Present and future trends of natural resources (land and water) management in Ethiopian agriculture

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Abstract

Agriculture depends fundamentally on natural resources and has an important role in their conservation. The deteriorating land and water resources in Ethiopia present a concern to rural land users, and wider public awareness of environmental issues is bringing urgency to conservation issues. Water depletion and land (natural resources) degradation, themselves the result of ever-increasing ecological imbalances, caused the recurrent drought and famine. Sustainable agriculture plays the central role in poverty reduction efforts of the country.

Meeting food security and food self-sufficiency in Ethiopia require, among other things:

- integrated land and water development planning and implementation
- increased efficiency of water use in agriculture giving due attention to the popular participation and empowerment of local governments and marginalised and resource-poor community groups and
- enhanced capacities and capabilities of integrated land and water users and their development partners, local governments, i.e. lower decentralised unit—*woreda*—for designing and executing development programmes.

Scientific land and water use planning and implementation are the fundamental processes needed to achieve these results. Nevertheless, it has to be founded on the basic principles of community-driven development and fully supported with participatory and applied research activities on the major biophysical and socio-economic land resources. The practice has to be enhanced with smallholder level rainwater-harvesting techniques in areas with relatively better length of growing period (LGP), followed by the huge dam construction works in lowland areas. This measure will be the basis for sustained productivity in the continuous and iterative process of producing and disseminating alternative land use options equipped with alternative land use technology packages to farmers/pastoralists in the specific agro-ecological settings. In addition, the proper involvement and participation of all stakeholders prior to huge investment works is essential. The human resources development (HRD) and training and education (TE) establishment gearing towards the efficient implementation of integrated land and water planning should not be overlooked.

Background

Land degradation and water depletion has been recognised as a serious problem in the Ethiopian highlands. The fear of losing the fertile topsoil has driven experts, planners and decision-makers to tremendous efforts focused on soil conservation measures.

Land and water resources are limited and finite. The wise use of rural land and water resources with the best technologies, in the most rational and beneficial way possible, is crucial for the social and economic well-being of the country and its people.

Land refers not only to soils, but also to land forms, climate, hydrology, vegetation and fauna, together with land improvements (terracing, irrigation, drainage works) and unsustainable land use practices (including all land using community).

Because of relatively better climate, rainfall amount and frequency and less health hazards, most of the Ethiopian farming communities live on the highlands (>1500 metres above sea level, masl). Areas extensively inhabited by pastoralists whose subsistence is dependent on extensive grazing also indirectly rely on the cereal productions of adjacent highland regions.

Although Ethiopia has an estimated area of 1.12 million km^2 with a wide ecological diversity, the uneven spatial and temporal occurrence of water resources are still the causes of underutilisation of arable land for agriculture. Between 80–90% of the country's water resources is found in four basins (Abay, Tekeze, Baro-Akobo and Omo-Ghibie) where the population is not more than 30–40%. The water resources in the other basins (east and central) are only 10–20% whereas the population in these basins is over 60% (MoWR 1995).

This clearly depicts that 'moisture stress' in most of the agricultural potential areas is the major constraint. According to FAO (1994), the total irrigated area in Ethiopian river basins amounts to 161,790 ha, which is only 4.4% of the predicted 3.4 million hectares of potentially irrigable land.

Faced with this situation and a poverty driven depleted resource base, the risk averting strategy that has been adopted by the rural community is increasing unsustainable pressure on natural resources through:

- over utilisation of the available land
- encroachment on wildlife and forest priority areas
- overgrazing etc.

These actions lead to land and water depletion and degradation and/or 'forced' migration to urban areas.

In addition, the absence of off-farm income in rural areas has also contributed to the high population pressure on arable land, which leads to fast deterioration of natural resources.

This situation will remain a challenge until a high rate of agricultural transformation coupled with maximum and sustainable agricultural productivity (per unit area of land-intensification) takes off from the present crisis. Realising the present socio-economic situations, it is evident that Ethiopia cannot meet its food security and food self-sufficiency objectives using the prevailing land and water use systems.

Taking into consideration the catchment areas of each river basin of Ethiopia *vis-à-vis* the population census of 1997, it can be observed that more than 129 persons/km^2 live in the Rift Valley, while the bulk of the lowlands are scarcely populated with as few as 8.3 persons/km^2.

Agriculture in Ethiopia contributes 40% of the total gross domestic product (GDP) and 85–90% of export earnings. It also accounts for 85% of the total employment. However, agricultural productivity is characterised by low productivity. The causes are various, diverse and often interlinked with poverty.

As most of the poor are living in the rural parts of the country, agricultural development will still play the central role in poverty reduction efforts. This implies that an increased productivity in agriculture will have a powerful dynamic general socio-economic equilibrium effect benefiting the poor.

Increased productivity in agriculture should be driven by technology and investment for sustainable productivity and agricultural transformation. The most prominent social benefits that can be brought by the increased productivity are elimination of hunger, fast economic growth, reduction of poverty and proper development and utilisation of natural resources.

Again, sustainable agriculture needs integrated land and water planning, implementation and management, which increase the efficiency of water use in agriculture. This process has to be led by the community and their development partners, i.e. local governments.

Land and water development can be undertaken for settlement and irrigated agriculture. The co-ordinated effort and consent of stakeholders plays an important role in minimising mistakes, which are very costly. Training and education are also important tools to achieve the desired productivity level for the rural poor.

Capacity building priorities in community driven land and water management

Experiences suggest that decentralisation will not work without vibrant, participatory communities, with *woreda* (local government) and also for sustainability. The two can evolve together dynamically, strengthening one another (Alkiire et al. 2001).

Learning-by-doing is an important way of creating capacity in communities and local governments. Technical schemes in the past often failed because they did not correspond to communities' needs and priorities (Esmail 2002).

Once communities and local governments are given the power and resources, they can choose and implement projects.

Community driven land and water management that relies directly on resource-poor land users has the potential to make poverty reduction efforts more inclusive and cost effective than programmes traditionally run by governments.

Though community-led development programmes are relevant across many sectors, they have the greatest potential for goods and services that are small-scale and not complex and which require co-operation, such as common pool goods best represented by the management of surface water irrigation systems, management of communal land (pasture, grazing), and management of public forestry etc. (Manor 1999).

Why community-driven land and water management?

- enhances social acceptance and confidence
- compliments public sector activities, improves efficiency, effectiveness and equitable utilisation of infrastructure
- makes development more inclusive of the interests of resource-poor, vulnerable and minority groups
- empowers poor people, builds social capital and strengthens good governance and
- allows poverty reduction efforts to work at the appropriate scale.

Technical assistance and skill-oriented education and training should be given to all people involved in and responsible for land and water management, planning, implementation and execution, i.e. communities, land users, decision-makers and technocrats.

Moreover, the installation of major data/information structures like mini-meteorological stations in specific agro-ecological settings with the necessary human resources should not be overlooked.

Regarding the above notion, the following important points are raised for discussion and verification for enhancing the capacities of communities and the lowest levels of local government.

1 Education and training

a. Surveying and mapping and database management with special reference to cadastral for land registration, certification of land title and deeds.
   This measure is important in ensuring security on land use rights and regulations.
b. Decision-supportive role in land/water use planning, management and enhanced local capacity in sustainable (rain, ground and irrigation) water use efficiency.
   The Agricultural Technical, Vocational Education and Training (Agri-TVET) programmes (rainwater harvesting and small-scale irrigation curricula) can be used as an opportunity to all people involved in land and water use management, i.e. *woreda*-level decision makers, technocrats and water users associations.
c. Develop institutional structures of irrigated agriculture and capacity building both at land (arable/grazing) and water use associations and local governments.
d. Enhance capabilities of local governments and community-based organisations in designing local land use planning standards, strategies and enforcement regulations.
e. Develop mechanisms for enhancing the capacities and ensuring the participation of private investors in direct investment, construction etc. of land and water planning.
f. Build capabilities of local governments in assessing the natural resources and undertaking of Environmental Impact Assessment (EIA) studies prior to any investment.

g. Develop demonstration facilities (rainwater harvesting techniques) in the Agri-TVET institutions where all stakeholders should be responsible.

2 Expansion of supportive institutional structures (access)

a. Meteorological stations in specific agro-ecological settings as much as possible and upgrading the services for practical application and applied research.
b. Training and education (TE) facilities in land and water management for human resources development (HRD)
c. Development of applied trial and research stations in specific agro-ecological settings.

Initiatives for future applied research on land and water management

Ethiopia gets an annual rainfall apparently adequate for rainfed food and fodder production. However, moisture stress prevails in most parts of the country due to the uneven and unpredictable occurrence of rainfall both spatially and temporally.

Moreover, the ever increasing unsustainable use of all bio-physical natural resources coupled with overwhelming rural poverty and mismatch between uncontrolled population growth and food and fodder production have been attributed to the ever increasing ecological imbalances. This ecological disturbance has in turn been attributed to the recurrent famine occurring every 3–5 years.

Furthermore, the traditional and backward agricultural practices and the absence of applied research and extension services to alleviate local situations also contribute to insufficient exploitation of the available rainfall amount. In addition, most of the available data are obsolete and not suited to local conditions.

The little efforts made to use the water resources by the government, non-governmental organisations (NGOs), farmers etc. are concentrated only on the natural courses of rivers on available plains and do not give due attention to resource-poor farmers and pastoralists. Moreover, investment on river diversions, levelling and other reclamation efforts are almost negligible.

The major reasons can be summarised as follows:

- total dependence on rainfed agriculture and traditional land use practices
- insufficient technical service from the government and other relevant institutions
- poor characterisation of the agro-ecological settings to enhance organic farming and alternative agriculture and the absence of alternative technology packages (extension) on homogeneous land units—intensification efforts build upon what farmers are already doing
- absence of coherent land and water information systems
- irrigation efforts are observed only in natural courses of rivers
- no investment by the government to alleviate constraints of potential areas for re-distribution of land and opening up of new settlement areas

- near spontaneous approaches in allotting land to private investment without prior and thorough attention to Environmental Impact Assessment (EIA) and the absence of land use policy on leased lands accompanying investment.

Despite the above shortcomings, the success exhibited in the production of cotton in the Afar Regional State can be cited as an indication for the potentials and opportunities for development of land and water harmonisation.

Shortage of rains and population pressure are blamed for food insecurity and low productivity of agriculture and the deterioration of natural resources. However, if strategies are designed to alleviate the above problems and water resources are developed to cater to irrigation, it would be possible to attain agricultural surplus enough for domestic consumption and external markets.

As the main problem of agricultural productivity even in the rainfed areas calls for mitigating moisture stress, rain, ground and surface water resources have to be made to contribute to agricultural development through supportive applied research on all crop–environmental interactions within specific agro-ecologies.

The main aspects for future land and water management research initiatives could be the following, but should be exhausted in the succeeding forums.

i. Agro-ecology characterisation on a larger scale for each regional state.

ii. The design of land use policy strategy, regulations at each level of planning and mechanisms of harmonising them.

iii. Crop–environment interaction within a given agro-ecology, i.e.:

- soil nutrient status and fertiliser recommendations
- minimum irrigation requirement
- irrigation frequency (with respect to soil quality and crop requirements)
- areas with relatively better rainfall amount but needing supplementary irrigation
- water balance calculations
- soil moisture storage capacity
- reference (potential) evapotranspiration and crop coefficient (Kc value)
- minimum climatic data/information needed
- length of growing period (LGP)
- rainfall amount, probability, intensity, frequency and distribution
- available water capacity of soils and other physical properties
- crop rotation and organic farming
- socio-economic studies (indigenous knowledge, attitude of the community towards land and hydrology)
- agro-industry and marketing, and other post-harvest technologies
- soil and water conservation requirements
- specific land and water management options
- other constraints and opportunities to development—exhausting all issues and assumptions in specific areas within a period of time.

iv. Major land use (irrigation, rainfed, specific crop, grazing, livestock) requirements, i.e.:

- rainfall amount, moisture availability and other land qualities

- nutrient requirements
- climatic requirements (temperature, humidity etc.)
- harvest index and yield response factors
- growing cycle
- slope and landscape
- salinity/alkalinity tolerance
- calcium carbonate ($CaCO_3$) and Gypsum ($CaSO_42H_2O$) tolerance
- soil physical properties requirements (texture, structure, infiltration capacity etc.).

Recommendations

Despite the challenges and setbacks, there is a window of opportunity for progress. There is no blue print for achieving progress. Strategies and interventions should reflect the actual situation and need thorough thought on how they might be used.

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