

**High Level Segment of the  
17<sup>th</sup> Session of the Commission on Sustainable Development**

**Round Table 3  
Integrated Land and Water Management for  
Sustainable Agriculture and Rural Development**

**Discussion Paper**  
Prepared by  
**Prepared by DSD/DESA**

### **Questions/Issues to Guide Discussions**

Land, water and population pressures are three critical factors that interact to influence food security. Ensuring food security through sustainable agriculture and rural development (SARD), therefore, involves achieving the proper balance between, integrated land management (ILM) and integrated water resources management (IWRM) as well as population policy and programmes. The round table will examine the interaction between land, water, and population and suggest policy measures that can achieve the balance between them needed to achieve food security through sustainable agriculture and rural development. A more detailed conference room paper covering these topics will be made available on the DSD website in advance of the round table.

Integrated land management, integrated water resources management and population policies and programmes must be integrated in a holistic way with other resource issues in order to promote sustainable agriculture and rural development. Focusing only on ILM and IWRM to the exclusion of population considerations, for example, is insufficient to achieve SARD and food security. Addressing falling per capita food production, insufficient food access and resource degradation calls, therefore, for strategic plans that incorporate population concerns such as population growth, distribution and rural-urban migration patterns with integrated land management and integrated water resources management.

Additionally, people-centred community development strategies that incorporate the empowerment of women, promotion of girls' education and vital social services, particularly for rural populations, as well as production resources are needed. Agenda 21 recognized population, land and water as vital, but distinct components of sustainable development, and discussed them in separate chapters – 5, 14 and 18 respectively. However, in recent years, there has been recognition that population policies and programmes, as well as land and water management must be pursued in an integrated manner for the achievement of food security through SARD.

#### ***Through what means and mechanisms can countries ensure holistic strategies for SARD which integrate land and water management as well as population policies and programmes?***

Supportive means and mechanisms for consideration include:

- Promote across ministries a holistic approach to SARD and achieving food security through integrated land and water management, which takes into account population growth, distribution and rural-urban migration patterns, and competing uses of water and land resources
- Draft comprehensive framework laws that take an integrated approach to water, land and population considerations
- In drafting national legislation, call for meeting basic water needs of people and ecosystems first before proposing pricing structures to penalize excessive water use in dry seasons
- Establish mechanisms for interministerial cooperation and collaboration covering land, water and population issues

Sustainable strategies that combat soil erosion and impoverishment, deforestation, falling agricultural output, and poor water management need to be designed and implemented. Additionally, rural agricultural extension schemes are needed which provide credit, seeds, fertilizers and advice to poorer farmers, regardless of whether they are men or women. Finally, research on combining traditional and emerging technologies for food production needs to be

promoted.

Watershed management is an iterative process of integrated decision-making regarding uses and modification of land and water within a watershed or hydrographic basin. Development of the watershed needs better understanding about the various natural resources their relations with each other and their relations with livelihoods of the stakeholders.

***What policies and measures can promote watershed management for integrated land and water management at the national and river basin levels?***

Supportive policies and measures for consideration include:

- Support the development of national integrated water resources management plans
- Expand land and water policies and programmes to rely on integrated land and water techniques
- Combine sustainable land management and integrated water resources management (IWRM).
- Support the development of national IWRM plans
- Adopt a water-security approach, integrating water policies with land management and sustainable agriculture
- Prepare strategies for the land and water sectors at the water basin level
- Promote legal instruments for integrated water resources management
- Create provincial water resources management offices
- Create river basin offices in major river basins
- Adopt sustainable watershed management as the platform for integrated land and water management and SARD.
- Promote land reform and equitable access to land and enforceable land rights
- Establish accessible land registration for the poor
- Promote a knowledge-based approach to land and water management
- Recognize the ecosystem services provided by land and establish schemes for the payment for ecosystem services
- Promote innovative incentives for sustainable land management, such as tax exemption on agricultural and forest products in desertification-affected areas, concessional loans for desertification rehabilitation actions, subsidies for readjusting grazing and farming structures
- Promote alternative water management techniques, including rainwater harvesting, water treatment and reuse, water recycling, and reclamation of water-logged land
- Use traditional knowledge and bottom-up approaches to land and water management
- Avoid inefficient irrigation which leads to groundwater depletion, degradation of water quality
- Deploy techniques for rainwater harvesting including underwater cisterns, rooftop collection and storage tanks
- Promote safe and productive wastewater and stormwater collection, treatment and reuse in agriculture

## **Introduction**

The Earth has a finite amount of land and a finite volume of freshwater but the demands on these two vital resources are growing exponentially. Food demand is rising, driven by population growth, growing affluence in parts of the world and the shift up the food chain to diets based on meat and other resource-intensive nutrients. Similarly, with expanding populations, the demand for fibres is also growing as is the demand for bioenergy. At the same time, the world has allowed the needs of ecosystems to languish for too long. There is a pressing need to restore ecosystems, protect forests and wetlands and conserve biodiversity for present and future generations. The challenge, therefore, is to balance land and water use with population growth through sustainable agriculture and rural development so that the accelerating demands for food and other agricultural products can be met while protecting ecosystems and ensuring sustainable livelihoods.

Ensuring sustainable agriculture and rural development, the ultimate objective of which is achieving food security, involves achieving the proper balance between sustainable land management and integrated water resources management as well as social and population policies and programmes. This paper examines the interaction between land, water, and population and suggests measures that can achieve the balance between them needed to promote sustainable agriculture and rural development. The paper is intended to stimulate round-table discussion and exchanges of experiences on concrete policy actions to promote integrated land and water management (ILWM).

Sustainable land management, integrated water resources management as well as social and population policies and programmes must be integrated in a holistic way, with other resource management issues in order to promote sustainable agriculture and rural development. Focusing only on sustainable land management and integrated water resources management to the exclusion of social and population considerations, for example, is insufficient to achieve sustainable agriculture and rural development. Pursuing sustainable agriculture and rural development through integrated land and water management (ILWM), therefore, involves a socio-political approach as much as a biophysical one. As such, both the biophysical as well as the social aspects of land and water must be taken on board in designing and implementing strategies and policies.

Ease of access to land and security of tenure are as important as fertility and topography. Security and ease of access to water are as important as timing and quantity of water availability. Technology that secures access to water is as essential as organizational and management structures. Security of access to other agricultural and rural development inputs such as sufficient and equitably remunerated labour, fertilizer, credit, and know-how are equally important.

Addressing falling per capita food production, insufficient food access and resource degradation calls, therefore, for strategic plans that incorporate population concerns such as population growth, distribution and rural-urban migration patterns with integrated land management and integrated water resources management. Additionally, people-centered community development strategies that incorporate the empowerment of women,

promotion of girls' education and vital social services, particularly for rural populations, as well as production resources are needed.

To achieve sustainable agriculture and rural development, sustainable strategies that combat soil erosion and impoverishment, deforestation, falling agricultural output, and poor water management need to be designed and implemented. Additionally, rural agricultural extension schemes are needed which provide credit, seeds, fertilizers and advice to poorer farmers, regardless of whether they are men or women. Finally, research on combining traditional and emerging technologies for food production needs to be promoted.

Agenda 21 recognized population, land and water as vital, but distinct components of sustainable development, and discussed them in separate chapters – 5, 14 and 18 respectively. However, in recent years, there has been recognition that population policies and programmes, as well as land and water management must be pursued in an integrated manner for the achievement of sustainable agriculture and rural development.

### **Sustainable Agriculture and Rural Development**

Sustainable agriculture and rural development, the subject of Chapter 14 of Agenda 21, is aimed at increasing food production in a sustainable way so as to enhance food security. Sustainable agriculture and rural development involves education initiatives, utilization of economic incentives and the development of appropriate and new technologies, thus ensuring stable supplies of nutritionally adequate food, access to those supplies by vulnerable groups, and production for markets; employment and income generation to alleviate poverty; and natural resource management and environmental protection.

### **Sustainable Land Management**

Planning and management of land resources is the subject of chapter 10 of Agenda 21, which deals with the cross-sectoral aspects of decision-making for the sustainable use and development of natural resources, including the soils, minerals, water and biota that land comprises. This broad integrative view of land resources, which are essential for life-support systems and the productive capacity of the environment, is the basis of the consideration of land issues in Agenda 21 and in the Commission on Sustainable Development.

Expanding population and economic growth are increasing pressures on land and water resources, creating competition and conflicts and resulting in unsustainable use of resources. Considering all uses of land and water in an integrated manner makes it possible to reduce conflicts, ensure the most efficient trade-offs to combine social and economic development with environmental protection for sustainable development.

### **Integrated Water Resource Management**

Integrated Water Resource Management is defined as a process, which promotes the coordinated development and management of water, land and related resources in order

to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.<sup>1</sup> Integrated water resources management is based on cooperation between all the sectors that influence water resources including forestry, agriculture, public works and the private sector. Integrated water resources management principles provide a platform for equitable, efficient and sustainable utilization of water resources.

A survey by UN-Water conducted in 2006 indicated that 17 or 22% of 77 developing countries queried had national integrated water resources management plans in place and 2 or 3% had fully implemented them. Some 10 or 37% of 27 developed countries surveyed had integrated water resources management plans in place and 6 or 22% had fully implemented them<sup>2</sup>.

### **Land, water and population**

Population, demographic dynamics and sustainability are the subject of Chapter 5 of Agenda 21. Demographic dynamics and sustainability was discussed at the third and fourth session of the Commission on Sustainable Development and the nineteenth Special Session of the General Assembly, as well as annually at the Commission on Population and Development.

According to the United Nations medium projection, world population was 5.5 billion in 1992, when Agenda 21 was agreed, stands at 6.7 billion in 2009, is expected to reach 8.04 billion in 2025 and 9.4 billion in 2050. However, the actual world population figure in 2050 could be lower or higher depending on policy choices and demographic developments. Over the next decade, more than half the population growth is expected to be in Africa and South Asia, where the risks of land degradation and water stress are most severe.

The Cairo Programme of Action indicates how slowing population growth will buy time and increase the ability of countries to invest in human capital. Slower rates of population growth can also buy time to combat poverty, protect and repair the environment, and build the infrastructure to pursue a more sustainable development path<sup>3</sup>.

Ensuring food security for all through sustainable agriculture and rural development therefore, will involve ensuring that the development of human resources, including population policies and programmes<sup>4</sup>, receives as much commitment as the integrated management of natural resources such as land and water. The development of human resources implies, among other things, extending national population programmes and

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<sup>1</sup> Global Water Partnership - Technical Advisory Committee (2000)

<sup>2</sup> UN Water, Status Report on Integrated Water Resources and Water Efficiency Plans, Report Prepared for the 16<sup>th</sup> session of the Commission on Sustainable Development, p.21

<sup>3</sup> Statement of Under-Secretary General Sha Zukang to the Commission on Population and Development, 30 March 2009

<sup>4</sup> Agenda 21: Chapter 5.31: "National population policy goals and programmes that are consistent with national environment and development plans for sustainability and in keeping with the freedom, dignity and personally held values of individuals should be established and implemented"

family planning services to the millions who currently lack them and empowering women and enabling girls' education.<sup>5</sup>

In 1960, when the world population numbered only 3 billion, approximately 0.5 ha of cropland per capita was available. This area is what is needed to produce the diet of plant and animal products consumed in the United States and Europe.<sup>6</sup> The total agricultural area in the world amounts to 5.0 billion ha. Of this, about 1.5 billion ha (30.4%) is arable land and land under permanent crops.<sup>7</sup>

As a result of the doubling of the world population since 1960, the average available cropland per capita in the world has now fallen to below 0.24 ha, which is roughly half the amount required to supply the varied food supplies consumed in the U.S. and Europe. Even if the amount of cropland were to remain constant in the world, at a billion and a half hectares, the growth of the world population to 9.4 billion in 2050 would reduce the per capita cropland to 0.16 ha.

However, total cropland is not remaining constant. Various forms of soil degradation lead in many parts of the world to the loss of croplands.

Only about 2.5 per cent of all water on the planet is fresh water—essential for most human purposes—and only about 0.5 per cent is accessible groundwater or surface water. Rainfall quantities vary greatly around the world. Portions of Northern Africa and Western Asia receive very small amounts of rain<sup>8</sup>.

Global population has tripled over the past 70 years and water use has grown six-fold as the result of industrial development and increased use of water for irrigation to satisfy diets relying to a greater extent on animal products with a higher demand in land and water resources. Satisfying the water needs of 77 million additional people each year has been estimated as requiring an amount roughly equal to the flow of the Rhine, some 64 billion cubic metres per year<sup>9</sup>. But the amount of available fresh water has not changed. Ensuring that there is enough water to sustain critical ecosystem functions of water is a related challenge.

Rapid population growth and increased total water consumption, including changing dietary habits, combine to rapidly deplete water resources. The present and future availability of adequate supplies of freshwater for human and agricultural needs is already critical in many regions, especially in the Middle East and parts of North Africa where low rainfall is endemic.

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<sup>5</sup> Statement of Under-Secretary-General Sha Zukang, op. cit.

<sup>6</sup> David Pimentel and Marcia Pimentel, *World Population and the Food Problem*, Cornell University, Ithaca, N.Y. 2004 <http://www.cafeweltgeist.org/ihtec/Resources/DPimentelWorldPopulationFood.doc>

<sup>7</sup> FAO Statistics, [http://www.fao.org/ES/ess/os/envi\\_indi/part\\_15.asp](http://www.fao.org/ES/ess/os/envi_indi/part_15.asp)

<sup>8</sup> UNFPA, State of the World Population, 2008 <http://www.unfpa.org/swp/>

<sup>9</sup> Third World Water Development Report 2009 Un-Water , Chapter 2 [http://www.unesco.org/water/wwap/wwdr/wwdr3/pdf/WWDR3\\_Facts\\_and\\_Figures.pdf](http://www.unesco.org/water/wwap/wwdr/wwdr3/pdf/WWDR3_Facts_and_Figures.pdf)

Irrigation enables crop production in arid regions, provided there is an adequate and sustainable source of freshwater and fossil energy to pump and move the water. Currently, approximately 70% of the water removed from all sources worldwide is used solely for irrigation.

The limitation of surface and ground water resources for irrigation, and its high economic costs, plus the required large energy inputs, will tend to limit future agricultural irrigation. This will be particularly the case in developing countries which cannot afford such expenditures<sup>10</sup>.

### **Evolution of the debate on promoting sustainable agriculture and rural development through sustainable land management , and integrated water resources management**

Sustainable land management and integrated water resources management can best promote sustainable agriculture and rural development when they are all part of a people-centred ecosystems approach to the management of natural resources, covering all aspects, including population, communities, air, water, land, and other living species. Effective management of land resources requires the full, active and informed participation of those whose livelihoods are at stake. Full implementation of sustainable land management and integrated water resources management, therefore, is a participatory process that requires the involvement of all major groups, business and industry, children and youth, farmers, indigenous peoples, local authorities, non-governmental organizations, scientific community, women, and workers and trade unions.

Governments and major groups have debated sustainable agriculture and rural development, Sustainable land management and integrated water resources management throughout the life of the Commission on Sustainable Development (CSD), but specifically at CSD-8, CSD-12, CSD-13 and CSD-16 as well as in the IPM of CSD-17. Earlier, the sectoral cluster of land, desertification, forests and biodiversity, as well as mountains (chapters 10-13 and 15 of Agenda 21) were considered by CSD-3 in 1995 and again at the five-year review in 1997.

In accordance with its multi-year programme of work, CSD-8 in 2000 reviewed integrated planning and management of land resources as its sectoral theme. Many of the issues addressed are also linked to the focus at CSD-8 on agriculture as an economic sector, and the documentation prepared for the session for agriculture is also relevant to the land item.

In its decision 8/3 on integrated planning and management of land resources, the Commission on Sustainable Development noted the importance of addressing sustainable development through a holistic approach, such as ecosystem management, in order to meet the priority challenges of desertification and drought, sustainable mountain development, prevention and mitigation of land degradation, coastal zones, deforestation,

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<sup>10</sup> Pimentel and Pimentel, op. cit.



climate change, rural and urban land use, urban growth and conservation of biological diversity. Such an approach should take into consideration the livelihood opportunities of people living in poverty in rural areas.

The Commission identified six priorities for future work, including: prevention and/or mitigation of land degradation; access to land and security of tenure; critical sectors and issues (such as biodiversity, drylands, rehabilitation of mining areas, wetlands and coastal zones, coral reefs, natural disasters, and rural-urban and land management interactions); access to information and stakeholder participation; international cooperation, including that for capacity-building, information-sharing, and technology transfer; and minerals, metals and rehabilitation of land degraded by mining in the context of sustainable development. Governments were urged to support the implementation of a number of important international agreements, including the UN Convention to Combat Desertification (CCD), the UN Convention on Biological Diversity (CBD), the UN Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, and the Habitat Agenda adopted by the UN Conference on Human Settlements in 1996.

Some of the issues raised specifically on integrated land and water management in recent debates were as follows:

Managing sustainably competing uses of water and land resources involves:

- Implementing efficient water resources development and management schemes, including at the basin level, and improve irrigation efficiencies and on-farm water management practices to overcome water shortages and enhance food security;
- Seizing opportunities offered by sustainable biofuels production to raise farmers' incomes, attracting investments into agriculture which can contribute to enhancing food security, and mitigate climate change, avoiding competition for productive arable land and displacement of small farmers and pastoralists;
- Further research and develop second and third generation biofuels;
- Fostering scientific and technical cooperation, including North-South and South-South cooperation, in the development, inter alia, of sustainable bio-energy production, arid and semi-arid agriculture and combating desertification.

### **Watersheds as the setting for integrated land and water management (ILWM)**

As water, land and other related resources all come together in a river basin or watershed, the concept of sustainable watershed management is the ideal strategy to realize ILWM, with greater efficiency in the use of land and water resources. Watershed management is an iterative process of graded decision-making regarding uses and modification of land and water within a watershed or hydrographic basin. Development of watersheds calls for better understanding of and accounting for the various natural resources, their relations with each other and their relations with the livelihoods of stakeholders.

Watershed management<sup>11</sup> relies on, among other techniques, remote sensing and geographical information systems to propose various water harvesting and soil conservation measures to arrive at integrated land and water resource development plans for watersheds.

Water resource development plans can be prepared by integrating information on hydro-geomorphological characteristics, surface water availability, land use and land cover, drainage, present status of ground water utilization and on the present and long term needs of water.

Conservation, management and development of land and water resources form integral components of the watershed development plan. Suitable structures can be suggested for surface harvesting and recharge. Proposing different soil and water harvesting structures plays a very crucial role, which requires a well-qualified and well-experienced work force with thorough knowledge in various water conservation programmes.

For a more comprehensive approach to the inter-related challenges of managing land and water resources, it is important to consider the impacts of land management measures on water resources, where, for example, the effects of poor land use such as pollution and sediment are absorbed by the water to the detriment of the fish population, on which the people may depend, and to the detriment of the water's use as potable supplies for the population.

Negative impacts of poor land and water management include houses washed away in floods; wells polluted or dried up; livestock congregating; topsoil washed away; silting up of reservoirs; channels blocked by aquatic weeds. All these ills affect the poor directly. Avoiding them requires a coordinated approach to land and water management

Given the diversity of interests groups affected by ILWM, it is also important to provide a participative way in which the issues can be selected and addressed among major groups at the ground level. The emphasis needs to be on partnerships and collaboration, essential for an integrated approach, and on national ownership.

ILWM programmes should seek to achieve improved on-the-ground management; improved governance; deliberate donor and agency collaboration; and encourage the recognition of the connection between the problems of individuals struggling for survival and the wider management issues of a river basin.

Typical basin-wide integrated land and water resources management programmes could include the following components: establishing effective soil and water protection measures by improving sustainable and participatory community-based forest and

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<sup>11</sup> See Praveen Raj Saxena a \*, N.S.R.Prasad, *Integrated Land and Water Resources Conservation and Management- Development Plan of Chevella R.R. District , Andhra Pradesh, India Sub-Watershed Using Remote Sensing and GIS*, [http://www.isprs.org/congresses/beijing2008/proceedings/8\\_pdf/7\\_WG-VIII-7/01.pdf](http://www.isprs.org/congresses/beijing2008/proceedings/8_pdf/7_WG-VIII-7/01.pdf)

rangeland management; enhancing irrigation water use efficiency and agricultural production and income through rehabilitation and modernization of the irrigation and drainage systems, together with improved operations and maintenance, diffusion of participatory water management, and training and support for agricultural extension and research.

An ILWM programme could also involve such components as technical cooperation to establish a basin water committee; a basin water fund to provide assistance for community-based activities for water and natural resources conservation, and the establishment of a support system that enables the basin water committee to discharge its functions.

Additional elements could include: water quality monitoring in rivers and aquifers, river ecology monitoring and mitigation measures; forest monitoring and management; an integrated pest management plan; resettlement instruments; cultural property; and public participation and public awareness-raising particularly on ecological literacy as well as on social capital building. The programme would, finally, provide support for project implementation and coordination at the national and basin levels.

Some illustrative case studies that provide lessons learned regarding watershed management include the Murray-Darling River Basin in Australia, the Ferghana Valley in Central Asia, the Liao River Basin in China, the La Cocha Lagoon in Colombia, Alborz integrated land and water management project in Iran, the Soussa-Massa River Basin in Morocco, the trans-boundary Pungwe River Basin in Mozambique and Zambia, and the Hudson River Valley in the USA.

### **Ensuring sustainable agriculture and rural development through ILWM**

Rather than an end in itself, ILWM is, of course, a means to achieve sustainable agriculture and rural development and ultimately food security while maintaining crucial ecosystem functions. Sustainable agriculture and rural development, land and related issues were last taken up during the 8th session of CSD in 2000. Major Groups called for continuation of the dialogue begun in 2000. Out of this grew the Sustainable Agriculture and Rural Development Initiative, launched at WSSD in 2002 as a major-groups-led, government supported and programme, facilitated at the intergovernmental level, which is a people-centred approach to sustainable development in agriculture.

The Sustainable Agriculture and Rural Development Initiative is a multi-stakeholder umbrella framework that engages major groups, governments and intergovernmental organizations in a joint effort to make rapid progress toward achievement of the Agenda 21 vision for sustainable agriculture and rural development.

The Initiative emerged from the Dialogue on Land and Agriculture at the Eighth Session of the UN Commission on Sustainable Development (CSD-8) in 2000 and the subsequent Forum that was organized as a side event at the FAO Committee on Agriculture (COAG) in 2001. In the run-up to the World Summit on Sustainable Development (WSSD), CSD decided to give much greater emphasis **to implementation processes involving**

**stakeholder partnerships, FAO facilitated preparation of the Sustainable Agriculture and Rural Development Initiative, with active participation of major groups.**

In many parts of the world most rural people are relatively disadvantaged and lack adequate opportunities to exchange information and learn about, test, adapt and replicate environmentally and socially appropriate approaches that would improve their livelihoods and achieve sustainable agriculture and rural development. Often they also have little possibility to influence policies, processes and institutions that affect them, especially in the context of globalization.

Since UNCED, many successful sustainable agriculture and rural development experiences have been recorded in specific localities. These experiences urgently need to be assessed, shared, adapted and scaled up, and complementary public sector investments in physical and institutional infrastructure for viable, equitable and sustainable rural development need to be programmed and implemented. The Initiative emerged in response to this need.

The Initiative helps to achieve sustainable agriculture and rural development by supporting pilot efforts and building the capacity of rural communities, disadvantaged groups and other stakeholders to improve access to resources (e.g. genetic, technological, land, water, markets and information), promote good practices for sustainable agriculture and rural development, and foster fairer conditions of employment in agriculture.

The Initiative provides catalytic support to strengthen the capacities, initiatives and innovations of farmers, fisher folk, pastoralists and other rural people to achieve such development and provides a framework through which local, national and regional initiatives related to sustainable agriculture and rural development can be recognized, supported and, if appropriate, replicated to contribute to improving rural livelihoods, as called for in Agenda 21. The Initiative links resources, expertise, knowledge and technologies to demands of rural communities and disadvantaged stakeholders. By up-scaling lessons, successful endeavours and approaches, the Initiative helps to promote wider access to, use of and benefits from existing resources<sup>12</sup>.

### **Proposed policy measures**

Building on the need for a socio-political as well as a bio-physical approach to integrate land and water management for sustainable agriculture and rural development, the following are a set of possible policy measures to promote ILWM for sustainable agriculture and rural development, at the local, national and global levels, in four essential areas: (1) local action for building capacity and forming social capital, (2) national action for improving planning, governance and administration, as well as sharing

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<sup>12</sup> [www.fao.org/SARD/en/init/2224/index.html](http://www.fao.org/SARD/en/init/2224/index.html)

global experiences and setting norms for (3) improving land and water use, and (4) increasing resource efficiency.

## **1. Local action for building capacity and forming social capital**

### ***Knowledge and capacity***

- Promote a knowledge-based approach to land and water management
- Improve land and water governance capacities
- Promote ecological literacy in the agricultural and rural sectors
- Promote capacity building for water-use strategies, including through transfer of technology
- Promote more effective water use in agriculture by improving infrastructure and farm education and training
- Transfer technology for sanitation, wastewater treatment, reuse and residuals management
- Disseminate information and guidelines on surface and groundwater quality and safe reuse of treated wastewater
- Develop and strengthen monitoring systems on the quantity and quality of surface and ground water at the watershed, national and local levels
- Promote the sharing of traditional and local knowledge on land and water management and its integrated use along with conventional technical knowledge
- Prepare to reduce vulnerability
- Invest in research and development for disaster preparedness
- Invest in early warning systems for drought

### ***Social Capital***

- Build rural social capital, including associations and cooperatives, devoted to sustainable and integrated land and water management
- Raise broad public stakeholder awareness of integrated water resources management
- Promote participatory water-user associations to plan water deliveries, resolve disputes among water users and maintain irrigation and drainage systems
- Establish and implement water allocation discipline for all watersheds
- Assess projects in watersheds not in isolation but with an integrated approach and participation of all stakeholders
- Improve water governance by strengthening role of local authorities and communities through committees, encouraging social participation, rehabilitating watersheds, enhancing the sustainability of ecosystems, preventing and mitigating meteorological disasters, improving efficiency of water use and involving all stakeholders
- Promote collective management practices for soil fertility at the ecosystem and watershed level

## **2. National action for improving planning, governance and administration**

### ***Holistic planning and governance***

- Promote across ministries, through inter-ministerial mechanisms, a holistic approach to sustainable agriculture and rural development and achieving food security through integrated land and water management, which takes into account population growth, distribution and rural-urban migration patterns, and competing uses of water and land resources
- Expand land and water policies and programmes to rely on integrated land and water techniques, combining sustainable land management and integrated water resources management
- Replace traditional water management plans with integrated water management master plans, which consider land and population dimensions, with stakeholder participation, as well as long-term strategies to protect aquifers.
- Adopt a water security approach, integrating water policies with land management and sustainable agriculture and invest in sustainable management of land, forests and natural resources, with stakeholder participation

### ***Social policies for sustainability***

- Ensure that population issues are included in social and health sector programmes and in their funding and also in integrated inter-ministerial policymaking on sustainable agriculture, rural development, and integrated land and water management.
- Increase national and international funding for family planning from the 2009 level of \$2.3 billion world-wide to \$4.1 billion in 2015, in order to meet the re-estimated funding goals of the International Conference on Population and Development
- Facilitate the demographic transition, including through the empowerment of women and promotion of girls' education, as well as through the widespread availability of reproductive health and family planning services

### ***Decentralized decision-making***

- Adopt sustainable watershed management as the platform for integrated land and water management and sustainable agriculture and rural development and prepare strategies for the land and water sectors at the water basin level, and establish a water regulatory authority with a river-basin focus
- Decentralize water management by creation of autonomous local water and sanitation authorities with greater local focus, as well as provincial water resources management offices and river-basin offices in major river basins

### ***Equitable legal frameworks***

- Legislate innovative incentives for sustainable land management, such as tax exemption on agricultural and forest products in desertification-affected areas, concessional loans for desertification rehabilitation actions, subsidies for readjusting grazing and farming structures
- Promote legal instruments for integrated water resources management and sustainable land management, taking into account the interests of all stakeholders
- Draft comprehensive framework laws that take an integrated approach to water, land and population considerations
- In drafting national legislation, call for meeting basic water needs of people and ecosystems first before proposing pricing structures to penalize excessive water use in dry seasons
- Organize an effective water police to enforce water legislation

### **3. Sharing global lessons and setting norms for improving land and water use**

#### ***Equitable land access***

- Promote land reform and equitable access to land and enforceable land rights
- Establish accessible land registration for the poor
- Involve women and indigenous people in land rights considerations

#### ***Sustainable land use and livelihoods***

- Promote sustainable forest management
- Promote linkages between sustainable land management and the mitigation and adaptation to climate change
- Use traditional knowledge and bottom up approaches to land and water use
- Attract livelihood-generating investments to degraded land areas
- Promote sustainable pastoralism and pastoral mobility in drylands through policy, investment, legal support, governance and service delivery, including training and extension on animal health
- Facilitate non-pastoral livelihoods for pastoralists
- Cultivate sustainable biofuels that generate jobs and do not compete with the cultivation of foodstuffs, building on best practices of countries such as Brazil
- Promote alternative livelihoods not dependent on land such as dryland aquaculture (fish, crustaceans and industrial compounds from microalgae), tourism, and new economic opportunities for people outside dryland areas including greenhouse agriculture.

#### ***Sustainable water use***

- Mitigate ecosystems risks by managing agriculture water demand, which currently accounts for 70 per cent of all water use world-wide
- Adopt new sustainable business models for wastewater treatment
- Support and effect water-demand and water-resource management in all sectors

- Avoid proportional water release strategies based merely on average monthly flow of water, which can prove wasteful of water
- Protect oases and promote sustainable use of deep groundwater resources

#### **4. Sharing global lessons and setting norms for increasing resource efficiency**

##### *Ecosystem measures*

- Recognize the ecosystem services provided by land and establish schemes for the payment for ecosystem services
- Raise the share of government budgets for agriculture and increase the agriculture and rural development share of official development assistance
- Implement policies to address the direct and indirect drivers of land degradation, desertification, erosion, salinity, and pollution
- Promote enhanced soil productivity
- Promote conservation tillage
- Replant trees to hold water
- Develop drought-resistant plants and crops
- Promote conservation agriculture and forestation projects
- Combine organic and inorganic sources of soil fertility, including environmentally sound fertilizer and vermiculture,
- Promote techniques to prevent wind erosion
- Promote conservation of biodiversity and soil-carbon sequestration
- Promote construction of *aricuts* (small check dams), digging and deepening of ponds and wells, stone earth and water packets for rainwater harvesting
- Select and plant drought-tolerant crops
- Research and scale-up on-site ecological sanitation systems and low-cost sanitation alternatives

##### *Integrated water resource management measures*

- Promote water-use efficiency, particularly in agriculture
- Deploy techniques for rainwater harvesting including underwater cisterns, rooftop collection and storage tanks
- Promote alternative water management techniques, including rainwater harvesting, water treatment and reuse, water recycling, and reclamation of water-logged land
- Promote safe and productive wastewater and stormwater collection, treatment and reuse in agriculture
- Promote solar-powered water desalination
- Promote community involvement in rainwater harvesting including through improving irrigation fields and recharging dry wells
- Avoid seepage losses in irrigation
- Improve maintenance of irrigation works
- Avoid over extraction of groundwater resources



- Promote energy and water-saving gravity-fed sprinkler irrigation
- Avoid inefficient irrigation which leads to groundwater depletion, degradation of water quality
- License surface and groundwater extraction and set standards for municipal waste-water discharge to drains
- Implement the user pays principle for irrigation, a heavy user of water, but use equity and human-rights principles for household water supply