How to implement the CSD-17 message on water and agriculture

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Sustainable Development: How to implement the CSD-17 message on water and agriculture

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Abstract

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In the 21st century, agriculture and water are crucial for poverty alleviation, economic growth and sustainable development. Water is endangered as a natural resource base in both quantitative and in qualitative ways, water is crucial in assuring food supply and hydrological extremes create direct threats to human life. Agriculture is a major user of water withdrawals. Integrated land and water resource management is needed in Africa, the continent with the lowest food security. This report describes the CSD-17 messages on this topic, the discussion following the CSD-17, activities underway and recommendations for further implementation.

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Summary

In the 21st century, agriculture and water are crucial for poverty alleviation, economic growth and sustainable development. Water is endangered as a natural resource base in both quantitative and in qualitative ways, water is crucial in assuring food supply and hydrological extremes create direct threats to human life. Agriculture is a major user of water withdrawals. Integrated land and water resource management is needed in Africa, the continent with the lowest food security. For full implementation of the CSD-17 messages better *Integrated Land and Water Resources Management is needed.* To obtain further progress in integrated land and water resources management a number of key areas need to be addressed in Africa: *Water Resource Monitoring*: To monitor water resources with regard to quantity, distribution and quality, including variability in time and space and their interaction with all water use processes in order to provide a firm basis for the optimal development of Zambia's water resources. *Water Resource Planning*: To produce catchment outline plans for all catchments in Zambia that addresses inter-sectoral linkages in the management of water resources aimed at supporting cross-sectoral development needs and maximise the economic benefits accruing thereto. *Water Resources Infrastructure Development*: To achieve sustainable water resources development with a view to facilitate an equitable provision of adequate, quantity and quality of water for all competing groups of users at reasonable costs and ensuring security of supply under varying conditions. *International Waters*: To strengthen capacity of regional cooperation on shared water courses in support of regional development.
Research and Development: To develop innovative and appropriate approaches and technologies for the effective development of the national water resources; and *Adaptation to Climate Change in water resources management and development:* To strengthen capacity for mitigation and adaptation to effects of Climate Change in Water Resources Management and Development.

1 Introduction

From 4-15 May 2007 the 17th session of the UN Commission on Sustainable Development (CSD-17) took place in New York, USA. The focus was on Africa and the thematic issues, agriculture, drought and desertification, land and rural development. The meeting was chaired by Mrs. Gerda Verburg, Minister of Agriculture, Nature and Food Quality, from The Netherlands. The input to the meeting, as well as the CSD Final Adopted Text and the Shared Vision (which is integrated in the Final Adopted Text), to which the participants to the meeting agreed, warrant follow-up, hence the decision of the Government of The Netherlands on a series of subsequent actions. This report builds on CSD-17 and describes actions taken to spread the message and analyzes content wise what is already ongoing in Wageningen and what should further be done to strengthen the impact of the DGIS-LNV 'Agriculture, Rural Economic Development and Food Security' program and the impact of the interdepartmental programme 'Water Mondiaal' program of the Government of The Netherlands. The overall goal is to realize sustainable land and water development to enhance harvest security.

2 Findings of the CSD-17

The Commission on Sustainable Development meets annually in two-year 'Implementation Cycles', with each cycle focusing on one thematic cluster alongside cross-sector issues. Each cycle is comprised of a Review Year and a Policy Year.

Delegates to the 17th session of the UN Commission on Sustainable Development (CSD-17), which convened from 4-15 May 2009, at UN Headquarters in New York, focused on the thematic clusters of: 1) agriculture, 2) rural development, 3) land, 4) drought and 5) desertification while Africa received geographical focus. In addition to negotiating policy options related to six thematic cluster of issues, CSD-17 delegates also engaged in dialogues with Major Groups and the Policy Research Community.

The High-level Segment and Ministerial Roundtables focused on the food crisis, a sustainable green revolution in Africa and integrated management of land and water resources for sustainable agriculture and rural development. The results from the Ministerial Roundtables were summarized in a Shared Vision Statement which is annexed to the CSD-17 report.

Below the thematic cluster recommendations and practical measures to expedite their implementation are discussed. The results of the Round Tables as summarized in the Vision Statement are presented below as well.

Water in relation to agriculture was one of the cross-cutting themes of the CSD-17 and received special attention in all thematic clusters mentioned above. In this report the actions recommended and adopted by CSD-17 to achieve sustainability of the themes in relation to integrated management of land and water resources and capacity development have been considered. They are particularly important when trying to balance water needs for food and ecosystems. In line with the objectives of this paper, the analysis will also help to identify what areas would be most relevant for Wageningen UR (University & research centre) to support institutional and organizational change processes through capacity development. All other actions and recommendations can be found in the CSD-17 report (2009).

2.1 Thematic clusters

2.1.1 Agriculture

In the past few years, agriculture has risen once more to the top of national and international policy agendas. Agriculture lies at the centre of sustainable development. It plays a crucial role in addressing the food security needs of a growing global population and contributing to the progressive realization of the right to adequate food and is inextricably linked to poverty eradication and attainment of the internationally agreed development goals, including the Millennium Development Goals.

Practical measures to achieve this in relation to integrated management of land and water resources for sustainable agriculture and rural development are:

– *Sustainable soil, land, livestock, forest, biodiversity and water management practices, and resilient crops are essential.*

– *International, regional as well as national efforts to strengthen the capacity of developing countries to enhance agricultural productivity and to promote sustainable practices in pre-harvest and postharvest agricultural activities are urgently needed.*

One of the actions identified to create a strong enabling environment for sustainable agriculture are:
– *Provide increased technical assistance to developing countries to strengthen national innovation capacity, training and extension services in sustainable agriculture, fish, livestock and integrated crop-forest and crop-livestock production systems.*
– *Support the capacity of developing countries to rehabilitate and develop rural and agricultural infrastructure sectors.*

2.1.2 Rural Development

The achievement of the Millennium Development Goals is at the centre of sustainable development. Sustainable rural development is vital to the economic, social and environmental viability of nations. It is essential for poverty eradication since global poverty is mainly rural. A healthy and dynamic agricultural sector is an important foundation of rural development, generating strong linkages to other economic sectors and providing the necessary platform for further urban and industrial development. Rural livelihoods are enhanced through effective participation of rural people and rural communities in the management of their own social, economic and environmental resources by empowering people in rural areas, particularly women and youth, including through organizations such as local cooperatives and by applying the bottom-up approach. Rural communities in developing countries are still faced with challenges related to access to basic services, economic opportunities and some degree of incoherence with regard to planning related to rural-urban divisions. Investments in environmental protection, rural infrastructure and in rural health and education are critical to sustainable rural development and can enhance national well-being. The success of sustainable rural development depends on, inter alia, developing and implementing comprehensive strategies for dealing with climate change, drought, desertification and natural disaster.

Actions needed to build social capital and resilience in rural communities are:
– *Promote equitable access to land, water, financial resources and technologies by women, indigenous peoples and other vulnerable groups.*
– *Support training and capacity-building of rural communities to effectively implement adaptation programmes to climate change at the local level.*
– *Foster and strengthen capacities of rural communities for self-organization for building social capital, taking into account relevant legislation.*

Practical measures to strengthen the human capacities of rural people include:
– *Encourage rural communities' participation in decision making, promote rural communities' empowerment and rural leadership.*
– *Improve access by rural people and communities to information, education, extension services and learning resources, knowledge and training to support sustainable development planning and decision-making.*

Actions to ensure environmental sustainability in rural areas include:
– *Encourage more robust systems of land and water use to prevent land degradation.*
– *Encourage the use of environmentally friendly practices.*
– *Promote sustainable use and management of natural resources, including ecosystem conservation through community-based programmes.*

2.1.3 Land

Land plays a crucial role for achieving poverty eradication, food security and sustainable development. Sustainable land management provides multiple benefits, such as sustaining agricultural productivity and food security and enhanced living conditions for local populations, providing ecosystem services, sequestering carbon, more efficient use of the available and contributing to the regulation of climate.

The CSD calls for promoting policies to manage water and land resources in an integrated manner, through:
- *Promoting integrated land and water resource management in addressing land degradation, water scarcity and adapting to impacts of climate change.*
- *Promoting efficient, effective and sustainable use of water resources, including water diversification by exploring the sustainable use of groundwater and effluent waste, sustainable desalination, rainwater harvesting and support water conservation and demand management initiatives, balancing among different water uses in all ecosystems.*
- *Strengthening the coordination and cooperation among authorities responsible for managing water and land resources.*
- *Improving the efficiency of irrigation and water management practices, such as the use of rainfall harvesting, so as to increase buffer capacities and create more robust agricultural production systems.*
- *Addressing the threat of coastal erosion and land losses caused by sealevel rise, in particular in small island developing States and low-lying coastal States and areas, through land-use planning and climate change adaptation programmes.*
- *Addressing the problems, in particular in small island developing States, of saltwater intrusion into freshwater supplies and agricultural land.*

Measures to enhance capacity-building, technology transfer and financing include:
- *Promote and scale up the development, transfer, as mutually agreed, dissemination and adoption, as appropriate, of safe and science-based practices, products and technologies, including advanced technologies and corresponding know-how, that enhance the sustainable use of land resources, particularly for developing countries taking into account local conditions.*
- *Support countries' efforts, particularly in developing countries, to enhance the scientific understanding of land resources systems through strengthened technological capacity, including, as appropriate, support for testing research findings through pilot projects.*
- *Further develop and improve human resources and capacities, particularly in developing countries, for sustainable land management through education and training activities.*

2.1.4 Drought

Combating drought is necessary to achieving sustainable development goals, including the maintenance of ecosystem services, and improving the livelihoods of millions of people living in drought-prone regions. The effects of climate change heighten the risk of droughts and drought severity and increase the need for effective drought management and disaster risk reduction. Drought must be addressed in an integrated fashion with the other themes of the current Commission on Sustainable Development cycle, considering social, economic and environmental aspects. Strategies for drought management, including contingency planning should be incorporated into sustainable agricultural practices, soil conservation, crop diversification and integrated water resources management and combating desertification, taking into account the legal framework and mandate of the United Nations Convention to Combat Desertification 28 and its role in mitigating the effects of drought.

Actions needed to create a robust enabling environment for drought preparedness and mitigation:
- *Highlight the importance of integrated water resources management as called for in the resolution of the Commission at its thirteenth session.*
- *Promote North-South, South-South and triangular cooperation and partnering for capacity-building and improving effectiveness in planning, monitoring and implementation of drought management plans, including data gathering, information management, modelling and forecasting.*

Practical measures to strengthen the knowledge base and information sharing on drought, water stress and drought risk management include:
- *Promoting the exchange of information, experiences and lessons learned in relation to drought risk management and reduction and increase public awareness about traditional and adaptable practices.*
- *Increasing knowledge-sharing and information on weather forecasts and climatic conditions among relevant key stakeholders, and increase the capacity to use such information before, during and after drought events.*

CSD-17 also recommends actions to enhance capacity-building, technology transfer and financing. In that context the action relevant is:
- *Promote access to affordable, appropriate and necessary technology, and provide corresponding capacity-building to enable drought forecasting and planning, development of user-based drought-related management triggers across time scales, and sustainable management, including efficient use of scarce resources and arable land, as mutually agreed.*

2.1.5 Desertification

Desertification and land degradation in arid, semi-arid and dry sub-humid areas are global problems that require a global response through concerted efforts, as recognized in the United Nations Convention to Combat Desertification. Desertification and land degradation continue to adversely affect agricultural activities, rural and urban development, land use, water resources and efforts to eradicate poverty and hunger and promote health and well-being. Combating desertification and land degradation and mitigating the effect of droughts require policies that, inter alia, link land use, food security and livelihoods to the goals of sustainable development, taking into account the adverse impacts of climate change and land use on land degradation, biodiversity losses and desertification and on the achievement of the Millennium Development Goals.

Practical measures to combat land degradation and desertification in relation to water include:
- *Promote sustainable land use and livelihoods, enhanced soil productivity, water use efficiency and greater tenure security for people living in the affected areas, including pastoralists.*
- *Promote sustainable water management and efficient irrigation, water conservation and utilization of alternative water sources, including flood water and subsurface flows.*
- *Support appropriate traditional practices and local knowledge concerning land use, water management and agricultural activities.*
- *Encourage land users to invest in soil and water conservation, including through land tenure security and access rights to land and natural resources for the rural population, particularly women, indigenous people and other vulnerable groups.*

Actions are also needed to enhance capacity-building, transfer technology and financing:
- *Support the improvement of existing and the establishment of new centres of excellence and monitoring in developing countries to combat desertification and promote capacity-building to adopt and implement, inter alia, integrated techniques for the conservation of natural resources and their sustainable use,*

and invite regional and international programmes and funds as well as donors to provide support to affected countries in their endeavours to combat desertification.
- *Support the establishment of and strengthen existing disaster management capacities at all levels, including information and early warning systems that allow effective management of the risks associated with drought, desertification, land degradation and the adverse impacts of climate change.*
- *Support developing countries in the development, deployment and diffusion of technologies on mutually agreed terms, including the sharing and scaling up of best practices and lessons learned in approaches undertaken at all levels to combat desertification such as sustainable agricultural practices, and conservation and rehabilitation of vegetation cover.*
- *Build the capacity of affected communities to address the impacts of desertification by promoting participation, including through participatory approaches that involve civil society, local communities, indigenous people and other major groups, in particular women in decision-making and policy formulation.*
- *Invest in sustainable land management, including land-use planning, sustainable management of forests and other natural resources, as it relates to combating desertification and land degradation in arid, semi-arid and dry sub-humid areas.*

2.2 Africa

Strong economic performance in Africa is needed to ensure an enabling environment for sustainable development. African countries have taken the leadership in addressing sustainable development challenges, including challenges for sustainable agricultural development, and charting the way forward at the local, national, regional and continental levels. Nonetheless, average gross domestic product growth remains below the minimum target of seven per cent set by the New Economic Partnership for African Development and has often occurred in sectors with little impact on employment and income for the majority. Africa still faces challenges in meeting the Millennium Development Goals targets, which are not on track, inter alia, as a result of poorly developed infrastructure, the lack of institutional capacity, and the continuing needs for investment in agriculture. Africa needs a green revolution to help to boost agricultural productivity, food production and national and regional food security in a way which supports ecosystem functions. This would provide a strong foundation for addressing rural poverty, land degradation, drought and desertification. The ongoing multiple global crises pose a serious challenge to the sustainable development prospects of Africa, including sustainable agricultural development. Actions are therefore required at the local, national, regional and global levels to support the ecologically and socially sustainable use of natural resources, the diversification of African economies as well as an African green revolution and the economic, social and environmental dimension of Africa's sustainable development.

To revitalize agriculture as a basis for sustainable rural development actions to be taken in relation to water, capacity development and promotion of an enabling environment, it is suggested to:
- *Ensure the equitable and sustainable use, as well as promote integrated management and development, of national and shared water resources in Africa, in accordance with existing international agreements.*
- *Facilitate and support the strengthening of commercial and technical capacity of farmer organizations, including through extension services architecture.*
- *Support and strengthen Governments' capacities to manage their resources by strengthening and adhering to their policies and legislations.*
- *Encourage and support African regional economic organizations to play a key role within the context of the ongoing multiple global crises. Regarding food security, underline the key role that regional economic organizations should play in terms of support to and coordination of national strategies and policies for agricultural development and food security, improvement of the institutional environment for the agricultural economy and sustainable management of trans-boundary water resources, in accordance with international agreements.*

2.3 CSD Vision statement

During the High Level Segment of the Seventeenth Session of the Commission on Sustainable Development, Ministers, other heads of delegations, representatives of Major Groups and representatives of United Nations bodies shared their vision on the topics of fundamental importance to our economies, societies and to the future of sustainable development: agriculture, rural development, land, drought, desertification and Africa. In roundtables three themes were discussed:

1. Responding to the food crisis through sustainable development.
2. Realizing a sustainable green revolution in Africa.
3. Integrated management of land and water resources for sustainable agriculture and rural development.

The discussions were summarized in a vision statement.

The vision statement highlights deep interconnections among agriculture, rural development, land, drought, desertification and Africa. It also stresses their close relationship to eradicating hunger and extreme poverty and addressing climate change. The vision paper emphasizes the close link between agriculture and water and recognizes the many competing claims on water.

The CSD vision paper emphasizes:

- Need for an integrated response to multiple challenges.
- Urgency of appropriate national and international action and greater cooperation to bring about a paradigm shift and to realize a truly sustainable green revolution.
- Need to put sustainable development of agriculture on the international agenda and developing countries at the center of the agricultural and rural revival.
- Need for political will, including investments in agriculture, a supportive enabling environment, fair prices for produce, fuller integration of markets and greater international market access.

The multiple challenges the world is facing in terms of climate change, degradation of ecosystems, the food insecurity, the financial crises and resulting economic recession require an integrated response that ensures that short term emergencies are addressed while developing long term strategies within the framework of sustainable development. The Ministers underlined the central role agriculture plays in sustainable development. It was emphasized that sustainable agriculture should be put on the international agenda again to lay the foundation for bio-based economies of the future.

Concerning the interactive round discussion of the Commission's High-Level Segment of the Seventeenth Session of the Commission on Sustainable Development, the outputs of theme 3, Integrated management of land and water resources for sustainable agriculture and rural development, will be the focus of this analysis.

The High Level Segment recognizes that agricultural water productivity has to be increased significantly and potentials of adequate and efficient water management should be explored through changes in policy and production techniques. Integrated management of land and water resources is seen as crucial for sustainable rural development and for ensuring food security for growing population. Sustainable land and water management plays a crucial role for achieving poverty eradication, food security and sustainable development. It provides multiple benefits, such as sustaining agricultural productivity and food security, enhancing living condition for local populations, generating ecosystem services and sequestering carbon.

Promoting sustainable land and water management will require effective land administration, equitable land access, integrated planning, broad participation and improved dissemination of knowledge and good practices. Small-island developing states are facing specific challenges in addressing sustainable land and water management in the face of climate change.

In response to the decreasing availability of water in many regions, there is a need for better water management, protecting ground and surface waters from pollution, enhancing availability of scarce water resources including through conservation and efficiency gains, and considering the ecological impacts of water use and pollution.

Achieving water productivity gains in rain-fed agriculture is especially urgent. Access to safe drinking water and sanitation services in rural areas, where coverage remains low, is crucial for preventing disease, promoting rural development and ensuring the attainment of the Millennium Development Goals.

3 Support for the CSD-17

A number of recent outcomings coincide with the CSD-17 results. Only a few outcomings in which FAO and WB are involved are mentioned here.

3.1 Food Security and Agricultural Mitigation in Developing Countries: Options for Capturing Synergies

The FAO report 'Food Security and Agricultural Mitigation in Developing Countries: Options for Capturing Synergies' (November 2009) calls for a more holistic vision on food security, agricultural mitigation, adaptation and development. Without a holistic vision synergies may not be maximized and trade-offs may not be minimized. Synergies between food security and agricultural mitigation are mostly found in strategies for agricultural intensification and for increased resilience of the food production system, while trade-offs tend to occur with changed land use. Synergies between food security and agricultural mitigation can be reached by increased available water in the root zone through water management. This stimulates biomass production that can be marketed and consumed, but it will also increase the amount of above-ground and root biomass that is returned to the soil. The biomass that is returned to the soil improves soil organic C concentration. To increase available water in the root zone measures that can be taken include irrigation and drainage measures, conservation tillage and improved soil nutrient management. Whilst these recommendations support the CSD-17 objectives, some further elaboration of the proposed strategies is needed with regard to the synergies and trade-offs with other uses of natural resources and biodiversity.

3.2 Declaration of the World Summit on Food Security

From 16 till 18 November 2009 the Heads of State and Government attending the World Summit on Food Security declared that they shall reverse the decline in domestic and international funding for agriculture, food security and rural development in developing countries, and promote new investment to increase sustainable agricultural production and productivity, reduce poverty and work towards achieving food security and access to food for all. The Heads of State also want to substantially increase the share of Official Development Assistance devoted to agriculture that fell from 19% in 1980 to 3.8% in 2006 and call on international financial institutions and regional development banks to do so likewise. This would mean that more financial resources would become available to implement programmes that support rural and agricultural sustainable developments. When it comes to the strategic objectives for implementation (point 10) the declaration refers to regional implementation. In this case for Africa the Comprehensive African Agriculture Development Programme (CAADP) under NEPAD is the framework to support agriculture and food security. The CAADP pillar 1 framework addresses integrated land and water management and is therefore also for the CSD follow-up a framework for guidance in the Water Mondiaal programme. Market Access, Food Supply and Research are the other three pillars of the CAADP that are less linked to the production side with its associated use of water and land resources. The OS-LNV programme 'Agriculture, rural economic development and food security' is related to the CAADP. Within the CAADP Nepad aims to provide a platform for delivering comprehensive support to agricultural water in Africa and has called on Wageningen UR to provide such services.
Under the same point the declaration refers for implementation in a.o. Indonesia, Vietnam and Bangladesh to the ASEAN integrated food security (AIFS). The AIFS framework has four components to improve harvest

security: addressing emergency situations, sustainable trade, information systems and innovation. It includes implementation of IRRI's Rice Action.

3.3 World Bank report 'Convenient Solutions to an Inconvient truth: Ecosystem-based Approaches to Climate Change'

In June 2009, the Environment Department of the World Bank together with the IBRD issued the paper Convenient Solutions to an inconvenient truth: Ecosystem-based Approaches to Climate Change. It aims to describe the best measures and instruments the WB has at its disposal to support better management of ecosystems that are resilient to climate change and contribute effectively to mitigation. With regard to the CSD-17 outcome the following elements in World Bank projects could and should receive stronger emphasis:

- Protection of terrestrial, freshwater and marine ecosystems and ecological corridors to conserve biodiversity and ecosystem services.
- Integrating protection of natural habitats into strategies to reduce vulnerability and disaster risks.
- Scaling up country dialogue and sector work on valuation of ecosystem services and the role of natural ecosystems, biodiversity and ecosystem services in underpinning economic development.
- Emphasizing the linkages between protection of natural habitats and regulation of water flows and quality of water, essential for agriculture, food security and domestic and industrial supplies.
- Scaling up investments for protected areas and natural ecosystems.
- Promoting greater action on management of invasive species, which are linked to land degradation and impact negatively on hood security and water supplies.
- Emphasizing the multiple benefits of forest conservation and sustainable forest management (carbon sequestration, water quality, biodiversity conservation, etc.)
- Promoting investments in natural ecosystems as a response to mintgation (avoided deforestation) and adaptation (wetland services).
- Integrating indigenous crops and traditional knowledge on agrobiodiversity and water management into agricultural projects as part of adaptation strategies.
- Promoting more sustainable natural resource management strategies linked to agriculture, land use, habitat restoration, forest management and fisheries.

As far as Africa is concerned the Zambezi basin (Zambia and Mozambique) can benefit from this approach as better food security can be achieved in combination with better carbon sequestration and water security, while for the Niger basin food security can be strengthened when using the approach advocated in this World Bank report. Given the resources the World Bank has, this could substantially help in achieving the CSD-17 goals.

3.4 World Bank report 'Agricultural Development under a Changing Climate'

In August 2009, the World Bank issued the paper Agricultural Development under a Changing Climate: Opportunities and Challenges. The report is a joint effort of the agriculture and rural development and environment departments. To allow for an overview of what is discussed in the document, its contents is given in Table 1.

Table 1

The contents of the World Bank joint departmental discussion paper on Agricultural Development and Climate Change.

	Title	Sections	*Remarks*
1	Introduction	I. Climate Variability, Climate Change, and Extreme Events II. Effects of Temperature Rise III. Effects of Crop Water Stress IV. Effects of Secondary Climate Change Impacts V. Regions Vulnerable to Climate Change	*Provides a broad introduction of how climate variability and change could affect agriculture*
2	Regional impacts	I. Sub-Saharan Africa II. Middle East and North Africa III. Europe and Central Asia IV. South Asia V. East Asia and Pacific VI. Latin America and the Caribbean	*Reviews the projected impacts of climate change on specific regions; impacts common across regions - such as land degradation, water shortages, and pest infestation - are examined in detail in subsequent chapters*
3	Vulnerability, adaptation and development	I. Vulnerability II. Adaptation III. Rural Development Policies and Adaptation	*Provides an overview of issues related to vulnerability, mainstreaming adaptation into agricultural development, adaptation considerations in rural policies, and enhancing knowledge and information flows to support adaptation. Change could negatively affect future plant-breeding efforts. It also examines seed systems as they relate to climate risk management and adaptation*
4	Climate information	I. Understanding and Managing uncertainty II. Using Climate Information for Adaptation and Development in Agriculture	*Explores issues of climate-scenario generation for agricultural applications and technical progress and capacity-building needs in climate-crop modelling, seasonal climate forecasting, and early warning systems*
5	Water	I. Climate Change and Agricultural Water Management Planning II. Rainfed Agriculture and Adaptation III. Irrigated Agriculture and Adaptation IV. Adapting Agriculture in Flood-Prone Areas	*Discusses impacts and adaptation issues related to water use for rainfed and irrigated production systems, as well as adaptation options for flood-prone agricultural areas*
6	Sustainable land management, adaptation and mitigation	I. Opportunities for Linking Adaptation and Mitigation II. Agricultural Land Management III. Market-Based Approaches to Promote Adaptation in Agriculture IV. Livestock Management in a Warming World	*Discusses options for combining mitigation with adaptation in the agricultural sector and examines adaptation options for sustainable land management and for livestock*
7	Crop genetic diversity and seed systems	I. Advances in Plant Breeding II. Conservation of Agricultural Genetic Diversity for Adaptation III. Seed Systems and Adaptation	*Discusses progress toward developing crop cultivars that will be better adapted to future climate change and how the potential loss of agricultural biodiversity from climate*
8	Pests and climate change	I. Impacts of Climate Change on Agricultural Pests II. Adaptation Options for Managing Pests III. Food Safety and Climate Change	*Examines how climate change could influence pest and disease pressure in agriculture, and it identifies potential adaptation options*
9	*Economic Diversification Peri-Urban and Urban Agriculture*	I. Climate Variability, Climate Change, and Extreme Events II. Effects of Temperature Rise III. Effects of Crop Water Stress IV. Effects of Secondary Climate Change Impacts V. Regions Vulnerable to Climate Change	*Discusses diversification strategies for agriculture, with particular focus on rural microenterprises, high-value enterprises, and peri-urban agriculture*

The overall message is a positive one. Farmers, assisted by governments, should, and can, adapt to the changing conditions. The 'across the board' adaptation measures include (as can be read in the Introduction):

- Improving access to new varieties and other production factors, which can help farmers improve overall production and better manage risks from droughts and floods.
- Enhancing the resilience of the resource base to extreme climate events through conservation agricultural practices that protect soils against runoff and erosion, promote biodiversity, and conserve water.
- Modernizing irrigation systems, which can increase water-use efficiency, bring greater flexibility to water delivery for agriculture, and help farmers diversify to better manage climate risks.
- Improving coordination around the containment and management of invasive alien species, which is needed for managing both current risks from invasive species and for building the capacity to cope with an expected increase in this risk with climate change.
- Creating opportunities for rural livelihood diversification, which can lead to increased economic security and less reliance on climate-sensitive activities (P. XIX, XX).

In the remainder of this section we will look at Chapter 5 on Water. Having said this, also Chapter 6 strongly supports the discussion at the CSD-17. The water resource management measures suggested by the World Bank, as summarized in the introduction, are read as follows:

> *Better capture and storage of rainwater is a key strategy for managing climate risks in rainfed agriculture. Rainwater harvesting methods range from simple technologies that increase the capture of surface water flow and concentrate runoff to more complex measures for storage of water in macrocatchments. In irrigated agriculture, policy reform measures that push water costs closer to its shadow price through changing incentive structures, and efforts to modernize irrigation infrastructure through both 'hard' (control structures to reduce seepage and evaporation) and 'soft' (institutional reforms to create more demand responsiveness) measures are important for helping agriculture adapt to future climate risks. Measures to improve water productivity (the conversion of water into food) through conservation tillage, improved soil fertility management, use of improved crop varieties, and better crop pest management are important under current climates and will become increasingly so for managing risks from climate change (P. XX).*

The emphasis is on the development of the entire water chain. This is congruent with the concept of Green Economy as developed by the CSD-17. Rainwater is the starting point and special efforts are needed to use rainwater as efficiently as possible, but also to plan rainwater use (and water from other sources, as snow layers, other natural and manmade reservoirs, groundwater) carefully when it passes through a river basin down to the lowest point in a delta. The World Bank links water management directly to land management and to crop management.

It is noted that in the excerpt above, mainly technical and to some extent institutional aspects are mentioned. Not mentioned is the need to provide security of title to resource uses, including security of titles to land and water by small farmers. This aspect is not forgotten and is also considered important. It is mentioned in the Introduction:

> *land tenure and resource ownership policies are complementary to the adoption of adaptation measures and do not exclude marginal groups that are often the most vulnerable to climate risks.*

Chapter 5 discusses three issues: rainfed agriculture, irrigation, and flood protection. In accordance with the subject of the report, the three subjects are discussed in relation to agricultural production. Note that under the heading irrigation, the importance and role of land drainage is explained in detail (see further below). The general, but nevertheless important, statement is made that the need for integrated approached (IWRM)

increases under conditions of climate change, and more attention for ecology and social equity. IWRM becomes more complex than it already was.

Note: rainfed agriculture produces 60-70% of the world's food in 80% of the world's countries (p. 66). There is good potential for increasing yields and productivity in rainfed systems, through water and soil management measures; rainfed systems have largely been ignored in development programmes. Rainfed agriculture can and should be made more productive, by means of locally adapted water buffering systems, both at small scale level, and at macro level. Again a broad perspective is favoured, including the need for:

> *Reducing socioeconomic barriers to adoption by supporting rural finance, including social fund financing and local credit systems, community-based management through forming cooperatives, village labor and water-user organizations that can initiate cost-sharing and labor-saving measures, and local organizations for governing the resource (p.73).*

Irrigation systems throughout the world are in need for upgrading (although the term 'upgrading' needs further specification to express what is actually needed). The opening statement concerning irrigation systems is alarming:

> *The reliance on irrigation in its current configuration will be difficult to sustain because of large-scale over-appropriation of water for irrigation (which accounts for approximately three-quarters of water withdrawals in the developing world), widespread degradation of soils in irrigated areas from water-logging and salinity, increasing demographic pressures, and competition for water by industrial sources as societies develop. Higher temperatures, more variable precipitation, and increased salinization risk resulting from climate change will further exacerbate these problems, particularly in areas where unsustainable extraction of irrigation for agriculture is widespread, such as the Middle East and North Africa, Central and South Asia, and northern China (p.74).*

The report calls for:
1. Reformulating irrigation policies.
2. Engaging water users.
3. Enhancing water productivity.
4. Improving water management in irrigated rice systems.
5. Expanding the economic and environmental viability of marginal water sources.
6. Expanding the area under irrigation.

Not explicitly mentioned, but here it must be stressed under the heading 'reformulating irrigation policies' that huge investments are required to make water provided by irrigation systems more productive. It is disappointing that this point is not elaborated in the text of the Worldbank. The emphasis in on economic instruments, like allowing the price of water to come as close as possible to its shadow price. Further down in the report, on p. 80, the need for modernization of irrigation systems is discussed and here it is said that canals should be lined, sprinkler systems should be installed, etc; all efforts to give farmers increased control over water.

Drainage is seen as part of the solution, especially in relation to salinization (note: drainage has much relevance in other settings as well). It is said that the following is required:
- Integrating drainage with irrigation planning, because the two are currently viewed as separate entities and coordination is lacking.
- Building capacity of institutions responsible for drainage management to work with stakeholders under an IWRM framework.

– Developing an enabling legal framework to set up levy fees for drainage user organizations, initiate cost sharing with non-agricultural beneficiaries, and engage with the private sector.
– Address agricultural policies that externalize poor water management and fertilizer pollution, as these exacerbate the impacts of poor drainage (see also World Bank, 2006b).

The report continuous with explaining more interventions that can and should be taken.

Throughout the report the need for capacity building, joint learning processes between local water users and experts, the need to promote comprehensive rural development and the need for dissemination of adaption-relevant measures is stressed.

The report is very practical in the approach to the problems that it discusses. In that sense it builds on the CSD-17 output, which provides the global support for this approach.

It can be concluded that the World Bank report provides many practical and necessary measures to deal with the issues that both the World Bank report and the CSD-17 final report identify as being critical for the wellbeing of mankind in the future.

4 Focus in CSD objectives related to water

Introduction
A large number of topics were discussed during the CSD-17. These discussions have resulted in a list of policy options and practical measures, covering the themes agriculture, rural development, land, drought, desertification and Africa. The scope of these proposed interventions is much broader than water issues only, whereas many recommended interventions cover more than one theme.

The recommended interventions were, therefore, scrutinized on water aspects and the topics that are directly or indirectly related with water were identified. This has resulted in the following 'long list' of water issues. They have been tentatively grouped into 'Strategic and operational management', 'Water resources management, 'Water for agriculture and ecosystems', 'Institutions and Human Resources' and 'Miscellaneous'. In the next chapter they will be worked out into a 'short list'.

4.1 Long list

Strategic and operational management

- Integration climate, food and energy
- Integrated land (use) and water resource management
- Supporting ecosystem functions through biodiversity, water, land, and forest management
- Integrated nutrient management
- Response to desertification, land degradation, drought, natural disasters
- Resilience of rural communities to climate change and natural disasters
- Upscaling climate change adaptation
- Drought (risk) management
- Weather insurance schemes
- Timely information and early warning systems
- Seasonal and multi-year forecasting
- Assessment methodologies
- Indicators and benchmarks
- Drought indices
- Data collection / remote sensing

Water resources management

- Sustainable and efficient water resources development and management
- Water harvesting and storage
- Water conservation (and utilization of alternative water sources)
- Water quality
- Saltwater intrusion

– Ground- and surface waters protection
– Water treatment and desalination
– Water reuse
– Soil conservation and improvement
– Management coastal zones, marine fisheries, wetlands
– Demand management
– Trans-boundary water resources
– Coastal erosion and land losses (by sea-level rise)

Water for agriculture and ecosystems

– Agricultural water productivity (general)
– Water productivity in rain-fed agriculture
– Irrigation and water management efficiencies
– On-farm soil and water management / soil water retention
– Drought- and flood-resilient seeds and crop varieties
– Salt-resilient crop varieties
– Sustainable bio-based products, bio-energy / bio-fuels
– Agro-industries
– Agro-ecological practices
– Development of non-primary production activities
– Ecological impacts of water use and pollution
– Management of biodiversity, control of invasive species

Institutions and Human Resources

– Integration of indigenous and state-of-the-art knowledge and practices
– Cooperation and knowledge-sharing
– Capacity-building
– Empowerment (small farmers, women, youth)
– Participation (communities and multi-stakeholders)
– Partnership development

Miscellaneous

– Drinking water and sanitation services
– Disease prevention (waterborne diseases)
– Small-island developing states

4.2 Short list of water issues

On the basis of the long list a short list was composed, in which the water issues are clustered under six main subjects. These six subjects are addressed by the various projects conducted by Wageningen UR (University & Research centre), either financed by LNV or by other clients. In this report examples are given of some projects in these fields. The scope of these projects generally does not entirely cover the six subjects. Where deficiencies exist suggestions for future projects (KB or otherwise) will be identified. The short list and the related projects may also be used to support LNV international policies and performances on international platforms. The six subjects cover the three dimensions of water: safe water (timely deliveries of sufficient

water of good quality for all demands), safe harvests (maximum production per drop), and safe life (no loss of lives or property because of water disasters).

4.2.1 IWRM

The holistic planning and management of water resources is required to ensure economical viability, social equitability (e.g. equitable access to land and water resources) and environmental sustainability. Integrated land and water resource management is also required to effectively respond to climate change and the (associated) desertification, land degradation, drought and natural disasters. For resources management and rural development effective stakeholder dialogues and broad, genuine participation of communities need to be materialized. Small farmers, women and youth need to be empowered.

4.2.2 Agricultural production

Agriculture is key to sustainable rural development. Intensifying agriculture is critical for ensuring food security for a growing population, including a response to major environmental change such as desertification, land degradation and drought. The water productivity should be increased, especially in rain-fed agriculture, e.g. through green water management and the scrutinous ('wise') selection of production locations. On-farm soil and water management should be improved and soil water retention systems enhanced. Also irrigation and water management efficiencies need to be improved. Drought-, flood- and salt-resilient seeds and crop varieties need to be developed and the opportunities and impacts of bio-based products and bio-fuels addressed. Considering the changing global demography and production chains attention should also be given to agroparks.

4.2.3 Water management

Unprecedented pressures on water (and land) resources result in scarcity, pollution and increasing competition among uses. Moreover in many regions the climate change will result in greater temporal and spatial variability, imposing increased risks of floods and droughts Therefore, major attention should be directed to sustainable water resources development and management, with increasing attention to water quality issues, resource protection and trans-boundary water resources. To respond to water scarcity and climate change water harvesting and water conservation methods need to be developed and implemented, as well as water reuse facilities and innovative water treatment and desalination. In addition to these 'supply management' options also water demand management needs to be further developed. The implications of saltwater intrusion, coastal erosion and land losses should be addressed, especially in coastal zones and small-island developing states.

4.2.4 Land management

The global climate change and other pressures on land have resulted in overexploitation, environmental degradation and desertification. Sustainable land use is critical to rural development. Sustainable and climate-resilient agro-ecological practices need to be developed to make communities more resilient. Adaptation and mitigation methods and strategies need to be upscaled. In rural areas the biodiversity should also be managed. Given their huge negative impacts on biodiversity and water resources invasive species must be controlled or eradicated. Sustainable rural development may implicate that current agricultural practices

be abandoned, land and water resources be reallocated and non-primary production activities (e.g. tourism) be developed.

4.2.5 Assessment and evaluation methods

Methodologies need to be developed to monitor, assess and respond to desertification, land degradation and droughts. To anticipate climate change and droughts seasonal forecasting and multi-year climate predictions are needed. Information and early warning systems need to be implemented.

4.2.6 Knowledge management

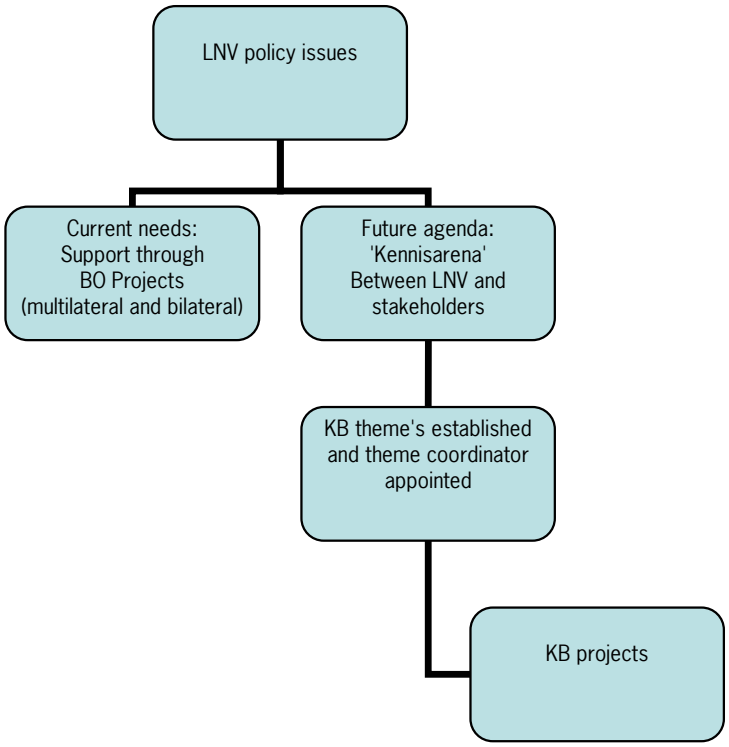
Traditional and indigenous knowledge should be integrated with modern technologies and the latest scientific knowledge about agriculture and the roots of sustainability. Countries have to share experiences and innovative technologies and cooperate in training and developing human capacities. Improved dissemination of knowledge and good practices is critical. Special attention should be focused to small farmers, women and youth.

5 Research and capacity building in Wageningen

The issues listed in the previous chapters are not entirely new and many of these issues have been addressed in research activities by Wageningen UR. In this chapter some examples of projects are presented that deal with the 'short list'. These projects merely serve as illustration and do not necessarily represent the full picture of the Wageningen UR activities on these water related issues.

5.1 Ongoing research in Wageningen supported by LNV

LNV policies are supported by Wageningen UR through so-called BO (short term) and KB (long term) projects, as illustrated below:



The coming years some of the Wageningen UR knowledge based **(KB)** research projects will provide results relevant for increasing water effectiveness in sustainable food production. For more direct policy support of LNV **BO** projects are executed for LNV.

5.1.1 IWRM

KB MIRAGE (Mediterranean Intermittent River manAGEment) assesses ecological integrity (or ecological status in the words of the European Water Framework Directive) in Mediterranean temporary streams. MIRAGE develops practical measures necessary to manage their impact on nutrient dynamics, toxic substances and organic matter and links this to integrated flood management. Since intermittent rivers are quite common in Africa (e.g. Limpopo, Save, Luangwa) lessons learned from the Mediterranean basins may also benefit intermittent rivers in Africa.

KB Prediction of drought in ungauged river basins further develops the physical model SIMGRO for large basins to predict the duration and severeness of drought, including the uncertainty in the prediction. The model is calibrated with data from the Pantanal in Latin America and the results have been made available to UNESCO in the FRIEND programme. As many African river basins have deficient or incomplete data the work can be further developed for basins in Africa, which will contribute to the increase of harvest security in data scarce production areas.

KB Soft coastal defence is a project focusing on embryotic walking dunes, wash-overs and tidal gullies in and around the Waddenzee. Soft coastal defence may reduce the flooding risks of populated areas and at the same time create morphological changes that enhance ecosystems development. Many deltas in the world face the challenge to adapt to climate change and the lessons learned in this project may well be very valuable for other deltas and be utilized in the Water Mondiaal programme.

5.1.2 Agricultural production

BO Policy support by Wageningen UR

In terms of policy support in the field of water Wageningen UR is currently active with research and training. Sustainable agriculture and ecosystems conditions under climate change with increasing water scarcity have a focus within the three general themes 'Robust Systems', 'Chains of sustainable products' and 'Scarcity and distribution'. Strengthening robustness of systems and coping with increasing scarcity are goals that require further operationalization, both in research and in training. The aim is to develop a comprehensive development and management of water, land and related natural resources for economic development as well as a sustainable green environment and social justice. This will be achieved by addressing specific topics within the activities under the general themes:

- *Robustness and Resilience of Systems*
  Expected consequences for agriculture of climate change include salinization and waterlogging issues, and larger inter-season yield variations. This will be tackled by increasing the adaptive capacity of agriculture and food production systems. Projects include:
  - BO-10-001-009-003 Climate and Adaptation (In Ethiopia a course on adaptation to climate change in agriculture and natural resource management is development, the LNV-FAO dialogue is supported and two cases studies (Central Rift Valley and Certifying forest coffee) in Ethiopia are studied (C. Terwisscha van Scheltinga)).
  - BO-10-001-009-107 Development of feasible sustainable agriculture strategies in a climate change context in Ethiopia (see BO-10-001-009-003).
  - BO-10-001-009-108 Increasing robustness of agricultural productivity and ecosystem conditions under water scarcity and drought in Turkey (Effects of water scarcity and possible mitigation measures are discussed with authorities and tested in Büjük Menderes (J. Harmsen)).
  - BO-10-001-009-109 Impact assessment: Incentives for Good Agricultural Practices (Two supply chain cases in Indonesia are described and analyzed for possibilities to comply with GAP (D. Boselie)).

  - BO-10-001-009-112 Assess the demand for weather index-based insurance as a means of adaptation to climate change (In Kenya and Ghana climate and cropping possibilities are studied including a survey among farmers (G. Meijerink)).
  - BO-10-001-009-113 Land Dynamics in Argentina (A workshop with the AACREA farmer association (J. Stoorvogel)).
- *Scarcity and distribution*
  The challenge of fair distribution of resources for the production of raw materials, whilst achieving food security, biodiversity and Water for Food and Ecosystems. To improve food security Wageningen UR works for LNV and OS, contributing to the 'Agriculture, rural economic development and food security' programme of OS and LNV. Integrated approaches for Water for Food and Ecosystems are being developed, that capture water quantity, water quality and changes in climate and land use. Projects include:
  - BO-10-001-011-005 Competing claims (Competing claims between food and biofuels are analyzed for their consequences on water and ecosystems based on models at national scales and discussions with stakeholders on local scales (E. Arets)).
  - BO-10-001-011-100 Water saving greenhouse technology for the Gulf region (A design for a demonstration site for water saving greenhouse technology is presented in Saudi Arabia and the United Arab Emirates (J. Campen)).
  - BO-10-001-011-107 Greening Saudi Arabia: The 2x2 challenge (Sustainable water management in the Kingdom of Saudi Arabia is discussed in three workshops to do more with less water in local agriculture (K. Roest)).

In the **KB Spearpoint water** (KRW/Waterpas) project a number of objectives are formulated. This includes improvements in the simulation model for grass production, including the associated costs and economic benefits for the farm economics programmes. In addition the model multi-SWAP will be able to evaluate more efficient and better nutrient management in the soil, while alternatives for the HELP tables (predicting drought losses on Dutch crops) are also being studied.
KB Integral design for sustainable horticultural crop production results in a method for the design of protected horticultural production systems meeting the local requirements and geared towards the international market. This tool will be useful, as horticulture will play a role in increasing harvest security in Africa and South Asia.
KB Improving crop establishment and harvest planning in African vegetables is a project with two elements: 1) Improving seedbed management for vegetables that are transplanted from seedbeds to the final production plots and 2) Develop planning tools to meet the market requirements.

5.1.3 Water management

KB The role of organism and in particular under-water plants aquatic ecosystems in Dutch ditches (PLONS) will be studied and the results will be used for recommendations to enhance biodiversity, water quality and nutrient recycling in the management and maintenance of ditches. The results might be applicable in ecosystems with comparable conditions.
KB Sedimentation in wash lands. Optical techniques are being developed to determine the age of sediments and combined in databases. This will result in better estimations of the potential to remove sediments from the Rhine wash lands in order to adapt the river capacity to the consequences of climate change. The results of this project are geared towards the Dutch situation. It is only in the long run that delta's in Water Mondiaal may benefit from this project.

5.1.4 Land management

KB LUPIS is a project on the ex-ante assessment of land use policies. It builds on SENSOR, a project that has built the ex-ante impact assessment of policy-making for sustainable development in Europe. LUPIS studies cases outside Europe, for example, in Kenya, Tunisia and Mali to evaluate if this approach is also applicable in such situations. SENSOR was an integrated project designed to substantiate the impact assessment process. It brought together 39 research partners from 15 European countries, China, Brazil, Argentina and Uruguay.

5.1.5 Assessment and evaluation tools

KB Eururalis' output sketches what could happen to rural Europe, based on conditions that differ in nature, course, duration or place. The implications for the land use and the People, Planet and Profit indicators is being assessed for four possible and plausible main scenarios. The approach can also be applied to other continents.
KB The decentralisation paradox that is going on in the Netherlands is studied. In this governance issue responsibility for nature and rural development is transferred from national level to regional level whereby at the same time more specific output parameters are part of the contracts between the national and regional levels. The project will result in recommendations to clear uncertainties, reduce the knowledge gaps and suggest new links between national and regional levels. Water is not an explicit but more an implicit part of this project.
KB Long term: Dealing with uncertainty will be a project that will start in 2011. It aims at providing guidance on consequences at various time scales of changes in the special planning and land use, including the costs and benefits of ecosystem services.
KB Competing claims and trade-offs is a project where the interactions of sustainability indicators at different scale levels are studied. The interactions will be studied in pilot studies and the interactions will be modelled. These tools will be available to study the effectiveness of policies.
KB Modelling results of land use and land management for ecosystem services is a project that aims to produce insight in the trade-offs between ecosystem services and biodiversity. The model will be integrated in the IMAGE-GLOBIO model of PBL and include GIS visualization. This will make it a tool that is also applicable in an international context where sustainable development must include utilization of ecosystem services and conservation of biodiversity.

5.2 Additional research going on in Wageningen

A variety of projects will in future contribute directly or more implicitly more in the background to the shortlist and include the following:

Competing claims on natural resources in the Central Rift Valley of Ethiopia

Key issues: biodiversity management, agricultural production, water management, water quality, development of non-primary production activities, water productivity, rural development, stakeholder participation, partnerships, knowledge exchange and cooperation, empowerment, monitoring, land degradation
Outline: The project aims to strengthen the capacity of local authorities, development authorities, development organizations and private sector in the field of natural resource management with the aim to mitigate competing claims for natural resources, and to improve resource management and the livelihoods of the rural population in the CRV. The biophysical, economic and climate resource base are characterized and evaluated for various production activities under current and changing climatic conditions. Robust and risk-tailored land and water management strategies and policy options are identified and explored on their contribution to different objectives such as food production, increase of income, water use efficiency and labor productivity. Potential synergies, tradeoffs and conflicts among various development objectives are studied, in view of livelihood improvement and sustainability.

WIBIS (South Africa, Swaziland, Mozambique)

Key issues: water productivity, multi-stakeholder dialogues, assessment methods, land management, trans-boundary water management
Outline: The WIBIS project is aimed at supporting inter-sectoral and inter-state (trans-boundary) policy development and sustainable (wise) use of the Incomati basin water. The project supports ongoing regional initiatives and projects, such as the PRIMA project (Progressive Realization of the IncoMaputo Agreement). WIBIS provides an interactive discussion support tool in land and water development and management. The tool can generate spatially distributed information on water consumption and water productivity for different land uses, based on a consistent method and impartial information.
The WIBIS tool enables stakeholders to - interactively - evaluate alternative land use scenarios, assess the economic water productivity of the various land uses within regions or countries, and assess the water availability to downstream regions or countries.

Managing land and water resources in the Baviaanskloof Reserve (South Africa)

Key issues: agro-ecological practices, development of non-primary production activities, biodiversity management, control of invasive species, water productivity, rural development, IWRM, stakeholder participation, monitoring, assessment methods, land degradation, (soil) water retention
Outline: The Baviaanskloof in the Eastern Cape Province in South Africa is a biodiversity hotspot and recognized as a unique World Heritage Site. Various land and water problems have become manifest, such as increased hill slope and stream bank erosion and water shortages. These are having detrimental effects on ecosystems and on agriculture.
The project supports the integrated development and management of land and water resources, including biodiversity conservation, nature restoration, the development of alternative rural livelihoods such as eco-tourism, erosion control and water retention measures.

NeWater (Africa, Central Asia, Europe)

Key issues: land planning and management, climate adaptation, water management, stakeholder dialogues, integration of water and energy
Outline: The project NeWater studied and fostered Adaptive Integrated Water Resources Management (AWM) as a concept guiding theory and practice. Considering the river basins as social-ecological systems, NeWater reflected the diversity of perspectives and potential through project partners from Europe, Africa and Central-Asia. The project supported stakeholders in seven different case study basins.

Improving livelihoods and resource management in the Central Rift Valley of Ethiopia (ILCE)

Key issues: rain-fed agriculture, agricultural productivity, water harvesting, soil water retention, partnerships, capacity building
Outline: ILCE aims to identify and explore options for more sustainable farming systems and integrated resource management to alleviate the pressure on available land, water resources and biodiversity. The capacity of farmers' abilities to add value to their production is being improved and partnerships are being built for more market-oriented local supply chains. By strengthening the capacity for collaboration between different institutional decision-making levels the governance of sustainable resource management is supported. The risks and variation in crop production under current and changing climatic conditions are being assessed and appropriate risk adaptive management strategies being developed.

Egyptian-Dutch Advisory Panel

Key issues: integrated Water Resources Management, partnerships, cooperation and knowledge-sharing, capacity building
Outline: The Egyptian-Dutch Advisory Panel on Water Management started in 1976. Since then a strong partnership has evolved between Egypt and The Netherlands involving cooperation between ministries and other organizations in both countries. The current Panel functions as a think-tank for the Egyptian Minister of Water Resources and Irrigation, who chairs the partnership. Benefits for both countries include human resource development and capacity building, institutional reform, technical solutions, policy formulation and enhanced coordination between projects, institutions and partners.

Agroparks

Key issues: Agricultural production, water productivity, integration of water and energy, land planning
Outline: The spatial clustering of different agro-production chains and the spatial combination of agro-processing and non-agro functions enable many prosperous scenarios. It includes not only the production of food, feed, vegetables and fruits, but also of fuels, fibers, fermented products, flowers, fragrances, flavors, functional molecules and pharmaceuticals. Wageningen UR works on an integrated approach of chain development and regional development. The concept of Agroparks is based on the principles of sustainable development, environmental benefits through lowering emissions and waste, application of principles of industrial ecology, i.e. mutual use of waste and by-products, advantages of scale through industrial production and processing, reduction of fossil fuel use and veterinary risks because of reduced transport, improved animal comfort, increasing production levels, independence of season and land by whole year products, better quality management by chain transparency, improvement of farmers position as a preferred supplier and a significant reduction of economic costs.

Waterlogging in Pakistan

Key issues: agricultural production, salt-resilient crop varieties, salinization, rural development, water quality, partnerships, cooperation and knowledge-sharing, capacity-building
Outline: The agricultural sector in Pakistan suffers from waterlogging and salinity problems. A bilateral cooperation agreement on waterlogging and salinity control between Pakistan (IWASRI-International Waterlogging and Salinity Research Institute) and the Netherlands (Alterra-ILRI) led to the creation of the Netherlands Research Assistance Project NRAP.
The partnership that evolved had two main activities: work on technical aspects of drainage and the development of a participatory approach to drainage. The cooperation achieved results in each of the fields of activity and it has been instrumental in assisting the partner institute IWASRI to become a nationally and internationally recognized centre on waterlogging and salinity research.

Robust Peatlands

Key issues: climate adaptation, land management, agricultural production, water management, rural development
Outline: Peatlands are threatened by subsidence of the soil surface, less favourable conditions for farming and, often, rising costs of water management and infrastructure. This project focuses especially on water management strategies to reduce soil subsidence and to create water systems which are more robust and adapted to climate change.

The Saline Coastal Fringe

Key issues: coastal zones, saltwater intrusion, climate adaptation, water management, stakeholder participation
Outline: The Dutch coastal zone is used intensively for agricultural production, fisheries, aquaculture, recreation and nature. These different demands lead to conflicting claims. Wageningen UR is investigating how these claims are developing in the light of climate change.

Dutch Climate Atlas

Key issues: climate adaptation, cooperation and knowledge-sharing, droughts and floods, rural development
Outline: Wageningen UR has provided provincial policy makers with multidisciplinary knowledge to enhance their awareness on climate-induced conflicts and opportunities with regard to rural planning. In a series of maps, the 'climate-proofing atlases' depict the effects of climatic change on local weather, river discharge statistics, groundwater tables, salinization risks, risks of drought and flooding. They also provide guidelines on how to convert effects of climate change into guidelines for sustainable rural development.

Changing water resources in Northern India

Key issues: climate change, stakeholder participation, response to extreme events, water management
Outline: Climate change will affect the hydrological system of Northern India, which in turn will affect water availability. The rapid socio-economic development also has a large impact on water resources. To anticipate the potential negative effects response strategies are developed that strengthen the cause for adaptation to hydrological extreme events through a participatory process.

Sustainable agriculture in the Mediterranean/Aqua-Stress

Key issues: water scarcity, droughts, IWRM, agricultural production
Outline: Scarce water resources, intensive water competition between users - in particular agriculture and tourism - and frequent drought episodes are common challenges in the Mediterranean. Agriculture is the sector most affected by anticipated water scarcity. Aqua-Stress aims for participative development of water stress mitigation strategies for sustainable agriculture in the Mediterranean.

Disposing of pesticides stocks in Africa

Key issues: human health, ground and surface water quality, risk assessments, cooperation and knowledge-sharing, environmental protection
Outline: Large amounts of pesticides have been shipped to Africa for locust control since the 1950s. High concentrations of pesticides are found in soils near stockpiles and pose a serious risk. The Africa Stockpiles Programme (ASP), launched by FAO, is designed to help Africa to dispose of the pesticides in an environmentally sound manner, considering the African conditions. Following a risk-based approach, site specific remediation technology using biodegradation and isolation have been developed and implemented.

The mangrove ecosystems in the Mahakam delta

Key issues: climate adaptation, coastal zones, biodiversity management, governance
Outline: The project aims to understand the integrated impact of human interferences and natural processes such as sea-level rise, climate change, upstream controls and ecological changes on the sediment and mangrove dynamics in the Mahakam delta. Special attention is paid to determining the resilience and restoration potentials of mangrove ecosystems and developing models that forecast catastrophic changes in coastal ecosystems. The project also addresses issues of governance at all levels, and how ecosystem nestedness and governance nestedness can be linked.

WATERWISE

Key issues: participation, stakeholder dialogues, land planning
Outline: Spatial planning of land use and integrated water resources management are closely related. Spatial planners and water managers should communicate more on their joint interests. The Waterwise tool integrates spatial planning with strategic water management decisions and choices. The tool facilitates discussions between stakeholders competing for limited water and land resources.

Development of coastal peatlands (Asia)

Key issues: land management, coastal zones, agricultural production, biodiversity management
Outline: The objective of the project on agricultural development in coastal peat swamps of Sarawak, Malaysia, was to provide the State of Malaysia with tools to properly coordinate and enhance the overall development of coastal peatlands, as well as to avoid conflicting land use. To this end, a set of guidelines for agricultural development in the coastal peat swamps of Sarawak has been developed. These guidelines provide advice on best practice in planning, assessment, design, implementation and management of water management systems for agricultural activities in the coastal peat swamps of Sarawak.

PEATWISE (Asia)

Key issues: capacity building, cooperation and knowledge-sharing
Outline: PEATWISE aims to develop a curriculum on the sustainable development of peatlands by introducing innovative educational methods and tools to promote the wise use of resources and to enhance sustainable economic development. The focus is on in the areas of Sarawak, Malaysia and Central Kalimantan, Indonesia. The project covers the entire sequence of curriculum development, the production of educational tools and course materials, and training staff to disseminate knowledge.

Role of valuation for water management

Key issues: water productivity
Outline: The main purpose of the project is to draw generic lessons from a number of case studies about the role of valuation in supporting water management decisions. Water valuation enables us to assess the implications of various kinds of allocations of the available water among users, while taking into account equity, sustainability and environmental sustainability. Valuation shows whether there is scope for improving the overall benefits from water use. Insight into the value of water enhances the ability of decision makers to evaluate tradeoffs between alternative water management regimes and courses of social action that alter the use of water and the multiple services it provides.

FLOW-AID

Key issues: irrigation efficiency, agricultural production
Outline: FLOW-AID contributes to sustainable irrigated agriculture by developing a deficit irrigation management system for farm-level crop production in cases with limited water supply and marginal water quality. It integrates innovative sensor technologies into a decision support system. It focuses on innovative, simple and affordable, hard- and software concepts; particularly a maintenance free tensiometer, a wireless and low-power sensor network; an expert system for farm zoning and crop planning in view of expected water availability and quality; and an irrigation scheduler for allocation of multiple water sources.

Ecosystem change in Lake Victoria (Africa)

Key issues: ecosystem management, climate change, water quality
Outline: Lake Victoria, Africa's largest freshwater lake, is changing fast under the combined effects of climate change, eutrophication and fisheries. Both eutrophication and fisheries caused the decrease in highly diverse cichlid stocks in the 1970-ies that paved the way for the switch to the new alternative stable state in the early 1980-ies establishing Nile perch as dominant predator in the lake's food web. Both processes still re-structure the fish community and the resource base of the fishery. The feedbacks in food webs and resource use with increased eutrophication and fishing pressure is studied, aimed to support fisheries and ecosystem management.

5.3 Capacity building at Wageningen UR

Wageningen UR provides an extensive set of academic and applied programmes aimed at training students in analyzing and resolving pressing issues in rural development. In addition to the regular programmes also various short courses are offered aimed at contributing to permanent learning of professionals after completing their formal studies. In the report 'Strategy for capacity development to balance water needs for food and ecosystems' by I. Gevers, A. Schrevel, M. Vernooij and H. Zingstra (Wageningen UR, 2009) an overview of the short courses currently offered is given. In this report it is concluded that current activities already provide strategic capacity building components to implement the CSD-17 messages but recommendations for the future are given. The report suggests to expand the current activities and include competing claims, conflict management, climate adaptations and focus on water demand management in India, agricultural water management in Africa, improving water quality in semi arid areas, increasing water productivity in arid regions and addressing typical delta problems.

6 Presenting CSD-17 messages

The results have been presented at the African Water Week in November 2009 and to the Dutch water sector in March 2010. Programmes have also been developed for the Waterproof Event (April 2010), the World Water Week (September 2010) and CAADP.

6.1 African Water Week

Wageningen UR participated in the second African Water Week, conducted from 9 till 13th November 2009 in Midrand, South Africa. The African Water Week is organized by AMCOW.
The African Ministers' Council on Water (AMCOW) was formed in 2002 primarily to promote cooperation, security, social and economic development and poverty eradication among member states through the management of water resources and provision of water supply services. The mission of AMCOW is to provide political leadership, policy direction and advocacy in the provision, use and management of water resources for sustainable social and economic development and maintenance of African ecosystems.
AMCOW is working with AU NEPAD (New Parthership for Africa's Development), the UN Secretary General Advisory Board on Water and Sanitation (chaired by the Prince of Orange) and the EU ACP Water facility.
Vraag: is het Sanitation of Sanatation?
The water for Agriculture and Energy in Africa is an important programme from AMCOW.

AMCOW and FAO have launched the Water for Agriculture and Energy in Africa.

This programme is:
- Assessing the challenges faced by the agricultural sector in view of the current food crisis in Africa taking into account the strong linkage with energy and climate change.
- Carefully examining how investment in the rural space can reverse trends to obtain well balanced sub-sectors that offset production risks, close food production gaps and ensure food security.
- Analyze the bottlenecks and constraints to accelerated water development in support of the continent's food and energy needs.
- Proposing ways to promote and secure investment in water to maintain food and energy security in the region.

An extensive website including national policies and investment briefs is available at:
www.sirtewaterandenergy.org/

The aim of Wageningen UR in attending the African Water Week was to cross the CSD message to the participants. Alterra therefore undertook three specific actions:

- Exhibit the CSD message by showing Dutch contributions in this field. Folders were distributed on issues through an exhibition stand (Annex 1).
- Organized a side event (Annex 2).
- Laid specific contact with several participants as in Annex 3.

Exhibition

Over 1,350 persons from all African countries participated in the programme, side events and exhibition.

A side event was organized

Managing Africa's trans-boundary waters by trans-boundary land management

The world faces huge water and food challenges in view of increasing pressures by population growth, the global climate change and socio-economical developments (urbanization, changes in lifestyle, etc.). This requires a fundamental rethinking of the conceptual framework of (land and) water management.
In dealing with water issues the general focus has been on supply and demand management related to surface water and groundwater resources (referred to as 'blue water' resources).
This approach does not sufficiently acknowledge the role of rainfall as the ultimate water resource. It should be recognized that the availability and quality of blue water resources is primarily determined by land use and land management. The land cover very much determines the faith of rainfall in terms of groundwater recharge and

surface water regimes. In arid and semi-arid areas the (exploitable) groundwater and surface water flow often represent only a small percentage of the rainfall.
Spatial planning and land management are, therefore, crucial. This principally refers to (commercial) forestry, agricultural lands and town planning, as these land uses are largely manageable, and subject to spatial planning. Agriculture and forestry can be regarded as the world's principal rainfall processing industry. In the side event options were presented to use spatial planning and land use management as tools in water management. Interactive discussion support tools are being developed to enable stakeholders to make rapid assessments and search for feasible land development options and set priorities, both in a national and trans-boundary context. In the side event the methodology to integrate land and water development options and possible prioritization evaluation criteria, such as crop water productivity (food security), economic water productivity (economic development), social water productivity (jobs and welfare) and ecological water productivity (integrity of ecosystems) were presented and discussed. An important implication of integrated land and water management is also that traditional distinction between rain-fed and irrigated agriculture becomes superseded. Sub-optimal or fractional irrigation may result that the policy objectives are better met, particularly in times of scarcity.

The presentation is included in Annex 2.

The participation to the African Water Week was highly successful in that many participants learned more about the CSD process and its messages. It resulted in an invitation for the CSD-17 chairwoman to address the assembled African ministers on the CSD-17 outcome. It also presented the Dutch interest in the development of Africa, especially in the field of agricultural water development and provided the contacts to prepare policy messages for the next Stockholm Water Week and other international meeting points where the Dutch policies can be exhibited and interlinked with the international agendas.

6.2 NWP meeting

On 11th March a workshop was organized together with Netherlands Water Partnership and LNV with the following programme

Water and Sustainable Agriculture and Ecosystems

The message from the 17th session Commission on Sustainable Development

World population growth to an estimate 9 billion by 2050 and a diet preference change in the direction of more meat, fish and dairy products driven by increasing wealth and urbanization, will give rise to a sharp food demand in the coming decennia. Also, climate change will confront agroproduction systems with the challenge of increasing variability in environmental conditions (drought, flooding) with consequent less stable food production. Finally, the negative climatic impacts on fossil energy, their limiting supply and the unstable geopolitical context of these resources, have increased the demand for biobased alternatives thus increasing the pressure on natural resources.

Agriculture plays a vital role in sustainable development and can be part of the solution in solving the multiple crises on food, climate change and energy. Good water management is of crucial importance for sustainable agriculture. To address these multiple crises and its challenges to increase agricultural productivity is of highest priority, including a Green Revolution in Africa. The required increase in food production and anticipated future population growth will lead to increased water stress, both by pollution and over consumption. For a safe harvest in the world we have to save water to safe lives. This message from the 17th Session of the UN Commission on Sustainable Development must be used to feed the world in a sustainable

way. You are invited to discuss how we can contribute to improve sustainable agricultural production and at the same time aim at sustainable use of water for food and ecosystems.

The programme included:
- Ir. Mathieu Pinkers (Ministry of Agriculture, Nature and Food Quality)
  Chairman
- Drs. Desiree Hagenaars (Ministry of Agriculture, Nature and Food Quality)
  'Sustainable Development, what needs to be done?'
- Dr. Essam Khalifa (Ministry of Water and Irrigation, Egypt)
  'After 6000 years of agricultural water management in the Nile, how do we handle the 21st Century
- Dr. Kees van 't Klooster (Wageningen UR)
  'Save Water, save harvest, save life'
- Henry Sichembe MBA (Department Director Agriculture, Ministry Agriculture, Zambia)
  'Water options to improve ecosystems, harvest security and hydropower for the Zambezi'
- Ir. Chris de Visser/ir. H.Hengsdijk (Wageningen UR)
  'Options for High Tech and Sustainable Agriculture'

Presentations are included in Appendix 4

6.3 Waterproof

At the Dutch Waterproof event a 'Werkplaats' is organized dealing with Water for Food and Ecosystems in Africa on 8th April 2010.

Africa faces the challenge to feed its growing population by producing more food. Exploiting the agricultural potential of Africa not only helps in the development of Africa and hence of the world economy but creates also business opportunities for those in close contact with the millions of hectares that can contribute to feeding the world population. Where water is a limiting factor efficient use of water should be promoted in such a way that other users of water may also benefit, notably ecosystems. The ecosystems in Africa are linked to the ecosystems in Europe notably by bird migration.

- Mathieu Pinkers (Ministry of Agriculture, Nature and Food Quality)
  Introduction
- Koen Roest
  Greening the desert, how (ICT) technology can increase water productivity in the Nile region
- Eddy Wymenga and Hans van Poppel
  How the right interventions in West African management agriculture
- Paul Sijssens
  Commercial and technical development of flood irrigation in the Zambezia province of Mozambique
- Herco Jansen
  How investors and ecosystems share the Incomati water to their mutual benefit
- Madeleine van Mansfeld
  Agro-Parks, the African version: A blueprint for the Beira Corridor in Mozambique

6.4 World Water Week

A seminar will be included in the main programme of the World Water Week on African Agricultural Water. The session is jointly organized through LNV, AMCOW, UNEP, African Development Bank and CAADP.

Draft programme:

- Welcome on behalf of the convenors and highlighting the intrinsic challenge for land and water management in Africa
  Bai-Mass Taal, AMCOW
- The wider dimension of water quality issues and needs for protecting water resources
  Thomas Chiramba, UNEP
- Using the momentum and focus from the 2009 CSD 17 'Shared Vision' to 'make Agriculture better' and to contribute to the water quality protection (tbd)
- Policy recommendations to minimize water quality hazards from increased pesticide use in Africa.
  Mark Davis, FAO
- NEPAD's view on future nutrient requirements in African agricultures and strategies to reduce negative impacts on African water quality
  Elijah Phiri, CAADP
- Water quality in Kafue River and Lake Kariba
  Chris Mukosa, Zambezi River Authority
- Implications of an intensification in land and water management in the Equatorial Lake region
  Emmanuel Olet, NBI-NELSAP
- Water quality development in the Niger
  Almoustapha Fofana, National Water Lab, Mali.
- Pesticides effects on Incomati and water supply of Maputo
  Mozambique Water Authority (or Ivo van Haaren, DHV)

7 Research gaps

Based on the on-going research programmes and projects new insights for policies can be extracted. For some specific topics that need to be addresses in the future, adequate and timely additional knowledge need to be developed to close the knowledge gaps and to develop future policies.. Focussing on the five previously mentioned themes, these knowledge deficiencies are:

IWRM

Drought management in ungauged basins or basins with limited data can be further developed for basins in Africa where it must and can be build on data scarce production areas, but where harvest security needs further improvement.

To operationalize schemes for Payment for Environmental Services and Green Water Credits a generic framework should be developed within which PES and GWCs systems are self sustainable in socio-economic, and socio-ecological terms, i.e. how to legalize, organize, institutionalize and finance environmental services, considering the various levels of institutions and policy.

Agricultural production

Global agricultural production can benefit from water saving techniques as developed in the Netherlands under a number of conditions. A basic condition is that to recover the higher investments per m^2, the value of the production obtained per m^2 must be high. As a consequence the technology is mainly applied in developed countries to vegetable and fruit production as well as ornamental plants rather than in staple foods, where returns per m^2 are limited. This implies that not only the technology must be available but good market access including the logistics involved is necessary. The risks associated with high tech agriculture are high, also requiring management that reacts swift and adequately on any change. Taking the above considerations into full account the options for more high tech production in less developed countries with erratic rainfall patterns should be taken up to utilize the vast potential to use less water in producing food by utilizing appropriate elements of the current available technologies.

Upscaling of indigenous knowledge on robust farming systems and water conservation systems.

Water management

Living with salinity: As rising sea levels may create salt intrusion and salinity problems, systems that are actually based on saline water, rather than fighting salinity, need further development. Some of the deltas in e.g. Vietnam and Mozambique provide opportunities to develop such systems. In Egypt the rising water level in the Mediterranean Sea increases salt intrusion in some of the agricultural production areas and policy strategies to cope with these changes are needed.

Managing saline water: The more frequent occurrences of brackish and saline water together with increased scarcity of fresh water requires conjunctive use, in which alternating water qualities are supplied, considering the (alternating) sensitivities of production systems.

Land management

Redesign of full fletched irrigation schemes to systems where water is used at the demand of the crop and supplemented by irrigation when rain and water available in the soil alone would limit crop production needs to be done to reach large water savings, providing also better availability of water for ecosystems and other uses. Such situations are at hand in e.g. the inner the upper Nile basin in Ethiopia, various schemes in the Zambezi and the Nile stretch in Egypt, the Chokwe irrigation scheme in Mozambique and in West Africa.

Assessment and evaluation tools

The development and utilization of early warning systems based on seasonal climate models will allow for enhanced efficiency in the use of water and nutrients. This opens the possibility to develop policy options that take the benefit from these forecasting techniques. Such an approach will not only have a positive impact on food production but will also have a positive effect on water quality as less nutrients and pesticides will be released. Ecosystems and other users of water will therefore benefit from this approach. It also provides opportunities for markets to incorporate the expected agricultural output in their operational planning.

Methodology for biophysical quantification of impacts of integrated catchment management with focus on nature restoration measures, in terms of water quantity and quality (and spatial/temporal), soil conservation/erosion control, carbon sequestration, ecological benefits.

Methodologies for valuation of environmental services need to be further developed. As the water assurance is generally more important than the water availability at a certain time, methodologies to valuate uncertainty and water assurance in water-scarce situations need to be developed.

Integrated Land and Water Resources Management

To obtain further progress in integrated land and water resources management a number of key areas need to be addressed in Africa:

- **Water Resource Monitoring**
  To monitor water resources with regard to quantity, distribution and quality, including variability in time and space and their interaction with all water use processes in order to provide a firm basis for the optimal development of Zambia's water resources.
- **Water Resource Planning**
  To produce catchment outline plans for all catchments in Zambia that addresses inter-sectoral linkages in the management of water resources aimed at supporting cross- sectoral development needs and maximise the economic benefits accruing thereto.
- **Water Resources Infrastructure Development**
  To achieve sustainable water resources development with a view to facilitate an equitable provision of adequate, quantity and quality of water for all competing groups of users at reasonable costs and ensuring security of supply under varying conditions.
- **International Waters**
  To strengthen capacity of regional cooperation on shared water courses in support of regional development.
- **Research and Development**
  To develop innovative and appropriate approaches and technologies for the effective development of the national water resources.
- **Adaptation to Climate Change in water resources management and development**
  To strengthen capacity for mitigation and adaptation to effects of Climate Change in Water Resources Management and Development.

Annex 1 Flyers Wageningen UR projects contributing to sustainable development on water and agriculture

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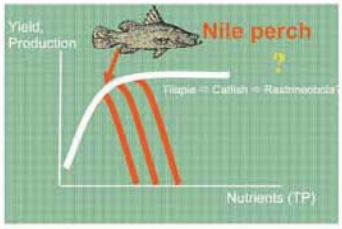
Eutrophication or exploitation as threat for fisheries? Ecosystem change in Lake Victoria

Paul van Zwieten

Introduction

Lake Victoria, Africa's largest freshwater lake, is changing fast under the combined effects of climate change, eutrophication and fisheries. Both eutrophication and fisheries caused the decrease in highly diverse cichlid stocks in the 1970-ies that paved the way for the switch to the new alternative stable state in the early 1980-ies establishing Nile perch as dominant predator in the lake's food web. Both processes still re-structure the fish community and the resource base of the fishery. Eutrophication has increased the productivity of the lake that now supports the largest freshwater commercial fishery in the World. Over 80,000 fishermen produce 1 million ton of fish, including 300,000 ton of Nile perch.



But, eutrophication continues with increasing population pressure and associated changes in land use in the catchment. The lake is now among the most heavily eutrophied large water bodies in the World, with blooms of cyanobacteria and an increased volume of seasonally anoxic deep waters. Could there be a third alternative stable state resulting from increased eutrophication and heavy size selective fishing on the top predator Nile perch?

Social and ecological drivers of ecosystem change (SEDEC)

We study the feedbacks in food webs and resource use with increased eutrophication and fishing pressure to aid in fisheries and ecosystem management. Our multidisciplinary program researches the responses of the fishery to changes in the food web and habitats for Nile perch; and the responses of the Nile perch stocks to the impacts of size selective fishing and eutrophication. Four PhD projects analyse (1) social factors that drive decision-making processes of individuals in the fishery; (2) ecological factors, including size-selective fishing and changes in Nile perch habitat, that drive spatial effort allocation by fishermen; (3) the impact of eutrophication and Nile perch predation on food web structure; and (4) model the interactions and feedbacks resulting from eutrophication and fishery, as most likely factors driving changes in Lake Victoria's food web.

Partners

The Tanzanian Fisheries Research Institute, The University of Dar es Salaam (FAST), The Netherlands Institute for Ecological Research (NIOO), and two research groups of Wageningen University (Law and Governance and Aquatic Ecology and Waterquality. Program funded by the Dutch Council for Scientific Research (WOTRO) and the Directorate General of International Development Co-operation (DGIS).

Literature

J. Kolding, P. van Zwieten, O. Mkumbo, G. Silsbe, R. Hecky (2008) Are the Lake Victoria Fisheries Threatened by Exploitation or Eutrophication? Towards and Ecosystem-based Approach to Management. In: G. Bianchi, H.R. Skjoldal, The Ecosystem Approach to Fisheries, FAO, CABI pp309 - 354

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Water saving greenhouse in Saudi Arabia

Jouke Campen (jouke.campen@wur.nl)

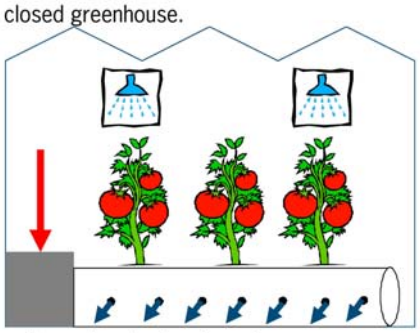
Introduction

Water shortage is a enormous problem in Saudi Arabia. Horticulture currently consumes a lot of water for evaporative cooling which is pumped for deep water resources. These water resources are getting scarce and the quality of the water is minimal as can be seen in the picture below showing the pad wall on which the water is sprayed. Cooling is essential for crop production due to the extreme climate.

Photo of a pad wall in a greenhouse in Saudi Arabia covered with salt

Alternative method for cooling

Wageningen UR participated in a mission with industry to evaluate the problem and to look at the possibilities of a closed greenhouse.



Schematic overview of a closed greenhouse

In a closed greenhouse the air is conditioned by means of a chiller. Hence no air is exchange with the outside so no water loss. Also the carbon dioxide levels can be raised which increases production.

Commercial closed greenhouse in The Netherlands

Outcome of the mission

- A closed greenhouse can save more than 90% of water compared the traditional greenhouse with pad and fan
- Production can be increased by more than 40% if carbon dioxide enrichment is applied.
- Energy consumption is eight times higher than the traditional greenhouse.
- The selection of a greenhouse covering material is very important (NIR reflection, insulation, haze properties)
- The economical feasibility of a closed greenhouse is yet to be evaluated.

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Water for Food and Ecosystems in the Baviaanskloof Mega Reserve

Objective

Support sustainable development and management of land and water resources to conserve biodiversity and to improve rural livelihoods in the Baviaanskloof Mega Reserve.

Problem Statement

The Baviaanskloof is a 75 km long valley between two mountain ranges in the Eastern Cape Province (South Africa). The area is a biodiversity hotspot and recognised as a unique World Heritage Site because of its beauty and biodiversity, which has global importance. This area is exceptionally diverse with over 1000 plant species recorded, including at least 52 Red Data Book and 20 endemic plant taxa, as well as a large faunal diversity. The area is part of the envisaged Baviaanskloof Mega Reserve (BMR) of about 500,000 ha, which will comprise a cluster of state owned protected land within a network of private and communal land.

In the Baviaanskloof various land and water problems have become manifest, such as increased hill slope and stream bank erosion, and water shortages, having detrimental effects on ecosystems and on agriculture. These problems are likely to aggravate due to the global climate change.

The area supplies water to the Kouga Dam, from where the water is diverted for irrigation of (high-productive) downstream agricultural lands, and for the public drinking water supply of the Nelson Mandela Bay Metropolitan Municipality (Port Elizabeth). The already existing pressure on water resources will further increase in the near future.

Project details

Rationale and project description

The acquisition of land and the subsequent banning of all adverse economic activities might be an effective measure for nature conservation, but the scope of such interventions is often limited due to elevated costs (both for the asset and -often- the management). In addition the impact on rural livelihoods can be huge, as people often have to abandon their home and their land, and/or search for alternative sources of income.

In the Baviaanskloof the feasibility of an alternative policy is being investigated, namely the option of "Payment for Environmental Services" (PES). It is believed that PES schemes offer a promising option for the Baviaanskloof. Farmers living in the nature reserve may adapt or transform their farming practises and –possibly- negotiate water rights, whilst developing alternative income generating activities such as eco-tourism. The environmental services will be beneficial for the nature reserve itself, but also for downstream water uses that generate a high social or economical return on the scarce water resources (e.g. municipalities and drinking water companies, high-output agricultural and industrial enterprises). PES schemes can thus be an instrument to help preserving ecosystems, improving rural livelihoods, and re-allocating and optimizing the use of scarce water resources.

Approach and activities

The following activities are being conducted:

1) Assessment of land and water resources and -uses in the Baviaanskloof river basin and its interrelated catchments;
2) Identification of measures to improve land and water management (for agriculture and ecosystems);
3) Determination of the value of water for the various water uses;
4) Investigation of opportunities for Payment for Environmental Services schemes;
5) Implementation of no-regret measures in the catchment of the Baviaanskloof and at the farm- level.

Results to date show that environmental services should principally be aimed at water conservation and water retention. A number of measures have been identified that will be further investigated. Possible locations for no-regret measures have also been selected. These will be further investigated and monitored.

The project activities are being executed in close collaboration with stake-holders and experts on biodiversity and river restoration programmes.

Relation to other projects and programs

Working for Water - Department of Water Affairs and Forestry (DWAF)
Working for Wetlands - South African National Biodiversity Institute (SANBI)
Cape Action for People and the Environment" (CAPE) - WB/GEF
River Health programme (RHP) - Department of Water Affairs and Forestry (DWAF)

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Partners: Agricultural Economics Research Institute (LEI), Netherlands Government Service for Land and Water Management (DLG), LivingLands/FRESENCE network, South African National Biodiversity Institute (SANBI), Eastern Cape Parks Board (ECPB), Rhodes University (RU) and the Rhodes Restoration Research Group (R3G), Council for Scientific and Industrial Research (CSIR), Nelson Mandela Metropolitan University (NMMU), Stellenbosch University (SUN), Department of Water Affairs and Forestry (DWAF), Department of Agriculture, Gamtoos Irrigation Board (GIB).
Website: http://www.kennisonline.wur.nl/BO/BO-10/005/051.02/producten.htm
Duration: 2007-2010.

Ministry of Agriculture, Nature and Food Quality

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International Training of Trainers on wetland management

A course focusing on facilitating multi-stakeholder processes and curriculum development

Wetlands

Wetlands are hugely diverse. But whether they are ponds, marshes, coral reefs, peat lands, lakes or mangroves, they all share one fundamental feature: the complex interaction of their basic components - soil, water, animals and plants. Wetlands fulfill many functions and provide many products that have sustained humans over the centuries. Unsustainable use of wetlands, and the river basins as a whole, has led to the disruption of natural hydrological cycles. This has often resulted in higher frequency and severity of flooding, drought and pollution. The degradation and loss of wetlands and their biodiversity imposes major economic and social losses and costs. Appropriate protection and allocation of water to wetlands is essential to enable these ecosystems to survive and continue to provide important goods and services to local communities.

Wetland management

One of the difficulties identified in wetland management is the division of management responsibilities between different administrative authorities in a river basin. This often results in fragmented and competitive approaches to water resources planning and management. The management of wetlands therefore requires a multidisciplinary approach that integrates the technical, economic, environmental, social and legal aspects of water management which does not end at country borders but needs to be carried out on a river basin scale.

Integrated wetland management is a process through which people can develop a vision, agree on shared values and behaviors, make informed decisions and act together to manage the natural resources of a river basin.
The primary condition for achieving integrated wetland management is the willingness of sectoral stakeholders to work together. To achieve the necessary cooperation, stakeholders in a catchment area need to be able to understand each other clearly. Steps to achieve understanding of the various views, and to explore how far such separate views can be shared, will be one of the main issues covered within the 'International Training of Trainers on Wetland Management' (ICWM-TOT).

Wetland management training

Several wetland management training initiatives took place in the past decade. One of these initiatives was RIZA's International Course on Wetland Management (ICWM). The 10th ICWM (2003) marked a change in strategy: instead of organising an international wetland management course in the Netherlands, RIZA and its partners wished to stimulate the development of similar courses in the different regions in the world (e.g. the International Course on African Wetland Management in Naivasha, Kenya). To support regional capacity building initiatives, Wageningen International and Rijkswaterstaat RIZA together have developed the International Training of Trainers on Wetland Management.

Aims and objectives

The ICWM-TOT aims to provide participants with the knowledge and skills necessary for curriculum development in the field of wetland management in their own region. The course will focus on the multi- stakeholder processes that play an important role in wetland management and the need for transboundry and cross-sectoral co-operation to manage the natural resources of a river basin and its wetlands.

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Website: www.cdic.wur.nl

Code: 88/06, Duration: 3 weeks, Period: 6 – 24 September 2010
Application deadline for full programme: 6 August 2010
NFP-Fellowship application deadline: 1 February 2010
Date of publication: 27 April 2009/FD

Who can participate?

The ICWM-TOT is designed for (future) trainers in wetland management. The course programme is suitable for wetland managers and land use planners, policy makers, consultants, researchers and NGO staff who have affinity with training.

Programme topics

Concepts in wetland and river basin management

- Concepts in wetland and river basin management (ecological, social and economic perspective) as well as ecosystem approach, Ramsar, CBD and other international agreements

Facilitation of multi-stakeholder processes

- Multi-stakeholder processes, tools and techniques to support the facilitation of multi-stakeholder processes in wetland management, public participation, stakeholder involvement in decision making and conflict management

Fieldwork wetland management

- Wetland management, stakeholder analysis and public participation in practice

Adult education and social learning

- Participatory learning principles, learning styles, the learning cycle, educational psychology, raising awareness

Curriculum development

- Training skills, curriculum development, development of a training programme for wetland managers.

The course will be interactive with a high degree of personal contributions by the participants. Besides lectures the course will include fieldwork, technical and social excursions. The ICWM-TOT will provide the opportunity of professional networking fostered by the institutions organising the course, as a follow-up after attending the training.

Organisation/Partners

Wageningen International in close co-operation with the WetCap Partnership, the Ramsar Convention Secretariat and the Dutch Ministry of Agriculture, Nature and Food Quality. Several governmental and non-governmental institutes will also be involved in the programme.

Requirements for admission

Applicants should meet the following requirements:

- Have at least a Bachelor level qualification or equivalent educational background
- Have at least two years of professional experience
- Be involved in wetland management and preferably assigned to capacity building in wetland management
- Be fluent in spoken and written English.

Certificate

Participants will be granted a Certificate of Attendance.

Fees and accommodation

The fee for this course is **€ 3500**. This includes administration costs, lecture materials and field trips, but excludes board and lodging and travel expenses. Participants will be accommodated at the Hof van Wageningen (formerly Wageningen International Conference Centre) on basis of full board and lodging. Prices are available on request.

Fellowships

A limited number of fellowships are available from the Netherlands Fellowship Programme (NFP) for nationals of certain countries. NFP-candidates must FIRST apply to Wageningen International for admission to the training. Acceptable candidates will receive a PROVISIONAL LETTER OF ACCEPTANCE from Wageningen International. Candidates can then apply for a NFP fellowship through the Netherlands Embassy or Consulate in their own country. Applications for NFP fellowships should be submitted to Wageningen International before **1 February 2010**.

More information:
www.cdic.wur.nl/UK/Courses, www.nuffic.nl.
Wageningen International can NOT provide any funds to finance the participants and is also unable to assist applicants in obtaining sponsorship.

Application
The admission deadline for application directly to Wageningen International, with funding other than a NFP fellowship, is **6 August 2010**. Early application is recommended. For online application and additional information, go to: www.cdic.wur.nl/UK/newsagenda and click on the course of your interest.

The course is supported by the Ramsar Secretariat

Ramsar

An African approach for Risk Reduction of Obsolete Pesticides

Situation

The Africa Stockpiles Programme (ASP), launched by FAO, the Food and Agriculture Organization of the United Nations, is designed to rid Africa of stockpiles of obsolete pesticides and to ensure that new stockpiles do not accumulate. A key objective of this programme is to ensure that stockpiles are disposed of in an environmentally sound manner. Most of the pesticides have been shipped to Africa for locust control from the fifties of last century, but did not arrive on the proper place or proper moment thereby be coming obsolete.

High concentrations of pesticides (e.g. dieldrin, parathion, malathion, chlorpyrofos) can be found in soils on the stockpiles and are a risk for human health, health of cattle, and quality of ground- and surface water. Removal of the high concentrations using northern technologies (e.g. incineration, bioreactor) or removal and transport of high amounts of contaminated soils was not found to be feasible for most of the sites involved. It is necessary to know the behavior of pesticides under different African conditions and explore local remediation technology for each site following a risk-based approach, not only based on removal of high concentrations of pesticides.

Sites are distributed over the whole African continent, and can also be found in delta areas. Two of the investigated sites were located in the inner delta of the Niger river in Mali.

Aim

In risk assessments, the risks of pesticides are evaluated on the basis of concentrations present and maximum allowable values in soil and water. If finance or technology to remove the pesticides are lacking, this kind of assessment will not lead to solve the local problems. From a risk-based point of view, contaminations are only a risk if they are or may become available. This widens the range of options and therefore can facilitate more tailor-made solutions for individual sites.

Approach

To solve the problem of sites polluted by pesticides, the following steps are necessary:

Pesticides may be a risk for drinking water sources

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1. Investigation of the site (e.g. historical use, hydrology, climate, transport)
2. Defining of the site specific risks
3. Gathering of missing information, including local conditions and sampling
4. Possibilities for site specific and sustainable remediation by risk reduction
5. Implementation of the risk reduction measures.

Field investigations, evaluation and set-up of the implementation were carried out in close cooperation with: FAO, Rome, Italy; African Stockpiles Programme-Mali, Bamako, Mali; Centre Nationale de Lutte contre le Criquet Pèlerin, Bamako, Mali; Laboratoire Central Vétérinaire, Bamako, Mali; Centre National de Lutte Antiacridienne, Nouakchott, Mauritania.

Results

Three sites in Mali and three sites in Mauretania have been investigated in 2007 according steps 1-3. Most important risks identified were: a) inhalation of volatilized pesticides, b) transport to groundwater, c) physical contact by human and cattle, d) run-off by rain (Mali) and e) wind erosion (Mauretania). Based on the results obtained and results of analysis of the samples taken, risk reduction proposals have been made and discussed locally (step 4). All proposals are based on the use of local conditions to stimulate biodegradation and/or to prevent rain water to transport the pesticides both vertical and horizontal. In populated areas, a plan for future use was part of the solution to prevent houses from being built on the isolated site. All plans have in common that they reduce the risks for the local population. Furthermore, they are simple and cheap and can be implemented on a sustainable way, even under the difficult African conditions.

Follow up

Implementations (step 5) in both countries have been started in summer 2008. In 2009 the implementation will continue and a workshop will be organized to present the results and to investigate the possibilities to use the concepts developed also in other African countries.

www.africastockpiles.org

Funded by

The project is part of the Africa Stockpiles Programme (ASP), launched by FAO

Contact Dr. J. (Joop) Harmsen, +31 (0)317 48 32 46, joop.harmsen@wur.nl

WAGENINGEN UR
For quality of life

Climate change adaptation in agriculture and natural resources management

Integrating climate change in policy making and programming for sustainable development

Background

This course is developed in an innovative partnership between Wageningen University and Research centre (Wageningen International, Alterra and PRI), the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) and the International Union for Conservation of Nature (IUCN). The course is the outcome of a process of needs assessment and dialogue between the partners on how to respond to Climate Change challenges in East Africa. It is part of a support programme for Climate Change Adaptation and Mitigation in East Africa, supported by the Ministry of Agriculture, Nature and Food Quality in the Netherlands. This training is one way of strengthening the capacities in the region, through well established local structures. The local implementing partner is the Horn of Africa Environmental Centre and Network (HoA-REC) at Addis Ababa University.

Course Focus

Changing climate and weather patterns are predicted to have severe negative impacts on food production, food security and natural resources in East Africa. Without appropriate responses climate change is likely to constrain economic development and poverty reduction efforts and exacerbate already pressing difficulties. Especially countries with economies rooted in climate sensitive sectors like agriculture, fisheries and forestry are expected to be hardest hit. Climate change is both a global environment and a local development issue, as it could jeopardize the livelihoods of millions, particularly where its impacts are compounded by other factors or where existing poverty and hunger make it particularly difficult to cope with its impacts. Targets as defined in the Millennium Development Goals will be more difficult to reach.

Simply because for countries in East Africa agriculture is, currently, the main economic activity and agriculture has traditionally been the key livelihood strategy for most people living in rural areas, it is also important in achieving development goals at national levels. Agriculture is at the forefront of shaping the concept of sustainable development. The renewed attention for the role of agriculture in development processes will have to take account of the vulnerabilities and risks posed by climate change. Also possible positive impacts on natural resources should be taken into account.

The formulation of climate change adaptation projects is done by most least developed countries via the National Action Programmes for Adaptation (NAPA's). Most projects focus on technical issues and not on the institutional and technical capacities that should be in place to actually implement possible adaptation strategies.

There is often limited knowledge and understanding of climate change adaptation concepts and local level implication. It is a rather new phenomena with potential risks but limited reaction of policy makers. Moreover the capacities for adaptive planning, informed policy development and climate proof programming are weak. This course will bridge the research-policy divide.

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Website: www.cdic.wur.nl

Code: 88/18, Duration: 2 weeks, Period: 1 – 12 March 2010
Application deadline: 1 February 2010
NFP Fellowship application deadline: 1 September 2009
Date of publication: 27 April 2009/FD

Aims and objectives

Participants of this course will have full understanding of climate change adaptation concepts. They are able to effectively and meaningfully contribute to the debate on climate change adaptation, either in the policy process and or in providing knowledge to the policy process. They will strengthen their positions in these processes on the basis of newly acquired concepts, skills and methodologies. For more information, contact *Jouwert.vangeene@wur.nl*

Training methods

The course uses interactive training methods. Subjects are conducted in a combination of lectures, plenary and group work, study assignments and role plays. Experiences of participants are the entry point for interaction. The course includes field work for vulnerability assessment and interaction with policy makers to discuss and refine strategies for policy development and programming.

Target group

The course is intended for mid-career professionals who are engaged at higher levels and deal with policy making either from the research side (as advisor), government side or from civil society. The focus will be on the research – policy interface. This course is intended for participants from Kenya, Ethiopia, Uganda, Tanzania, Rwanda and Burundi.

Requirements for admission

Candidates should meet the following requirements:

- relevant tertiary education and at least five years of experience in one or more of the course-related disciplines (agriculture, water management, biodiversity, forestry, crop breeding, crop production or otherwise related to natural resources management)
- the course needs to be directly relevant to their work for the research – policy interface on climate change adaptation. In their day to day work they have to 'translate' the impact of climate change into practical solutions and climate informed policies or programs
- Competence in English.

Programme

The main topics of the course are:

- Understanding climate change (concepts, causes, risks) and implications for food security and agriculture
- Agricultural and NRM vulnerability assessment
- Exploring indigenous knowledge and practices for adaptation to climate change (coping strategies)
- Innovative practices for adaptation
- Competing claims, conflict management, advocacy
- Policy making processes, integrating climate change issues into existing policy processes and rural development strategies.

Wageningen UR reserves the right to change the programme.

Certificate

Participants are granted a Certificate of Attendance.

Fees and accommodation

The tuition fee is **€ 3200** for two weeks. This amount includes administration fees, lecture materials and excursions. The course will be conducted at Addis Ababa University (HoA-REC). Participants will be accommodated in the vicinity of the University. Prices for accommodation and lodging are available upon request. These costs are not included in the tuition fee.

Fellowships

The deadline for the fellowships application from the Netherlands Fellowship Programme (NFP) has passed. There are no fellowships available at this moment.
Wageningen International can NOT provide any funds to finance the participants and is also unable to assist applicants in obtaining sponsorship.

Application

The admission deadline for application directly to Wageningen International, is **1 February 2010**. Early application is recommended. For additional information and online application, go to: *www.cdic.wur.nl/UK/newsagenda/* and click on the course of your interest.

Horn of Africa Regional Environment Centre and Network

RUFORUM

ASARECA Transforming Agriculture for Improved Livelihoods

IUCN

WAGENINGEN UR
For quality of life

Farm Level Optimal Water Management: Assistant for Irrigation under Deficit (FLOW-AID)

J. Balendonck

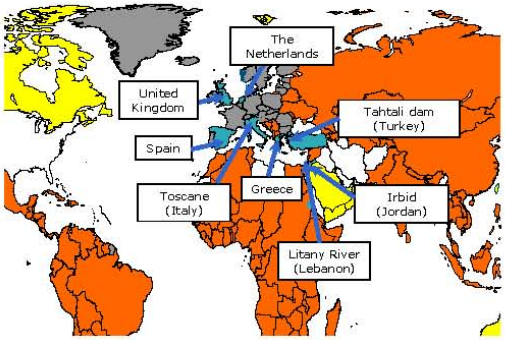
Objectives

- Sustainable irrigated agriculture for low water availability and quality
- New, simple and affordable sensor technologies
- Decision Support System for deficit irrigation
- Evaluation in semi-arid Mediterranean countries

FLOW-AID system

In view of the expected water availability (amount and quality) the system allocates available water among several farm zones and schedules irrigation for each individual zone. The following tools are being developed by partners from the Netherlands, United Kingdom, Spain, Italy and Greece:

- An expert system to assist farm zoning and crop planning
- A short-term irrigation scheduling module
- A crop response model for deficit irrigation
- A low-power wireless sensor network
- A maintenance free tensiometer
- Smart real-time and remote irrigation controllers



These tools are evaluated at test-sites in 4 Mediterranean countries: Italy, Turkey, Lebanon and Jordan, as well as in the Netherlands which are chosen in such a way that they differ in the type of constraints, irrigation structures, crop types, local water supplies, availability of water and water sources, in amount and quality, the local goals, and their complexity.

The work was carried out between 2006 and 2009 as a 6th Framework European project (no. 036958) under the call for water in agriculture, new systems and technologies for irrigation and drainage (FP6-2005-Global-4, PRIORITY II.3.5).

Benefits

- Maximum crop yield and economic profit under given constraints
- Optimal water gift when marginal water resources are being used
- Generic tools, adaptable to local situations
- For open field, as well as protected crop production systems


Wireless sensor test set-up for container grown plants (CeSpeVi, Italy)


Irrigation controllers in a cucumber greenhouse (Menderes, Turkey)


Dual water quality irrigation at test site in Irbid (Jordan)

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FLOW AID

Partners
University of Pisa; CeSpeVi; Spagnol Automation (Italy)
Ege University Faculty of Agriculture (Turkey)
Jordan University of Science and Technology (Jordan)
Lebanese Agricultural Research Institute (Lebanon)
Rothamsted Research; Delta T Devices (United Kingdom)
University of Castilla La Mancha (Spain)
Geomations (Greece)

More Crop per Drop

Technology supports growers to cope with water shortage challenges

Water shortage forces growers to adopt deficit irrigation practices. They tend to irrigate with less water at a lower quality. To avoid crop damages and income losses, they need to manage their water and nutrients more precisely. New technology based tools might help them by making the most optimal operational decisions. The extra income, due to slightly higher yields and use of less fertilizers, might help to invest in these new technologies.

The Problem

Agriculture is the largest user of water, making it a big competitor for domestic and industrial users. To secure our food production for future generations, the irrigation water use efficiency must be increased drastically, in other words: we need "more crop per drop".
Generally the way to go is to avoid spilling of water, and to ensure that all the irrigation water is being used by the crop. Over-irrigation invokes leaching of water and fertilizers affecting the environment. This can be ensured by optimizing irrigation equipment and irrigation management.

However, in many cases this step is not enough, and currently growers need to adopt a deficit irrigation strategy in which they supply water under the advised FAO amount or even use non-fresh water resources. Crop yield is closely related to water and fertilizer use. Limiting water supply or using marginal water resources might result in yield and quality losses. Working under deficit conditions means that the grower needs to operate his water management more precisely to prevent income losses. He cannot longer rely on his common sense, but needs help from technology.

Objectives

FLOW-AID contributes to sustainable irrigated agriculture by developing a deficit irrigation management system for farm-level crop production in cases with limited water supply and marginal water quality. It integrates innovative sensor technologies into a decision support system, taking into consideration boundary conditions and constraints for a number of practical growing systems in the Mediterranean. It focuses on innovative, simple and affordable, hard- and software concepts; particularly a maintenance free tensiometer, a wireless and low-power sensor network; an expert system for farm zoning and crop planning in view of expected water availability and quality; and an irrigation scheduler for allocation of multiple water sources. The system is being evaluated at five sites located in Italy, Turkey, Lebanon, Jordan and the Netherlands, which differ in the type of local constraints, irrigation structures, crop types, local water supplies, availability of water and water sources in amount and quality, the local goals, and their complexity.

Methodology

The FLOW-AID system consists of irrigation controllers, distributed over the irrigated farm zones. They are connected via a wireless link to a local computer that regularly reads out sensor data and updates the scheduling programs running autonomously in the controllers. A Decision Support System containing an expert system with "best practice irrigation rules", running either on the local or remote (connected via internet) computer helps growers to optimise their scheduler programs in view of the expected water availability and climatic conditions on a long-term as well as short-term basis. During three growing seasons, the system components are mainly being evaluated at Mediterranean test-sites. Over the years, the system is enhanced and the final system was shown to farmers during the 3rd year at the test-sites. The FLOW-AID system is being developed through a close partnership between research institutes, universities and SME's.

Results

Case studies have shown that compared to current practices, by using innovative technologies, the water use efficiency can be raised up to 10% while maintaining the existing crop yields.
Application of new technologies cost money. Some case studies have shown that by using technology and adapting strategies one could even raise the productivity up to 10%, while the amounts of water and nutrients being used where less than current practices. By using treated waste water resources farmers could benefit from the already available nutrients in these water sources. Farmers might use this extra income for investing in new technologies.

WAGENINGEN UR
For quality of life

REDUCING RISKS OF PESTICIDES IN ETHIOPIA

Joint collaborative project on pesticide registration and post registration

Background and context

Over the last 10 years, the Ethiopian government has been concerned about the safe disposal of obsolete pesticide stocks. However, the country is still not free from obsolete pesticides and large quantities of contaminated containers and pesticide application equipment remain scattered over the country. In addition, residue problems have been reported on some export crops. This reflects a mismanagement of pesticides at different stages of their life cycle in the country.
One of the basic problems in the management of pesticides is the lack of a proper registration system in Ethiopia. Pesticide registration is still in the development stage and expertise is limited.

At the same time, Ethiopia is in the process of intensifying its agriculture both to meet national demands for food and to increase agricultural exports (e.g. coffee, flowers, and vegetables). As a result, pesticide overuse and misuse was documented over the last decade.
Pesticide management therefore receives much attention from the government in order to attain high quality agricultural produce for local consumption and export, protect public health and natural resources. In view of this, the Government of Ethiopia has initiated a national programme to improve pesticide management

along the pesticide life cycle: from the registration and import of pesticides, to use and monitoring, and including quality control and waste management. In 2006, the Animal and Plant Health Regulatory Department (APHRD) initiated a strategy for pesticide use reduction and introduced IPM on cotton and awareness building on misuse of pesticides, in close collaboration with FAO and local NGOs In the meantime, APHRD requested FAO assistance to review the pesticide legislation and to assess the capacity of national laboratories with regard to pesticide formulation and residue analysis. It also requested Alterra Wageningen- UR, in the Netherlands, to support the development of local technical capacity for the registration of chemical pesticides and bio-pesticides.

During a workshop in Addis Ababa, in September 2008, it was decided to design one comprehensive programme in order to cover the various above mentioned activities. APHRD, Alterra Wageningen-UR, the Swedish Chemical Agency (Kemi) and FAO started a joint collaboration on pesticide risk reduction in Ethiopia. This collaborative project is intended to figure as a pilot for other countries in Africa.

Objectives

- To develop a legal framework for the registration and post registration of
  pesticides (proclamation and relevant regulations).
- To develop a proper pesticide registration system for Ethiopia and train local staff on dossier evaluation.
- To develop a post registration system (including pesticide residues and quality control, monitoring, inspection, pesticide storage, capacity building and training).
- To develop a formal consultation platform that will support APHRD with advice on (post)registration issues.
- To execute an impact assessment of the new (post) registration system.

Project partners

The main project partners are:

- Animal and Plant Health Regulatory Directorate (APHRD), MoARD, Ethiopia
- Alterra, Wageningen University and Research Centre, the Netherlands
- Swedish Chemical Agency (Kemi), Sweden
- Food and Agricultural Organisation of the United Nations (FAO)

Project approach

The project is divided into 5 work packages.

Work package A: Legal framework

A new legal framework for pesticide management was already elaborated before the start of the project. The goal of this work package is to ensure consistency between the legal framework and the methodologies, guidelines and approaches that will be developed during the project.

Work package B: Development of a registration system for pesticides

This goal of work package B is to develop a:

1. Pesticide administrative registration management unit
2. Scientific evaluation system for the registration of chemical pesticides and bio-pesticides.

APHRD staff will receive intensive on-the-job training in dossier evaluation. A manual of procedures, new application forms, a database and web page with registered pesticides, etc., will be developed in order to strengthening the pesticide registration system of Ethiopia. The evaluation system will focus on biological efficacy, human health aspects, pesticide residues and environmental issues.

Work package C: Development of a post-registration system for pesticides

The goal of this work package is to develop a well functioning post-registration system and covers the development of:

1. Reference laboratory for pesticide residues and quality control
2. Monitoring system
3. Inspection system
4. Storage of pesticides
5. Public awareness and capacity building of professionals
6. Training of pesticide distributors, retailers and pesticide applicators, and
7. Empty container management.

The approach will focus on capacity building, while much attention will also be given to the development of guidance, standards and protocols.

D. Sustainability of the developed systems

This work package intends to develop procedures and methodologies to support the scientific aspects of pesticide registration and monitoring. Scientific expertise will be developed at 2 levels: First, at APHRD-level for routine-based dossier evaluation; and second, at University level in order to scientifically underpin the development of new methods and procedures in the future.

In addition, particular attention will be given to the administrative and financial sustainability of both the registration and the post-registration system. Feasibility studies will be carried out to assess the best options to long-term continuity and financial sustainability of the various proposed systems.

E. Impact assessment

The goal of this work package is to evaluate the impact of the newly developed systems related to (post) registration of pesticides. At the start of the project (2010) a study on the reference situation will be done focussing on:

1. Pesticide use by farmers
2. Environmental impact of pesticide use
3. Impact on human health of pesticides use
4. Existing capacity of professionals, and
5. Knowledge of pesticide users.

After 5 - 10 years the study will be repeated and the impact of the activities within project will be evaluated.

Funding of the project

The following parties have indicated their interest in participating in the project.

- The Royal Netherlands Embassy in Ethiopia, as representative of the Dutch Ministry of Agriculture, Nature Management and Food Safety (LNV)
- Food and Agricultural Organization of the United Nations (FAO)
- Swedish International Development Cooperation Agency (SIDA) Additional funding will be sought to realise all the objectives of the project.

Contact

For more information about the project please contact the project coordinators:

- Floor Peeters, Alterra Wageningen UR, the Netherlands (floor.peeters@wur.nl)
- Alemayhu Woldemanuel, APHRD, Ethiopia (alemaworke@yahoo.com)
- Dr. Haimanot Abebe, APHRD, Ethiopia (haimanotabebe@Yahoo.com)

WAGENINGEN UR
For quality of life

WIBIS: Coping with Competing Claims on Water in the Incomati Basin through Interactive Science

Rationale

The Incomati river basin is shared between South Africa, Swaziland and Mozambique. The basin faces huge challenges in terms of water scarcity and over-allocation of water resources. Population growth, economic development, socio-economic reforms (including the issue of land to emerging farmers) and the global climate change will cause additional pressure on the already scarce land and water resources.

To cope with the competing claims impartial information and good communication between the stakeholders in land and water management is imperative. This refers to the various sectors, regions and the three countries.

Objective of the project

The WIBIS project is aimed at supporting inter-sectoral and inter-state (transboundary) policy development and sustainable (wise) use of the Incomati basin water. The project supports ongoing regional initiatives and projects, such as the PRIMA project (Progressive Realisation of the IncoMaputo Agreement).

Approach: Interactive science

WIBIS provides an interactive discussion support tool in land and water development and management. The tool can generate spatially distributed information on water consumption and water productivity for different land uses, based on a consistent method and impartial information. The WIBIS tool enables stakeholders to –interactively– evaluate alternative land use scenarios, assess the economic water productivity of the various land uses within regions or countries, and assess the water availability to downstream regions or countries.

The tool does not optimize land and water management. The stakeholders should establish their own priorities, i.e. whether to increase land productivity (ton/ha), crop water productivity (kg/m^3), economic water productivity (R/m^3) or the socio-economic water productivity (e.g. poverty alleviation, job creation, nature). WIBIS is principally a tool for identification and quick scanning of land use scenarios, which helps stakeholders to investigate and discuss land and water policy scenarios.

Crop water productivity (CWP) and economic water productivity (EWP) for sugarcane in the Incomati Basin

	ET mm	Biomass ton/ha	Yield sugar ton/ha	CWP kg/m^3	EWP R/m^3
2002-2003	827	53.06	11.51	1.39	1.02
2003-2004	812	57.41	12.45	1.53	1.06
2005-2006	867	55.23	11.98	1.38	1.00

The tool

The WIBIS tool is an open-source web application with which the user can evaluate the implications of land use scenarios. The interactive tool is accessible to any authorized user, whereas others can freely browse through the existing data presented in the tool. It generates on-line an extensive set of maps with land and water indicators, which are continuously updated as long as the user is working with the tool.

In the current version 15 land use types are distinguished. These include 9 cultivated land uses (agricultural crops and forest plantations) and 6 other uses (nature lands and built areas). The Incomati basin is subdivided in 24 regions.

Whilst working with the tool the user can adapt any land use. The tool will then calculate the expected water consumption (mm), biomass water productivity (kg/m^3), crop water productivity (kg harvestable yield/m3) and economic water productivity (R/m^3) in each region, as well as the available water to downstream regions. This is done on an annual basis, through water accounting. The economic water productivity is calculated on the basis of market prices and production costs (per region).

The user can compare the value of various land and water indicators in a wet, dry and average year. For the 15 land use types the regional differences in water consumption, biomass production and water productivity can be presented. For the 24 regions the rainfall, reference evapotranspiration, rainfall surplus and existing monitoring data can also be displayed.

The WIBIS tool can assist in prioritizing land uses and can also be used in a trans-boundary context.

The WIBIS tool is based on a consistent method and impartial information, using satellite images. Actual evapotranspiration and biomass production are calculated on a monthly basis with the SEBAL algorithm applied on MODIS images, having a spatial resolution of 250x250 m. Rainfall is retrieved from the Tropical Rainfall Measurement Mission (TRMM), which carries a precipitation radar. All these monthly (as well as annual) data can be consulted with the WIBIS tool (hence at grid level).

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Water Watch

Project organization

LEI
LEI is part Wageningen UR. Within the Netherlands, it is the leading institute for economic research in the field of agriculture, horticulture, fisheries, management of rural areas, agribusiness and the production and consumption of foodstuffs. The research supports the decisions that government bodies need to make.
For more information please visit: www.lei.wur.nl/UK

WaterWatch
WaterWatch is a Wageningen based - scientific advisory firm, active in the niche of remote sensing and water resources management. Satellite image analysis to support water management applications is the core activity of WaterWatch. The portfolio covers essentially irrigation and drainage studies throughout the world, but also environmental studies towards the quantification of soil and land degradation. WaterWatch is the intellectual owner of the Surface Energy Balance Algorithm for Land (SEBAL), which has become one of the internationally leading algorithms for estimating actual evapotranspiration. For more information please visit: www.waterwatch.nl

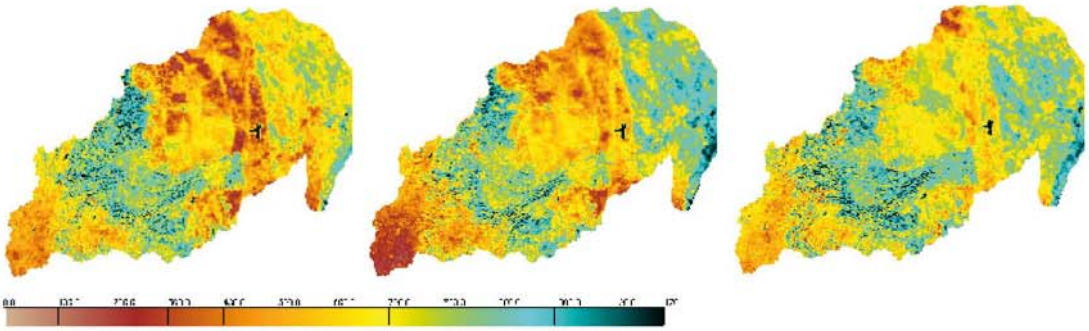
Alterra
Alterra is part of Wageningen UR. It co-operates with the school of Environmental Sciences of Wageningen University. With this partner Alterra contributes to a high quality and sustainable green living environment. The exchange of expertise and capacity and the match between fundamental and practical research in various projects gives Alterra a scientific advantage.
For more information visit: www.alterra.wur.nl/UK/

DGIS-WUR partnership programme
The project is funded by the DGIS-Wageningen UR partnership, which aims at effectively contributing to poverty alleviation, food security and livelihood improvement for the (rural) poor. Taking the trends in globalization into account, and acknowledging the role which science, technology and institutional development can play in addressing the complex issues involved, DGIS and Wageningen UR established a partnership that aims at developing recommendations for policy development and tools for resource management.

The DGIS-Wageningen UR partnership programme aims at:
- Supporting a better understanding in the South of the linkages between globalization and natural resource based sustainable development
- Translating this understanding into policy recommendations for developing countries, for Netherlands' development co-operation and for stakeholders in the development process
- Developing scenarios for sustainable development
- Strengthening national capacities and institutions to cope with globalization and to implement the scenarios and mechanisms developed.

Through the Partnership Programme, DGIS and Wageningen UR want to make tangible contributions to three of the major Millennium Development Goals:
- Eradicating extreme poverty and hunger (MDG 1)
- Ensuring environmental sustainability (MDG 7)
- Developing global partnerships for development (MDG 8) through active involvement of multiple stakeholders.

Planning
The project is running from the 1st of March 2008 until the 1st of Jun 2010.



Calculated water use (evapotranspiration) in mm/yr in a dry (2002-2003), average (2003-2004) and wet (2005-2006) year

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Annex 2 Managing Africa's trans-boundary waters by trans-boundary land management

Managing Africa's trans-boundary waters by trans-boundary land management

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ALTERRA
GREEN WORLD RESEARCH

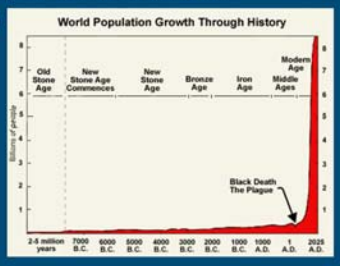
Structure of presentation

- Rationale
- Conceptual framework
- Consumptive use of water
- Trans-boundary land planning
- Indicators for prioritization
- Communication stakeholders
- Example: Inkomati basin
- Discussion

Rationale

Unprecedented pressures on land and water:

- Population growth



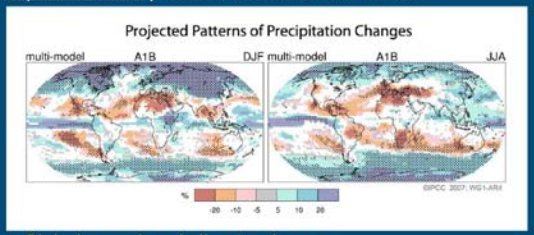
Rationale

Unprecedented pressures on land and water:

- Population growth
- Socio-economical developments (e.g. urbanization, industrialization, land reforms)
- Socio-cultural developments (changes in lifestyle, diet)
- Global warming / climate change

Rationale

Unprecedented pressures on land and water:



- Global warming / climate change

Rationale: (Global) Challenges

- Competing claims Land & Water Resources (between sectors and areas/countries), scarcity, over-allocation, conflicts
- One in three people face water scarcity
- Vital ecosystems are being degraded or destroyed
- Basic human right of access to sufficient food is infringed or at risk for more than 800 million people
- The poor are most affected by the extremes of water shortage or flooding and food shortages

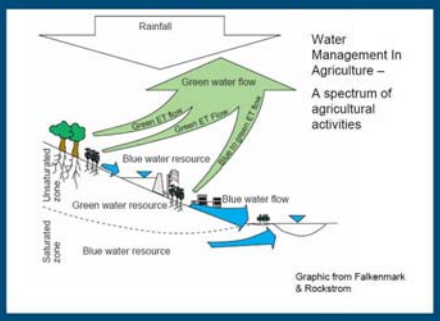
Rationale

Basic concept

- The availability of surface water resources (and groundwater resources) is primarily determined by land use and management
- Water planning and management is the secondary determining factor

⇒ *Consider the "green water" !*

Rationale: Green and blue water



Rationale

⇒ Focus on rainfall and (all) consumptive use of water:

- Rainfall is ultimate water resource
- Consumptive use: "green" and "blue water"

(⇒ do not only focus on blue water)

Rationale: Green and blue water use

Rainfall
≈ 5 billion m³/year

Example: In the Inkomati basin agriculture and forestry receive more than 5 times more water as rainfall than the amount of freshwater withdrawn for irrigation

Agriculture (incl. forestry)

Irrigation
< 1 billion m³/year

Runoff

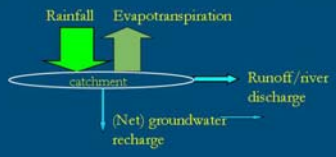
Conceptual framework

Assumption:

- Consumptive use of water
  ≈ Actual evapotranspiration + inter-basin transfers

Conceptual framework

How can we manage consumptive use of water?

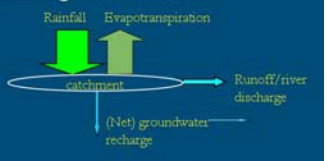


Consider managed (or manageable) and unmanaged (unmanageable) land uses

Conceptual framework

Unmanaged (or –poorly- /unmanageable) land uses:

- Natural forest
- Bushland, savanne
- Natural grasses
- Weeds
- Lakes and wetlands
- Etc.

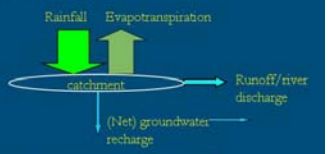


Nature areas are, generally, not managed (from a water use perspective)
Rainfall and evapotranspiration occur without human interference

Conceptual framework

Managed (or manageable) land uses:

- Agriculture – crop production
- Grazing lands
- Commercial forestry



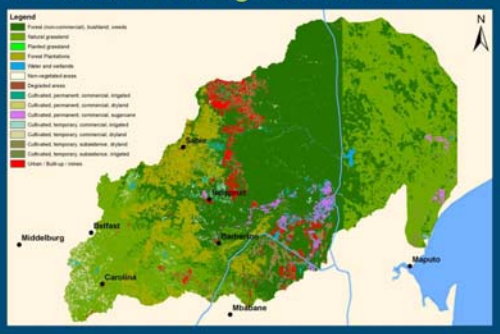
!! We don't discriminate between irrigated agriculture and rainfed agriculture !!

Transboundary land planning

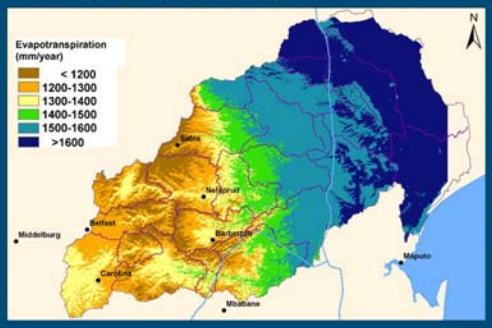
- Identify and categorize land uses
- Quantify for each land use how much water is consumed (incorporate spatial and temporal variability)
- Assess which part of the water consumption is manageable (either by land management and water management)
- Assess which part of the water has economical, social or ecological benefits
- Develop indicators and quantify these economical, social or ecological benefits
- Set policy priorities
- Plan land use (-re-allocate land and water resources)

Assure acceptance and commitment by stakeholders through transparency and genuine participation

Identification and categorization of land uses



Consumptive water use - quantification



Consumptive water use - countries/areas

Gross water balance entire catchment:

2003/2004 ("Average year")	Rainfall (mm)	Evapotranspiration (mm)	Surplus (mm)
Mozambique	710	778	-68
Swaziland	717	804	-87
South Africa	677	618	59

Consumptive water use - sectors

Land use	2003/2004 ("average")
Nature: forest (non-commercial), bushland, weeds	667
Forest plantations	777
Permanent cultivated commercial irrigated land	822
Sugarcane	840
Temporary cultivated subsistence dryland	561

Consumptive water use – areas/countries and sectors

Average year	Evapotranspiration (mm/year)	
	Forestry	Sugar
Mozambique	777	1001
Swaziland	939	808
RSA	802	765

Assess (type of) benefits of land uses

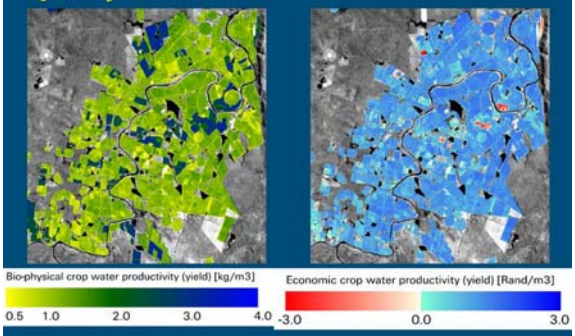
(from Bastiaanssen, 2008)

Land use	Beneficial Economy	Beneficial Environment	Non-beneficial
Crop	T		E
Weed			E & T
Natural lakes	E	E	
Reservoirs	E		
Fish ponds	E		
Evaporation pond			E
Saline sink			E
Pasture	T		E
Golf course & sport parks	T	E	
Natural wetlands		E & T	
Managed wetlands		E & T	
Savanna		T	E
Woody savanna	T	T	E
Plantation forest	T		E
Natural forest		T	E
Phreatophytes			E & T
Desert			E & T
Oases	T	T	E
etc			

Indicators for prioritization

- Crop water productivity CWP (kg/m³) — *Food security*
  beneficial biomass per unit of water consumed
- Economic water productivity EWP (€, $, R/m³) — *Income*
  net private benefits per unit of water consumed
- Socio-economic water productivity SWP (e.g. jobs/m³) — *Social security*
  net social benefits per unit of water consumed
- Ecological water productivity (e.g. biodiversity/m³) — *Ecological integrity*
  net ecological benefits per unit of water consumed

Quantify indicators



Transboundary land planning

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- **Set policy priorities**
- **Plan land use (-re-allocate land and water resources)**

Assure acceptance and commitment by stakeholders through transparency and genuine participation

Communication planners and stakeholders

Assure acceptance and commitment by stakeholders through transparency and genuine participation

- **Communication is key in land and water management,** particularly in policy development to address inter-sector, inter-regional and inter-state (trans-boundary) wise use of land and water

⇒ Promote participation

⇒ Promote interactive methods

Communication planners and stakeholders

Example of interactive tool

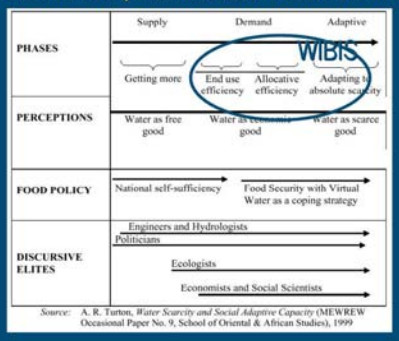
Communication planners and stakeholders

Application:

Rapid assessments of difficult management strategies:

- *Demand management / allocative water management (land use)*
- *Demand management / end-user efficiency (water saving)*

Communication planners and stakeholders



Application of WIBIS for L & W scenarios

Compare and assess scenarios using spatially distributed criteria:

- Water availability for downstream uses
- Crop Water Productivity (harvest per unit of water)
- Economic Water Productivity (economic benefits per unit of water)

- *Social water productivity (e.g. employment per unit of water).*
- *Ecological water productivity (benefits for ecosystems per unit of water).*

WIBIS tool

- GIS based
- Global access (web based)
- Open-source software
- Open standards
- Personalized (user-name, password)
- Rapid assessments (interactive use)
- Scenarios: Analyze current situation and evaluate alternatives, save and modify scenarios

WIBIS tool

- Visualize geographical and sectoral distribution of water consumption and water productivity
  - ⇒ *Geographical: (24) land management areas*
  - ⇒ *Sectoral: (15) land uses*

- Analyze current situation and evaluate alternatives

WIBIS: land uses (15 categories)

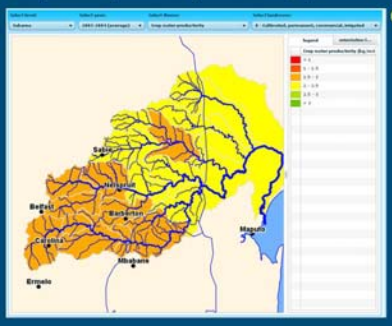
Land cover class	Land cover category
Forest (indigenous)	Forest (non-commercial), bushland, weeds
Woodland	
Thicket, Bushland, Bush Clumps, High Fynbos	
Shrubland and Low Fynbos	
Herbland	
Natural Grassland	Natural Grassland
Planted Grassland	Planted Grassland
Forest Plantations (Eucalyptus spp)	Forest Plantations
Forest Plantations (Pine spp)	
Forest Plantations (Acacia spp)	
Forest Plantations (Other / mixed)	
Forest Plantations (clearfelled)	
Waterbodies	Water and wetlands
Wetlands	
Bare Rock and Soil (natural)	Non-vegetated areas
Bare Rock and Soil (erosion: dongas, gullies)	
Bare Rock and Soil (erosion: sheet)	
Degraded Forest & Woodland	Degraded areas
Degraded Thicket, Bushland, etc	
Degraded Shrubland and Low Fynbos	
Degraded Herbland	
Degraded Unimproved (natural) Grassland	
Cultivated, permanent, commercial, irrigated	Cultivated, permanent, commercial, irrigated
Cultivated, permanent, commercial, dryland	Cultivated, permanent, commercial, dryland
Cultivated, permanent, commercial, sugarcane	Cultivated, permanent, commercial, sugarcane
Cultivated, temporary, commercial, irrigated	Cultivated, temporary, commercial, irrigated
Cultivated, temporary, commercial, dryland	Cultivated, temporary, commercial, dryland
Cultivated, temporary, subsistence, dryland	Cultivated, temporary, subsistence, dryland
Cultivated, temporary, subsistence, irrigated	Cultivated, temporary, subsistence, irrigated

WIBIS: land uses (15 categories)

- *Select land uses subject to planning*
- *Calculate the occurrences in each land management area*
- *For each land use calculate the average evapotranspiration and biomass production (for each of the 24 areas and for each year)*
- *Assign harvest indices for each commercial land use (discriminate geographically and between years)*
- *Assign economic parameters (price, variable and fixed costs) for each commercial land use (discriminate geographically and between years)*
- *Calculate for each of the 24 areas, for each year and for each of the land uses:*
  - *Discharge to downstream areas*
  - *Crop water productivity*
  - *Economic water productivity*

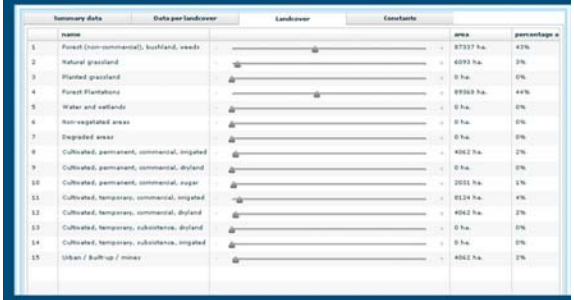
Example: Rainfall surplus

Example: Crop water productivity permanent irrigated commercial land



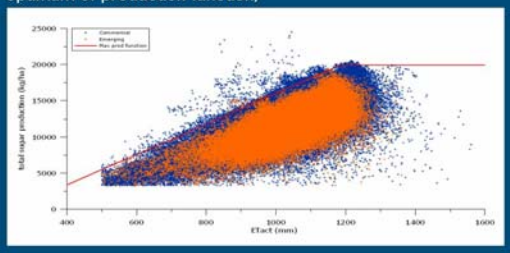
Example: Economic water productivity sugar

Example: Land planning



Conclusions : Various future options can be added

- Incorporate water saving (fractional water allocation based on optimum of production function)

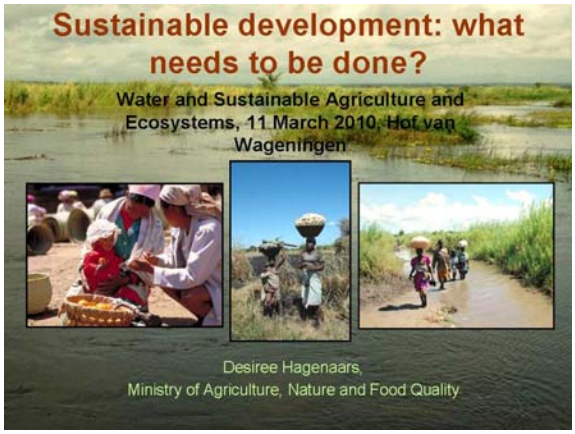


Annex 3 Contacts during Second African Waterweek

Patrick	Mwangi	WSP/Worldbank	Kenya
Charles	Hakizimana	Tac-Amcow	Ethiopia
Thabiso	Mudau	ARC	South Africa
Lahmouri	Abaldaem	Secretary state of water and environment Morocco	Morocco
Bafedile	Raneskono	Dept Watter Appaits	South Africa
Samba B.A.	Raby	UN-HABITAT	Mauritania
Sampie	Shabangu	Kobwa	South Africa
Gerald	Tenywa	The New Vision	Uganda
Georges	Gulemvuga	CICOS	Congo
Mburente	Nestor	Avedec-Burunai	Uganda
Priscilla	Achakpa	Woman Environmental Programme	Nigeria
Dr. Sipho	Nkambule	Kobwa	South Africa
Bathermy	Tsafaek	Wesde Cameroon	Cameroon
Ada	Oko-Williams	Wateraid	Nigeria
Charles	Makuwerber	Bambani S. Africa	South Africa
Mildred	Mkandla	Earth Care Africa	Ethiopia
Sharon	Machutela	Protechnik Laboratoirs	South Africa
Frans P.	Wemba	Operation Hunger	South Africa
Esther	Ngorima	CSIR	South Africa
Masego	Thebe	Frances Board District Municipality	South Africa
Madeleine	Fogde	SEI	Sweden
Jill	Ovens	Wits	South Africa
E.	Karabo	MAWF	Namibia
Simon	Thuo	NBI /Global Water Partnership	Uganda
LZ	Maswuma	Water Affairs	South Africa
Dr. Kane	Alioune	University Cheekh Senegal	Senegal
Chuck T.	Tandia	CREPA	Burkina Faso
	Matshepo	DWA	South Africa
Bilal	Randeree	Enviro Journalist	South Africa
F.	Hoogveld	BuZa	Mozambique

George	Tsibani	Mthengenyat AD	South Africa
Dr. Alain	Randriamangrisort	University of Water	Madagaskar
Basiro	Fantole	Federal Min. of Agriculture and Water	Nigeria
Saliha	Alemayehu	Federal Institute of hydro UNESCO IHP and WMO-HWRP	Germany
Cecil	Mohlala	CSSP	
Richard	Cupido	Chosen for Greatness	South Africa
Mohamed H.	Elrasal	Public Water Corporation	Sudan
Nomasonto	Malsi	PB World	South Africa
Phakamani	Buthelezi	BOCMA	South Africa
Dieter	Van den Broeck	Livinglands	South Africa
Nicholas	Mkhatshwa	KOBWA	South Africa
Emmanuel	Lesoma	Water Commission	Lesotho
Patrick M.	Wangi	WSD / WB	Kenya
Ir. Dick C. van	Ginhoven	Ministerie Buitenlandse Zaken	Netherlands
Drs. Simon J.H.	Smits	Ministerie Buitenlandse Zaken	Netherlands
Dr. Rose	Kaggwa	National Water & Sewerage Corporation	Uganda
Marius	Claassen	CSIR	South Africa
Dr. Keith	Kennedy	CSIR	South Africa
Rose Osinde	Alabaster	UNEP	Kenya
Lisa	Rheinberg	DEFRA	South Africa
Ms Thembi	Mtselu	University of the Witwatersrand, Johannesburg	South Africa
Emmanuel	Mwendera	IUCN	Kenya
Mbangiseni P.	Nepfumbada	Water Affairs, Rep. of South Africa	South Africa
Michel	Tozan	Min. de l'Environnement, des Eaux et Forêts	Cote d'Ivoir
Barbara	Lopi	SADC-groundwater	Botswana
Jonathan	Timm	The Mvula Trust	South Africa
Ir. M.A.	Ivalo	Ministerie Buitenlandse Zaken	South Africa
Sylvain	Usher	African Water Assocation	Cote d'Ivoir
Sering B.O.	Jallow	African Development Bank	Tunesia
Rwakakamba	Morrison	UNFFE	Uganda
Ngusa L.	Izengo	Ministry of Water and Irrigation	Tanzania
Ndileka K.	Mohapi	Water Affairs and Forestry	South Africa
Saadou Ebih	Oald	CNRE	Mauritania

Annex 4 Water and Sustainable Agriculture and Ecosystems, Seminar 11th March 2010



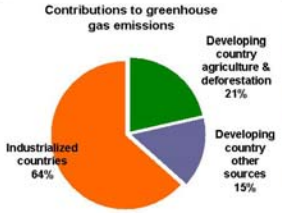
CSD-17

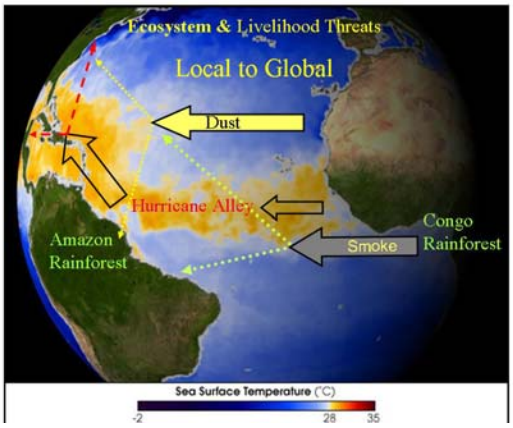
- UN Commission on Sustainable Development: 17th session
- Topics 2008/2009: Agriculture, rural development, land, drought, desertification and Africa
- Context: multiple crises

Agriculture & Sustainable natural resource management

Important user of natural resources:
- 80% of fresh water resources
- 40% of land area
- 21+ % of greenhouse gas emissions

Competing claims and scarce resources:
Food, feed, forests, bio fuels, water etc.





Water as cross cutting topic: poverty impact in Africa

Poverty and water stress (too much or too little):

- Today water stress in 14 countries.
  In 2025 50% of Africa's population (1.5 billion) will be seriously suffer from water stress.
- About 50% (300 million) of Sub Saharan Africa population has insufficient access to clean drinking water and 41% has no adequate sanitation.

Too much water:

Zambezi floods in 2007

Too little water:

Zambezi drought one year later

Message Chair CSD-17

Agriculture in development: Minister Verburg vision along 5 tracks:

- Improving agricultural productivity
- Improving an enabling environment
- Sustainable value chain development
- Increased access to markets (national, regional, international)
- Securing food security and income distribution mechanisms

VN SG Ban Ki-moon

- CSD-17 is of crucial importance for the integrated approach to the multiple crises
- Way forward: climate change agenda, food security

Results CSD-17 (1)

- Consensus (180 countries) on the need of an urgent transition towards a sustainable, inclusive and resource efficient path of world economy. With a strong role for agriculture.
- Agriculture is not longer part of the problem, but part of the solution.
- Compared with the text of CSD-8 on sustainable agriculture in 2000.
- The outcome document was adopted with consensus.
- It contains 278 policy measures and actions.

Results CSD-17 (2)

- Scaling up sustainable agriculture under ecological modernisation.
- The importance of sharing experiences, innovative technology, training and developing human capacities and agricultural practices and extension.
- New and additional resources, public, private, national and international, for strengthening sustainable agriculture, especially in developing countries.
- Sustainable and home grown green revolution in Africa. New, creative and innovative thinking on how to combine best science with farmers' knowledge.
- Agriculture more central role in addressing challenges related to climate change agenda, in Copenhagen and beyond.

Results on water (1)

- Innovative ministerial round table on water
- Prince of Orange (UNSGAB) broadened the water agenda
- Main message regarding water:

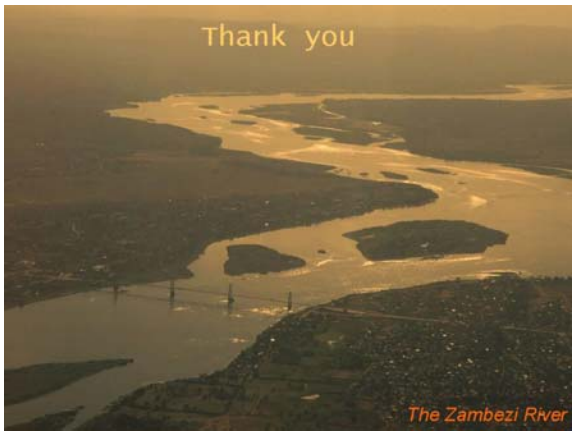
CSD-17 message on water

- Water and agriculture are interlinked
- Segmented water use has to stop - Integrated Land and Water Resource Management, by including principles of sustainability, also for 'ecosystem services'.
- Innovation and Implementation: Innovative ways to use water in a more efficient way
- Governments have an important role in protecting natural resources, but cannot do it alone
  - Improving access to land
- Women have a special role to play

Follow up of CSD-17 decisions

Advancing the implementation of CSD-17 decisions:

- The agenda CSD-17 is by no means simple.
- Coordination needed among all stakeholders from global level to country level.
- Linking up with other agenda's (climate change, deforestation, sustainable consumption and production)
- Water specific: UNSGAB's agenda renewed in Hashimoto Action Plan II: now including integrated water management and agriculture + climate change



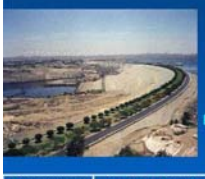
CSD-17 follow up

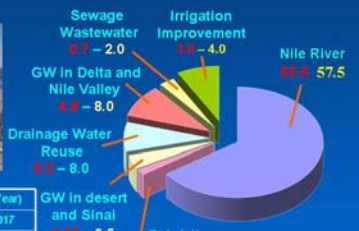
- Role Minister Verburg
- Follow up in the Netherlands
  - Link between agriculture and water in "Agriculture, rural economic development and food security
  - Research and development: on water for food and ecosystems
  - Netherlands National Water Agenda
  - Agriculture and climate change

After 6000 years of agricultural water management in the Nile, how do we handle the 21st Century

Dr. Essam A. Khalifa
Ministry of Water Resources and Irrigation

Available Water Resources 2010 - 2017

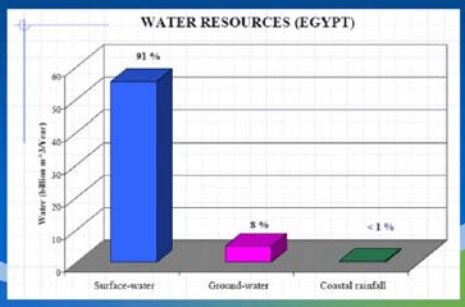




Requirements	Quantity (Bm³/ Year)	
	2010	2017
Agriculture	55.20	70.70
Municipal	4.55	6.60
Industry	7.60	10.60
[illegible]	0.30	0.00
Total	67.80	87.90

Current 2010
Future 2017

Distribution of Fresh Water Resources in Egypt

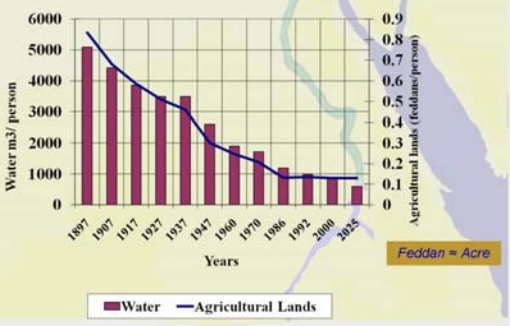


Challenges facing the water sector in Egypt

- Limited water resources (Nile, non-renewable groundwater, rainfall,…)
- Population increase and demographic distribution
- Water quality degradation
- Costs for new projects and O&M are escalating dramatically
- Lack of awareness and need for more coordination between different stakeholders
- Lack of water supply and sanitation
- More than 90% of water supply of Egypt comes from outside its borders
- Impacts of world trade agreements and globalization on local economy

Challenges facing the water sector in Egypt

Population **increase** and Demographic distribution



Evolution of Water Policies in Egypt

- Water Policy in 1975 (matching between supply and demand)
- Water Master Plan in 1981(water requirements for agricultural growth)
- Water Security Projects in (1993).
- Water Policies of (1998).
- *National Water Resources Plan development (2005).* Towards achieving the Millennium Development Goal (MDGs)

Main Themes of Water Policy

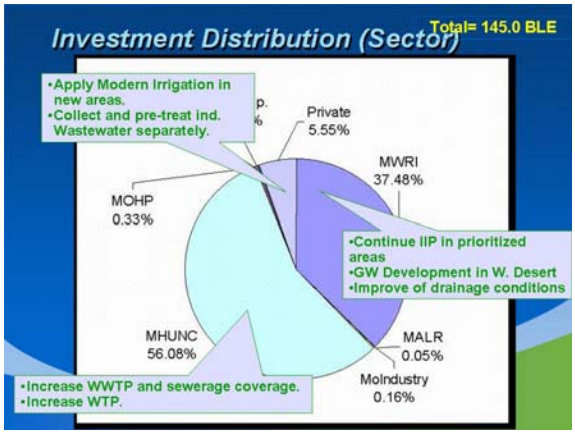
- Optimization of the Current Available Water Resources
- Water Resources Protection and Pollution Mitigation
- Development of Additional Water Resources

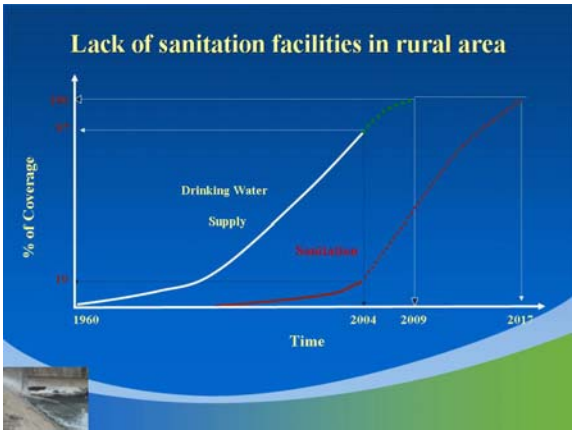
Examples for Stakeholders Ministry of Housing,

What, Who, How, When, Finance

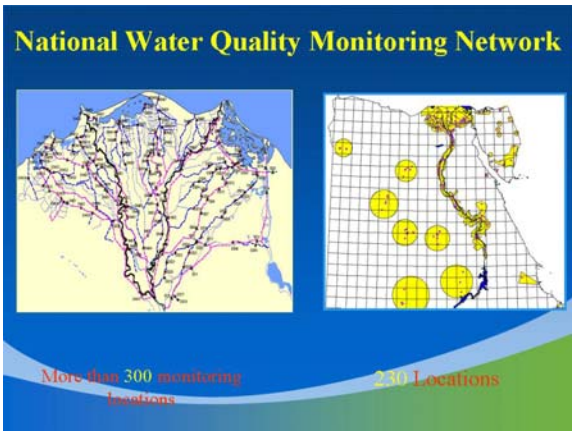
Recommended Measures/Actions	Stakeholders															Implementation			
	N. Water Council / MWRI	Min.of Water Res.& Irrig.	Min.of Agric.& Land Recl.	Ministry of Industry	Ministry of Investment	Ministry of Housing	Ministry of Health	Ministry of Electricity	Min. of Transportation	Ministry of Planning	Min. of Local Developm.	Ministry of Tourism	NGOs, etc.	MUAs / Water Boards	Universities/Research Org.	Private Sector	No. of the measure	Type of measure	Total investment (or M.U.)	Total recurrent costs (M.U.)
Install / rehabilitate drinking water metering systems						●					○					X	18	inv.	249	104
Review price policy for drinking water						●										O	19	pol.	1	
Intensify water conservation awareness campaigns		O				●					○		○				43	man.	90	
Reduce leakage losses in PWS network by prioritization						●					○		○				67	inv.		2,000
Reuse treated wastewater in New Industrial and Canal Cities		O				●					○					O	58	study		
Increase municipal sewerage and wastewater treatment		O				●	O				○						10	inv.	38,680	4,019
Increase drinking water treatment capacities		O				●	O				○						11	inv.	17,790	2,736
Select proper sources for public water supply		O				●	O				○		X		O		1	inv.	38	

● Responsible | ○ Co-operating partner | ☒ Consulted partner

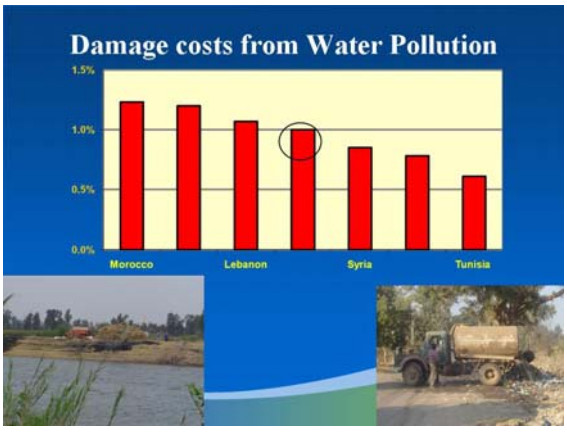

Investment Distribution (Sector)
Total= 145.0 BLE
•Apply Modern Irrigation in new areas.
•Collect and pre-treat ind. Wastewater separately.
Private 5.55%
MWRI 37.48%
MOHP 0.33%
•Continue IIP in prioritized areas
•GW Development in W. Desert
•Improve of drainage conditions
MHUNC 56.08%
MALR 0.05%
MoIndustry 0.16%
•Increase WWTP and sewerage coverage.
•Increase WTP.

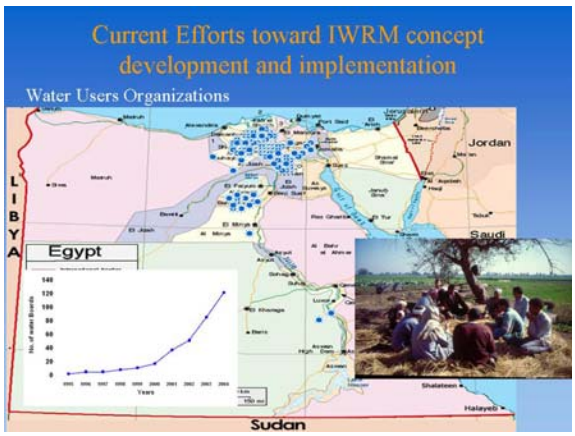

Lack of sanitation facilities in rural area
% of Coverage
Drinking Water Supply
Sanitation
1960
2004
2009
Time

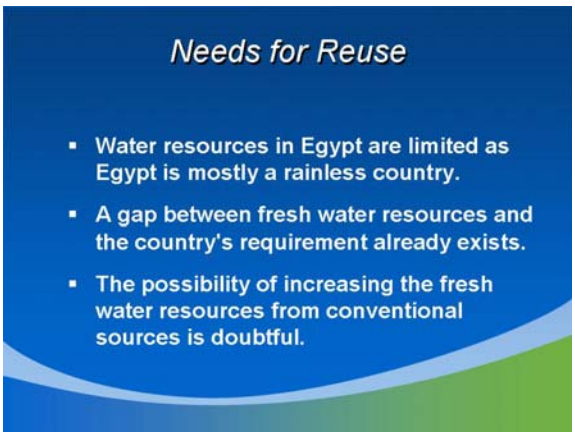

Water Quality Management Unit - Major Activities
Coordinate and Cooperate with different sectors within and outside the Ministry
Training programs and awareness campaigns to control pollution
Identify feasible actions within existing laws enforcement at selected districts
Standardize monitoring procedures and establish de-central monitoring at district level.


National Water Quality Monitoring Network
More than 300 monitoring locations
230 Locations

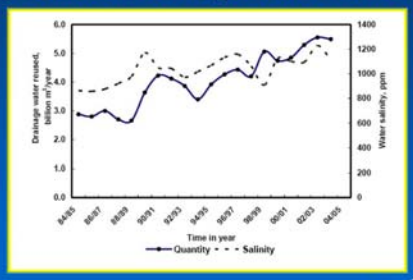

National Water Research Center
Central Laboratory for Environmental Quality Management


Damage costs from Water Pollution
1.5%
1.0%
0.5%
0.0%
Morocco
Lebanon
Syria
Tunisia


Current Efforts toward IWRM concept development and implementation
Water Users Organizations
LIBYA
Egypt
Jordan
Saudi
Sudan


Needs for Reuse
Water resources in Egypt are limited as Egypt is mostly a rainless country.
A gap between fresh water resources and the country's requirement already exists.
The possibility of increasing the fresh water resources from conventional sources is doubtful.

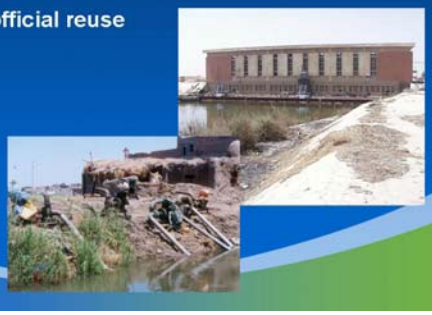
Agricultural Drainage Water Reuse



Currently, about 5 billion m³ of drainage water in Nile Delta is used officially after mixing with fresh water to bring the salinity of mixed water to maximum 800 ppm.

Reuse Practice of Drainage Water in Egypt

- Official reuse
- Un-official reuse



LAKE MANZALA ENGINEERED WETLAND

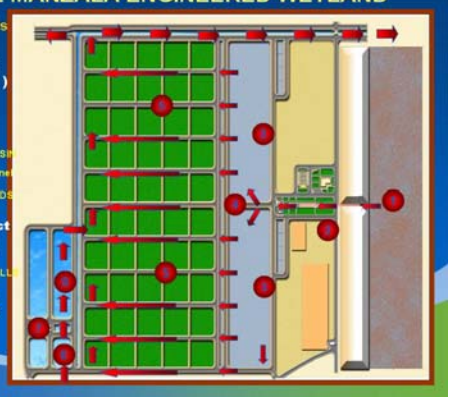
Wetland Elements

Main Project (25000m3/ Day)

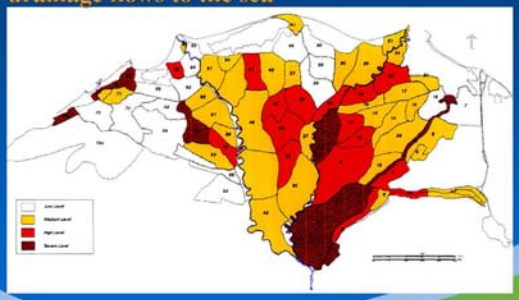
1- INTAKE
2- PUMP STATION
3- SEDIMENTATION BASIN
4- DISTRIBUTION Channel
5- SURFACE FLOW BEDS

Secondary Project (500m3/ Day)

6- RECIPROCATING CELLS
7- HATCHERY PONDS
8- FINGERLING PONDS

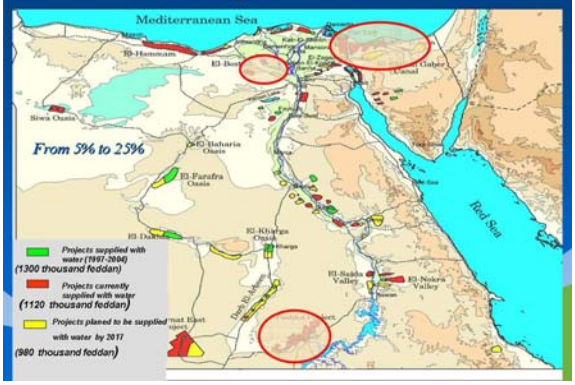


Assessing the impacts of major reductions in drainage flows to the sea

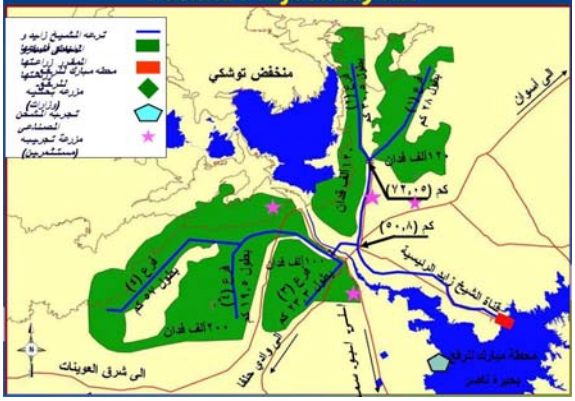


Priority areas based on Population Densities

Horizontal Expansion National Plan



Toshka Project Layout



Project Objectives

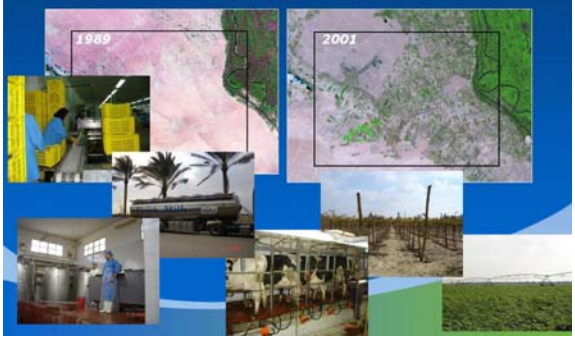
- Add 540 000 feddans of Arable land.
- Create a base for the integrated development of the surrounding area.
- Build sustainable communities to accommodate some 2 million people by year 2017.
- Create job opportunities (700 000 persons).
- Develop, enhance, and promote agro-industry, mining and tourism activities.

Horizontal Expansion West of Suez Canal and North Sinai

EL-SALAM CANAL PROJECT

- Project area (250,000 hectares) is allocated as: 50% to large investors; 20% to small investors; and 30% to small farmers.
- Transfer of low cost farming technologies from large investors to small investors and individual farmers.

West Delta Project

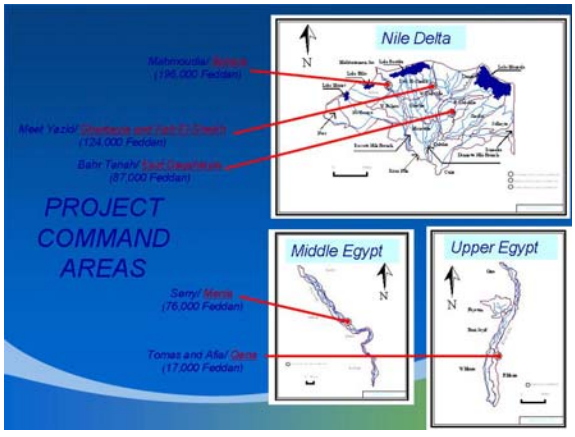


West Delta Project Area!

- Located on both the East and West side of the Cairo-Alexandria Desert Road, between km 45 and km 80.
- 255,000 Net Feddans, of which 47% is already cultivated.
- Agriculture economy dependant on groundwater usage currently estimated at over 1 billion m3 per year.
- Supports economy of $300 MM to half billion annually employing 250,000 in agricultural sector alone.
- Important producer of high value fruit and vegetables, much of it destined for export markets.
- Increasing trend of groundwater declining levels and deteriorating quality

West Delta Project Opportunities!

- Government positive response allocating @ 5200 m3 per feddans surface water to the area.
- Willingness of farmers to connect to the surface water on full cost recovery basis of capital and O&M.
- Available Funding ($ 175 million - World Bank loan) at low interest rate and 25 years maturity with 3-4 grace period.



BROAD OBJECTIVES

- Improve the sustainability of the Land and Water Management Systems through decentralization and strengthening the participation of users in the investment costs along with the operation and maintenance at Tertiary/ Branch Canal/ and District levels.
- Increase farm incomes through the optimal use of the available resources (water, land and human) as well as the improved infrastructure.
- Reform the existing institutions within the concerned agencies to attain integrated planning and implementation of the IIMP components.

PROJECT COMPONENTS

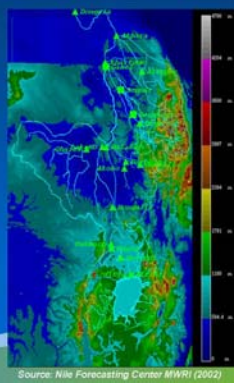
- Preparation and implementation of Integrated Water Management Plans in the selected command areas.
- Establishment and expansion of WUAs and WBs in the Project areas.
- Improvement and modernization of irrigation and drainage infrastructure.
- Assessing the environmental impacts that are anticipated due to improvement and modernization, and determine the associated mitigation measures.
- Demonstration of improved on-farm water management.

Vulnerable Sectors in Egypt

- Water Resources
- Coastal Zones

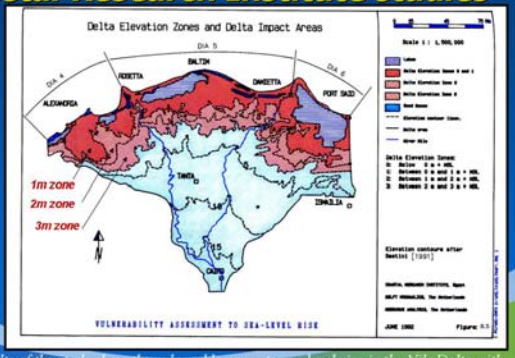
The Nile Basin

- Large area (2.9 x 10^6 km^2)
- Total Amount of Rainfall (1680 BCM)
- Low specific discharge (5%)
- Spans several climate regions
- Variable topography.
- High runoff variability.



Source: Nile Forecasting Center MWRI (2002)

Costal Research Institute studies



Results of the Study show the vulnerable areas to sea level rise in the Nile Delta with different water levels

Shore protection projects at Damitta promontory

Company LOGO

Ras El Bar breakwaters 1996

El Diba triangle bridge & inlet 1996

Ezbat El Borg Revetment 6.5km/1998

MAIN COASTAL PROBLEMS at Rossetta

Company LOGO

Raas El Bar (AFTER)

Raas El Bar (BEFORE)

Shore protection main projects at Rossetta promontory

Company LOGO

Rosetta Western revetment 1.5km/1990

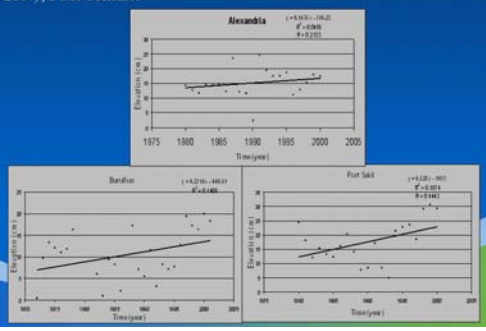
Rosetta eastern revetment 3.5km/1990

Costal Research Institute studies

- Impact of climate changes on coastal zones was investigated by Coastal Research Institute (CoRI) and Delft Hydraulics, Netherlands (1989-1992)
- Estimate the sea level rise impact on all the entire coastal zones of Egypt in terms of quality and quantity.
- Focus on the Nile Delta coast (most vulnerable area
- The morphological features of the Nile Delta coastal zones (Sand dunes and Ridges)
- Impacts of sea level rise if water has raised by 1m, 2m, and 3m.

Costal Research Institute studies

Trend and Accelerated Sea Level Rise (ASLR) Measured Along the Nile Delta Coast. (CoRI-2007), First Scenario



Adaptation Assessment

- *Most of eroded sectors in the Nile Delta coast are protected by protection structures implemented by MWRI (CoRI & SPA).*
- *Protection works are designed against high waves and surge waves.*
- *Alexandria as well as northwestern coasts are located on a limestone ridges (8 ridges with heights from 10m to 110 m above mean sea level).*

Adaptation Assessment

- *The Nile Delta is protected in many areas by natural sand dunes.*
- *Threatened (vulnerable) areas are not projected to high waves or strong currents as water depths in the lakes are about 1.0 m.*
- *Except Sahl Al-Tina, coastal zones of Sinai are protected by natural system of sand dunes.*

Adaptive Supporting Systems

- According to IPCC summary report for decision makers, Nov. 2007, it is recommended to create wetlands in areas vulnerable to the impacts of sea level rise in low lying deltas. (Al-Manzalla, Al-Burullus, Idku, and Maryot Lakes are one of the natural adaptation processes).
- Constructing Protection carried out by Shore Protection Authority (Damietta, Rosetta, and Al-Burullus).
- The Natural sand dunes systems

Northern Lakes in Egypt

Laws dealing specifically with water and responsible ministries

Law 12/1984	Irrigation and drainage	MWRI
Law 93/1962	Drainage of liquid waste	Ministry of Housing, Utilities and New Communities
Law 48/1982	Protection of the River Nile and Water ways	MOHP
Law 4/1992	Law for the Environment	Ministry of Environmental Affairs/Egyptian Environmental Affairs Agency
Law 213/1994	Legalizes WU as on old lands	MWRI
Law 27	Drinking water quality	MOHP

Water Laws Modernization

To achieve better water use and maximize the return from water activities:

- MWRI has prepared a draft law for groundwater that allows for effective regulation of groundwater aquifers.
- It has also proposed a draft law for shore protection that promotes the concept of Integrated Coastal Zone Management.
- In addition, MWRI has proposed some amendments to the Irrigation and Drainage law no. 12/1984 by adding some articles that deals with the principle of participation as well as with the structure of fines for non-compliance with modern irrigation systems in the new lands.

These draft laws and amendments have been submitted to the Egyptian Cabinet to be approved and then discussed at the Parliament.


Institutional Reform in the water sector
• Institutional reform in the water sector is needed to promote economic efficiency and support sustainable water use in addition to environmental and ecological sustainability
• support the move from sub-sectoral to cross-sectoral water management approach. (IWRM)
• offer greater participation and involvement of varies stakeholders through which transparency, and better communication could be achieved.


Thank You

Save water, save harvest, save life

Kees.vantKlooster@wur.nl

WAGENINGEN UR

Water in MDG

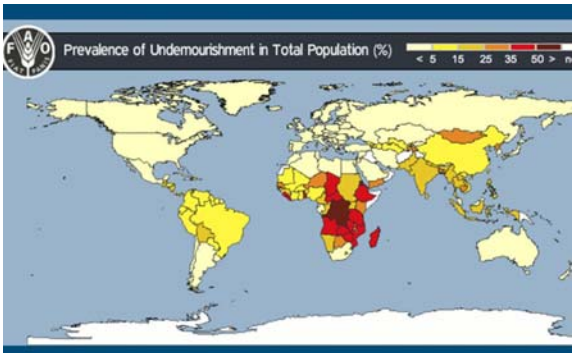
Water is a central component in all 8 MDG's

- Water is endangered as a resource base in qualitative and quantitative ways.
- Water is critical in assuring food supply
- Hydrological extremes create direct threats to human life

WAGENINGEN UR

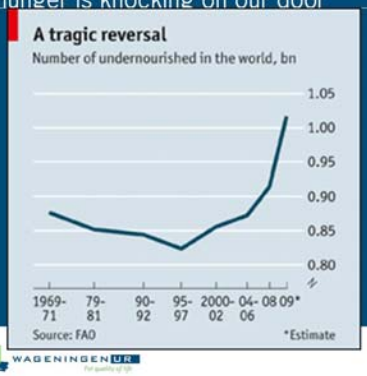
Lake Tsjaad is an endangered resource base

WAGENINGEN UR



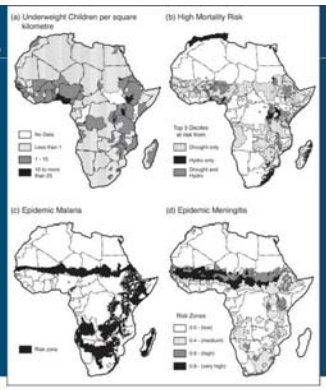
WAGENINGEN UR

Hunger is knocking on our door



WAGENINGEN UR

Safe life



WAGENINGEN UR

Costs of water extremes in Kenya

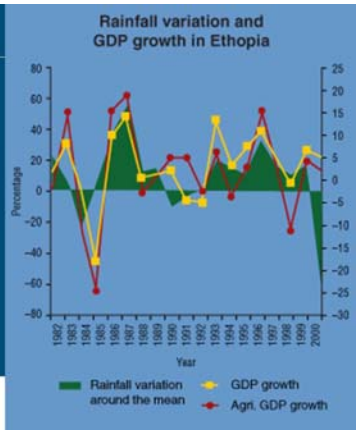
10/97-02/98 flood	infrastructure damage		$ 2.39 b
10/98-05/00 drought	crop loss	$ 0.24 b	
	livestock loss	$ 0.14 b	
	reduc. HP production	$ 0.64 b	
	reduc. industr. production	$ 1.39 b	
	total		$ 2.41 b
10/97-05/00	**Lack of water buffers costs**		**$ 4.8 b**
	approx (annual) GDP	($9b/yr)	$ 22 b
	impact as % GDP/annum		**22%**

WAGENINGEN UR

GDP

Many economies in Africa have large rural components.

National development is not fast when agriculture can not develop



WAGENINGEN UR

Water, sustainable development and the MDG's

Water as a Resource Base

Water for Nature

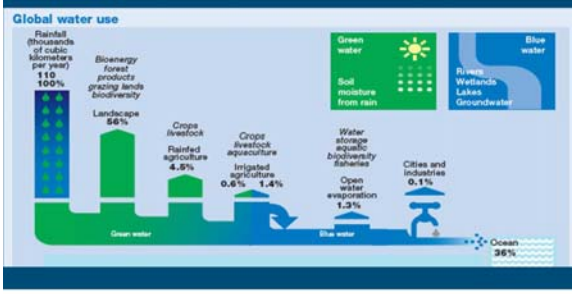
Water for Food Security

Water for Safe Life

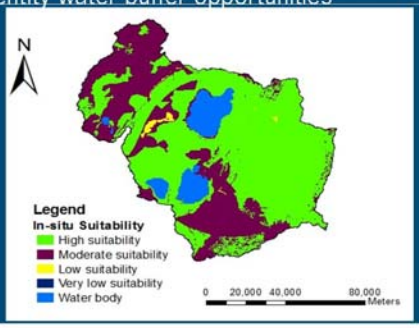
Increasing sustainability by reducing vulnerability

- Identify your potential to buffer water and use the potential
- Consider impact of climate change and plan accordingly
- Embed food production in ecosystems to ensure public and private valuing of water and other public goods.

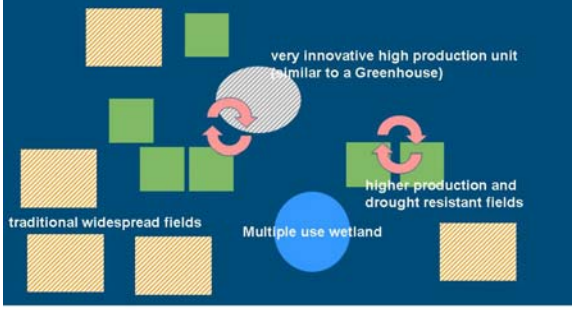
Rain is the source of water to consider



Identity water buffer opportunities

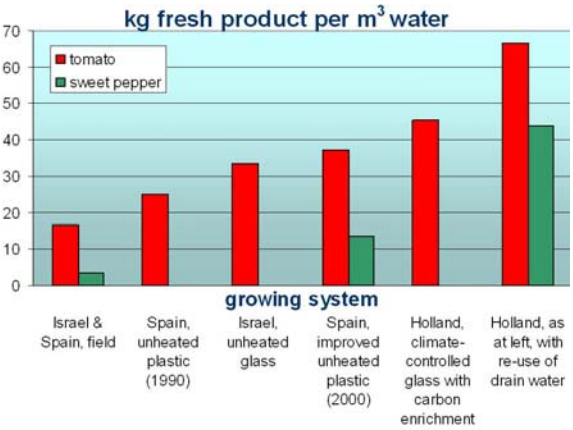


Land and water use planning to create food security and economic development



Boosting productivity

- Targeted innovations can create improvements in land, water and nutrient practices in both rain fed and irrigated food production
- Innovative production techniques in Africa, when properly designed serve as engines for economic development while at the same time securing sustainability by valuing all uses of water and land
- With (supplementary) irrigation let the farmer control her or his water use



Public goods

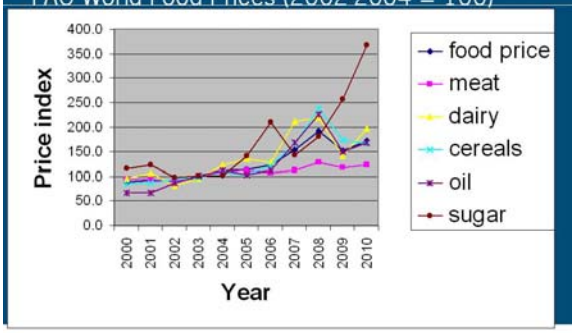
- Let nations develop mechanisms with stakeholders, to assess public goods and primary beneficiaries to manage public and private demand.
- Investments in innovative water use foster diversification of water use.
- Nations will secure access of the rural poor to natural resources.

WIBIS

WIBIS Interactive open source tool for land use management to show impact on water availability and productivity

WAGENINGEN UR

FAO World Food Prices (2002-2004 = 100)



WAGENINGEN UR

Market links are needed

WAGENINGEN UR

WAGENINGEN UR

Water Options to Improve Ecosystems, Harvest Security and Hydropower in Zambia :

Henry Sichembe
Deputy Director -Technical Services
Ministry of Agriculture & Cooperatives (MACO)- Zambia

OUTLINE

- **Introduction-**
- **Technical Aspects**
- **Policy and Incentive Aspects**
- **Institutional Aspects**

Vital Statistics Zambia (NAPA, 2007)

- Area: 752,614 km² **(25% Congo and 75% Zambezi Basins)**
- Population: 10 million
- Rural population: 64%
- Total labour force: 4.39 million
- Female labour force: 45%
- Administration: 9 provinces, 72 districts
- Literacy: 74%
- Climate: Tropical
- Temperature: 13ºC - 34ºC
- Rainfall: 600mm -1400mm
- Woodlands: 353,729 km² (47%)
- Arable land: 43.7 million hectares (58%)
- Cultivated area: 10.5 million ha (14%)

INTRODUCTION

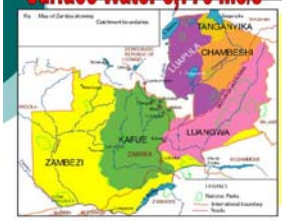
- Zambia generates an estimated 100Km³/year* of surface water.
- An estimated annual renewable ground water potential of 49.6Km³ per year*.
- Most of the surface water resource is poorly distributed while ground water is fairly distributed.
- In any case, most f this water needs to be developed to meet present and future demand for various uses such as irrigation, domestic water supply and hydropower generation.
- * (Water Master Plan of 1995)

River Basins

- Zambezi River Basin
  - Zambezi
  - Kafue
  - Luangwa
- Congo River Basin
  - Luapula
  - Chambeshi
  - Tanganyika

Water Resources (JICA,1995)

Surface Water 3,770 m3/s



	m³/s
Zambezi	**1,900**
Kafue	**350**
Luangwa	**500**
Luapula	**690**
Chambeshi	**230**
Tanganyika	**330**

Zambezi Basin

- 13 Sub basins (see map)
- Sub basins are hydrological catchments
- Located 9-20' south and 18 -36'East Southern Africa
- Fourth largest river basin
- Total Area 1.37million Km²
- Mostly plateau with elevations as high as 800m and 1,450m, small portion below 100m or above 1,500m
- Elevations contribute to hydropower potential.

Zambezi Basin

- Poverty is endemic (GDP<90US$ per annum for over 50% of HH)
- Relatively many FHH
- Life expectancy at birth is 42 years

Hydropower in the Zambezi

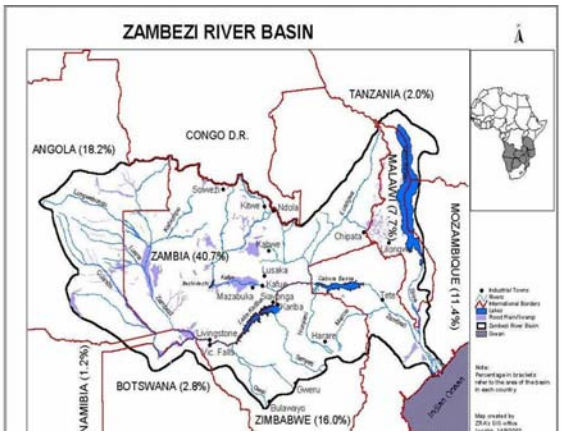
- 12 dams with total 4900 MW of developed hydropower, 7 sites in Zambia (Total power generation in SAPP stands at 50,000 MW, mainly coal generated)
- Potential to expand from 4900 to 13500 MW

Biodiversity and Zambezi

- Outstanding biodiversity importance for:
  - Lake Malawi (aquatic species)
  - Kafue flats and other wetlands (Extremely high conservation value)
  - Middle Zambezi/ Luangwa- Large mammals)
  - Delta of Gorongossa/Cheringoma/Zambezi

Major wetlands in Zambia

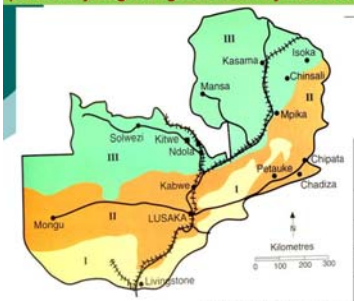
- Zambia has 8 major RAMSAR sites(wetlands of international importance). These include Zambezi floodplains (900,000ha, of which 760,000 ha swamps) and the Kafue flats (650,000 ha of which 260,000 ha swamps)



A. TECHNICAL ASPECTS

Agro-Ecological Zones of Zambia (MACO,2004)

These influence the type of crop and agric method to be used to increase productivity. Irrigated agriculture is very much needed in low rainfall areas I to IIb



Region	Rainfall (mm)
I	below 800
IIa	800 – 1,000
IIb	above 800
III	above 1,200

Water Withdrawal

- Estimated Total water withdrawal =11.69 km³
  - Domestic use =5.0 km³
  - Industrial use =5.0 km³
  - Irrigation =1.69 km³
- Users abstracting more than 500m3/day of surface water shall apply for and hold a Water Right (Water Act, 1993). Consumption as per water rights held are:
  - Power/Energy =91%
  - Agriculture = 7%
  - Water Utilities = 1%
  - Mining = 1%
- Southern (62%), Luapula (17%) and Central (12%) hold the highest proportion of water rights.

Water Resources and Uses

- 650 mm to 1800mm annual rainfall
- Five river basins
- Underground water resources > 1.7 million m³
- Surface water resources 136-237mm³ per day
- About 40% of surface water resources of SADC
- Internal renewable water resources = 163.43km³/year
  - 114.83 km³/year is runoff
  - 49.6 km³/year is ground water
- Zambia renewable water resource per capita = 8,700 m³ per year
- SSA renewable water resource per capita = 7,000 m³ per year

Water Resources and Uses

- Total water withdrawal as % of actual renewable water resources is only **7.15 percent**
- Planned public and private sector water withdrawal works total **234,444 Million m³**
- In view of low consumption levels, most smallholders applying low cost AWM technology do not apply for water rights.

WaterOptions for improvement of Ecosystems, Harvest Security and Hydropower

Agriculture Water Development (AWD) is key to food security

- Water withdrawal for agriculture stands at 1.69 km3.
- Irrigation potential of 2,750,000 hectares
- 423,000 ha can be economically developed
- 156,000 hectares is currently being irrigated

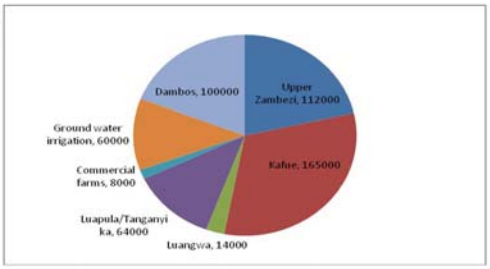
WaterOptions for improvement of Ecosystems, Harvest Security and Hydropower

Current Estimate of Irrigated Land in Zambia

- **Land under Agricultural water Management (Ha)**
  - Irrigation Potential 2,750,000
  - Surface irrigation 32,189
  - Sprinkler irrigation 17,570
  - Localised Irrigation 5,628
  - Developed lowlands 100,525
- **Total Land under Irrigation** 155,912
  - Flood recession cropping area 100,525
  - Cultivated lowland 100,000
- **Agricultural Water Managed Area** 255,525
- **Land under Irrigation by Source of Water (Ha)**
- Groundwater 6,750
- Surface water 149,162
- **Irrigation Schemes by Size (Ha)**
- Small Irrigation schemes 111,525
- Medium Irrigation schemes 7,372
- Large irrigation schemes 37,015

WaterOptions for improvement of Ecosystems, Harvest Security and Hydropower

IRRIGATION POTENTIAL



WaterOptions for improvement of Ecosystems, Harvest Security and Hydropower

B. POLICIES AND INCENTIVES

WaterOptions for improvement of Ecosystems, Harvest Security and Hydropower

International and Regional Policy Context

- Global growth affects AWM - cost of machinery and inputs
- International trade conditions affect access to international markets for irrigated products
- CAADP targets 6% sector growth and a level of irrigation close to 15% of all agricultural land by 2015
- and allocation of 10% of national budgets to agriculture
- CAADP pillar of "*expanding area under sustainable land management and reliable water control systems*".
- International partners "*Investment in agricultural water for poverty reduction and economic growth in sub-Saharan Africa*" is being developed.

WaterOptions for improvement of Ecosystems, Harvest Security and Hydropower

Perspectives on AWM in promoting irrigation development

- The primary purpose of Zambia's irrigation policy and strategy is shift from over dependence on vulnerable rain fed agriculture for **food security.**
- Irrigated crop production can make positive contributions to **poverty alleviation** and **economic growth.**
- While formal irrigation can directly enhance food security and economic growth, there is no direct link between formal irrigation and poverty alleviation. Therefore, the style and quantity of investment in irrigation has to be carefully judged.
- Zambia's irrigation policy and strategy has determined **four strategic paths** that can be followed, each with its specific impact on the three types of players in the irrigated sub-sector
- An illustration of an impact typology for irrigation sector initiatives in Zambia shows this:

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TYPE OF FARMER	POVERTY ALLEVIATION	FOOD SECURITY	ECONOMIC GROWTH
TRADITIONAL FARMERS	Improved equity through a more enabling environment - Water Harvesting - Dambo Development - Participatory Rehabilitation and Upgrading of existing infrastructure	Improved equity through a more enabling environment - Water Harvesting - Dambo Development - Participatory Rehabilitation and Upgrading of existing infrastructure - Participatory development of demand driven irrigation	▪ Participatory Rehabilitation and Upgrading of existing infrastructure ▪ Irrigation Management Transfer
EMERGING FARMERS	Increasing employment opportunities on small farms through a more enabling environment	Increasing employment opportunities on small farms through a more enabling environment	▪ A more enabling environment ▪ Improved and expanded support infrastructure ▪ Improved and expanded supply side infrastructure ▪ Expanded Value Added Opportunities
COMMERCIAL FARMERS	Increasing employment opportunities on commercial farms through a more enabling environment	- Increasing employment opportunities on commercial through a more enabling environment - Better incentives for production of food staples	▪ A more enabling environment ▪ Improved and expanded support infrastructure ▪ Improved and expanded supply side infrastructure ▪ Expanded Value Added Opportunities

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Strategic aim for irrigation development

- The strategic aim is to expand the emerging farmer base in Zambia by promoting commercial irrigation enterprises building on the experience of the large-scale commercial sector. This vision suggests a notional objective model for the agricultural sector.
- This however, will depend on the correct identification of market opportunities at the local, national and regional level.

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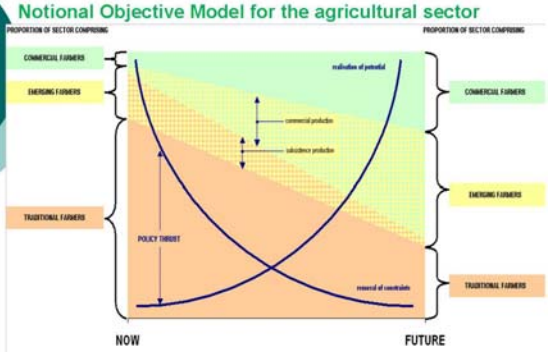
Notional Objective Model for the agricultural sector



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Paths to realize potential

PATH 1: Establishment enabling the environment:

- Establishment of commercial finance and investment;
- Institutional restructuring and capacity building, especially with respect to improved service delivery;
- Legal and policy framework.

PATH 2: Alternatives to formal irrigation:

- Water harvesting technologies,
- Dambo development subject to observations of stringent environmental limits.

PATH 3: Improving productivity of existing assets:

Rehabilitation and upgrading, infrastructure upgrade, irrigation management transfer.

PATH 4: New Investments

Promoting new investment (PPP development, new infrastructure).

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International and Regional Policy Context

- Global growth affects AWM - cost of machinery and inputs
- International trade conditions affect access to international markets for irrigated products
- CAADP targets 6% sector growth and a level of irrigation close to 15% of all agricultural lands by 2015
- and allocation of 10% of national budgets to agriculture
- CAADP pillar of "*expanding area under sustainable land management and reliable water control systems*".
- International partners "*Investment in agricultural water for poverty reduction and economic growth in sub-Saharan Africa*" is being developed.

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National Policy Context

- 1.1 million small, medium and large scale households firms
- Sector provides livelihood for over 50% of the population
- Sector absorbs about 67% of the labour force
- FNDP targets for agricultural sector:
  - Attainment of food security for 90% of the population by 2010;
  - Contribution of sector to foreign exchange earnings from 3-5% to 10-20% by 2010;
  - Sector growth at 10% per annum from 2006 onwards;
  - Sector contribution to GDP 18-20% to 25% by 2010;
  - Incomes for those involved in the agricultural sector will increase.
- National Agriculture Policy and National Irrigation Plan defines various pathways that cover formal and informal irrigation systems including traditional, emergent and commercial farmers.
- The National Agriculture Policy has also incorporated conservation farming in 1999.

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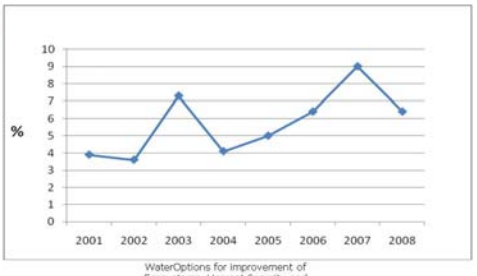
Share of Agriculture in National Budget



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Challenges

- Budgetary allocations to the drivers of agricultural sector growth including irrigation, research, technology and extension, soil fertility management, reliable and competitive markets and strategic infrastructure sidelined.

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Policy Incentives for Investment in AWM

- GRZ shown commitment to support and provide incentives for agriculture and AWM
- Smallholders may not be position to benefit from most incentives
- Evidence of response to some of the incentives in AWM is discernible

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No.	Incentive	Relevance to AWM
1	Duty free exemption for Agriculture & mining machinery	High
2	5% customs on other capital machinery	Medium
3	Duty exemption on raw material imports of organic and inorganic chemicals, iron and steel, rubber and plastics	High
4	0-5% duty on other raw materials	Medium
5	15% duty on intermediate goods	Medium
6	25% duty on final products	Medium
7	15% income tax on NTEs	Medium
8	Tax on companies listed on LUSE is 33% compared to 35% corporate tax	Medium
9	Excise duty on electricity reduced from 10% to 7%	Medium
10	100% profit repatriation	Medium
11	No FOREX controls	Medium
12	Expenditure on the conduct of research, technical education or any further training related to a company's specific business activities are eligible for tax deductions	High
13	Dividends payable to farmers are tax exempt for the first five years of operation	Medium
14	A 15% income tax is levied on profits generated from farming activities	Medium
15	Income Tax Allowances – wear and tear allowance of 50% per year on farm machinery	Medium
16	A 100% Tax Allowance for outlay on land development, conservation and other costs	High
17	Capital expenditure on farm improvements qualify for an allowance of 20% pr annum for the first five years	Medium
18	Substantial rate of depreciation allowing farm machinery to be rapidly written off	High
19	Customs duty exemption for on capital machinery and equipment used exclusively for agriculture	High
20	Import duty deferment on eligible plant/machinery and raw materials	Medium
21	Special development allowances for growing certain crops such as tea, coffee, banana and citrus fruits	Medium
22	Standard rate all agricultural products except baby cereals, maize and flour	Medium

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C. INSTITUTIONS AND MARKETS

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AWM is Cross-Sectoral

Investments in AWM transect:

- Land Resettlement Policies and Reforms
- Social Security and Emergency Rehabilitation
- Environmental Control/ and Climate Change mitigation
- Energy and Water Development
- Private Sector
- Agricultural Sector Trusts and Boards
- NGOs and Civil Society Organizations

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AWM is Cross-Sectoral

Knowledge hub to assist Zambia in AWM with international information would be highly desirable. This would clarify any 'fog' in information created through factors like language use, wikipediarism, use of outdated data, etc and provide support in monitoring

This would maximize the effect of our national investments

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Marketing AWM products

- The demand for irrigated crops is very much concentrated in urban areas.
- Urban markets in Lusaka, Ndola and Livingstone
- FSRP is conducting on-going market chain analyses at major urban markets
  - Mushrooming but poorly serviced roadside markets
  - Contract marketing emerging
  - Outgrower schemes
  - Supermarket chains
  - Processors and industry
  - Institutional buyers like hospitals, colleges

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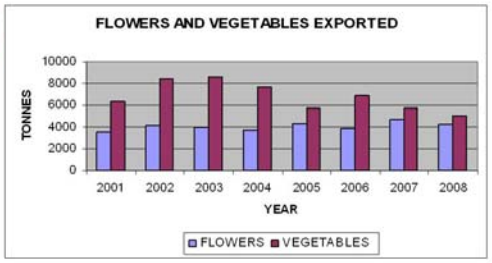
Stored water in dams for irrigation and other purposes to accelerate development in rural areas and household wealth creation and GDP growth

International Trade



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ZEGA Export products

Challenges of marketing

- Agriculture component of Non-Traditional Exports has risen phenomenally due to export of irrigated products.
- Smallholder farmers engaged in AWM face difficulties accessing institutional markets and international markets because of entry problems but potential exists for their engagement with capacity building.
- Marketing and market access holds the key to expanded viability of AWM solutions