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May 2011

منظمة الأغذية والزراعة للأمم المتحدة | 联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Agricultura y la Alimentación

CONFERENCE

Thirty-seventh Session

Rome, 25 June - 2 July 2011

The State of the World's Land and Water Resources for Food and Agriculture (SOLAW)

Executive Summary

This document is based on a full report on 'The State of the World's Land and Water Resources for Food and Agriculture' (SOLAW) prepared as part of the implementation of the Programme of Work and Budget of the last two biennia under Strategic Objective F.

The State of the World's Land and Water Resources for Food and Agriculture, was prepared on the basis of 17 technical papers on land- and water-related subjects and is the result of the work of an inter-departmental and inter-disciplinary FAO team as well as external experts and institutions. It will be officially released to the public in the fourth quarter of 2011 in all FAO official languages.

SOLAW outlines the availability and state of land and water resources for food production at global and regional levels, and threats to food security and sustainable development resulting from the scarcity and degradation of water and land resources due to their present allocation, use and management, continuing population growth, changes in diets and climate change. The potential of the world's different land and water systems to meet these challenges is examined, as are the attendant risks and trade-offs as well as the options to achieve sustainable levels of output. The document discusses also the institutional and policy changes required at global, regional and national levels, and technical approaches needed in the specific environments. It recommends that land and water allocation and management need to improve markedly to meet continually increasing demands for food and agriculture production as well as ecosystem services (e.g. forest and biodiversity, regulating services of water, carbon and nitrogen cycles, recreational and cultural values and other supporting services) required by various sectors, including urban development and industry. The main recommendations are for improved governance of land and water resources and a closer integration of policies, combined with increased and more strategic investment in sustainable land and water resources and ecosystems management targeting food security and poverty alleviation.

Suggested action by the Conference

- priority attention to production systems facing water and land scarcity and related sustainability constraints, as well as national and global monitoring of such systems;
- support and work towards global and national policy changes for improved land and water governance favouring the adoption of more integrated and sustainable land and water management.

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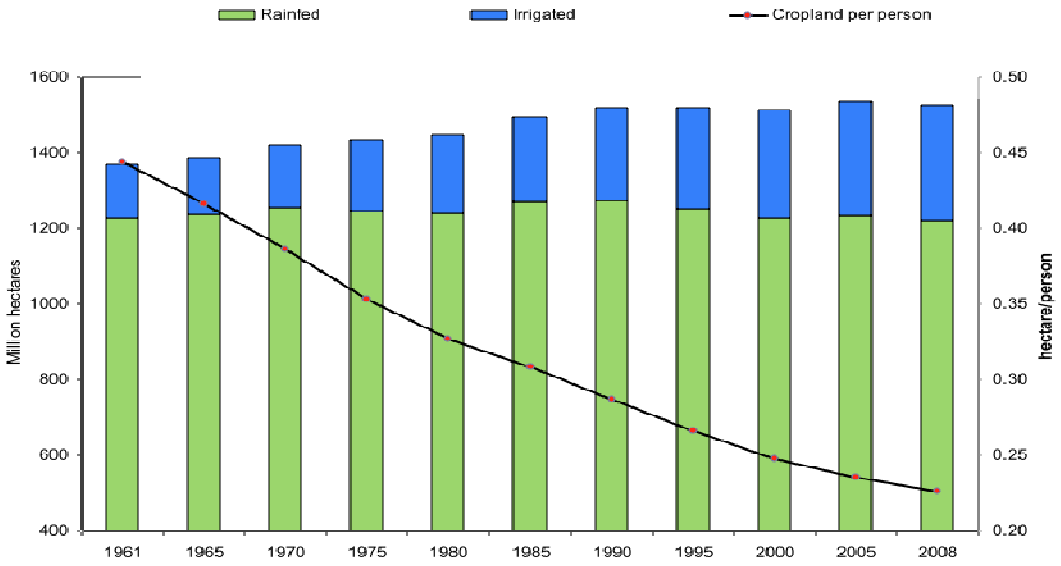
I. The Challenge of Land and Water

1. The availability of land and water to supply national, regional and global food and agriculture production, under conditions of increased land and water scarcity and competition for these resources by different sectors, has attracted renewed attention following the recent rise in food prices, commodity price volatility and increased large-scale land acquisition. Rapid food price inflation hurts the poor the hardest. The buffering capacity of global agricultural markets to absorb supply shocks and stabilize agricultural commodity prices is mostly tied to the continued functioning of land and water systems particularly in agriculture dependent economies. At the same time, climate change brings additional risks and further unpredictability of harvests for farmers – from warming and related aridity, shifts in rainfall patterns, and the frequency and duration of extreme events. While warming may extend the limit of agriculture in the northern hemisphere, it is anticipated that key agricultural systems will need to cope with new temperature, humidity and water stresses.

Status and Trends in the Use of Land and Water Resources

2. Land and water management has met rapidly rising demands for food and fibre. In particular, input-intensive, mechanized agriculture and irrigation have contributed to rapid increases in productivity gains. The world's agricultural production has grown between 2.5 and 3 times over the last 50 years while the cultivated area has grown by 12 percent. More than 40 percent of the increase in food production came from irrigated areas, which have doubled in surface. In the same period, global cultivated land per person gradually declined from 0.44 ha to less than 0.25 ha (Figure 1).

Figure 1: Evolution of land under irrigated and rainfed cropping (1961-2008) (Source: FAOSTAT)

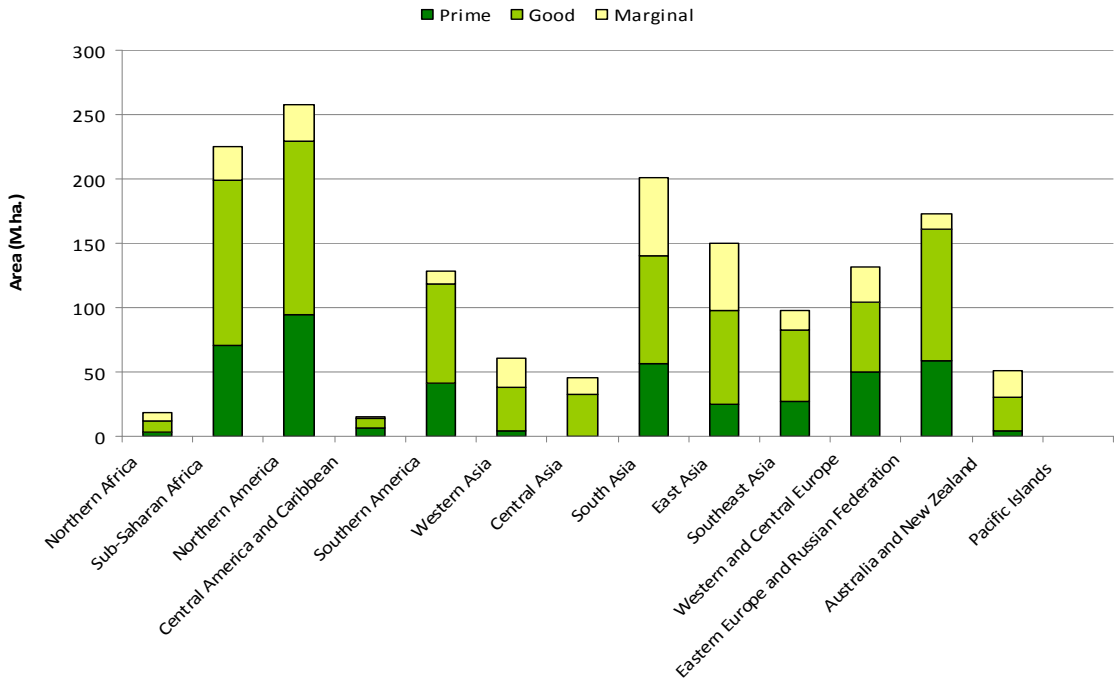


3. Agriculture currently uses 11 percent of the world's land surface and uses 70 percent of all water withdrawn from aquifers, streams and lakes for crop production. Land and water resources are, however, unevenly distributed. Cultivated land area per person in low income countries is less than half that in high income countries (Table 1), and its suitability for agriculture is generally lower (Figure 2).

Table 1: Share of the world's current rainfed and irrigated cultivated land which is considered suitable for rainfed cropping, assuming appropriate management (2008 data)

Regions	Cultivated land (million ha)	Population (million)	cultivated land per capita, ha	Land suitability for Rainfed crops (%)		
				Prime Land	Good Land	Marginal Land
Low Income Countries	441	2651	0.17	28	50	22
Middle Income Countries	735	3223	0.23	27	55	18
High Income Countries	380	1031	0.37	32	50	19
Total	1556	6905	0.23	29	52	19

Figure 2: Total extent of cultivated land by land suitability category for each geographic region, (2008 data)



4. Rainfed agriculture is the world's predominant agricultural production system; although increasing climate variability and change is bringing growing uncertainty of production levels. Natural soil nutrient availability in developing countries, particularly in Africa, is often low, and rainfall impact and runoff on sloping terrain contribute to erosion and poor soil water retention. In the dry tropics and subtropics, low and erratic precipitation results in inadequate and fluctuating soil moisture availability, which reduces plant nutrient use efficiency. Current productivity in rainfed systems is, on average, little more than half of its potential and, in the poorest countries, only one-fifth of the potential obtainable under conditions where the required agricultural inputs are available and that appropriate management is applied.

5. The concentration of high-input irrigated agriculture on prime land has relieved pressure on land expansion to some extent. However, many irrigated farming systems are performing well below their potential, and there is considerable scope for improving land and water productivity. While much

of the prime agricultural land suitable for irrigation has been developed, the irrigated area is still expanding at 0.6 percent per year. Groundwater is used on almost 40 percent of the irrigated area.

6. Global aggregate achievements in production have been accompanied in some cases by poor management of cultivated land and associated water resources, leading to the deterioration of the ecosystems of which they are part. Poor land and water management has contributed to loss of biodiversity, biomass, carbon storage and soil nutrients; to reduced water storage and supply; to surface and groundwater pollution by pesticide use and excess nutrients; and, in irrigated drylands, to salinization of soils and groundwater.

7. Water availability to agriculture is a growing constraint in areas where a high proportion of renewable water resources are already used, or where transboundary water resource management cannot be developed because agreements on cooperative use are not in place. Overall, increasing water scarcity constrains irrigated production, particularly in the most highly stressed countries and areas. Because of the dependence of many key food production areas on groundwater, declining aquifer levels and abstraction of non-renewable groundwater present a growing risk to local and global food production.

Policies, Institutions and Investments in Land and Water

8. Agricultural policies in some countries have focussed on state-led investments in high-potential areas and on irrigation, mechanization and crop specialization (mono-cropping) for marketed commodities and export crops. The benefits from such policies have accrued mainly to farmers with productive land and access to water, machinery and capital, largely bypassing the majority of smallholders who are constrained by generally poor and vulnerable soils under typically low-management, low-input systems. Such policies often prioritized short-term economic gains ignoring long-term resource degradation and ecosystem services, leading to inefficient or excessive use of water, fertilizer and pesticides, groundwater depletion and poorly planned expansion of agricultural lands.

9. Large-scale land acquisitions are on the increase in parts of Africa, Asia and Latin America where land and water resources appear abundant and available. Concerns about food and energy security are key drivers, but other factors such as business opportunities, demand for agricultural commodities for industry and policies of recipient country are also at play. Although large-scale land acquisitions remain a small proportion of suitable land for agriculture in any one country, there is very little 'empty' land as most remaining suitable land is already used or claimed, often by local people and communities. While they may offer opportunities for investment and development, there is a risk that the rural poor could be evicted or lose access to land, water and other related resources. Many countries do not have good data and sufficient mechanisms to protect local rights and take account of local interests, livelihoods and welfare. The lack of transparency and of checks and balances in contract negotiations could promote deals that do not maximize the public interest. Insecure local land rights, inaccessible registration procedures, vaguely defined productive use requirements, legislative gaps and other factors, too often undermine the position of local people.

10. The trend in land acquisition needs to be addressed through appropriate regulations, and well-informed agricultural and food policies that take more account of land and water availability and access rights. Developing guidelines for land governance, or a code to regulate international investments backed up by capacity building at all levels, would be useful instruments to improve decision-making and negotiations.

11. Although land and water function as an integrated system, many laws, institutions and rights tend to deal with them separately. Even institutions that are dedicated to integrated regional or basin management deal primarily with either land or water resources and their respective multiple uses, rather than with land and water jointly. In many countries, national and local institutions that regulate land and water use have come under growing pressure to arbitrate between different uses as competition for land and water has increased. The lack of clear and stable land and water rights as well as weak regulatory capacity and enforcement have contributed to competition and conflict over water use and to rapid risk of exhaustion of groundwater in many aquifers. The absence in some cases, and

weaknesses in others, of transboundary cooperation frameworks have led to suboptimal investment and tensions between upstream and downstream countries.

12. Investment policies and institutional approaches have raised productivity and output but often entailed negative environmental impacts in major land and water systems. The growing inter-dependence and competition over land and water resources in intensively used river basins require more integrated, adaptable and authoritative institutions. These should allocate resources efficiently and equitably, and manage incentives and regulations that align farmer behaviour and practices with the interest of the broader community in sustaining natural resources and ecosystem services.

Perspectives for Land and Water Use towards 2050[1]

13. By 2050, rising population and incomes are expected to demand 70 percent more production over 2009 levels. Increased production is projected to come primarily from intensification on existing cultivated land. Expansion will still be possible in Sub-Saharan Africa and Latin America. In the longer run, climate change is expected to increase the potential for expansion in some temperate areas.

14. Both irrigated and rainfed agriculture will respond to rising demand. A projected doubling of current production by 2050 in developing countries could be derived from already developed land and water resources. Some further land and water resources could be diverted to crop production, but in most cases they already serve important ecological and economic functions. Possible conversion to crop production would require careful prior evaluation of the trade-off between production benefits and loss of their current ecological and socio-economic services.

15. Most of future growth in crop production is likely to be from intensification, with irrigation playing an important role through improved water services, water-use efficiency improvements, yield growth and higher cropping intensities.. This will require investment in both modernization of irrigation infrastructure and institutional improvement. Both irrigated area and agricultural water use are expected to expand rather slowly: land equipped for irrigation will increase from 301 million ha in 2009 to 318 million ha in 2050. However, any expansion will require trade-offs, particularly over inter-sectoral water allocation and environmental impacts. Considerable growth of supplemental and pressurized irrigation is likely and mostly on private farms.

16. Competition for land and water will become stronger, within agriculture – between livestock, staples and non-food crops, including liquid biofuels – and with municipal and industrial demands. Particularly their water demands will be growing much faster than those of agriculture. Water availability on time to meet demand, both for rainfed and irrigated agriculture, will be a factor that will have a major impact.

17. Climate change is expected to alter the patterns of temperature and atmospheric moisture upon which agricultural systems depend. While some agricultural systems in higher latitudes may gain net benefits from temperature increases as more land becomes suitable for crop cultivation, lower latitudes are expected to take the brunt of the negative impacts. Global warming is expected to increase the frequency and intensity of droughts and flooding in subtropical areas. Deltas and coastal areas are expected to be impacted negatively by sea level rise. Mountain or highland systems and irrigated systems that rely on summer snowmelt are also expected to experience long-term changes in base flows. Adaptation and mitigation strategies should focus on increasing resilience of farming systems to reduce current and likely risks such as droughts, excessive rainfall and other extreme events. These strategies should also mitigate the negative impacts of climate change on agricultural production.

18. Even where the risks to land and water systems can be addressed, the economic, social and environmental trade-offs will need to be evaluated and resolved if production is to meet rising demand. For this reason, a renewed emphasis on well informed basin planning and negotiated territorial planning among stakeholders will become essential.

[1] Projections reported in paragraphs 13-18 and section II are based in large part on: J. Bruinsma, 2009. The resource outlook to 2050: By how much do land, water use and crop yields need to increase by 2050? Page 33, Expert Meeting on How to Feed the World in 2050. Rome, FAO

The Need to Focus: What and Where

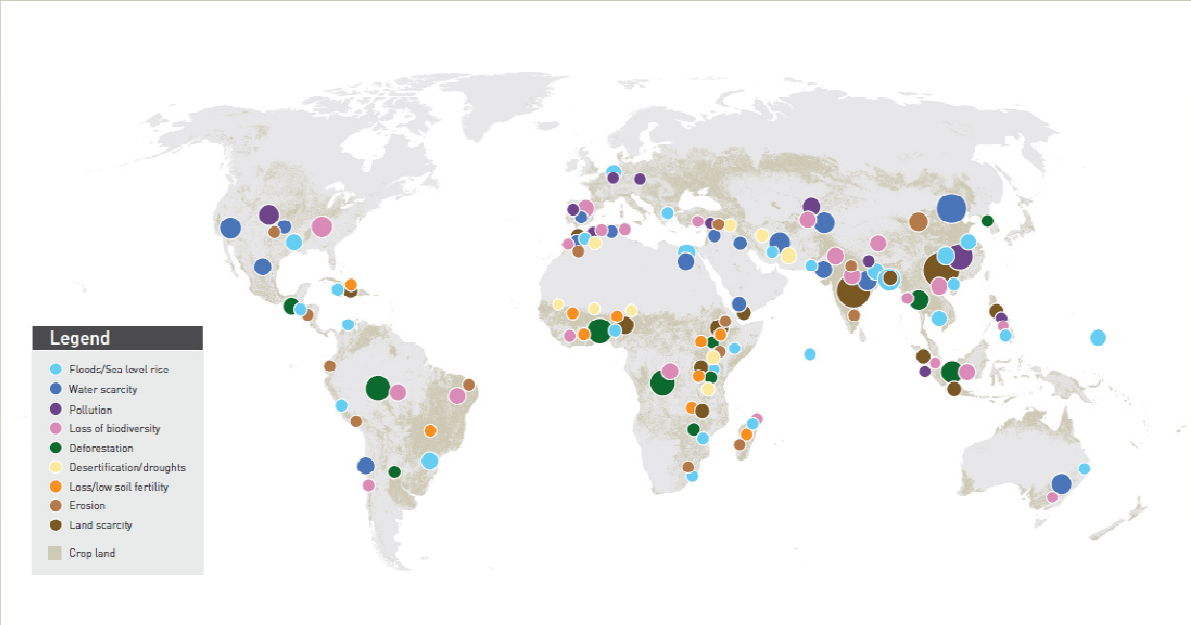
19. The SOLAW report highlights the great diversity of local land and water conditions and the need to focus on those production systems where the current availability and access to suitable land and water resources are constrained, or where scarcity of land and water resources are further constrained by unsustainable agricultural practices, growing socio-economic pressures or climate change. Such situations occur locally within the nine major categories of global agricultural production systems mapped in SOLAW (Table 2). Figure 3 presents the global distribution of the main categories of risks associated with these production systems. This global overview provides preliminary insights on the geographic locations where remedial interventions (described in subsequent sections of this document) may be targeted. Further development of technical approaches to reliably identify and characterize such systems at different scales (global to sub-national) would broaden the usefulness of such information to a wide range of development partners. The map does not specify risks related to local extreme events.

Table 2: Land and water systems requiring priority attention (a broad typology)

GLOBAL PRODUCTION SYSTEMS	AREAS REQUIRING PRIORITY ACTION
RAINFED CROPPING Highlands	Densely populated highlands in poor areas: Himalaya, Andes, Central American highlands, Rift Valley, Ethiopian plateau, Southern Africa (Risks: erosion, land degradation, reduced productivity of soil and water, increased intensity of flood events, accelerated out-migration, high prevalence of poverty and food insecurity)
RAINFED CROPPING Semi-arid tropics	Smallholder farming in Western, Eastern and Southern Africa savannah region and in Southern India; agro-pastoral systems in the Sahel, Horn of Africa and Western India (Risks: desertification, reduction of the production potential, increased crop failures due to climate variability and temperatures, increased conflicts, high prevalence of poverty and food insecurity, out-migration)
RAINFED CROPPING sub-tropical	Densely populated and intensively cultivated areas, concentrated mainly around the Mediterranean basin (Risks: desertification, reduction of the production potential, increased crop failures, high prevalence of poverty and food insecurity, further land fragmentation, accelerated out-migration. Climate change is expected to affect these areas through reduced rainfall and river runoff, and increased occurrence of droughts and floods)
RAINFED CROPPING Temperate	Highly intensive agriculture in Western Europe (Risks: pollution of soils and aquifers leading to de-pollution costs, loss of biodiversity, and degradation of freshwater ecosystems)
	Intensive farming in United States, Eastern China, Turkey, New Zealand, Parts of India, Southern Africa, Brazil (Risks: pollution of soils and aquifers, loss of biodiversity, degradation of freshwater ecosystems, increased crop failure due to increased climate variability in places)
IRRIGATED Rice-based systems	South-eastern and Eastern Asia (Risks: land abandonment, Loss of buffer role of paddy land, increasing cost of land conservation, health hazards due to pollution, loss of cultural values of land)
	Sub-Saharan Africa ,Madagascar, Western Africa, Eastern Africa (Risks: Need for frequent rehabilitations, poor return on investment, stagnating productivity, large-scale land acquisition, land degradation)

IRRIGATED Other crops	RIVER BASINS Large contiguous irrigation systems from rivers in dry areas, including Colorado river, Murray Darling, Krishna, Indo-Gangetic plains, Northern China, Central Asia, Northern Africa and Middle East (Risks: increased water scarcity, loss of biodiversity and environmental services, desertification, expected reduction in water availability and shift in seasonal flows due to climate change in several places)
	AQUIFERS Groundwater dependent irrigation systems in interior arid plains: India, China, central USA, Australia, North Africa, Middle East and others (Risks: loss of buffer role of aquifers, loss of agriculture land, desertification, reduced recharge due to climate change in places)
RANGELANDS	Pastoral and grazing lands, including on fragile soils in Western Africa (Sahel), North Africa, parts of Asia (Risks: desertification, out-migration, land abandonment, food insecurity, extreme poverty, intensification of conflicts)
FORESTS	Tropical forest-cropland interface in South-eastern Asia, the Amazon basin, Central Africa, and Himalayan forests (Risks: cropland encroachment, slash and burn, leading to loss of ecosystems services of forests, land degradation)
Other locally important sub-systems	DELTAS AND COASTAL AREAS: Nile delta, Red river delta, Ganges/Brahmaputra, Mekong, etc. and coastal alluvial plains: Arabian peninsula, Eastern China, Bight of Benin, Gulf of Mexico (Risks: loss of agricultural land and groundwater, health-related problems, sea level rise, higher frequency of cyclones (Eastern and South-eastern Asia), increased incidence of floods and low flows)
	SMALL ISLANDS including Caribbean, Pacific islands (Risks: total loss of freshwater aquifers, increased cost of freshwater production, increased climate-change related damages (hurricanes, sea level rise, floods)).
	PERI-URBAN agriculture (Risk: pollution, health-related problems for consumers and producers, competition for land)

Figure 3: Global distribution of risks associated with main agricultural production systems.



II. Land and Water for Sustainable Intensification

20. More than four-fifths of agricultural production growth to 2050 is expected to come from increased productivity on currently used land. A variety of agronomic and technical approaches are available to achieve higher output, overcome constraints and manage risks. These will need to be accompanied and guided by increasingly effective and integrated land and water institutions.

21. Land productivity is generally low on rainfed croplands, particularly in Sub-Saharan Africa, because of low inherent soil fertility, severe nutrient depletion and poor soil structure. Large fertilizer applications are unaffordable and too risky in many low-potential rainfed cropping systems. Sustainable land and water management techniques can greatly increase productivity through integrated soil fertility management, employing organic and inorganic nutrient sources and agronomic techniques such as plant diversity, agroforestry, crop rotation and maintenance of protective soil cover. Feasibility and risk assessments are needed to evaluate socio-economic constraints and formulate effective incentive packages for farmers to adopt appropriate management approaches and adapt techniques and practices to their specific farming situation.

22. Several integrated rainfed production approaches, such as conservation agriculture, agroforestry and integrated crop-livestock systems, combine best management practices adaptable to the local ecosystem and culture and to market demand. Pesticide use and risks can be minimized by integrated pest management (IPM). Integrated soil fertility management, combined with rainwater harvesting and soil and water conservation on slopes could improve rainfed yields. However, risk and initially low profitability often inhibits adoption. The above-mentioned approaches have proven to be successful when they form part of a rural development and livelihoods improvement strategy which includes support services and better market access. Education, incentives and farmer field schools speed the transition to more productive and resilient land-use systems.

23. Additional irrigation water is likely to come from multi-purpose hydropower schemes. Small-scale water storage projects are also expected to boost supply. Although some new groundwater development is anticipated, active management by users can improve water-use efficiency where there is collective interest in maintaining aquifer function and services. A combination of improved irrigation scheme management, investment in modern technology, knowledge development and training can substantially increase water-use efficiency and improve supply to the often poor tail-end users. The highest gains are possible in sub-Saharan Africa and parts of Asia.

24. Recycling and re-use of water is another option, but only with effective regulation can water be safely derived from drainage, saline and treated wastewater. On-site and off-site risks from salinization and water-logging require careful drainage planning, investment and management in many irrigation projects. Salt and water balance studies and a regulatory and monitoring system are required.

25. To raise land and water productivity on larger irrigation schemes, an integrated modernization package of infrastructure upgrades and management system improvements is required, together with an economic environment providing undistorted incentives, manageable risk, and market access. There is also scope for improving irrigation efficiency and productivity in small-scale and informal irrigation. This requires mechanisms to ensure the availability of knowledge, technology and investment support, adapted to the local management practices and socio-economic context.

26. Many sustainable crop, livestock and agro-forestry management practices, which have long been recommended for ecological and economic reasons, increase resilience to climate change and extreme events and mitigate GHG emissions largely through carbon sequestration. The contribution of practices such as conservation agriculture, green manure, fodder crops, improved pasture and rangeland management and recycling of crop residues and animal wastes can make the agriculture sector more carbon-neutral.

National Support to Sustainable Land and Water Management

27. The world's farmers are the prime actors and stakeholders in the planning and sustainable management of land and water, but many are forced into unsustainable practices by poverty and lack of the right incentives; insecure land tenure and water-use rights; lack of adequate local organizations; and inefficient support services including rural credit and finance, markets and access to technology. National governments are responsible for ensuring that an enabling environment and a supportive incentive structure exist. They need to invest in public goods such as roads, storage, and land and water protection works, and to facilitate private investment, including local credit. Investment is also needed in the institutions regulating and promoting sustainable land and water management: research and technology development; incentives and regulatory systems; and integrated land and water-use planning and management. A coordinated river basin planning or territorial planning approach, as appropriate, is needed to drive targeted land and water investment programmes. In addition, most existing irrigation schemes need modernization of both infrastructure, including improved drainage, and institutional arrangements.

28. Land and water administration institutions should be strengthened to improve systems for land and water rights where shortcomings inhibit improved productivity. Common-property systems can be adapted to provide secure land tenure by legal recognition and protection or by negotiated and legalized conversion to individual rights. Land markets can be promoted to improve allocation efficiency and equity.

29. Integrated approaches across coupled land and water systems and multi-level stakeholder participation can greatly enhance water productivity and reduce stress by improving allocation efficiency among sectors and by introducing technologies and a governance structure promoting efficient water use. Examples are participatory collective irrigation or groundwater management. Cooperation in transboundary water management, starting from the technical level, can promote optimal, multi-objective investment and basin-wide benefit-sharing.

30. Improving the application of technology for sustainable land and water management requires the integration of knowledge from research with local diagnosis and adaptation. There is an extensive research basis for most land and water systems, but research and extension need to be equipped to offer adapted technology on demand, for example through outreach programmes such as Farmer Field Schools, in partnership with local farmer groups, NGOs and the private sector.

31. A first step to manage land and water more efficiently is removing distortions that encourage land and water degradation, such as energy subsidies that drive inefficient, energy-intensive farming or groundwater depletion. An incentive structure including price incentives and regulatory measures can then be designed to promote better practice. Payments for Environmental Services (PES) may rebalance costs incurred by small farmers and benefits to other sectors of society.

Requirements for International Cooperation and Investment

32. International cooperation on sustainable land and water management has become a high priority in many institutions because of concerns about food security, poverty reduction, environmental protection and climate change. Several international agreements contain principles of conservation of natural resources, including land and water, but these have rarely been translated into substantive action on the ground or national codes of conduct or practice, and a consolidated agreement and framework for action on sustainable land and water management is not yet in place.

33. Several organizations and programmes, including the Global Environment Facility (GEF) have been raising awareness and prompting action on sustainable land and water management, and some have strengthened institutions and governance. However, different organizations often work in the same field, which reduces focus and impact, and approaches remain largely sectoral rather than integrated.

34. New technologies, particularly remote sensing, are contributing to resource inventory and monitoring. Yet, international and national efforts remain fragmented, and joint measures are needed to ensure harmonization, accessibility, and effective data sharing and use.

35. Globally, investment in land and water has increased slightly in the last five years but remains far below the levels necessary to address food security and poverty. Official development assistance to land and water fell in the 1990s and stagnated until recently, and agriculture's share of government expenditures worldwide has declined.

36. Gross investment requirements in developing countries between 2007 and 2050 for irrigation development and management are estimated at approximately US$960 billion (about US$ 22 billion per year). Moreover land protection and development, soil conservation and flood control will require around US$160 billion (about US$ 3.7 billion per year)[2]. New financing options include Payments for Environmental Services and the carbon market. The recent calculation of the investment needs in water for agriculture and energy (hydropower) in Africa under the likely climate change scenario suggests some US$ 67 billion for the next 25 years[3]. Global-level financing should complement public and private finance at the national level. To effectively attract and absorb these higher levels of investment, nations need to develop favourable policies, institutions and incentives, along with a strong monitoring and evaluation mechanism that addresses the social, economic and environmental dimensions of sustainability.

III. Meeting the Challenges

37. The clear challenges facing agriculture are to produce at least 70 percent more food by 2050; improve food security and livelihoods of the rural poor; maintain the necessary ecosystem services; and reconcile the use of land and water resources among competing uses. All these challenges will need to be addressed together with the anticipated impacts of climate change where they have a net negative impact on agricultural production. These challenges will not be met unless:

- Existing agricultural practices can be transformed to reduce pressure on land and water systems.
- Negative impacts of production systems are reduced markedly and increased food production is associated with poverty alleviation, food and livelihood security diversification and the maintenance of ecosystem services.
- Agricultural systems facing land and water-related constraints are addressed as a priority and progress in redressing risks is monitored.
- Investment, economic and trade policies favour sustainable agriculture and balanced rural development.

[2] J. Schmidhuber,J. Bruinsma & G. Boedeker 2009. Capital requirements for agriculture in developing countries to 2050. p. 21in: How to Feed the World in 2050. Proceedings of Expert Meeting. Rome, FAO, 24-26 June 2009.
[3]Ministerial Conference on Water for Agriculture and Energy in Africa, The Challenges of Climate Change, Sirte Libya, 2008.

- Sustainable intensification can be implemented through integrated planning and management approaches that can be scaled up from local levels to address constraints and mainstream climate change mitigation and adaptation simultaneously.

Principal recommendations are:

- Broad adoption of participatory and pluralistic approaches to land and water management, with growing devolution and local accountability.
- Increasing investment for improvement of essential public good infrastructure related to the whole market chain from production to consumer.
- Allocation of national and international dedicated funds to support sustainable land and water management in systems requiring priority attention linked to FAO strategic objectives on small farmers and Impact Focus Area on Water and Land Scarcity(IFA-WALS) and promotion of incentive programmes such as Payments for Environmental Services for watershed management and clean water, biodiversity and sustainable production schemes could then promote adoption of sustainable land and water management practices capturing carbon and reducing negative environmental impacts.
- Appraisal of ecosystem services including land and water audits developed to frame planning and investment decisions.
- A review of the mandates and activities of existing global and regional organizations for land and water to promote closer collaboration, if not integration.
- Promoting 'green economy' approach to assure improvements in human well being and social equity while reducing environmental risks through International trade agreements (e.g. improved use of WTO green fund) and contribution to sustainable agriculture overall.
- Cooperative frameworks and basin-wide management institutions should work together to optimize economic value and ensure equitable benefit sharing in international river basins.

IV. Conclusion

38. The land and water systems, underpinning many key food producing systems worldwide, are being stressed by unprecedented levels of demand. Climate change is expected to exacerbate these stresses in some key productive areas.

39. There is scope for governments and the private sector including farmers to be much more proactive in enabling and promoting the general adoption of more sustainable land and water management practices. These have the potential to expand production efficiently to address food security and poverty while limiting impacts on other ecosystem values. However, this will require profound changes in the way land and water are managed. Global, regional and national policies will need to be aligned and institutions transformed to become genuine collaborators in applying knowledge and in responsible regulation of the use of natural resources.

40. The status and trends of land and water resources for food and agriculture described in SOLAW provide a basis for designing and prioritizing regional programmes and financing to enhance sustainable management of land and water where it is most needed.