Submitted by: International Commission on Irrigation and Drainage (ICID), icid@icid.org
In consultation with various experts from different (international)organisations
Date: 3 February 2008, revised version

Theme	**2. Advancing Human Development and the Millennium Development Goals (MDG)**
Topic	**2.3 Water and Food for ending poverty and hunger**
Main Question	***How can poverty and hunger be reduced with the growing demand for food, the increasing pressure on land and water resources and the development of bio-fuels?***
Related sub-questions	*Question 1: What should be the overall objectives in terms of food and nutritional security to all? What strategies for agriculture and for water should be in place in various contexts to that end? What interventions and investments are necessary?* *Question 2: To what extent can institutional and technical water management improvements (water harvesting, irrigation, drainage, artificial recharge, etc.) contribute on existing cultivated land - either with or without a water management system - to the required increase in food production? How much should be sought for in expanding productive agriculture areas? How should strategic investments be designed and funded?* *Question 3: What are the overall effects of bio-fuels production with regard to: alleviating poverty, food security considering both the risk and the capacity to absorb food supply chocks by allowing a rapid reversing to food production, on natural resource management and environment, and on agriculture prices?* *Question 4: In what aspects and how should local markets be strengthened for farmers and national capacity for trade developed in the least developed countries to enable investing in improved agricultural practices and post harvesting processing activities generating employment, taking into account the complex interactions which typify the rural water sector, particularly the agricultural water sector?*
	Global population will grow to some 8 billion in 2025 and 9 billion in 2050, increasing the global population density per km^2 of arable land from the present 430 to 525 in 2025 and 600 in 2050. In 2050 two-third of the world population will live in cities. Food production roughly has to double in 25 - 50 years to meet the needs of the world's population, including the presently 850 millions under-nourished, the population increase and the changes in diets. To meet the increase in food demands under the increasing pressures on water and land resources due to urbanisation, competition with other uses, pollution and climate change more productive water use in rainfed and irrigated agriculture is essential. This will require large investments to realise productivity gains that will ensure that fewer rural producers can supply the demand of a rising urban population. The magnitude of such investment requires understanding by governments, corporations and individual farmers on the economic and financial returns. This requires a reconsideration of subsidy and tariff systems to enable farmers on the one hand to access markets but on the other hand to be sufficiently protected against advanced competitors to allow them to develop their own capacity. It also requires attention to the role of small producers and labourers who currently survive close or below the poverty line, to ensure that new patterns of intensification bring positive agrarian transformations. *Resulting Question 1: What should be the overall objectives in terms of food and nutritional security to all? What strategies for agriculture and for water should be in place in various contexts to that end? What interventions and investments are necessary?* --- Population growth is expected to take place predominantly in the urban areas in the emerging and least developed countries. Therefore, especially these countries will be

confronted with the need to increase their food supply by increasing production in their own territory, maybe in combination with increased imports. Emerging countries face the additional complication that the standard of living is rapidly rising resulting in an increase in consumption per person and a change in diet.

From the point of view of food production there is a common feeling that in the coming decades about 80 - 90% of the required increase will have to be realised on existing cultivated land and about 10 - 20% on newly reclaimed land.

At present 45% of global food production is achieved at 1,100 million ha without any water management system, 40% of the food production is achieved at 270 million ha irrigated land and 15% at 130 million ha rainfed land provided with a drainage system. These figures imply that the largest proportion of agricultural area is without any water management system. In the rainfed areas without a water management system, water harvesting and watershed management may result in some improvements, especially in the livelihood of poor farm families. There is, however, no way that the cultivated area without a water management system can contribute significantly to the required increase in food production. Due to this the share of irrigated and drained areas in food production will have to increase.

Irrigated agriculture counts for some 70% of total water withdrawals. It will therefore be of importance to continue with the efforts to increase the efficiency of irrigation water use, while ensuring multiple other factors, including environment, related to irrigation. Much of the production in the arid and semi-arid zones is based on the mining of groundwater resources. Pollution of water resources and environmental concerns with respect to application of agro-chemicals may reduce the potential for their use for agriculture.

Resulting Question 2: To what extent can institutional and technical water management improvements (water harvesting, irrigation, drainage, artificial recharge, etc.) contribute on existing cultivated land – either with or without a water management system - to the required increase in food production? How much should be sought for in expanding productive agriculture areas? How should strategic investments be designed and funded?

Surging fuel prices and the quest to reduce green house gas emissions triggered the interest for development of bio-fuels, which have positive consequences on agriculture prices at farm gates. Consequently, more and more land is converted to production of bio-fuels and more and more water is required to grow these energy crops. Though this provides opportunities for farmers to escape the poverty trap, this may happen at the cost of food production and environmental integrity. The question of rapid reversibility to food from non-food agriculture production might be critical to set national strategies that deal with bio-fuels production, reduce food self-sufficiency on routine basis while safeguarding potential supply in case of global food supply shocks. Finally the question whether bio-fuels production and dissemination will help in reducing green house gas (GHG) emissions must be discussed seriously.

Resulting Question 3: What are the overall effects of bio-fuels production with regard to: alleviating poverty, food security considering both the risk and the capacity to absorb food supply chocks by allowing a rapid reversing to food production, on natural resource management and environment, and on agriculture prices?

To maintain food security or food self-sufficiency, many countries in the arid and semi arid zones have reached or are already beyond their water carrying capacity: they use more than the renewable amount. Importing food as an alternative to producing it themselves will alleviate stress on their water resources and make water available for priority and more productive purposes. Financing food imports requires access to world markets which for most of the least developed countries is difficult due to the subsidy and tariff systems of most developed and emerging countries but also relates to quality and food safety standards which are difficult to attain at the stage of development these countries are in. Most of the poverty exists in rural areas in emerging and least developed countries. Increase in food prices will therefore

	contribute to reduction of poverty in rural areas in these countries, provided that poor farmers reach such a level of production that they can sell a substantial part of their yield. Only with access to markets farmers can invest in improved agricultural practices and post harvesting processing activities generating employment. Another development, as it occurs, for example in countries in the Middle East/North Africa and also in areas in the North China plain where groundwater depletion is occurring, is generally conversion to more precision irrigation in order to supply local or regional/global horticultural markets. Market access is not really a problem for these countries. However, the staple crops continue to be imported and commercial food import bills rise. Whether this involves an adverse balance of trade depends on the market conditions, but whether there is a need for a deliberate policy or not is a moot point. In such cases the more pertinent question is for how long will such water scarce countries be able to continue with irrigation. *Resulting Question 4: In what aspects and how should local markets be strengthened for farmers and national capacity for trade developed in the least developed countries to enable investing in improved agricultural practices and post harvesting processing activities generating employment, taking into account the complex interactions which typify the rural water sector, particularly the agricultural water sector?*
(Types of) Organizations to be involved in topic consultations	Farmer Associations, IFAP (International Federation of Agricultural Producers) International Agencies: FAO, IFAD, UNEP, WEC, WFC National Governments (min of finance/agriculture/economic affairs/water resources) Trade organizations: WTO, … Association(s) of agricultural producers: SAI Professional Associations: ICID, ICOLD International Research Institutions: CPWF (incl. IWMI, IFPRI), ILRI Multilateral donors: World Bank, AFDB, ADB Environmental agencies / NGOs: IUCN, WWF, Wetlands International, CARE, Watchdogs, OXFAM, SEI Bio-fuels production associations Universities National Research Centres Local civil society
Process of paper and session development:	1. Draft 1 of topic scoping paper to be sent to key institutions for comments 2. Improved draft to be placed on website 3. Improved draft with comments received to be discussed at the February coordinators meeting to: a. Agree on key questions b. Agree on the topic document so that it can be placed on the Forum web-site c. Agree on key stakeholders to take part in the development of the topic d. Agree on consultation process: relevant meetings with key stakeholders e. Agree on the process and actors to develop the forum session.

For Reference:

Question 1	**What should be the overall objectives in terms of food and nutritional security to all? What strategies for agriculture and for water should be in place in various contexts to that end? What interventions and investments are necessary?**

Agriculture and food production are key to the future of our world and key also to the Millennium Development Goals (MDG). 850 million people remain under-nourished and this number, which has been on the decline for several decades has become stable or even slightly increasing in the past 5 years.

The population in 2005 and prognosis for 2025 and 2050 are shown in Figure 1. From Figure 1 it can be observed that by far most of the population (73%) lives in emerging countries, but that most of the population growth in percentage is expected in least developed countries. In developed countries, no growth is expected. Population growth in emerging and least developed countries is expected to be concentrated in urban areas.

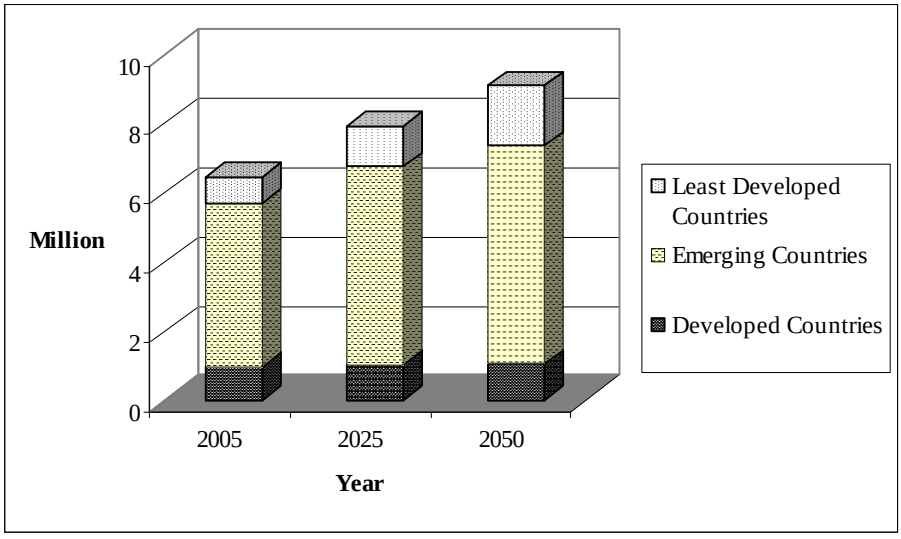


Figure 1. Population in 2005 and prognoses for 2025 and 2050

With respect to agriculture, it is of importance that it first of all plays a role to produce food crops. However, a variety of non-food crops, like cotton, tobacco, flowers, etc. may be produced on agricultural land. Cultivation of bio-fuel products, like sugarcane, oil palm and maize may have far reaching consequences. In fact it is probable that for a substantial part of bio-fuels production, food-producing lands are or will be transformed to non-food producing lands. The complexity of land and rural water is an important factor when analysing the issues at stake (Figure 2)

With respect to this it is also interesting to observe how prices for basic food crops have developed over the past period. After a continuous lowering of global food prices during many decades, the bottom was more or less reached in 2000 - 2001, since then prices at the World Market are rising. Although the average prices of 2007 were still at the level of 1998/1999, during the last months of 2007 a sharp rise could be observed. If this trend continues, it will become increasingly difficult for the urban poor in the emerging and least developed countries to purchase their food (Figure 3).

Notwithstanding some measures for control of population growth undertaken by some emerging and least developed countries, projected needs for an envisaged increased population must be properly planned. In respect of the emerging and least developed countries where the population growth will take place, these countries will be confronted with the need to increase their food supply by increasing production in their own territories, maybe in combination with increased imports. For emerging countries, there is the additional complication that the standard of living is rapidly rising resulting in an increase in consumption per person and a change in diet.

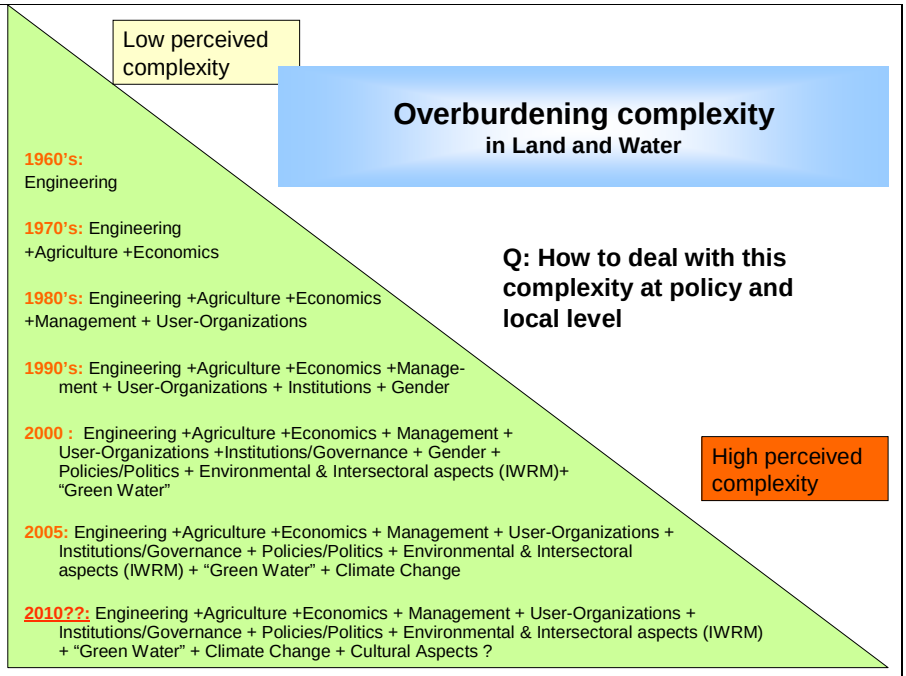


Figure 2. Complexity of land and rural water (Huppert, Bradford, 2006)

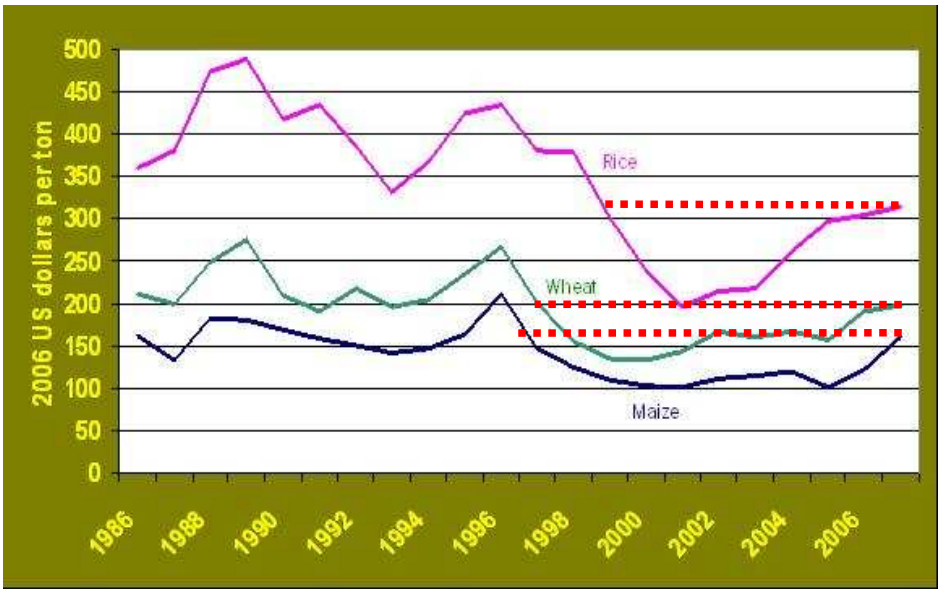


Figure 3. Development of prices on the world market for some basic food crops

From the point of view of food production, there is a common feeling that in the coming decades 80 - 90% of the required increase will have to be realised on existing cultivated land and 10 - 20% on newly reclaimed land. From the point of view of sustainable rural development, socio-economic and environmental aspects play especially crucial roles.

Food security, Food stock and food/non-food production

The security of food supply results at a given point of time in a combination of food production potential for the short term and food stocks. The sharp increase of food prices in 2007 is reflecting the tension on both terms: less land for food production (more for bio-fuels) and declining food stocks at least in relative terms. There are many worrying about a possible food supply shock if this tension exacerbates. The question of rapid reversibility from non-food production to food production is thus coming into as

an important feature of the food security. For instance a system that has massively turned to sugarcane for ethanol can revert very rapidly (one season) to rice in case of a big shock on food supply.

Thus for some countries developing non-food production on intensive agricultural lands might be a good strategy to take advantage of staple food imports from countries which have a comparative advantage while maintaining a potential capacity for food that can match population needs in case of crisis.

If we look at production of cereals in the three types of countries, as well as in different continents, the following figures are of interest. Developed countries have an export surplus of about 10% of their production. Emerging countries have a net import, but this is quite low if we express it in deficit per person and it looks like they are overall able to be food self-sufficient. Least developed countries have an import surplus in cereals of 30% of their own production. Granting that, in the absence of water management facilities, these figures could vary due to linkages with variations in precipitation, planning for the global requirements would have to be on a robust basis of projected trends. Solutions for such tendencies, that are temporal with linkages with climate, are best achieved by interventions that can insulate the impact of variations in climate. With respect to this the declining trend in investments in the sector - at least from international donors - during the last decade needs a critical review. The question is if it is needed to reverse this trend and if so to determine in consultation with the local governments, which may be the priorities?

Agriculture remains key to development of many countries. In many emerging and least developed countries, agriculture remains the main component in the Gross Domestic Product (GDP) and farmers (especially small-scale) represent the majority of the population. The situation differs, however, and can be classified in three main blocks:

- *Developed countries.* Agriculture's share of the GDP is low and farmers represent only a small and declining proportion of the population. Agriculture is generally supported by these societies, which has several debated effects on the world food trade. This situation is the result of several decades (if not centuries) of technological progress. Today the productivity in these countries is about 500 times more than that of small-scale farmers in emerging and least developed countries;
- *Emerging countries*. The situation in several of these countries shows similarities with what prevailed in the recent past in developed countries: the development of economy drives farmers from their land to the urban areas and increasing demand generates increases in production. In these countries there remain large numbers of rural poor lacking access to land or other resources; some of these countries have recently become among the largest food exporters. As far as farmers are concerned, one may observe three different trends:
  * increase in farm sizes and introduction of mechanisation;
  * cultivation to higher value crops (vegetables, cash crops) in order to retain a living on a relatively small plot;
  * part-time farming, in combination with a job in the industry or the service sector.

  Such changes have had far reaching consequences in the developed countries, reducing the farmers' population to 2 - 3%. Such a process has already started in several emerging countries and one may expect that during the coming century such a process will occur in a substantial number of these countries. A special problem occurs when workers migrate to cities and the rural area remains without experienced farmers. All fieldwork is then generally put on the shoulders of the women. In such a situation, strong support of new farmers will be needed, especially through training, promotion of local processing of agricultural production, and low cost credit for farmers;
- *Least developed countries.* One may expect that for the medium-term future, agriculture will remain the activity of a majority of farmers with little productivity, lacking all types of inputs and resources to increase their productivity. Despite this situation, these countries are increasingly importing food. It will be of importance to find ways that these countries become overall food self-sufficient, or access imported food in socio-economic conditions that don't challenge their own food production and keep away local farmers from local markets. Specific points of attention are: how will investments take place in countries that have

	suffered conflict, or where states are failing, and many of the poorest producers live, what place will remain for smallholder irrigators in new global food markets, and how will investments support and not dislocate these small-scale irrigators? The processes of agrarian intensification need special attention to limit further marginalisation of the poorest farmers and environmental degradation. The question of agriculture and rural development will remain a major concern in many of the contexts belonging to the latter category. However given the biophysical and economical handicaps many farming and rural communities are facing, the development can hardly be only on the traditional agriculture entrepreneurship model. The social set up and the family sharing of activities are also experiencing major changes, in some cases dramatic as a result of military conflicts or natural disasters, in others still drastic but pushed by the economy. For instance many rural areas are experiencing a feminisation of the agriculture as the result of men becoming part time urban workers. Accelerated changes, diversification, various sort of threats including those related to climate changes, are all calling for a more integrated rural development based on diversified sources of incomes, livelihood oriented and focusing on multi-option for adaptation and resilience to develop or absorb chocks. Obviously this new strategy of rural development (new rurality) more flexible, reactive and adaptive will have strong implications for natural resources and water management: water being used differently over time by different users in different locations with different service interactions with different governance, competition. This calls for differentiated and context-specific responses such as Multiple Use Services or actions more users oriented (women).
Statement 1	*The trend of increasing food prices on the world market necessitates far reaching interventions and investments to prevent under-nourishment, especially for the urban poor and the (landless) rural poor in the least developed countries. These increasing prices also need to reach the smallest farmers and bring profitable agriculture to them*
Statement 2	*The increase in food prices will result in higher production levels per unit area, especially in emerging countries, which will result in food production such that under-nourishment can be substantially reduced.*
Statement 3	*The required global increase in food production needs to be achieved in a sustainable and equitable way, such that environments remain stable and small produces retain access to water and land resources.*
Statement 4	*The on-going decline in the global food stock of cereals will have to be reversed by far reaching interventions and investments to promote food production in emerging ad least developed countries*
(Types of) Organizations to be involved in session consultations	Farmer Associations: International Agencies: FAO, IFAD, UNEP, WEC National Governments (min of finance/agriculture/economic affairs/water resources) Trade organizations: WTO, Association(s) of agricultural producers: IFAP (International Association of Agricultural Producers), SAI Professional Associations: ICID International Research Institutions: CPWF (incl. IWMI, IFPRI) Multilateral donors: World Bank, AFDB, ADB Local government NGOs: CARE, OXFAM Universities National Research Agencies Local civil society

Question 2	**To what extent can institutional and technical water management improvements (water harvesting, irrigation, drainage, artificial recharge, etc.) contribute on existing cultivated land – either with or without a water management system - to the required increase in food production? How much should be sought for in expanding productive agriculture areas? How should strategic investments be designed and funded?**

Agricultural land is about 1,500 million ha. About 1,100 ha (73%) are cultivated without a water management system. In about 270 million ha there is an irrigation system only (210 million ha) or an irrigation and drainage system (60 million ha). In about 130 million ha there is a drainage system only. Irrigated agriculture is responsible for about 70% of withdrawals from either surface or groundwater.

At global level: roughly 7,000 billion m^3/year of water are required for food production (considering only evapotranspiration of crops and pastures) that is roughly 1,100 m^3/cap/yr of which 1,800 billion m^3 come from irrigation, the other 5,200 billion m^3 from rainfall. This is the result of plant functioning: plants evaporate water so that they can absorb CO_2. Producing 1 kg of cereals costs from 500 to 1,500 litres of water. Producing oil or meat costs much more (to the total process involved) from 3,000 to 15,000 litres of water per kg produced. Producing 1 kcal requires roughly 1 litre of water. Each person requires a minimum of 2,800 kcal/day i.e. 2,800 litres/day or 1,020 m^3/yr.

Increasing the productivity of agricultural water is nevertheless possible and required. Three main ways are to be considered:

- Integrated water resources management, preferably at river basin level in combination with efficiency improvements in irrigation systems. Increasing hydraulic efficiency of irrigation systems by reducing 'losses', improving the systems, changing the irrigation technologies, improving the operation and maintenance. At large scale the potential of saving must be scrutinize considering real and virtual losses at basin level, real loss is water evaporation from bare soil whereas seepage losses from canals might be or not real losses depending on the recycling process of this water further downstream;
- increasing low yields (i.e. less than 2 tons/ha) which result in excessive evaporation (be they in irrigated or rainfed systems). If all yields would be above 2 - 3 tons/ha, water use would be reduced by about 1,500 billion m^3 (Figure 4). Increase in water use efficiency is mainly caused by reduction of evaporation from the soil, due to the better cover of the plants and the resulting increased interception;
- reduction of post harvest crop losses (only 50% of the production is consumed) and looking after virtual water conservation and storage.

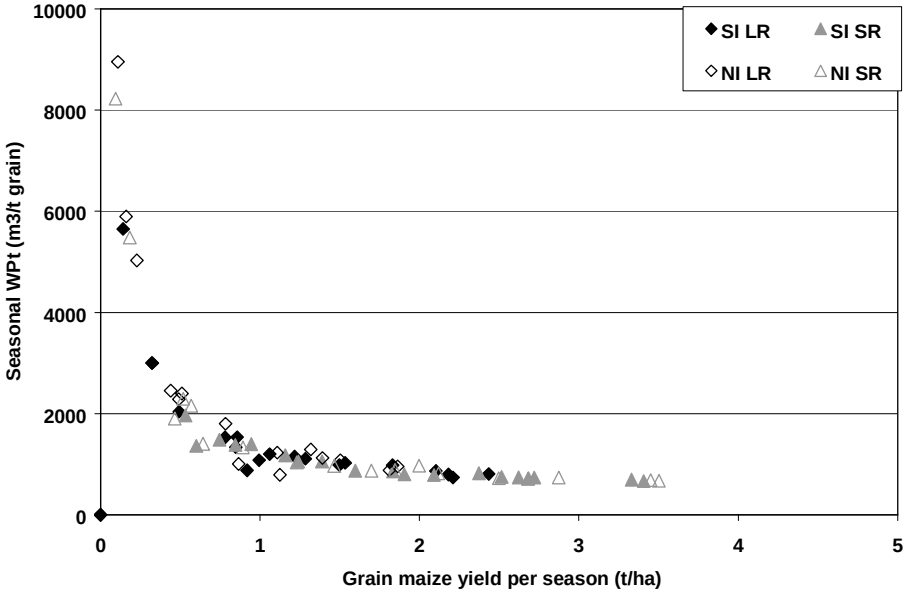
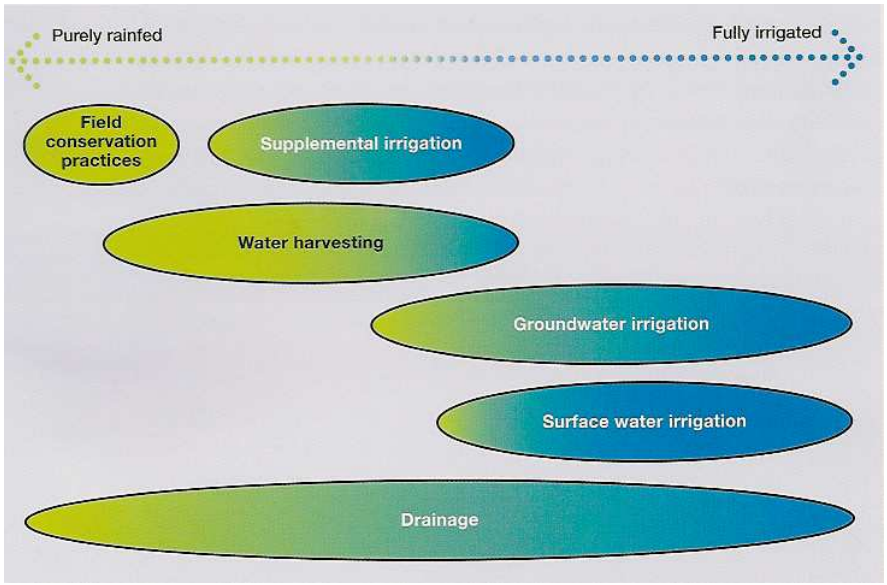


Figure 4. Relation between yield and water use in m^3 per ton of grain for maize.

A question is whether an important source of water efficiency increases lies in the improvements in small-scale agriculture (low yields). Better agricultural water management to improve the yields of that agriculture is the key, keeping in mind that water is not the only production factor, others being land, fertilisers, reduction of post harvest crop losses, looking after virtual water conservation and storage, etc. There is an important social dimension in this. Often the pathway to move from low to high yield is through land consolidation, mechanisation, etc. Keeping low yield farming systems might be a social objective to keep small farmers which are securing their food supply through

	their farming activities in business. It is same even for part time farmers who secure food for the family by practising a loose agriculture, getting income from elsewhere. To really engage into yield improvement farmers have to be dynamic and making their living only out of it. This, however, will put a lot of farmers migrating towards cities. The required increase in food production means a range of water for food between 10,000 and 14,000 billion m^3. This depends to a large extent of the capacity of small-scale agriculture to increase its productivity (yields and water productivity) and the required expansion of irrigated agriculture. Out of the increase of 3,000 to 7,000 km^3 in rainfed areas without a water management system, water harvesting and watershed management may result in some improvements, especially in the livelihood of poor farm families. There is, however, no way that the cultivated area without a water management system can contribute significantly to the required increase in food production (with the additional threat posed due to Global Climate Change). Due to this, the share of irrigated and drained areas in food production will have to increase. This can be either achieved by installation of irrigation or drainage systems in areas without a system, improvement or modernisation of existing irrigation and drainage systems, installation of irrigation systems in rainfed areas with a drainage system, or installation of drainage systems in irrigated areas. There is thus a need to consider a series of water management solutions from purely rainfed to large-scale irrigated areas (Figure 5).  *Figure 5. Diverse options for agricultural water management (International Water Management Institute, 2007)* At each level of this continuum, the issues of water storage, artificial recharge and efficiency need to be considered depending on the local conditions. Thus a range of potential solutions needs to be developed, keeping in mind in particular the level of development, the capacities of the farmers, market prices and farm costs, including those of water management. Especially in the emerging and least developed countries it will be of importance to analyse how water can be managed more effectively for sustainable agriculture to continue to be a key pathway out of poverty and means to achieve food security, especially for the poor, how will water rights be shaped or threatened by changes in technology, and how will water rights be ensured for the poor, and for small and marginal farmers?
<u>Statement 1</u>	*Globally water is not limiting for agriculture. But heterogeneity prevails and some countries will increasingly face water scarcity. Future needs of water for food are huge and up-to-date water management systems will be required at a large scale.*
<u>Statement 2</u>	*External factors, like: impacts of bio-fuel products, climate changes, virtual water trade, changes in agri market and the price of commodities have a strong influence on the*

	engine of the agriculture activities. Such changes will require additional adaptations in the development of water management measures to ensure global food production and to reduce the probability of a severe crisis in the coming years.
Statement 3	*Modernization of irrigation and drainage systems in the broad sense (technical, management, financial, environmental) will be required at a large-scale, especially in emerging countries, to achieve the required increase in food production, also in some cases to save water for other uses, and in other cases to save money to develop further the water resource.*
(Types of) Organizations to be involved in session consultations	Farmer Associations, International Agencies: FAO, IFAD, UNEP, WEC National Governments (min of water resources/agriculture) Association(s) of agricultural producers: SAI Professional Associations: ICID Inter national Research Institutions: CPWF (incl. IWMI, IFPRI) Multilateral donors: World Bank, AFDB, ADB Environmental agencies / NGOs: WWF, Wetlands International Local Government Universities National research Agencies NGOs Local civil society

Question 3	**What are the overall effects of bio-fuels production with regard to: alleviating poverty, food security considering both the risk and the capacity to absorb food supply chocks by allowing a rapid reversing to food production, on natural resource management and environment, and on agriculture prices?**
	Bio-fuels (also called agro-fuel) are solid, liquid, or gas fuel consisting of, or derived from biomass. Bio-fuels can be produced from any carbon source that can be replenished rapidly e.g. plants. Bio-fuels reduce up to 60 - 80% of carbon emission as opposed to using fossil fuels such as petroleum and diesel. Bio-fuels are used globally with the most common use in automotive transport. Bio-fuel industries are expanding in Europe, Asia and the Americas. Sugarcane is the most important crop for producing bio-fuels today and the feedstock for more than 40% of all fuel ethanol. Corn ranks a close second: the primary source for bio-fuels production in the USA, it supplies nearly the same share of world fuel ethanol as sugarcane. Bio-diesel, produced mainly from rapeseed or sunflower seed, comprises 80% of Europe's total bio-fuels production. The EU accounted for nearly 89% of all bio-diesel production worldwide in 2005. Germany produced 1.9 billion litres, or more than half the world total. In 2005, Brazil produced 16.5 billion litres of fuel ethanol (45.2% of the world's total) with the USA a close second at 16.2 billion litres, or 44.5% of the total. Ethanol provides roughly 40% of Brazil's non-diesel fuel and 2 - 3% of USA non-diesel fuel. Brazil plans to expand production of bio-diesel, which must contain 2% by 2008, increasing to 5% by 2013. Colombia mandates the use of 10% ethanol in all gasoline sold in cities with populations exceeding 500,000. In Venezuela, the state oil company is supporting the construction of 15 sugarcane distilleries over the next five years, as the government introduces an E10 (10% ethanol) blending mandate. An EU directive has set the goal of replacing 5.75% of transportation fuel by bio-fuels by 2010 in all member states. In Canada, the government aims for 45% of the country's gasoline consumption to contain 10% ethanol by 2010. In Southeast Asia, Thailand has mandated an ambitious 10% ethanol mix in gasoline starting in 2007. For similar reasons, the palm oil industry plans to supply an increasing portion of national diesel fuel requirements in Malaysia and Indonesia. In India, a bio-ethanol program calls for E5 blends throughout most of the country targeting to raise this requirement to E10 and then E20. In China, the government is making E10 blends mandatory in five provinces. Important issues are: what investments, policies, and agreements are needed to ensure that the diversion of land and water resources for bio-fuels production does not offset national and international efforts to alleviate poverty and enhance food

	security? On the other hand a point would be if there are investments, policies, or agreements that can be made to increase the likelihood that bio-fuels production might be helpful in alleviating poverty and enhancing food security?"
Statement 1	*Bio-fuels will provide least developed countries and poor farmers with new opportunities for employment to improve their economy and livelihoods.* Of the world's 47 poorest countries, 38 are net oil importers, and 25 of these import all of their oil. Yet many of these countries have substantial agricultural bases and are well-positioned to grow highly productive energy crops. Bio-fuels could help to reduce poverty in the emerging and least developed countries, through increased employment, wider economic growth multipliers and energy price effects. However, it will have to be investigated whether such new opportunities will really substantially improve the conditions for poor farmers. Can bio-fuels also be coordinated from smallholder production? What have we learned about the link between poverty-reduction and livelihood improvement for small irrigators producing commodities now also being targeted for bio-fuels. Introduction of bio-fuels also provides farmers with higher returns, not only of the bio-fuel crops but also of their regular food crops: as many farmers convert to bio-fuels, the supply of staple food crops will reduce and prices increase, which can then make food production more attractive. Even with subsidies, economic savings with bio-fuels from avoided oil imports can be considerable: from 1976 - 2004, Brazil's ethanol production substituted for oil imports worth US$ 60.7 billion - or as much as US$ 121.3 billion including avoided interest that would have been paid on foreign debt. Bio-fuels rely on many of the same policy, regulatory or investment shortcomings that impede agriculture as a route to poverty reduction. As many of these shortcomings require policy improvements at a country level, rather than a global one, a country-by-country analysis of the potential poverty impacts of bio-fuels is required.
Statement 2	*Bio-fuels will raise the food prices - the poor will be the first affected* Due to rising demand for bio-fuels, farmers worldwide have an increased economic incentive to grow crops for bio-fuels production instead of staple food production. Without political intervention, this could lead to reduced food production and increased food prices. Impacts of this would be greatest on poorer countries or countries that rely on imported food for their subsistence. An increase in bio-fuels demand will lead to sustained higher food prices and adversely affect poor consumers in developing countries. Recent increases in corn prices were reportedly related to the opening of new bio-fuel plants. In early 2007 there were a number of reports linking stories as diverse as food riots in Mexico due to rising prices of corn for tortillas, the pasta price hike protest in Italy and reduced profits at Heineken, the large international brewer, to the increasing use of corn (maize) grown in the US Midwest for bio-ethanol production (the barley area was cut in order to increase corn production). The most recent UN report on bio-fuels also raises issues regarding food security and bio-fuels production. While the argument for bio-fuels in terms of energy efficiency and climate change are legitimate, the effects for the world's hungry of transforming wheat and maize crops into bio-fuels are 'absolutely catastrophic', and terms such use of arable land a 'crime against humanity'.
Statement 3	*Bio-fuels are detrimental for the environment* Bio-fuels aim to be carbon neutral. In practice, bio-fuels are not carbon neutral because energy is required to grow crops and process them into fuel e.g. fertilizer manufacture, fuel used to power machinery, and fuel used to transport crops and fuels to and from bio-fuel processing plants. However, using bio-fuels to replace a proportion of the fossil fuels that are burned for transportation can reduce overall greenhouse gas emissions.

	This does assume, however, that the land used for growing the crops would alternatively be desert or paved area. If the land was previously a (tropical rain-) forest, the carbon absorption of this forest should be deducted, which implies that the net effect of burning bio-fuels is an increase in greenhouse gasses. Also the 'displacement' effects of large-scale bio-fuels production, in terms of its direct and indirect role in promoting land use changes and soil carbon losses have to be incorporated The release of Nitrous Oxide (N_2O) among the commonly used bio-fuels, such as bio-diesel from rapeseed and bio-ethanol from corn (maize), can contribute as much or more to global warming than fossil fuel savings. Second generation bio-fuels production processes use non-food crops. These include the stalks of wheat and corn, wood, special energy or biomass crops and waste biomass. These processes could utilise the waste products of current food-based agriculture to sustainably manufacture fuel. It is important to note that carbon in waste biomass is used by other organisms, e.g. it is broken down in the soil to produce nutrients, and provides a habitat for wildlife. The large-scale use of such 'waste' biomass by humans might threaten these habitats and organisms. In some regions of the world, a combination of increasing demand for food, and increasing demand for bio-fuel, is causing deforestation and threatens biodiversity. The expansion of sugarcane plantations will place pressure on environmentally sensitive native ecosystems, including rainforest in South America. In forest ecosystems, these effects themselves will undermine the climate benefits of alternative fuels, in addition to representing a major threat to global biodiversity. The best reported example of this is the expansion of oil palm plantations in Malaysia and Indonesia, where rainforest and peat domes are being destroyed to establish new oil palm plantations. It is an important fact that 90% of the palm oil produced in Malaysia is used by the food industry Malaysian Palm Oil Council; therefore bio-fuels cannot be held solely responsible for this deforestation. There is a pressing need for sustainable palm oil production for the food and fuel industries; palm oil is used in a wide variety of food products. Various institutions have argued for a 5-year freeze on bio-fuels while their impact on poor communities and the environment is assessed. One problem with this approach is that economic drivers are required to push the development of more sustainable second generation bio-fuel processes: these will be stalled if bio-fuels production decreases. Supporters of bio-fuels claim that a more viable solution is to increase political and industrial support for, and rapidity of, second generation bio-fuels implementation from non-food crops.
Statement 4	*Bio-fuels production will increase the stress on land and water resources* Bio-fuels production will compete with food crops for scarce land and water resources, already a major constraint to agricultural production in many parts of the world. If all national policies and plans on bio-fuels are successfully implemented, an additional 30 million hectares of crop land will be needed along with 180 km^3 of additional irrigation water withdrawals. Impacts for some individual countries could be highly significant. China and India, the world's two largest producers and consumers of many agricultural commodities, already face severe water limitations in agricultural production, yet both have initiated programs to boost bio-fuels production. From a water perspective it makes a large difference whether bio-fuel is derived from fully irrigated sugarcane grown in semi-arid areas or rainfed maize grown in water abundant regions. The use of water-extensive oilseeds (such as Jatropha trees), bushes, wood chips and crop residuals (i.e. straw, leaves and woody biomass) is promising though these often are used as animal feed or organic fertilizer (compost). While some areas face water and land limitations, others have sufficient capacity, provided that productivity improvements materialize. Thus, production may take place in land and water abundant regions that are currently not involved in bio-fuels production.
(Types of) Organizations to be involved in	Farmer Associations, International Agencies: FAO, IFAD, UNEP, WEC National Governments (min of water resources/agriculture/economic affairs) Trade organizations: WTO, …

session consultations	Association(s) of agricultural producers: SAI Professional Associations: ICID Research Institutions: CPWF (incl. IWMI, IFPRI) Multilateral donors: World Bank, AFDB, ADB Environmental agencies / NGOs: WWF, Wetlands International, CARE, Watchdogs Bio-fuels production associations Local Government Universities National research Agencies NGOs Local civil society

Question 4	**In what aspects and how should local markets should be strengthened for farmers and national capacity for trade developed in the least developed countries to enable investing in improved agricultural practices and post harvesting processing activities generating employment, taking into account the complex interactions which typify the rural water sector, particularly the agricultural water sector?**
	Especially in least developed and emerging countries farmers have a specific role in the societies they feed: they are requested to produce food at a price that is affordable in particular to the poorest people living in cities. Through this role they guarantee social stability and as a counterpart, they pay little taxes. This role is very much related to the concept of food-sovereignty; it explains why food prices are not and most probably will never be simply regulated by market rules. Population dynamics and agriculture development are strongly and in a complex way interrelated. Increases in productivity require (or are the result of) increases of farm size and mechanisation (in addition to increase of inputs). These changes require farmers who are in a development mode and not in a survival mode. However, in many least developed countries, local markets are almost inexistant, and do not allow farmers to market they products, ranging from staple food to higher value crop products (e.g. vegetables, fruits). The development of such markets is key to move farmers out of the survival mode, since otherwise people living in urban zone may get imported food products cheaper than local ones. Question remains how different forms of market access and commercialisation may reshape livelihood opportunities for the poorest farmers? In these conditions, rural exodus is positive if it actually helps those who remain on their farms to develop their production. This is likely to be the case if the migrants are attracted to urban areas where they have alternative job opportunities. It is negative if migrants move to urban areas because they cannot survive anymore or if they are ready to accept the difficulties of slums or shanty towns. A good balance between farmers and poor population migrating to urban areas is therefore a key to development and to food sovereignty. Interactions between agriculture and natural resources (land, water, ecosystems) also need to be considered, this is especially the case in Asia and in the Near and Middle East where the density of population is the highest. It is also very relevant, as it is expected that, by far, most of the increase in production will have to come from existing cultivated land. This may imply: introduction of or improvement in water management, increase in cropping intensity, increased application of fertilisers and pesticides. Especially the last item may have far reaching implications for the environment and would require strong regulation to prevent very damaging consequences.
<u>Statement 1</u>	*Most of the poverty exists in rural areas in emerging and least developed countries. Increase in food prices will therefore contribute to reduction of poverty in rural areas in these countries, provided that poor farmers reach such a level of production that they can sell a substantial part of their yield and they retain land and water rights.*
<u>Statement 2</u>	*Before examining the relation between water and agriculture, it is fundamental to understand the dynamics of agriculture development that are related to population dynamics especially between rural areas and urban areas in emerging countries, and low agricultural productivity in least developed countries. It is also fundamental to understand the processes of agrarian change, and changing access to water and*

	land.
Statement 3	*The demand for production cannot be met with the existing structure and anticipated trends in irrigated and rainfed production, this need to change significantly, at national regional and global levels. The optimal mix of small-scale and large-scale systems under prevailing and expected future conditions will have to be identified*
Statement 4	*Most least developed countries have sufficient resources to be food self sufficient, but local markets are almost inexistent and do not allow a proper local food economy.*
(Types of) Organizations to be involved in session consultations	Farmer Associations, International Agencies: FAO, IFAD, UNEP, WEC National Governments (min of finance/agriculture/economic affairs) Trade organizations: WTO, … Association(s) of agricultural producers: SAI Professional Associations: ICID Research Institutions: CPWF (incl. IWMI, IFPRI) Multilateral donors: World Bank, AFDB, ADB Environmental agencies / NGOs: WWF, Wetlands International, CARE, OXFAM, Watchdogs Bio-fuels production associations Local Government Universities National research Agencies NGOs Local civil society
Process of session development:	1. Draft 1 of session description to be sent to key institutions for comments 2. Improved draft to be placed on website/included in announcements 3. Call for session participation (March 2008) and selection of candidates 4. Collaborative work to develop sessions, with or without resource base assistance

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