Harvest for the world

Inaugural address

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Dear Rector of ITC, members of the Board, professors, staff and students of ITC, distinguished guests, dear friends.

This occasion is to celebrate my appointment to the Chair of Sustainable Agriculture at ITC. There is one problem though: sustainable agriculture is an incomplete concept. It suggests that when agriculture is sustainable, everything is fine, even for the generations to come. But that is too simple, because agriculture competes with other land uses in terms of space and in terms of using ecosystem services. Sustainable agriculture for two billion people is not the same as sustainable agriculture for eight billion people, which makes it a difficult concept.

Figure 1 Tea Garden

The word "agriculture" has Latin roots, and this history is deeply felt when drinking *café latte* on the balcony of FAO's eighth floor in Rome, overlooking the Palatino and Circo Massimo. But the origins of agriculture date back to what is known as the Neolithic

Revolution, more than 10,000 years ago. It first arose in the Fertile Crescent, covering parts of what is now referred to as the Middle East. Even here, agriculture was not sustainable in the end, when salinity spoiled the arable fields of Mesopotamia. And following climate change in Ethiopia, the Nile started to incise into its own riverbed, no longer flooding the fields along the banks. Even in Ethiopia itself, the old kingdom of Axum lost its initial sustainability when prosperity and population growth led to forest cutting and the massive loss of fertile topsoil (Reader, 1997).

The data and the views

These days, to many people, talking tropical agriculture means talking food insecurity and hunger. Several studies have shown, however, that the world as a whole is able to supply enough food for over 10 billion people (e.g. Penning de Vries et al., 1995). A harvest for the world is, therefore, technically possible. There are many reports and statistics on food security and agriculture that look backwards and forwards. I will take you quickly through a few of the most striking facts and figures. *Figure 2* shows projections by the International Food Policy Research Institute (IFPRI) for total grain production in 2020. It will still be sufficient to meet demand, but the gap between the haves and the have-nots will have widened further by then (Rosegrant et al., 2001). The conclusion is that the developing world will be increasingly dependent on surpluses from the developed world. *Figure 3* shows how the supply constraints in developing countries are amplified by the low prices of agricultural commodities. Data from the World Bank show the ongoing price slump since the early 1980s (World Bank, 2001). This is due not only to global production surpluses, but also to all sorts of national price policies. Governments all over the world want the urban consumer to be happy, and for that to be the case food prices have to be low. *Figure 4* shows that almost all population growth between now and 2030 will be urban (Dixon et al., 2001). This development offers new opportunities for farmers, who will face massive growth of nearby markets. And finally, *Figure 5* shows the sharp rise in the consumption of animal products (CAST, 1999). This goes together with urban expansion. The more people live in cities and the more they earn, the more animal products they consume. Between 1993 and 2000 meat consumption in China almost doubled, and consumption will continue to grow in all tropical continents. Many animals these days are zero or semi-zero grazers, living partially or entirely on feed grains. And to produce 1 kg of meat, you need 2 to 4 kg of feed. Currently, about one-third of the total world grain production is for animal consumption (Keyzer et al., 2005).

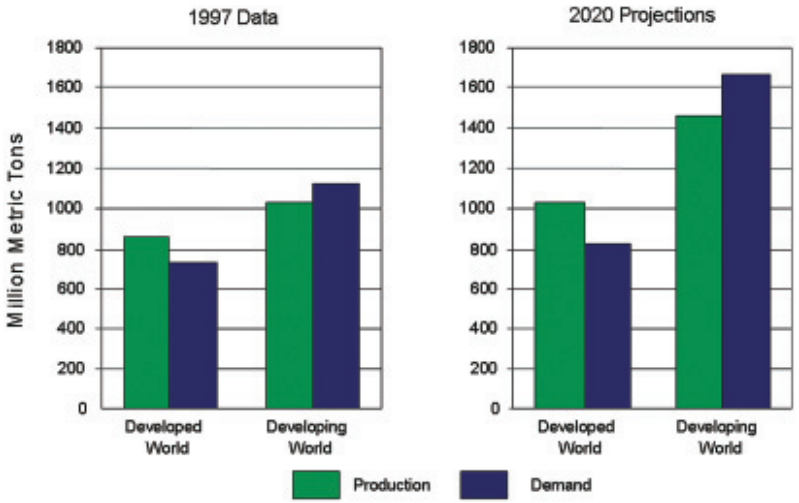

Figure 2 Comparing grain production and demand (Rosegrant et al., 2001)

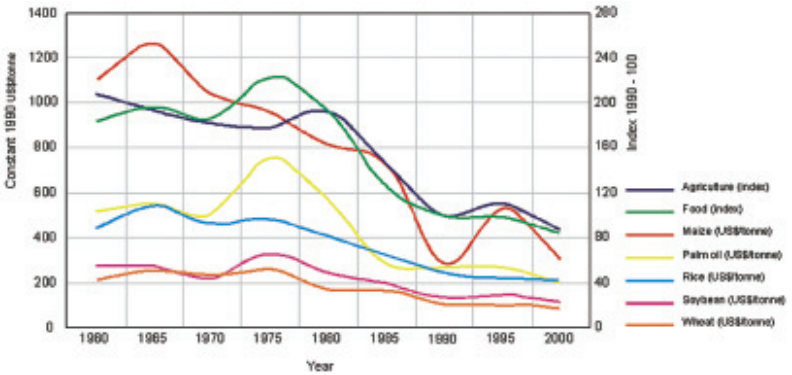

Figure 3 Price development in food and agriculture (World Bank, 2001)

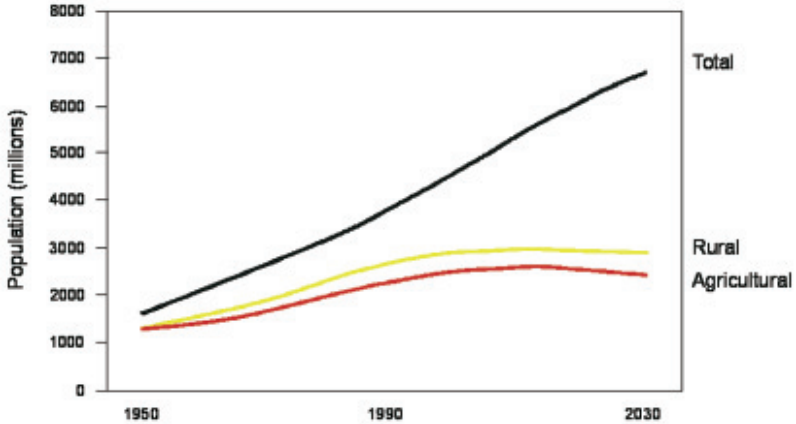

Figure 4 Projected population development to 2030 (Dixon et al., 2001)

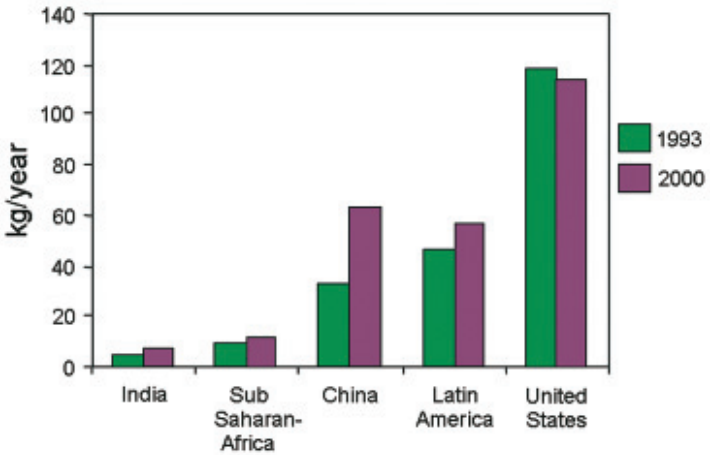

Figure 5 Changing per capita meat consumption (CAST, 1999)

In September 2000, the member states of the United Nations unanimously adopted the so-called Millennium Declaration, including eight specific Millennium Development Goals (UN Millennium Project, 2005). Goal number 1 has everything to do with agriculture: poverty and hunger have to be halved between 1990 and 2015. That should be relatively easy. Apart from the general basic level of investment that is

needed anyway, the marginal costs of reaching the first half are much lower than the costs of reaching the second half. Of all the hungry, some are hungrier than others. And some are within close reach, while others are living in remote areas. So, will Millennium Development Goal 1 be met by 2015? *Figure 6* shows that it will not - although significant achievements are foreseen for South and East Asia. Hunger is particularly stubborn in Africa, with projections for 2030 showing more hungry people than in the early 1990s (FAO, 2003). One should not forget, however, that over such a period of time, hundreds of millions of children are born, and many of them become new members of the hunger force - the unfortunate AIDS orphans in Africa being a case in point. So, Millennium Development Goal 1 is in fact addressing a moving target.

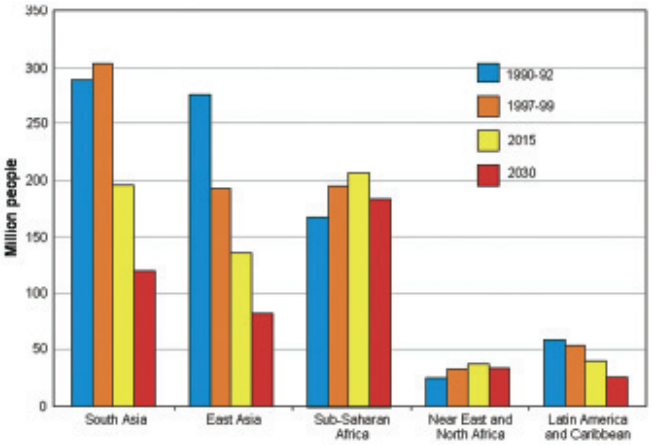

Figure 6 Past and projected malnourished individuals (FAO, 2003)

Notwithstanding this, the Millennium Task Force sounds determined and optimistic in its recent progress report (UN Millennium Project, 2005). I quote: "We have the opportunity in the coming decade to cut world poverty by half. Billions more people could enjoy the fruits of the global economy. Tens of millions of lives can be saved. The practical solutions exist. The political framework is established. And for the first time, the cost is utterly affordable. (…) All that is needed is action." The Millennium Project has certainly achieved a lot, getting OECD countries to (promise to) spend more on the fight against poverty, and catalysing the agreement by the G8 on debt elimination for the poorest countries. A remarkable milestone is the establishment of so-called Millennium Villages in rural Africa. These villages receive large amounts of benefits,

incentives and services that they would normally not be able to afford. These may indeed lift the villagers out of poverty, but the approach also raises a number of questions. Can the villagers handle the sudden changes? Will the prosperity be sustained when the funding is over, and how does it affect the social cohesion in the village itself and its neighbourhood? But given the fact that so much has NOT worked, it is certainly worth trying.

Finally, the Millennium Task Force is quite outspoken on "upscaling". It works! - so it is claimed. The conclusion is based on successes in fighting malaria in Vietnam and in achieving universal basic education in Tanzania. The question is whether these examples really address "upscaling". They rather seem to be policy responses to a problem of national importance. Scaling up a successful Millennium Village is a different ballgame. Why? Because when going from the village to the province, to the river basin and to the country, we come across major differences in ethnic and cultural identity, population and livestock density, cropping systems, soil and water quality, seed systems, land tenure systems, distances to markets, road networks, etc. And when everyone starts growing the crop that has been so successful in the village, its price will certainly plummet. Hence, upscaling development requires a proper assessment of drivers of change at village, district and national scales. Interventions at one scale should take into account effects at other scales.

The book *Feeding the World: A Challenge for the Twenty-First Century* by Vaclav Smil (2000), one of the opinion leaders on food security, is very well known. Smil's work seeks the balance between the "catastrophist" view that we are populating ourselves beyond a possible capacity to feed ourselves, and the "cornucopian" view that more humans will mean not only more Mandelas, Kasparovs and Catherine Deneuves, but also more brain power to find solutions to our food needs. Smil's optimism is based largely on the many options enabling greater efficiency in different parts of the food chain. These can relate not only to the efficiency of water and nutrient use and the productivity of crops and animals, but also to post-harvest storage and processing, the preparation of foods for consumption, and waste management (*Figure 7*). Achievements in the developed world have been stunning, but are based on subsidised clean technology development. Incineration plants for household waste are, however, uncommon in developing countries, sewerage systems in cities are scarce, and a composting industry exists only on a small scale. Smil thinks that organic wastes in particular can be used much more efficiently in animal production, but this optimism is

not supported by model calculations by the Centre for World Food Studies at the Free University (Keyzer et al., 2005).

Figure 7 Waste in Bamako city

It is always interesting when optimists such as Smil (and also Lomborg (2001) in his *Skeptical Environmentalist*) are confronted with the apocalyptic pictures painted by their more alarmist peers. Smil, for example, thinks that China is able to continue to feed a large and growing population - and to do so with the limited arable land and water available. This is in stark contrast to Lester Brown's much criticised catastrophist approach to the same situation. But let's face reality. Did not China's President Hu visit a large number of Latin American countries in 2004? As *The Economist* of 1 January 2005 puts it: "With galloping GDP growth and a scarcity of arable land, China's appetite for natural resources and farm products seems insatiable, and South America has both. China's imports from the region, primarily soya products and minerals, have nearly trebled since 2002." China promised to bring more tourists and to invest in South America's transportation infrastructure. This will speed up the movement of increasing production volumes from the distant interiors of South America to the ports. Has

Lester Brown a point? Is Vaclav Smil wrong? It seems that China can indeed feed its animals and its people, Mr Brown, but to achieve this it does have to borrow South American territory, Mr Smil.

It may seem like a perfect win-win deal between China and South America, and the kind of agriculture to be developed may well be sustainable from a purely technical viewpoint. Still, large areas in South America will be stripped of their natural vegetation; carbon and biodiversity losses will be inevitable; soil acidity and nutrient depletion will manifest themselves rapidly; and the animals in China eating the imported products contribute to greenhouse gas emissions. As the 2003 Global Environmental Outlook of UNEP puts it: "expansion of agriculture into marginal lands and clearance of natural habitats such as forests and wetlands is a major driving force behind land degradation" (UNEP, 2003). And this is my point: agriculture based on area expansion is always detrimental and can not be designated sustainable, unless the forgone ecosystem services are accounted for somehow. Intensification is to be strongly preferred as long as the use of fertilisers is targeted at soil and climate and plant characteristics. Structural adjustment programmes in the 1990s lowered agricultural benefit/cost ratios in the countries that had to implement them. As a result, farmers turned to area expansion at the expense of intensification.

The recently completed Millennium Ecosystem Assessment (2005) focuses strongly on ecosystem services, which can be:

- provisioning: food, water, timber, fibre
- regulating: climate, floods, disease, wastes, water quality
- cultural: recreation, aesthetic value, spiritual benefits
- supporting: soil formation, photosynthesis, nutrient cycling.

Agriculture makes use of provisioning ecosystem services. It implies the removal of biomass and nutrients, which are not or only partially returned. Therefore, I prefer the concept of sustainable land management to that of sustainable agriculture. It is more holistic. And establishing trade-offs between land uses, and between "harder" and "softer" ecosystem services is, in my view, one of the great research challenges of today. Environmental sustainability, after all, is also a Millennium Development Goal.

Sounding negative on Sub-Saharan Africa

It is time now for some gloom and doom on sustainable agriculture in Sub-Saharan Africa. As regards fertiliser use, we see Sub-Saharan Africa having an average rate of around 10 kg of nutrients per ha, against a developing country average of around 100 kg/ha. That is a full order of magnitude. But even in terms of native soil fertility, Sub-Saharan Africa is simply less endowed than Europe. The major European agricultural soils have at least twice as much soil organic carbon and near-neutral soils, as opposed to the acid soils of Africa (*Table 1*). This has nothing to do with colonial history, but everything to do with unfavourable climate and geology. Decomposition of biomass is a rapid process in consistently warm temperatures, leaving little time for the accumulation of humus. As a result, extensive layers of deep fertile topsoil are rare in Africa. Also, Africa is the world's oldest land mass. Nutrient-impoverished granites, basement sediments and sands cover about 90% of the African land surface. These kinds of proven adverse natural conditions in Africa are brushed under the carpet or are deemed irrelevant when most macro-economists have the floor. You often hear pleas for a level playing field in world trade. But there simply isn't one. Using the expression "level playing field" testifies to the ignorance that exists on the distribution of natural resources in the world. Something for which we as earth scientists may have ourselves to blame.

Table 1 Carbon and pH in European and African soils (summarized from Batjes, 2002)

	Carbon (%)	**pH**
Europe		
Cambisols	2.6	6.3
Chernozems	2.2	7.4
Luvisols	1.8	6.2
Sub-Saharan Africa		
Ferralsols	1.3	4.9
Acrisols	1.0	5.0
Luvisols	0.6	6.1

Compared to Asia, Sub-Saharan Africa has a very small area under irrigated agriculture. A Senegalese farmer will generally be happy if harvesting 800 kg of rainfed sorghum per ha, but the farmer in the floodplains of the Indus and the Ganges who manages two irrigated rice crops and one wheat crop in one year can harvest 8,000 kg/ha (adding up

the three harvests). In the process, the sorghum crop withdraws approximately 50 kg of N+P+K from the soil, whereas the multiple cropping system in Asia withdraws 500 kg, helped by fertilisers, which are generally more cost-effective in irrigated than in rainfed systems. A ten times larger harvest, and ten times as many nutrients withdrawn from the soil. Again, the difference is a full order of magnitude.

Comparing Europe, Asia and Sub-Saharan Africa in the context of agricultural trade also gives a strongly skewed picture. Tables 2a to 2c, derived from FAO's statistical database, just show import and export surpluses exceeding 100 thousand tons. The Netherlands is short of all cereals, of fruits, and of cassava and oil crops to feed all the animals. At the same time, it is a net exporter of potatoes, vegetables and all animal products (*Table 2a*). It is a real transit-and-trade country, with many commodities listed in both the import and the export columns of the budget. Thailand is a major exporter of rice, sugar, fruits, milk, fish, and … cassava (*Table 2b*). In 2000, more than 1.5 million tons of cassava were shipped to the Netherlands. A normal trade deal? Yes. Sustainable agriculture? No, because the cost of soil fertility depletion and deforestation in Thailand is not included in the price (De Gier, 1995), and the nutrients in the cassava end up being part of the Dutch manure problem. The trade balance at the country level for Thailand looks fine though: nine major export products against just four major import products. Finally, in Ghana cocoa is the only major export product (*Table 2c*). And then I mean cocoa beans - not the chocolate bars and Santa Claus letters, which are subject to high import tariffs in Europe in the same way that handkerchiefs and T-shirts from Mali are less welcome than cotton bales.

Table 2a Import-export balance for the Netherlands (2000) (only when exceeding 100,000 tons)

Import Surplus	**Export Surplus**
- Wheat	- Potato
- Barley	- Vegetables
- Rice	- Beef
- Maize	- Pork
- Cassava	- Chicken
- Oil Crops	- Milk
- Fruits	- Eggs
- Coffee	- Fish
- Spices	

Table 2b Import-export balance for Thailand (2000) (only when exceeding 100,000 tons)

Import Surplus	**Export Surplus**
- Wheat	- Rice
- Maize	- Cassava
- Potato	- Sugar
- Oil Crops	- Plant-derived oil
	- Vegetables
	- Fruits
	- Chicken
	- Milk
	- Fish

Table 2c Import-export balance for Ghana (2000) (only when exceeding 100,000 tons)

Import Surplus	**Export Surplus**
- Wheat	- Cacoabean
- Rice	
- Sugar	
- Fish	

Many other African countries show similar figures, and this seems to suggest that Africa's agricultural future hardly lies in conquering foreign markets. Also, the world is no longer partitioned into developed versus underdeveloped. "Tigers" such as Brazil, Thailand, India, China, and the more Mediterranean South Africa are a third force to reckon with. This is certainly refreshing for the balance of power in the world, but countries and trade blocks increasingly find themselves caught in a prisoner's dilemma: if I move but the others do not, why should I move in the first place? In this context, where is the particular comparative advantage for Africa? Is it in future oil revenues, as Colin Reeves alluded to in his valedictory address (Reeves, 2005)? Wouldn't it make sense for Africa at this stage to focus on its own and growing regional markets, and be allowed to protect itself to a certain extent from more or less artificially cheap imports?

Sounding positive on Sub-Saharan Africa

But now let's cut the gloom and doom, because there is a surprisingly large body of documented successes in African agriculture and land management. Success is quantified by performance indicators and is typically expressed in a dynamic way: something has changed for the better (*Table 3*). A study by IFPRI gives an interesting overview of successes in African agriculture (Gabre-Medhin and Haggblade, 2004). Out of some 250 cases, 62% of the successes proved to be commodity-specific, and relate mostly to advances in breeding and selection, in pest and disease control, and in improved market opportunities. In all cases, performance indicators have been used to show evidence of success (*Table 4*). Area-specific successes have also been convincingly documented, for example by Reij and Thiombiano (2003), who looked back on 20 years of rehabilitation efforts on Burkina Faso's Central Plateau and were able to quantify and explain success.

Table 3 Examples of success indicators

Positive change in:

- Production and productivity
- Diets (proteins, vitamins, minerals)
- Income (farmer, state)
- Hectares reforested
- Tons of carbon sequestered
- Kms of contour bunds
- Square kilometres of protected area
- Number of women groups
- Effectiveness, efficiency, impact, rate of return

Table 4 Commodity-specific successes (after Gabre-Medhin and Haggblade, 2004)

Maize	47% of area improved varieties, yield gains 40%, 5-10 M small farms benefit
Cassava	10-15 M small farms benefit; mosaic virus, mealy bug control, very high B/C
Horticulture	500,000 Kenyans benefiting, exports in Zambia (15 yrs) from 3-24 M$
Rinderpest	1.8$ income/1$ costs of vaccination programme
Rice	Yield increases due to good policies (Office du Niger, Mali), NERICA variety improvement

Apparently, the optimism derived from the case studies contrasts very strongly with the aggregate pessimism that is reflected in the global statistics of Figures 2 to 6. There may be several reasons: (1) local successes may just be islands in a sea of stagnation or decline at national level; (2) current data collection methods are inadequate, because they are based on samples that are too small; (3) there is significant elasticity of food consumption in many poor rural households, implying that people are eating the increased food produced instead of marketing it. This may lead to the conclusion that aggregate statistics understate Africa's agricultural accomplishments, a view shared by Vaclav Smil, who emphasises the sometimes shaky basis of FAO statistics on which so many discourses are based.

Finally, I will look at West Africa. Without borders it has a territory of 4.4 million square kilometres (*Figure 8a*). For comparison purposes, this area is half that of Brazil and less than half that of China. There are several ways of looking at this part of the world. John Reader (1997), in his fascinating book *Africa, a Biography of the Continent*, says that one of Africa's problems is the vast number of countries. Africa indeed has 54 countries, 15 of which are landlocked. In South America, which has 60% of Africa's surface, there are just 12 countries, and only Paraguay and Bolivia are landlocked. Reader claims that as a result border areas are lagging behind in development and infrastructure. ITC's Boudewijn van Leeuwen checked this claim by comparing road density "close to" and "further away" from borders, based on the US Geological Survey Digital Data Series (DDS 62H). No significant differences were found, however, for the area covering Nigeria, Benin, Togo, Ghana, Ivory Coast and Burkina Faso. Nonetheless, the area does cover 16 countries, with a total interior border area of almost 17,000 km (*Figure 8b*). West Africa as a region has strong potential economies of scale because of the relative uniformity of the landscape and the gradual changes in the climate from North to South. This makes it markedly different from East Africa, with countries as diverse as Kenya and Ethiopia. A second way of looking at West Africa is through the dominant farming systems (*Figure 8c*). John Dixon et al. (2001) recognises six major farming systems here, running more or less in parallel bands from the pastoral zones bordering the Sahara to the humid forest zone in Cameroon. Irrigated and peri-urban farming systems are not shown because of the limited spatial significance. And a third way is by looking at population density or the rate of urbanisation. Jean-Marie Cour of OECD's Club du Sahel showed that around 1960 the most densely populated areas were along the southern coast and in the semi-arid regions. The in-between savanna zones were sparsely populated owing to river blindness and tsetse fly infestation. In 1990, there

were 2,500 cities in the region, of which 90 had more than 100,000 inhabitants (*Figure 8d*). For 2020, he projects 6,000 cities, of which 300 will have more than 100,000 inhabitants. In particular, coastal regions and Nigeria show explosive urbanisation (*Figure 8e*).

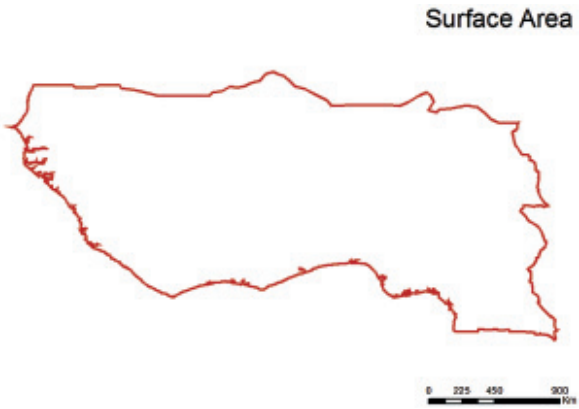

Figure 8a Surface area of West Africa (including Cameroon, excluding islands, excluding desert parts of Mauretania, Mali, Niger): 4.4 million km2

Figure 8b West Africa (including 16 countries and 16,800 km interior border)

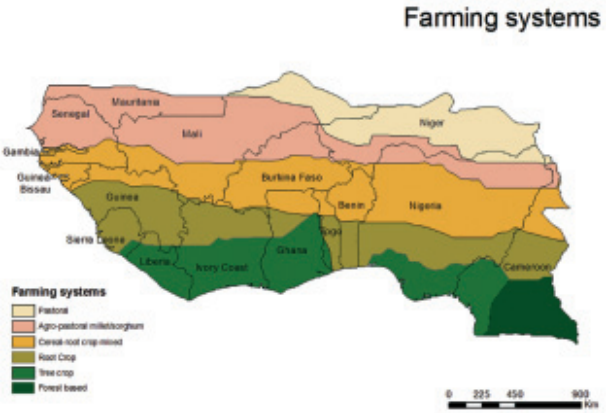

Figure 8c Global farming systems in West Africa (after Dixon et al., 2001; excluding irrigated, coastal and urban farming systems)

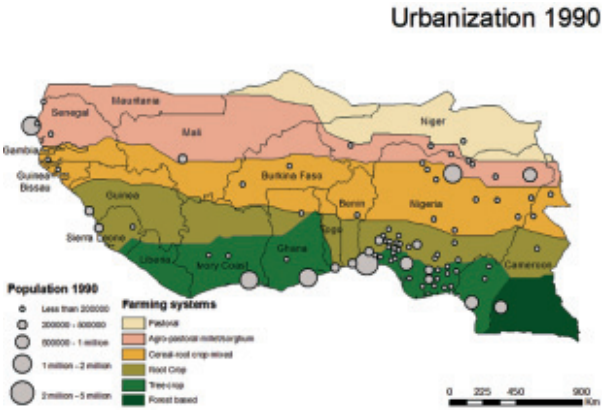

Figure 8d Urbanisation in West Africa in 1990 (after Cour and Snrech, 1998)

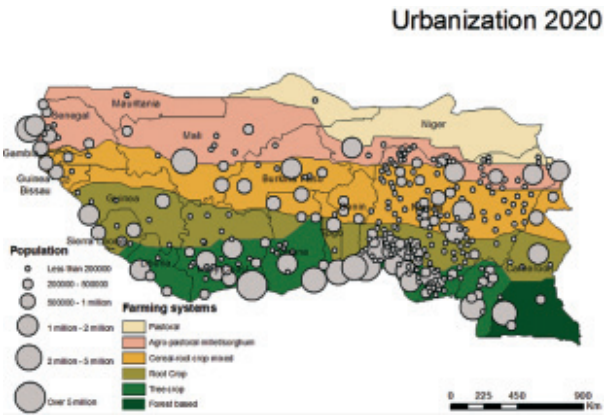

Figure 8e Projections of urbanisation in West Africa in 2020 (after Cour and Snrech, 1998)

Is this bad or is this good? The cities will undoubtedly meet many obstacles in the fields of housing, sanitation and employment. But all urban people need to eat, and offer an attractive target group for farmers in the region. Coastal cities can be reached easily by ship. The challenge here is to see that rural West Africa gets a major share in feeding urban West Africa. When looking at the transboundary level, the transaction costs of the national level include 17,000 km of border, many policies on similar issues, many languages, many currencies, many armies, and always at least a couple of civil conflicts. The relatively "empty" cereal-root crop mixed farming system (*Figure 8c*), cutting across 12 countries, may deserve a regional development plan rather than 12 national development plans.

And what about the World Bank-led Soil Fertility Initiative, aimed at fighting nutrient depletion in Africa. Most countries in West Africa have a country action plan now, and these plans look very much alike. A regional view could have been cheaper and more effective. In the countries themselves, inefficiencies crop up too, as was discovered during work for the FAO-Netherlands Partnership Programme. In Burkina Faso, the outcome of the Soil Fertility Initiative exercise led to a national action plan, costing about US$ 20 million. At the same time, a national action plan for integrated water resources management had been drafted, also at an estimated cost of US$ 20 million (*Figure 9*). No matter how pro-poor and pro-agriculture the government is, it is simply

not in a position to fund all such plans at the same time. The water plan was eventually endorsed in 2003, whereas the soil plan had been put on hold since 1999. The question is this: would not a regional approach to start with have been more efficient and effective and, above all, cheaper?

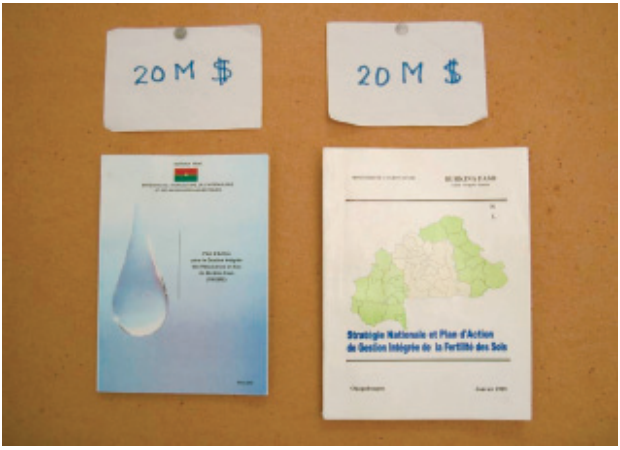

Figure 9 Water and Soil Fertility Action Plans for Burkina Faso

I think West African governments can break new ground here, with a lead role for ECOWAS, the Economic Community of West African States, assisted by other relevant institutions, such as CORAF, the West African Council for Agricultural Research and Development, the international and national research centres in the region, and advanced research institutes such as ITC and Wageningen UR. A regional plan for sustainable land management should include strategic choices on crop and animal production zones and required levels of inputs, technologies and information, on protected areas to conserve biodiversity, on targets of carbon sequestration, on the necessary level of regional market integration and protection, and on investments in infrastructure and land ownership. And last but not least, as mentioned in a recent report by the InterAcademy Council (2004), the region needs some centres of excellence where the best West African brains can work for the future of their region.

I hope to devote a good bit of my time at ITC in the coming years to the vulnerable agro-pastoral millet/sorghum farming system (*Figure 8c*). I want to analyse change (i.e., failure and success) in the field of land use change, agricultural area, soil quality and

yields, making use of earth observation techniques and time series to show evidence of change. The findings will be linked to policies, land management and land user perception in order to bridge the gap between research and development. To address "upscaling", research will take place (1) at the regional level of the Dixon maps, allowing comparison of land use policies between four countries, and alluding to my hypothesis of regional economies of scale; (2) in smaller "windows" of 50 x 50 km, representing meso-level and well-detectable spatial variation, a level also where land users and other stakeholders meet and do business; and (3) in villages inside these windows (*Figure 10*). Villagers all have their "best practices" to survive, but they differ between villages, regions and countries. By comparing best practices among villages and adding new knowledge, more sustainable systems may be put in place and scaled up through exchange of know-how and innovation.

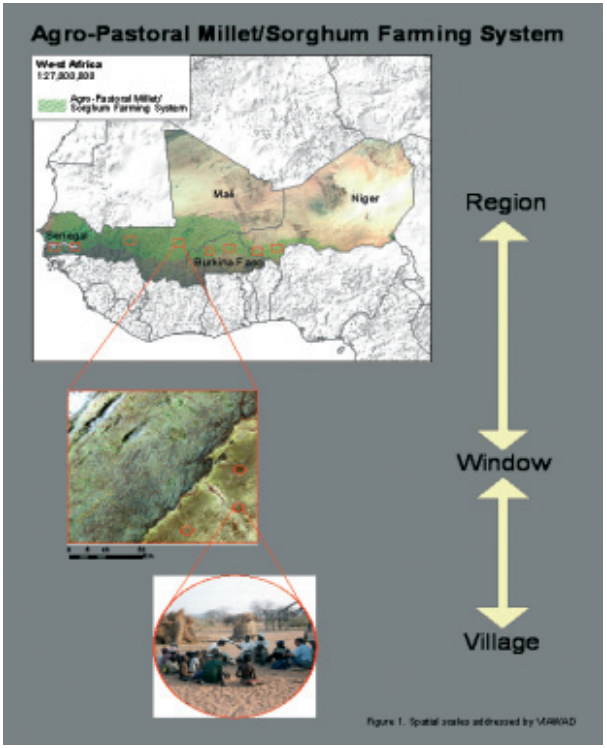

Figure 10 Multi-scale approach in studying West African drylands

Conclusion

What do I find most important?

1. It is important to be on top of the international R&D agendas. It seems useful for ITC, for example, to simultaneously and explicitly address Millennium Development Goals 1 and 7 in its research proposals and education curricula. We can also be more strategic in summarising essential parts of documents such as the Millennium Ecosystem Assessment, and the multi-annual outlooks that are published by the United Nations, World Bank, World Resources Institute and the centres of the CGIAR. GIS and remote sensing *per se* may be selling points for capacity building, but in a problem-driven international agenda, "monitoring change", "upscaling success", and "showing trade-offs between development pathways" show our core business better.
2. Along the same lines, issues such as carbon sequestration, biodiversity conservation, land degradation and international water management could be addressed in a more coherent way. International agencies such as the Global Environmental Facility are looking for clues to define inter-linkages between these fields, and to finance projects that address them (e.g., Gisladottir and Stocking, 2005).
3. There are opportunities for a stronger integration of research on rural and urban development. Cities in the tropics will grow fast over the next decades, whereas the rural population will remain relatively stable. Required know-how that comes together here includes land use planning, urban food demand needs assessment, waste recycling, land ownership and cadastral development.
4. On the aggregate pessimism versus case-study optimism, ITC may be able to play a role in supporting national statistics departments. It may not sound too glamorous, but it is highly important to improve the reliability of the data on which (inter)national development narratives and strategies are based.
5. To safeguard sustainable land management and food security in West Africa, it would be of great help to perform scenario studies comparing national and transboundary goals and food needs. Boundary conditions may range between full market protection and full liberalisation to get a good picture of the range of options. A larger multi-partner programme on this is desirable in my view.
6. It may be useful to have one strategic, cross-cutting think-tank at ITC that occasionally brings together representatives of the different expertise groups, and which tries to be forward-looking and innovative. As GIS and remote sensing tools and technologies are still getting better and becoming more accessible, ITC needs a forum where these advances can be matched with the needs in research for

development. Only last week did I read that we are now able to tell forest under selective cutting from undisturbed forest. This is the kind of breakthrough in remote sensing that will keep ITC in business.

Words of thanks

I am grateful to the rector and to the Board of ITC for appointing me to the Chair of Sustainable Agriculture in the Department of Natural Resources, led by Professor Andrew Skidmore. I look forward to contributing to research and education at ITC in a broad sense, but also through some targeted research efforts. I am also thankful to Wageningen University and Research Centre, where I was granted a 0.0 appointment at the Plant Production Systems chair group of Professor Ken Giller. My long history with both Ken and Wageningen will make it easy to mount joint research projects and trigger other activities that I hope will be to the benefit of both organisations.

I thank you all for your kind attention, and am sure that everyone would like a cup of strong Malian tea from Moussa now (*Figure 11*).

Figure 11 Moussa presenting tea along the Bamako-Sikasso road

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