

**The Future of Agriculture in a Resource-Constrained World: A Scenario
Analysis**

by

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ABSTRACT

This study evaluates the potential to feed future world populations with available endowments of land and water. It then evaluates two ways for mitigating the pressures caused by future increases in demand. One way is to tolerate unsustainable resource use by expanding agricultural production onto forestland and withdrawing quantities of water for irrigation beyond the amount necessary for social and environmental needs. A more sustainable alternative is considered in which food demand is reduced in rich regions while technologies are adopted in Africa and Latin America that improve crop yields and allow alternative land use options. Four hypotheses are proposed about the feasibility of meeting future food demand under these conditions and the resulting differences in agricultural production, food prices, and resource use. These hypotheses are tested in a scenario analysis using a global, inter-regional input-output model that determines production and resource use endogenously based upon regional comparative advantages based on production costs and physical availability of factor inputs.

The study concludes that future demand for food cannot be met without either unsustainably expanding land and water use or adopting dietary and technological solutions. Feeding future populations is possible if land and water are allowed to expand unsustainably, but land use increases by 50%, water withdrawals for irrigation by 75%, and water uptake from rainfall by 110% (compared to the baseline). A significant portion of this land expansion takes place on forestland in Latin America, Africa and North America. Feeding future populations is also possible by adopting the dietary and technological solution, with increases in land use of only 14% (also compared to baseline). This solution requires a higher dependence on irrigated crop production and hence further global increases water withdrawals (by 79%). However, the regional situation is nonetheless improved, as withdrawals are reduced in water-scarce China while net increases come from water rich regions such as Latin America. In both cases, world production is dependent upon large increases in agricultural production in developing countries, particularly Africa. Also in both cases, food commodity prices rise, but only 11 - 18% if technological and dietary solutions are adopted compared to 37 - 63% with unsustainable resource expansion.