the volume of production in tonnes of product line i , and C its food calorie content per tonne according to the FAO (FAO 2003) or to our own inferences.

Is there a sustainable agricultural productivity path?

Despite a fantastic OECD's growth in terms of labour productivity due to motorization and quite easy rural-urban migrations, the world average agricultural productivity path remains rather close to the ASIA one based, above all, on a yield boost. This land productivity is high in ASIA as well as in OECD, but in both cases, seems now to level off for various possible reasons (low market or political incentives, increasing prices of fossil energies and of other agricultural inputs, water stress, soil or biodiversity erosion...).

Future important yield growth may take place in FSU where both land and labour productivities seem still rather easy to improve. In LAM where the productivities are already significantly high, the extension of the cultivated area may be the first challenge and problem, while in SSA, it is the peaceful land access along with mechanisation and sustainable yields improvement. Whatever happens, future employment and livelihood of present agricultural families remains a global key question, and one may wonder if the high OECD motorization of agriculture is a possible and desirable path to follow elsewhere in the world.

References

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