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Synergy between Traditional and Introduced Sustainable Land Management Practices in Ethiopia

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I. Introduction

The agricultural potential and natural resource bases of the Tigray Region have been continuously exploited for a long period of time without appropriate conservation practices for sustainable use. These inappropriate use and lack of attention by the previous regimes have led to cyclic drought, environmental degradation, decrease in productivity and deep-rooted poverty. The government of FDRE has designed a development policy to bring about sustainable development in a short period of time. The Regional Government of Tigray has also adopted the Rural Centered Agricultural Development-Led Industrialization (ADLI) Strategy with the following main directions: Ensuring food security, nature conservation and environmental protection, employment opportunity, improved livelihood, market-oriented agricultural production and poverty reduction through mitigation of root causes of poverty.

The current development effort of Tigray Regional government emphasizes on household package formulation based on area specialization (market- oriented commodity production) and diversification of enterprises that are complementary to specialized commodities. This household based package formulation is natural resources conservation based approach in which water harvesting is central and the core component of packages: water harvesting-centered household package approach. This approach favours integration and linkage of crop-livestock- natural resource base sectors to enhance ecologically, socially and economically sound sustainable land management principles and practices. The household based package was prepared and is implemented based on agro-ecological potentials, priorities, opportunities and existing and desired infrastructures for production and post-harvest aspects. To date an exemplary and huge environmental rehabilitation and development work has been done and majority of degraded lands have been rehabilitated in Tigray and had given lessons to other regions.

Currently, environmental rehabilitation and agricultural development efforts in Tigray are supported with a tremendous water harvesting works (ponds, shallow and deep wells, series of ponds, run off and river diversion, dams, roof and rock catchments, in-situ moisture conservation and catchments treatment) to tackle recurrent drought and to bring about the desired agricultural transformation, sustainable development and alleviate poverty. These development endeavors should be translated into economic terms and our grass-root community (farmers) should gain economic benefits and generate income to improve their livelihoods (Abbadi et al, 2003).

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II. Materials and Methods

a) Case studies

Kombolcha, Alemaya and Fedis weredas of East Hararge and Doba and Mesella weredas of West Hararge Zones were visited. The visit included introduction by zonal and wereda heads, field visit and interaction with experts and farmers, direct observation of farm lands and catchments and wrap-up meeting and open discussion with were da and zonal personnel to share experiences of both counterparts.

b) Area description

East and West Hararge Zones have varied traditional agroclimatic zones including "kola", "weina dega' and "dega". Rainfall is bimodal and erratic and climatic aridity increases to the East and South East. Landforms vary from plain to undulating rugged topography (Table-2). The farming systems of these zones are characterized as follows:

- Mixed crop-livestock system
- Small land holding size
- Market-oriented cash crop/livestock production system
- Intensive traditional land resource management practice
- Labour intensive working tradition of farmers and farming activity is done all year round (365 days).
- Diversified and intensified cropping systems of perennial and annual mixed crops that enhance income generation minimize risk and soil degradation.
- Zero grazing system that excludes livestock from farm lands where cut- and- carry feeding system practiced.
- Livestock number per capita is very small and practice of oxen plough is minimum and non-existent in most cases where hand digging is the dominant tillage practice.
- Rich and ecologically sound traditional land husbandry practices/knowledge base but lack technical backup.

Table 1 : Contrasting environments and farming systems

Hararge	**Tigray**
Zero grazing	Free grazing
Row planting	Broadcasting
Bimodal rain fall and erratic	Erratic
Perennial and annual mix cropping	Dominantly annual cereal crops
No oxen cultivation	Oxen cultivation
Farmland not far from residence	Fragmented

Table 2 : Area description of visited weredas

Wereda	Population	Density (Persons/ Km^2)	Rainfall (mm)	Altitude (m. a. s. l.)	Land holding (Ha)	Soil texture	Topography	Agroclimatic zones
East Hararge Zone								
Kombolcha	120,063	258	600-900	1600-2400	0.5	Clay loam / sandy loam	Plain & undulating	26% Kola 74% W/Dega
Alemaya	204,982	393	600-900		0.25-0.5	Clay loam	Plain	68%W/Dega 32%Kola
Fedis	222,835	109	400-800 in kola 600-1200 (W/Dega)	500-2118	0.75-1.25 (W/Dega) 1-3 (kola)	Red brown clay loam with 1-1.5m depth	80% plain	86%Kola 14%W/Dega
West Hararge Zone								
Doba	143,000		Erratic				Steep, Rugged, undulating	5% Dega 41%W/Dega 54%Kola
Mesela	159,000	231		1200-1700			Rugged	20%Kola 80%W/Dega

c) *Experiences from China show that*

- Massive watershed management with project approach
- Zero grazing: enforcement: doubled livestock population and not destocking through availing quality and enough feed source from treated watersheds
- Intensive watershed treatment

Have resulted in sound environmental rehabilitation and improved rural economy within a decade (Ayalneh, 2004, Azene, 1997).

III. Results and Discussion

Intensive field visits and open discussions were done to share experiences. Summary of these experiences gained at farm land (plot) and watershed/catchment level and promising techniques,

technologies, skills and knowledge for possible adoption into Tigray's situation and recommendation on adjustment, biophysical and socio-economic setups, technical (research and extension service) backups are presented below.

a) Water Harvesting (WH) and Moisture conservation

Rainfall is erratic in intensity and distribution in dry lands of Ethiopia. Rain water Harvesting (RWH) and storage minimizes the risk of frequent crop failures due to drought. East and West Hararge zones have some innovative methods of water harvesting techniques to store and conserve water on farmlands for efficient water utilization to enhance farm productivity.

i. *Run-off diversion*

Run-off diversion into farmlands to feed tie-ridges and enhance in-situ moisture harvesting is a common practice of the visited weredas. Farmers in the visited weredas practice this water harvesting mechanism (e.g. 605 ha in kombolcha and 1500ha in Alemaya weredas) to maximize run–off water to alleviate moisture stress. There are also efforts to utilize run-off water and traditional run-off diversion is common practice in some weredas and efforts should be made to utilize excessive run–off lost after each rain shower.

ii. *Shallow Wells*

A lot of shallow wells have been dug to irrigate crop fields with spate irrigation with motorized pumps. More than 1500 in kombolcha, 1548 in Alemaya and considerable number of shallow wells in other weredas have been dug. More than 1600 waters pumps in Kombolcha and 3600 water pumps in Alemaya were purchased by farmers to irrigate their field. The farmers have interesting water lifting mechanism to up lift water from shallow wells in to up hills. They utilize relay of motorized water pumps to lift water to undulating and sloppy areas to irrigate their fields. This allows cultivation of cash crops in sloppy areas. There are some similar experiences in Tigray but should be further exploited to expand and introduce cash crop/ agroforestry in the rugged and undulating areas of Tigray.

Fig. 1 : Shallow well

iii. *Ponds*

A large number of ponds have been constructed recently in East and west Hararge. These ponds are fenced with dry and live fences to stabilize ponds and protect entry of livestock and children. Fencing ponds can have similar advantage in Tigray and farmers should be advised to fence their ponds for sustained use of their ponds and to protect ponds from entry of livestock and children.

Fig. 2 : Typical plastic lined pond in Tigray

iv. *Conveyance and storage of excess run-off using cut off drain in to large reservoirs*

Shortage of water for agricultural production in dry land areas of Ethiopia is mainly related to the temporal and spatial distribution; meaning water is not always available in the right place at the right time. During the rainy period, rain water is left to flow over different landscapes. It also causes flooding, massive soil erosion, land slides and destruction of rural and urban infrastructure like roads, SWC structures, farm lands and residence houses. Farmers at Mesela wereda have vital experience in channeling excessive run off from town roof catchment through ditches into far distance (5km) and storing the runoff into large naturally occurring well (sink well). This effort shows that there is great potential to collect excessive run off from towns and catchments and to convey run off to the desired distance and store it in natural reservoirs or artificially made large wells and use it when water is critically needed to the desired purpose. This experience created an opportunity to maximize and explore all available ways of water harvesting techniques for optimum water harvest in Tigray. Efforts should continue to utilize all possibilities of water harvesting mechanisms.

Figure 3 : Natural reservoir at Mesella wereda, West Hararge

b) Intensification of agroforestry on farmlands

Agroforestry species can be intensified and integrated on irrigated areas.

Figure 4 : Traditional Agroforestry

c) Integrated Watershed Management

We observed good experience catchment treatment at Keraba watershed of Doba wereda of West Hararge. We observed integrated and intensive catchment treatment using integrated and intensified SWC technologies. There was integration of different type of physical SWC techniques based on slope gradient and soil depth of the catchment area. These include:

Hill side terraces, microbasins, eye brow basin, hearing bone, cut off drain, stone and soil bunds, tie-ridging and trenches.

Figure 5 : Integrated Watershed Development in West Hararge

There was also good integration of biological and physical SWC techniques. There was intensive inter-terrace management. The terraces are well designed to harvest rainwater. This enhanced agroforestry practice in sloppy areas. Biological entities include: Grass strips, fodder trees, fruits and indigenous and exotic tree species.

Agroforestry in hilly and communal areas allows

- Bund Stabilization
- Income generation
- Animal feed
- Bee flora
- In-situ moisture/water harvesting that enhances discharge of water sources down stream
- Overall environmental rehabilitation

Figure 6 : SWC structures, West Harage

Catchments were excluded from livestock interference and human settlement and allowed land use change in hilly areas into forest/agroforestry areas and resulted in complete vegetation cover and discharge of water in the catchment discharge area. The catchment was distributed to different grass root community organization for local management, ownership and development and had positive effect in minimizing conflicts among land users. The potential of this catchment approach should be explored to adapt to other regions.

Figure 7 : Catchment treatment and gully stabilization resulted in ground water recharge

d) Diversification of income generation and asset building

Diversification cash crops, fattening, dairy, poultry and other enterprises were good experience gained to improve the livelihood of our farmers to gain economic benefits from rehabilitated water sheds. They can be allocated to landless youths and enterprises could be diversified, integrated and market-oriented.

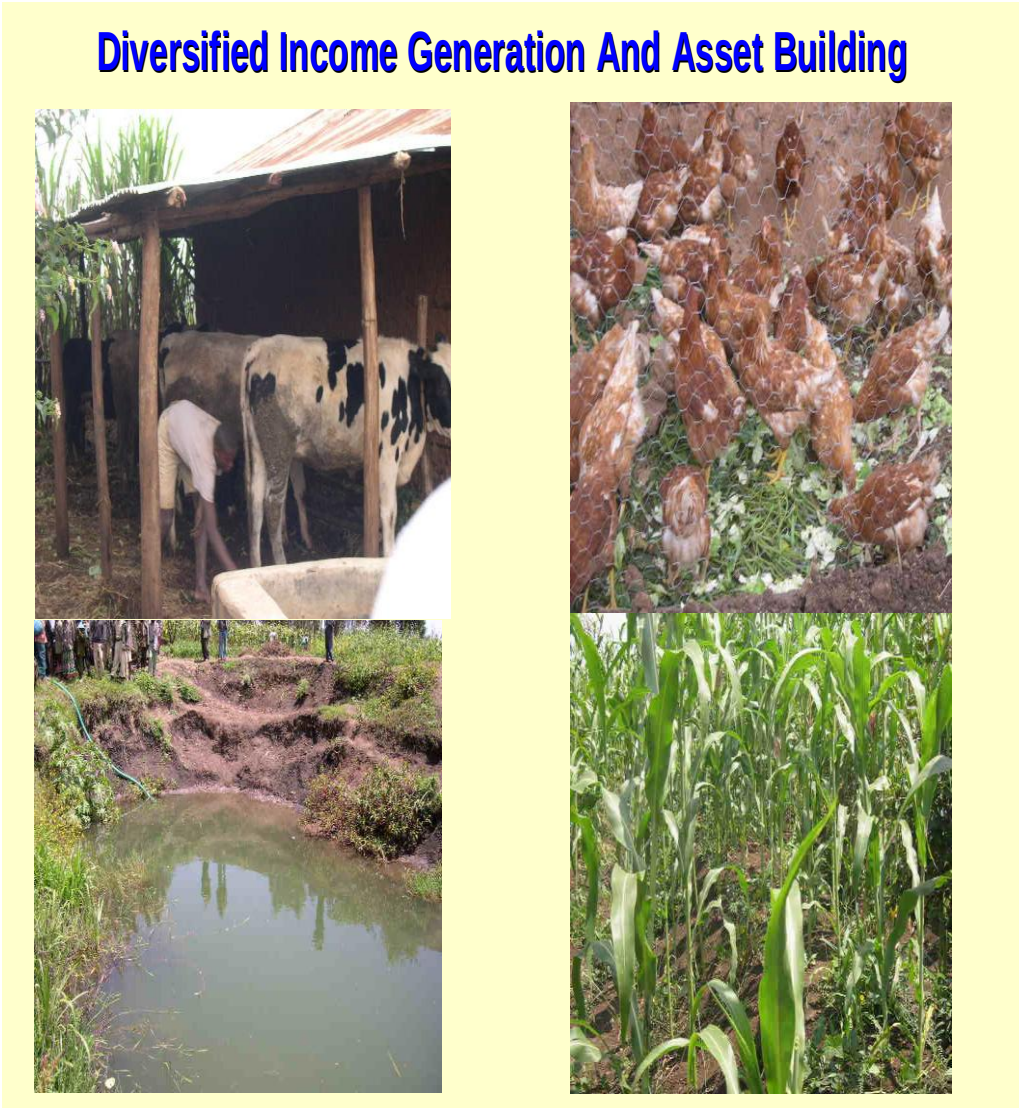

Figure 8 : Income diversification

IV. Concluding Remarks

a) Taking in to account contrasting environments, farming systems, socioeconomic setups variability is mandatory in adopting technologies. We need to adjust such traditional knowledge gained from Hararge to fit to the existing circumstances of Tigray and other drylands of Ethiopia. We may need to start some of these activities at pilot and model level (pilot learning sites- PLS) to scale up and scale out diffusion of new and introduced RWH innovations.

b) Important knowledge gained to fill gaps of current water harvesting-centered development efforts are:

- Water harvesting (In-situ moisture/ water harvesting through tie-ridges)
- Irrigation(crop diversification and intensification)
- Community ponds and reservoirs
- Zero grazing and
- Intensive and integrated watershed management approach

c) Empowering current grass-root community development efforts through:

- Working culture: need for transformation of working culture
- Mobilizing public and local resources

- Enhancing indigenous knowledge of RWH and labour intensive rather than capital intensive approach
- Strong policy, research and advisory support

d) Further integration of current joint development efforts on RWH by government agencies, NGOs, donors, and the grass-root community is imperative to accelerate and revitalize natural resources conservation–based agricultural development strategy to achieve sustainable development and reduce poverty in Ethiopia.

e) Network of professionals working on different aspects of land management, development and utilization is badly needed to address multidimensional and cross-sectoral issues and impacts of SLM development and intervention endeavors.

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