

Featured Speaker at SGP (Sustainable Governance Project) International Conference on Sustainable Agriculture and Environment, Rakuno Gakuen University as well as at International Council on Sustainable Agriculture, Hokkaido University, Sapporo, Japan, 2-5 July, 2008.

Factor Fⁿ: Future Farming, Food, Feed, Fitness, Fuel, Fiber, Freshwater, Fishery, Forestry, Flora, Fauna, Fun, Freedom Global Trends 2008/2025/2050

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Agriculture is a new global mega-trend in the coming decades and will be triggered by sustainable food and energy production! Globalization and climate change will shape the whole of agriculture!

Food & Fuel is a global challenge for the 21st century.

Food security has top priority in future. There is no discussion about the fact that everybody must eat. Nevertheless, this fundamental need was globally addressed by the United Nations in the Universal Declaration of Human Rights in 1948, Article 25: *“Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary services ...”* At the beginning of the 3rd millennium, we all knew that this human right is not being realized worldwide.

Four questions are of key importance: “How can we feed the future world population in a sustainable way and in keeping with human dignity?” (Kern, M., 1996), “Who will be fed in the 21st century?” (Wiebe, K. et al., IFPRI, 2001), “What do we eat in the 21st century?” (Kern, M., 2001), and “What can or must be done by whom to react to changes in time?” (Kern, M., 2002).

Within the next 30 years, world food requirements will more than double because of population growth and dramatically changing consumption patterns, which means we will have to produce more food worldwide during this period than over the last 10,000 years put together.

Besides food availability the purchasing power of people as well as moderate global food prices are essential to reduce hunger and to improve livelihood worldwide.

Related to higher food prices, a lot of people will explain in future why the world will not reach the millennium target to halve hunger by 2015.

“Food is energy. And it takes energy to get food. These two facts, taken together, have always established biological limits to the human population and always will. The same is true for every other species: food must yield more energy to the eater than is needed to acquire the food.”

“Humans have become champions at developing new strategies for increasing the amount of energy – and food – the capture from the environment. The harnessing of fire, the domestication of plants and animals, the adoption of ards and plows, the development of irrigation networks, and the harnessing of traction animals – developments that occurred over tens of thousands of years – all served this end.” (Heinberg, R., “Threats of Peak Oil to the Global Food Supply”, 2005).

Energy security is a global concern at the beginning of the 3rd millennium. Ministers and Government representatives have reaffirmed their urgent commitment to substantially increasing the global share of renewable energy in the total energy supply. They share the vision that renewable energies, combined with increased energy efficiency, will become a most important and widely available source of energy and offer new opportunities for cooperation between all countries (Bonn Declaration, 2004; Beijing Declaration, 2005).

Key conclusions “Access to energy: A Human Right?!” , “Energy is a fundamental prerequisite of every life“, “The availability of energy is a fundamental and indivisible human right“ were addressed by the World Council for Renewable Energy (2005). The political agenda is well defined.

Country-specific goals for renewable energy from biomass between 2025 and 2050 vary from 30 to 50 percent of total energy consumption. A global vision of biomass and crop-based renewable resources for biofuels production and consumption for 2025 and 2050 shows a 5-fold increase by 2025 and is expected to set the stage for another 5-fold increase by 2050. By that time renewable resource inputs will begin to match the use of fossil fuels to meet the projected growth in demand for consumer goods.

Forecasts for 2025 state that 20 to 30 percent of arable land will be used for biomass production, mostly to produce bioethanol and biodiesel based on corn, sugar cane, wheat, sugar beet, coconut, palm oil, sunflower, oilseed rape, cassava, switch grass, *Jatropha*, and *Pongamia*.

Preserving fertile arable land, implementing sustainable land management practices, enabling access to water and combating desertification will become increasingly important in the future.

Climate change mitigation and adaptation are further key challenges at the beginning of the 3rd millennium. Many people tend to think of climate change as something that will impact the future, but warming over the past 20 years has already had real effects on global crop supplies. Between 1981-2002 higher temperatures have reduced the combined production of wheat, corn, and barley by 40 million tons per year. Global warming is creating a drag on production of the world's leading food and feed crops, as well as of raw materials for biofuels. Agriculture is the industry whose fate is most closely linked to climate.

Plants and plant crops have always been, and will continue to be, of vital importance for humankind. Conservation of biodiversity and sustainable use are key factors. Plants and crops are an essential source of food, feed, fiber, fuel, fun, freedom, raw materials, and energy. Plants, especially biomass crops, will be one answer, and they are a further essential key in renewable energy strategies of the future. Nevertheless, powerful breeding programs are at present rudimentary or in an early phase for the more than 40 plants which are described as potential energy crops.

Agricultural biomass production, and especially biofuels production, must not compete with food production, but should increase diversity in some regions of the world and make feasible the beneficial use of often destructively exploited land resources. But caution is necessary. If the population-food supply balance is to be maintained in future, long-term planning will be essential.

Relevant factors triggering global food prices in 2008 and in future are: regional droughts, e.g. in Australia, stocks held back by farmers, low global food stocks, high mineral oil prices, increases in global demand, food industry, impacts of investment funds and increasing biofuel business. What will happen in future? For example, drought in Spain, frost in China, the farmers' strike in Argentina, the hurricane in Myanmar, the earthquake in China, global politics and other unknown factors. This all together will challenge agricultural production systems worldwide.

Key questions at the beginning of the 3rd millennium are: *"How can we improve the value creation in plant production? How can we improve the biomass/crop energy production in agriculture? How can we develop a more efficient and effective use of land, energy and material, or: how can we establish a superior 'industrial ecology'?"*

Fortunately, the World Bank claimed in their *World Development Report 2008*: **"After 25 years, agriculture has top priority – again!"**

In the 21st century, agriculture continues to be a fundamental instrument for sustainable development and poverty reduction. Managing the connections between agriculture, natural resource conservation, and the environment must be an integral part of using agriculture for development. In many regions, agriculture will have to shift to high-value agriculture. The focus is definitively the right one.

Factor Fⁿ: Future Farming, Food, Feed, Fitness, Fuel, Fiber, Freshwater, Fishery, Forestry, Flora, Fauna, Fun, Freedom are milestones on a roadmap for tackling the challenges of the 21st century.

Sustainable production of food, feed, fiber, fuel, freshwater and industrial products in the future will depend for its success on a future-oriented, knowledge-based and added-value agriculture – that, finally, will enable freedom and safeguard global peace.