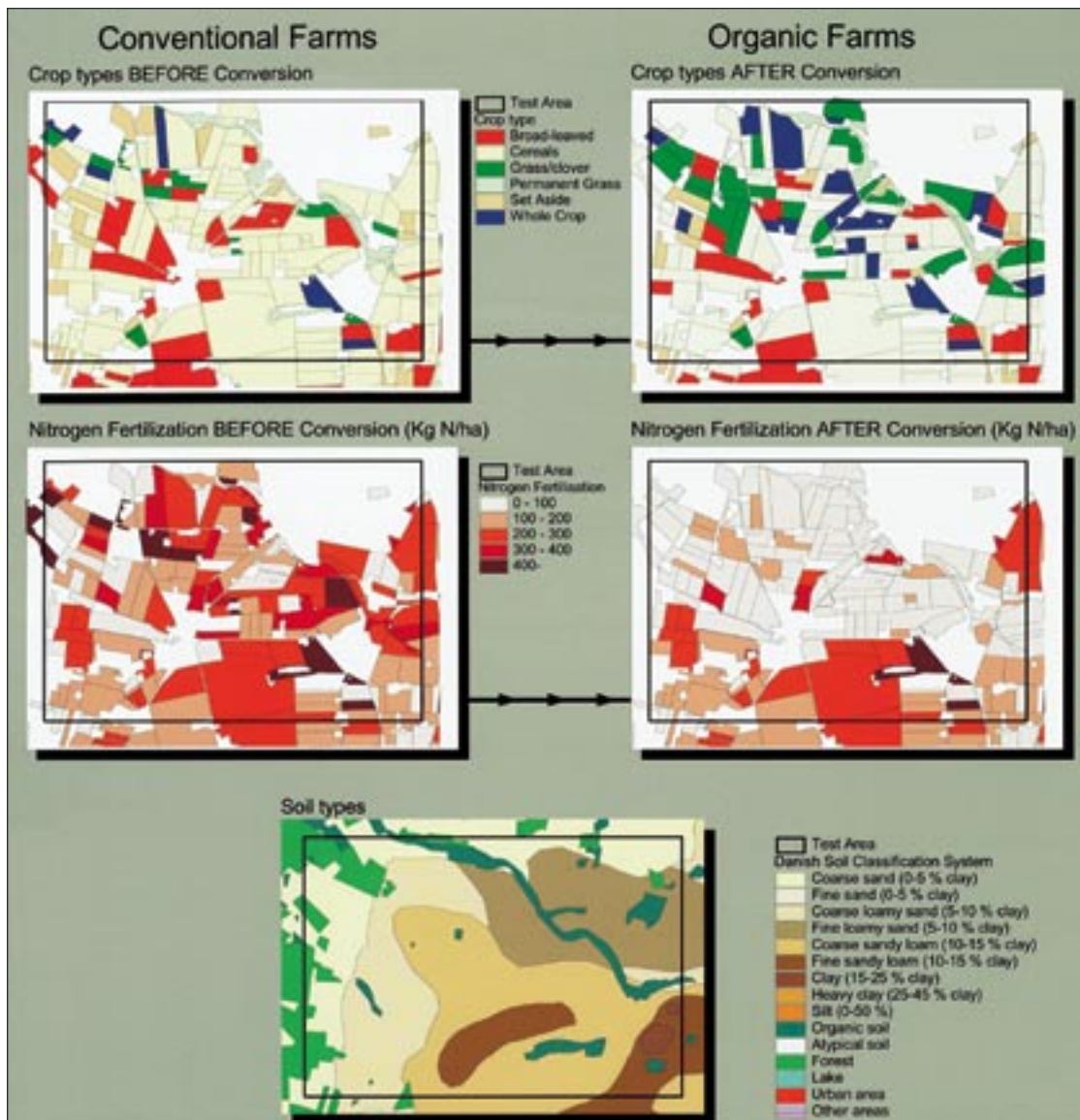


## FOOD PRODUCTION

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Map courtesy of Tommy Dalgaard, Inge Heidemann, and Birgit M. Rasmussen, Danish Institute of Agricultural Sciences, Department of Agricultural Systems.

The maps in this case study show soil types and four different scenarios for use of 2,000 hectares of farmland in Denmark. The goal of the project was to reduce the amount of nitrogen (from fertilizer) leaching into the ground water of environmentally sensitive areas.

*Definition*

To cultivate, harvest, generate, produce, or raise plants and animals that are consumed to sustain life, provide energy, and promote growth.

*Description*

The past fifty years have seen a dramatic increase in the amount of food being produced. The development of agribusiness and integrated processing and marketing systems have created new opportunities, while a general liberalization of markets has increased possibilities for export of surplus. These new strategies and technologies, however, have done more to simply increase global production than they have to reduce social disparities among producers and consumers, or to combat land degradation and ensure fertility and sustainable productivity. In short, more food is being produced, but more people are starving.

The contradiction of severe poverty and undernourishment in the midst of unparalleled plenty remains a central issue in global welfare. It is estimated that more than 820 million people in the world remain undernourished, including 790 million living in developing countries and a further 34 million living in industrialized countries and countries with economies in transition. By the year 2020, the world will have some 2.5 billion more people, and cereal demand is expected to double to two billion tons annually in the Third World.

As the arable land per capita has continued to decrease during recent decades, the increase in food production has largely been achieved by use of external inputs. However, these external inputs have come at the expense of natural control processes and resources, rendering the environment even more vulnerable. Pesticides have replaced biological, cultural, and mechanical methods for controlling pests, weeds, and

diseases; inorganic fertilizers have substituted for livestock manure, composts, and nitrogen-fixing crops. The specialization of agricultural production and the associated decline of mixed farming have also contributed to the worsening situation.

While nutrients, such as nitrogen and phosphorus, are essential to agricultural production and to raising productivity, nutrients in excess of immediate crop needs can pollute surface and ground water (contamination and eutrophication), the air (acidification), and contribute to global warming (greenhouse effect). Similarly, another central farming strategy, the limiting of losses from the effects of pests, diseases, and weed competition through application of pesticides, certainly contributes to higher productivity but also poses risks to human health as well as the environment. There are international consequences to consider, too, as chemicals used in one place find their way into the food chain or one of the planet's many other systems of natural transportation, and have transboundary effects. This is particularly the case with persistent organic pollutants, or POPs.

Agriculture also plays a key role with regard to biodiversity, which is highly dependent on land use. The expansion and overspecialization of farm production and intensification of input use are considered a major cause of the sharp drop in the number of species worldwide, as well as the consequent weakening of the ecological resilience of agricultural systems.

At the same time, certain agro-ecosystems can serve to maintain biodiversity. Farming is dependent on biological services such as the provision of genes to develop improved crop varieties and livestock breeds, crop pollination, and the soil fertilization provided by microorganisms. Properly managed, these needs and services complement each other

and create a perpetually renewing source of energy. Mismanagement of these services, and concomitant dependence on technological “solutions,” give rise to such calamities as “mad cow disease” and less obvious problems such as cross-fertilization of genetically modified crops with wild species or landraces, and the consequent narrowing of the genetic base of crop and animal production—making farmers dependent on seed manufacturers rather than on the millennia-old method of saving seed from the harvest to use in the next season’s planting.

Stress on the environment and land resources is further reinforced by natural disasters and climate-related events, such as droughts, floods, and landslides. Land degradation, soil loss, and desertification persist with particular intensity and impact for many lower-income dryland countries and less advantaged groups, endangering the livelihoods of smallholder farmers and inducing changes in land-use systems that lead inexorably to a vicious circle of further resource depletion. There is a clear cause-and-effect relationship between poverty, land degradation, and desertification; land degradation and land use; natural disasters and land use; and food contamination and production practices. The degradation of land resources is a global phenomenon but acted out at local levels. It is estimated that worldwide soil degradation affects over two billion hectares, putting at risk the livelihoods of more than one billion people.

Finally, it is not only terrestrial natural resources that continue to degrade and shrink—more than 25 percent of the two hundred main marine fisheries worldwide are overexploited, depleted, or recovering, while another 40 percent are fully exploited. Fisheries are collapsing in some parts of the world and international disputes over fish stocks are increasing. Warnings about over-fishing and the potential threat to food security among the poor are being taken increasingly seriously at the national and international levels. The research and development of aquaculture that has been undertaken in recent years, while not without environmental implications, may prove highly effective in alleviating the plundering and weakening of marine resources.

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