

3. Environment, Natural Resource and Climate Change Research Sub-thematic Area

3.1 Water Resource Potential of eastern Ethiopia

The water supplies of urban and rural populations in Eastern Ethiopia region heavily depend on groundwater resource (bore holes, dug wells and springs). Future water supply expansion projects of these in other parts of the country are also targeted on groundwater resources. However, including the surface water resource, the potential of groundwater resource is not well estimated and modeled. They have been overexploited for different purposes without having knowledge on the occurrence, distribution, flows and quality of the groundwater systems. Therefore, detail hydrologic and hydro-geologic investigations are needed in the region and the nation as a whole, for sustainable use of the water resources. In addition, rain fed agriculture is predominant land use type in the drier farming regions (arid and semi-arid environments) of Ethiopia, which implies the need for alternative water resource development. Some of the research components are:

- Ground and surface water resources potential estimation and modeling;
- Alternative water sources development;
- Water Harvesting Systems/Technology Development;
- Waste water treatment;
- Sediment and pollutant load estimation;
- Land suitability assessment for irrigation purposes;
- GIS and remote sensing for assessment of water resources;
- Socio-economic issues in water resource development, use and management.

3.2 Water Scarcity, Overexploitation and Misuse of Water Resources

Water is the finite resource that enables life and is critical for future economic growth. However, businesses in water-scarce areas are already at risk. Land users, including investors are increasingly taking water supply into consideration in their decision-making processes. If water resources are not smartly managed, they will increasingly threaten investment and also the fundamental needs of populations. Similarly, the future of water resources in our nation is being threatened by the misuses and mismanagements. Taking action to implement the available solutions and models will ensure the viability and sustainable development of our society. Therefore, it is essential that the public, industries and policymakers understand, prioritize and act timely. A clean water supply is the single most important determinant of public health. Water and sanitation are fundamental to human development and well-being. Research components include:

- Sustainability of the water resources;
- Analysis and quantification of water for different uses;
- Coverage of safe water provision and utilization;
- Identification of water efficient engineering and management approaches;
- Monitoring and evaluation of water resource development techniques;
- Basin wide water resources allocation;
- Evaluating community based water use byelaws and regulations.

3.3 Soil Resource Assessment

There is limited information on soil resources in Eastern Ethiopia. Classification, characterization and mapping of soils of an area is, therefore, a significant contribution for sustainable management of the natural resource.

The major research components include:

- Characterization and classification of soils in the mandate areas;
- Characterization, classification and mapping of the soils of Eastern Ethiopia.

3.4 Soil Erosion and Vegetation Degradation

Erosion and related problems are common limitation of agricultural productivity in Eastern Ethiopia. They are some of the most widespread threats to soil quality. It is therefore, the task of researchers to study the hazard, distribution, extent and effect of soil degradation in the area. Forest resource is also degraded due to various reasons such as road development, building constructions and agricultural expansion and overgrazing. There is high population increment and energy demand. Therefore, new technologies are required to minimize the effect. Priority research areas include:

- Fundamental research on environmental causes of soil erosion;
- Assessing and delineating areas of risk for soil erosion, taking into account climate variability and climate change, using GIS and other technologies;
- Assessment of the extent and type of soil erosion in the mandate areas;
- Identification of local soil and water conservation approaches and their effectiveness;
- Assessment of the status of forest resource and other vegetation in the mandate area
- Assessment of the status of vegetation degradation and rate of rehabilitation;
- Investigating the values of forest goods and services and their contribution to poverty alleviation and the environment;
- Vegetation watershed management and rehabilitation strategies;
- Human population trends and reliance on vegetation resources;
- Monitoring vegetation utilization in East Hararghe.

3.5 Water Pollution

Surface and ground water are threatened worldwide by pollution. Increased human activities are threatening the nearby lakes, rivers, spring and wetlands. A major concern of the presence of polluting elements in the aquatic environment is related to the negative health effects they may cause in humans, animals and plants. Therefore, water pollution assessment, estimation of pollution level and extent, assessment of pollutant dynamics in water bodies as well as studying methods to reduce pollution of water resources is not only a necessity but a must.

3.6 Mismanagement of Solid and Liquid Waste

The situation of inadequate waste management is pervasive in many developing countries. It is one of the largest environmental challenges that societies have faced. In lower-income countries as well as poorer parts of middle-income nations, about 30 to 50% solid waste produced in urban areas is left uncollected. Poor waste management practices such as dumping of waste in water bodies and uncontrolled dump sites aggravates the problem across the country. Research components under this problem may emphasize on:

- Urban solid waste management (plastics, electronics, others);
- Urban liquid waste treatment and management.

3.7 Climate Change Adaptation and Mitigation

The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as adjustments in ecological, social or economic systems in response to actual or expected climatic stimuli and their effects. It includes adjustments to moderate harm from, or to benefit from, current climate variability as well as anticipated climate change. The climate change mitigation, on the other hand, will produce rapid discovery of the scientific knowledge base needed to quantify the potential for purposeful carbon

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sequestration/ GHGs removals, and will be a critical component of future climate change mitigation programs and will contribute to efforts to slow down the increase in atmospheric greenhouse gas concentrations. Research components under this problem may emphasize on:

- Development of resilient farming systems;
- Advance understanding of the opportunities and challenges of implementing adaptation;
- Create effective and innovative approaches to measure and value the monetary and non-monetary aspects of short- and long- term adaptations and mal-adaptations and compare these across groups, sectors, regions and timeframes;
- Investigate a range of evaluation criteria for prioritizing adaptation decisions;
- Conduct studies on communication, participation and capacity building for CCA;
- Research into mitigation options in agriculture and forestry and other land use (AFOLU);
- Development of production systems with enhanced carbon sequestration ;
- Agro-forestry investigation of the potential for low-rainfall tree species to be integrated into farming systems;
- Development of technologies for the production of bio-energy and other bio-products from agricultural and forest biomass;
- Examination of soil carbon dynamics in forests;
- Development of improved models of sequestration for dry-land forest species and mixed-species re-vegetation;
- Development of acceptable methods for inclusion of wood products in carbon trading schemes, acknowledging their important role in continuing carbon sequestered during forest growth;
- Conducting Technology Need Assessment (TNA) for CC Mitigation.