ANNEX 4 IPMS Environmental Assessment and strategy

Part 1 ENVIRONMENTAL ANALYSIS

1.0 Introduction

Securing a livelihood is inextricably linked to the exploitation of the natural resources base (land, water and forest) in Ethiopia, where over 85 percent of the population lives in rural areas and depends on smallholder agriculture. The pressure of intense human activity and improper farming and management practices pose serious threats to the sustainability of the natural resources and maintaining ecological balance. There is a widespread problem related to intensive cultivation, overgrazing and deforestation, soil erosion and soil fertility decline, water scarcity, livestock feed and fuelwood demand. These factors often interact with one another resulting in a reinforcing cycle of a "poverty, food insecurity and natural resources degradation trap".

Unsustainable land management practices pose a serious threat to crop and livestock productivity and thus to food security The IPMS project will endeavour to respond to these issues though project activities which take into consideration the various agro-ecological zones within which the Project will operate, the associated environmental issues, together with assessing farmers' capacity to invest in low-cost, environmentally-friendly, innovative agricultural technologies. The Project is committed to introducing sustainable and innovative agricultural practices which will enhance crop and livestock productivity and farmer's livelihoods.

Planned project activities to date have been assessed vis-à-vis the application of the Canadian Environmental Assessment Act (CEAA). Based on this assessment, it is evident that proposed IPMS activities do not constitute a "project" under the CEAA. As such, the CEAA does not apply and environmental screening reports are not required.

While project activities are not subject to the CEAA, the IPMS project is committed to promoting innovative agricultural production methods based on an understanding of the environmental linkages and possible effects. The Project recognizes the need to consider environmental aspects in its planning and implementation activities and is cognizant of the numerous environmental issues and linkages within the agriculture sector.

Towards that end, the Project will review and document environmental issues linked to project activities in the agriculture sector. Based on these reviews, the Project will compile the pertinent information on the environmental effects (and mitigation measures) of specific externalities associated with productivity-

enhancing technologies. This will subsequently form the basis for the development of training materials for capacity-building initiatives on environmental management.

1.1 Ethiopia: An Overview

Ethiopia is a country with high biodiversity and distinctive ecosystems. Located between 33^0 and 48^0 East longitude, and 3^0 and 15^0 North latitude, it comprises an area of 111.5 million hectares (ha). Out of this, 74 million ha or 66 percent of the total area is deemed suitable for agriculture.

The country's population is estimated at 72 million and is expected to reach 120 million by the year 2030. This has implications on the sustainability of the natural resource base and the efforts to attain national food security given that nearly half of the current population is classified as undernourished with a daily consumption per head of 1,765 kcal, well below the required energy supply level of 2,600 per day.

Ethiopia's topography and ecological regions vary greatly. The Ministry of Agriculture and Rural Development classifies its 525 Woredas into 18 agroecological zones. These reflect significant variation in temperature, moisture and altitude. The Ethiopian highlands above 1,500 meters comprising 43 percent of the country, present favourable conditions for agriculture. Here variations in rainfall and soils have enabled the development of a wide array of farming systems.

Mean annual temperature in Ethiopia is estimated to range between 10^0 C in the mountains of the northwestern and southwestern highland areas and 35^0 C in the northeastern lowlands. The higher parts of the highlands record nightly minimum mean temperatures of 0^0 C or below between November and February.

Ethiopia can be characterized as having a rugged and mountainous topography with the altitude ranging from a height of 4,620 m above sea level (asl) at Mount Ras Dashen in North Gonder to a low of 110 below sea level in the Dalol Depression of the Afar region. Mean annual rainfall distribution decreases from the southwestern areas of the country, which have the highest rainfall to the drier northern and eastern parts. The maximum mean annual rainfall reaches 2,000 mm in some of the southwestern parts of the country, while the lowest mean annual rainfall is below 250 mm in the northeastern and southeastern lowland areas.

The north primarily has a sloping terrain, fragile soils and is subject to erosive rainstorms during the main agricultural season. The plough-based mixed farming system contributes to soil erosion. In the central and southern highlands, soils are in general higher in organic matter. Here rainfall is heavier and distributed more evenly over the year. Compared to the northern highlands, there is greater

natural vegetative cover here. Through a combination of conquest, expanding commercial and state farms, small-farmer migration, private and state governance of forests, natural forests have been reduced and grasslands brought under the plough over the past century. The densely populated southwestern highland areas have been characterized by intensive, highly integrated horticulture using a variety of labour-intensive agricultural techniques.

More than half the country consists of lowlands (below 1,500 meters), where pastoral and agropastoral systems traditionally dominate. Sedentary and shifting cultivation systems are also practiced, especially in the western lowlands bordering on Sudan. The wetter margins of these lowland areas have been subject to both spontaneous and planned resettlement of cultivators. Pastoral systems are under pressure as a result of this loss of land, combined with population growth and recurrent droughts in recent decades. Lowland areas subject to settlement by highlanders often face environmental problems arising from the inappropriateness of highland farming systems, which can encourage accelerated erosion, as has occurred in the Beni Shangul region.

Ethiopia's natural resources are critical to the economy and form the basis of the livelihoods of its people, particularly 85 percent of the population living in rural areas. Agriculture is the mainstay of Ethiopia's economy and accounts for approximately 50 percent of the country's GDP and employs more than 80 percent of the labour force.

Ethiopia has large water resources and is often described as the water tower of the Horn of Africa. Much of the volume of the White Nile comes from Ethiopian tributaries. Transboundary rivers include the Webi Shebelle (shared with Somalia) and the Omo (Kenya). Hydropower is the main source of urban energy. Fuelwood, dung, and other biomass sources provide some urban and all rural energy supplies. Sound functioning of the ecological system is essential for ensuring clean water supplies in rural areas and for maintaining the flow of rivers during the dry season to sustain irrigation and rural and urban water supplies.

2.0 Key Environmental Issues in Ethiopia

Given the importance of agriculture in Ethiopia's economy, unsustainable land management practices pose a serious threat to crop and livestock productivity and thus to food security. A number of factors contribute to this. Population growth is increasing the pressure on forested areas and is contributing to the extension of the area cultivated and grazed. Each year, according to the Ethiopian Forestry Action Plan, approximately 150,000 hectares of woodlands are cleared for agriculture (the World Bank estimates the clearing at 62,000 hectares). Reduced vegetative coverage contributes to the loss of fuel supplies and to accelerated soil erosion. Free grazing by livestock (estimated at over 60 million cattle, sheep, goats and equines) slows the regeneration of natural

vegetation and varying degrees of soil compaction reducing infiltration of rainfall and increasing runoff.

Indeed, soil erosion is the most visible form of land degradation affecting nearly half of the agricultural land and resulting in soil loss of 1.5 to 2 billion tonnes annually, equivalent to a monetary value of US$1 to 2 billion per year. Many studies attribute water erosion, particularly on cropland, as a major cause for such a high level of soil erosion in Ethiopia, while others have pointed out that the significant role of livestock (overgrazing) in fueling the soil degradation process is the main cause, since it is integrated into a smallholder farming system. The loss of soil depth is estimated around 4 mm per year, outstripping the rate of soil formation estimated at no more than 0.25 mm per year in Africa. The effective soil depth in Ethiopia is estimated anywhere between 20 to 59 cm (depending on the area), and if such a loss of soil depth continues unabated, Ethiopia could lose nearly all of its topsoil in about 100 to 150 years.

Continued deforestation has not been matched by replacement planting, which has been limited, even on homestead plots. The result is a significant shortage of fuelwood, and as a consequence, crop residues and dung are often burned as fuel rather than being used as organic fertilizer. It is estimated that nationwide, about 18 percent of the energy consumed in rural areas comes from crop residues and dung. The use of these fuels contributes to a significant environmental health problem – exposure to smoke and indoor air pollution, which causes elevated under-five mortality and leads to a high incidence of respiratory diseases, mainly in women and children.

Using crop residues and dung as fuel, rather than returning this organic matter to the soil, causes a decline in soil fertility and deterioration in soil structure. The consequences include less infiltration of rainfall, more runoff, and reduced water storage capacity in the soil, which makes crops less able to withstand drought. The degraded land is more prone to erosion, leading to the aforementioned loss of fertile topsoil and to a reduction in soil depth, both of which can have an adverse effect on crop yields. A recent study demonstrated the level to which soil degradation contributes to loss in crop productivity: total loss per hectare of wheat is estimated at about 400 birr (CDN $70) in areas of low soil loss and 4,736 birr (CDN $840) in areas of high loss.

Environmental degradation undermines the livelihoods of the rural poor by reducing direct consumption and income from product sales. The impacts on the rural poor are considerable given that they inhabit more marginal lands that are prone to land degradation. Better land management is therefore one critical element for the sustainable improvement of food security.

Problems of water quality and quantity are caused by a range of factors including unreliable rainfall, shortcomings in water resource development, an inadequate framework for water resource management, in particular, neglect of catchment

management; and, limited access to financial and human resources. Poor use of irrigation water contributes to salinization and to the loss of highly productive land. The increased desiccation of the highlands as a consequence of land degradation and reduced vegetative cover has led to reduced storage in the catchments and in more rapid runoff, resulting in increased flooding, reduced groundwater recharge, and increased sedimentation of rivers, lakes, including water bodies behind dams.

Environmental health issues emanating from water quality problems are pervasive in Ethiopia. It is estimated that only 24 percent of the population has access to a safe water supply – even less in the rural areas where the bulk of the population resides.

Water storage for irrigation and stagnated canal irrigation water can cause health problems: examples are the spread of bilharzia in the major schemes in the Rift Valley and increased malaria prevalence reported near storage dams in the lower parts of the highlands. In Ethiopia, malaria is reported to be on the rise. A recent study showed a sevenfold increase in malaria prevalence among 7,000 children under 10 years of age, living within 3 kilometers of small dams, compared with children living outside mosquito flight ranges. In pastoral areas, mistakes in well location and management have had negative environmental effects, adding to the general problems of moisture deficiency and overgrazing common to Ethiopia's rangelands.

There is a critical need for improved water resources management. In particular, integrated management should be seen as a compliment to other technical measures for addressing water supply issues, since better-vegetated and better-protected catchments will improve water infiltration and storage. This is likely to improve groundwater recharge, reduce floods, and extend the period of stream and river flow into the dry season. Such an integrated approach would produce a win-win situation – improved operation of the hydrological system, and better land management, which will enhance food security and the supply of biomass for fuel and humus.

Another major environmental issue is solid and liquid waste management. This includes an acute lack of sewerage facilities, and wastewater treatment plants; the shortage or lack, and poor management of latrines (it is estimated that 26.9 percent of urban dwellers, not having latrines in their homes, defecate in the open spaces of the cities and towns). Industrial pollution by organic water pollutants occurs in both urban and rural areas: for example, from the coffee agro-processing industries. The main emitters are the food and beverage industries (59 percent of all organic water pollution in 1999).

3.0 Environmental Policies and Institutions

Public awareness and government concern about environmental issues increased after 1973, when a military junta (the Derg) established a Marxist government. The link between land degradation and famine was increasingly recognized. Donor interest in ensuring that food distribution was accompanied by land rehabilitation as well as by development activities led to soil conservation and afforestation efforts in connection with relief grain distribution; this was the origin of food-for-work activities. During the 1970s and 1980s, the Soil Conservation Research Project and the Ethiopian Highland Reclamation Study stressed the serious threat that soil erosion posed to the country's ability to feed itself, and this finding was used to justify state direction of large-scale terracing, bunding, and afforestation programs.

Environmental rehabilitation programs based on food-for-work led to a focus on the food-insecure and food-deficit *woredas* at the expense of other rural areas. A top-down approach to environmental rehabilitation was taken, with little or no involvement of local communities in planning or design and with no economic analysis of the measures proposed. The emphasis was on the protection or conservation of the resource base rather than on identifying ways of using natural resources or on alternative land use systems that could increase livelihood benefits for communities.

In the 1990s, Ethiopia made significant progress in laying a foundation for addressing environmental problems. One major initiative for introducing environment into the national policy arena was the Conservation Strategy of Ethiopia (CSE) process, which started in 1989 and completed its work in 2003, culminating in a five-volume report. The CSE was instrumental in:

- Developing and obtaining government approval for the Environmental Policy of Ethiopia;
- Prompting the establishment of the Environmental Protection Authority;
- Introducing new thinking about environmental issues and development and put into circulation new ideas about sustainable development;
- Initiating and undertaking capacity-building activities for environmental management at the federal and regional levels;
- Facilitating the development and publication of a considerable amount of guidance, providing the government and donors with a basis for environmentally sustainable planning at the federal and regional levels.

The CSE was one of the influences that led to the inclusion of several references to environment in the 1995 Constitution of the transitional government. Article 44 guarantees the right to live in a "clean and healthy environment". Article 92 refers to the state's responsibility to design and implement programs and projects that do not damage the environment and establishes the joint responsibility of the government and citizens to protect the environment.

In 1992, a year after the Ethiopian People's Revolutionary Democratic Front (EPRDF) government came to power, the government established a Ministry of Natural Resources Development and Environmental Protection (MONREP), thus taking a crucial step toward institutionalizing management of environmental concerns. This recognition was partly stimulated by the UN Rio 92 conference, but also by the new government's recognition of the importance of natural resource management for the country's development, as was also underlined by the Agricultural Development Led Industrialization policy, which has guided the government's approach to national development.

In 1995, however, MONREP was dissolved; the responsibility for natural resources was returned to the Ministry of Agriculture, and a new ministry was created for water resources. The Environmental Protection Authority (EPA) was created to take on MONREP's remaining functions. In addition to the EPA, under Proclamation 9/1995 an Environmental Protection Council (EPC) was established, with representatives from most of the federal ministries, to supervise the EPA's work. The extent to which the EPC is meeting its mandate remains unclear.

The CSE, the EPE, and the RCS were policy documents that outlined a coherent system of environmental mainstreaming and coordination, from the *woreda* level to the federal level. They are referred to in many recent policy statements, including the regional development plans. But the RCSs had limited distribution at the regional level, and in most cases they did not reach the *woredas*. So, despite the achievements of the CSE process, institutional development for sustainable environmental management, including the empowerment of local communities to manage their resources sustainably, remains a challenge.

In the last quarter of 2002, three new environmental proclamations were approved. This legislation to a large extent operationalizes the objectives and the broad framework for environmental management stated in the Environmental Policy of Ethiopia.

- Establishment of *Environmental Protection Organs* (Proclamation 295/2002) clarifies the institutional mandate and responsibilities of the EPA and aims to integrate environmental considerations into the policies and decision making of sectoral agencies through such means as the establishment of environmental units in these agencies at the federal level and the creation of independent environmental agencies at the regional level.
- *Environmental Impact Assessment* (Proclamation 299/2002) specifies the projects and activities that will require environmental impact assessment. The EIA must be prepared by the proponent of the project, following the format specified in the legislation. The EPA will then review the EIA study, approve the project (with or without conditions), or reject it.

- *Environmental Pollution Control* (Proclamation 300/2002) addresses the management of hazardous waste, the establishment of environmental standards for various environmental media (air, water, and soil), and the monitoring of pollution. The problem of improper handling of hazardous substances is increasingly important- for example, with respect to pest management and industrial development.

Proclamation 295/2002 defines the EPA's mandate and gives it authority to undertake its work. The proclamation is notable for its emphasis on human welfare and development. This is reflected in the EPA's mission statement, which begins, "The mission of the EPA is human well-being and ensuring environmentally sustainable development".

The new environmental legislation requires that regions establish their own independent regional environmental agencies (REAs) or designate an existing agency for this work. The mandate of the REA is not clearly outlined in the proclamation, but there is a general understanding that it will involve functions similar to those of the federal EPA. These will include mainstreaming environmental considerations into the development process and the activities of all government, civil society, and private sector organizations, and clarifying the role that environmental management can play in addressing development issues.

4.0 Ethiopian Capacity for Environmental Management

Throughout Ethiopia there exists a current lack of institutional capacity for environmental management. This shortcoming extends to the establishment and functioning of the institutions envisaged in government proclamations, as well as the skills and experience of staff within existing institutions and available for staffing the new ones. It also has wider implications, in that a number of donors have highlighted the integration of sound environmental management as a prerequisite for their budgetary support to Ethiopia.
A process of formative capacity building is required, whereby the functions and tasks of the agencies will be clarified as a prerequisite for identification of specific training needs. Capacity for environmental management differs at the Federal, Regional, and *Woreda* levels.

Federal Level

The Environmental Protection Authority (EPA) is the key national level environmental agency, with a mandate to address environmental issues. Since 2002, the new environmental legislation has given the EPA powers to fulfill its role, support all federal agencies in establishing environmental units and develop skills in strategic environmental analysis of policy and legislation, setting standards for environmental media, monitoring pollution, Environmental Impact Assessment, Environmental Information Systems, and undertaking capacity

development in relevant agencies to ensure the integration of environmental management in policy development and decision making.

Most federal agencies have some environmental responsibilities or involvement, although their capacity to fulfill these responsibilities is often limited. Two sectoral agencies have established environmental units, but are poorly staffed and have limited effectiveness (Ethiopian Roads Authority and the Ethiopian Electric Power Corporation). In other key agencies, much remains to be done in terms of integrating environmental concerns into their policies and programs.

Issues at the federal level that remain to be addressed include:

- The need for increased political support to ensure the integration of environmental management considerations into federal and sectoral policies;
- The need for cross-sectoral coordination and systematic collection of environmental information;
- The need to widen stakeholder involvement in environmental matters;
- Shortages of environmentally skilled staff, lack of awareness about environmental management, and limited capacity to follow up on measures to mitigate environmental impacts;
- Overlapping responsibilities and the need for institutional development to mainstream environment, including environmental units and appropriate sector legislation.

Regional Level

At the regional level there is a diversity of experience. Some regions are actively developing capacity to address environmental issues, as in Addas Ababa, or to address land administration within an enlarged regional environmental agency (REA), as in Amhara and SNNPR. But not all regions have their own REAs (for example, Tigray), and guidance on how they are to operate, especially in mainstreaming and integrating environmental issues, is limited. Most regions lack approved conservation strategies to guide their environmental management, and where such strategies exist, they are limited in practical utility.

Issues that need to be addressed include:

- Lack of awareness of the importance of integrating environmental management into all development activities;
- Institutional considerations such as frequently changing structure and authority;
- Shortages of skilled staff and of funding for staff and operations, especially for support by the Regional Environmental Agency (REA) to the *Woredas*;
- Development of appropriate skills related to EIA and other environmental management activities;

- The need for systematic collection and analysis of environmental information to inform policy development;
- The absence of regional legislation to give authority for implementing federal legislation.

Woreda and Kebele Levels:

In general, at the *woreda* level there is no capacity for adequately addressing environmental problems, and an enabling environment is lacking. There is no political or administrative institution at the *woreda* level that is specifically accountable for the environment as a whole, nor is there a program for institutional development for environmental management. The *woreda* is not required by law to establish an environmental authority or office. It is understood that only those regional environmental agencies with rural land and natural resources functions (for example, in Amhara and Southern Nations) will have their own offices at the *woreda* level, and they tend to focus on specific issues. In general, therefore, responsibility for environment rests with various sectoral offices, such as Agriculture.

Environmental issues at the *woreda* level include pollution and waste issues associated with small urban centers, health and water safety issues, and in rural areas, natural resource management issues related to forests, land use, and erosion. These come under very different departments. There is clearly a need for cross-sectoral coordination within *woredas,* and coordination between *woredas* and regions.

Issues that need to be addressed include:

- Guidance and legislation to ensure appropriate inclusion of environmental considerations in the various sectors and coordination between them;
- Sensitivity to community skills and environmental awareness to improve understanding of local perspectives on environmental issues;
- Support from the regional level where required, and provision of resources at the *woreda* level to buy-in support, training and advice.
- Capacity development, through additional staffing and training of existing staff; emphasis should be placed on providing environmental training to staff who are already living in *woredas* and are familiar with the issues. This would likely be the best way to address human resource capacity needs at this level. The training should also be linked to data collection for the Environmental Information System.
- Similarly, staff at the *woreda* level should have the time and resources to respond to requests from *kebele* leaders for support in addressing environmental aspects of their development planning.

5.0 Ethiopian EIA Legislation and the CEAA

The Ethiopian EIA legislation is similar in content and application to the Canadian Environmental Assessment Act (CEAA). A comparative analysis of the two environmental legislations undertaken by the Environmental Assessment and Compliance Branch of CIDA (2004) concluded that the environmental assessment process in Ethiopia as prescribed in the legislation met with the minimal standards of the CEAA. This was however predicated upon the Ethiopian EIA legislation having the force of law since it was also noted that the Ethiopian EA enabling legislation is silent in many areas.

With respect to the critical issue of project types requiring assessments, the Ethiopian EIA list of projects requiring an environmental assessment is extensive. The environmental assessment is triggered early in the project cycle and the factors addressed in the assessments are specified in detail and include biophysical, socio-economic effects and mitigation measures.

Public participation is allowed and solicited; the public may provide input on the decision to proceed with a more detailed environmental impact study and the scope of such study. Furthermore, public participation is solicited during the review process and the reasons for proceeding with projects are made public. Cumulative effects are examined in the Environmental Impact Statement (EIS). Furthermore, it was found that the Ethiopian EIA goes one step beyond the CEAA - it includes what is the equivalent to a Strategic Environmental Assessment.

Part 2 Environmental assessment

1.0 The IPMS Project and Environmental Assessment under the CEAA

The IPMS project will work in ten (10) Pilot Learning Sites (Woreda-level) in four (4) Regions of the country. They are:

1. Atsbi (Tigray)
2. Alamata (Tigray)
3. Metema (Amhara)
4. Fogera (Amhara)
5. Bure Wemberma (Amhara)
6. Mieso (Oromiya)
7. Ada'a (Oromiya)
8. Goma (Oromiya)
9. Alaba (SNNPR)
10. Dale (SNNPR)

The IPMS project is will work within these ten PLSs through the strengthening of the Farmer Training Center's (FTC) personnel, agricultural Technical Vocational Education and Training (TVET) Colleges, Development Agents, and farmers to better develop, introduce and incorporate innovative agricultural methods. In tandem, the Project will work with public and private institutions to foster a climate of collaboration vis-à-vis the identification or development of innovate agricultural technologies.

To further enhance the utilization and adoption of this knowledge and innovative methods, the IPMS project will provide assistance to extension, input supply, marketing and finance institutions, including cooperatives. This institutional support will be in the form of technical assistance, training initiatives, including the supply of demonstration and training materials, and certain limited funding for innovative institutional arrangements and studies aimed at developing innovative institutional arrangements.

The CEAA applies to 'projects' that meet the following definition: "project" means the undertaking of a physical work, construction, operation, modification, decommissioning, or abandonment.

It is very unlikely that the IPMS project will undertake physical works associated with any aspects of project implementation; or, as in the case of the establishment of the Agricultural Information Research Center (AIRC), it is envisaged that the AIRC will be located in a government building with minimal renovations, if any. Therefore, if there are indeed certain renovations, this IPMS project activity will be listed on the *Exclusion List Regulations*, given that the AIRC will require, at most, minor modifications to an existing physical work, in this case an existing government building.

It is certain that the AIRC will not require the construction of a new building to house the Center. At the time when a decision is made to locate the AIRC, the applicability of the CEAA will be re-visited and the decision documented. Apart from the AIRC, there will be no initiatives over the course of the project in relation to a physical work and as such the IPMS project is not subject to the CEAA. Subsequently, there will be no need to undertake environmental screenings.

The emphasis of the IPMS project is on innovative agricultural technology transfer and adoption. This will in large part be realized through training and technical assistance activities. The CEAA does not apply to training or technical assistance activities unless these activities are specifically related to a "physical work". Lastly, The IPMS project does not envisage training or technical assistance activities specifically related to a "physical work".

The Project will ensure that over the course of the project's implementation, all activities proposed will be reviewed by the contracted Environmental Advisor; where there are environmental issues associated with inputs, production,

harvesting or processing of commodities, these will be documented and monitored, and a capacity building element outlining these issues and most common mitigation measures applied, will be built into the training and methods-transfer mechanisms.

The FTCs, the agricultural Technical Vocational Education and Training (TVET) Colleges, and the DAs at the PLSs will be the principal recipients of this direct knowledge. These 'extension agents' will in turn transfer the knowledge on environmental issues to the farmers, all the while soliciting and remaining cognizant of farmers' understanding of the issues through his/her traditional environmental knowledge.

2.0 Environmental Issues associated with IPMS Project

The IPMS project has identified a number market-led priority crop and livestock commodities that will serve as the focal points for IPMS project interventions. These are:

Priority Crop Commodities	**Priority Livestock Commodities**
Coffee	Dairy Production
Pulses: haricot and faba beans; chick peas, field peas, lentils	Meat Production (fattening)
Teff and Wheat	Skins and Hides Processing
Fruits	Poultry Production
Vegetables	Apiculture Production
Rice	Small-scale Aquaculture

For each of these priority crop and livestock commodities, the Project will focus its efforts on introducing tested methods and innovative measures (technologies) which are environmentally friendly, promote environmental sustainability, and take into consideration existing traditional knowledge, including traditional environmental knowledge (TEK).

For example, in the coffee farming system: the Project will promote organic coffee production through the use of organic inputs such as humus from the composting of the waste pulp and organic fertilizer (manure), already practiced by many farmers. This coffee production will be free from any application of pesticides, herbicides and fungicides or inorganic fertilizer. Integrated pest management (IPM) techniques will be actively promoted. The Project will also promote propagation techniques including grafting and the use of cuttings; and, strengthening the development of on-farm coffee seed production and strengthening the re-introduction new Sidama varieties, which are more coffee-berry disease (CBD) resistant.

The Project will strive to increase coffee production through these improved practices without necessarily increasing the acreage under production (if farmers wish to increase acreage under production, the Project will attempt to ensure that this is undertaken with minimal impact to the local environment and minimal disturbance to the present ecosystem).

In regards to improving the processing of organic coffee for quality improvement purposes, the processing methods applied by cooperatives will be reviewed, and interventions recommended which reduce the environmental effects (impacts) from the disposal of coffee pulp (coffee waste management issues such as water pollution, use of pulp as feed, etc.)

Haricot and faba beans and chickpeas: the Project will promote the use of biofertilizers (inoculums) in order to increase nitrogen in the soils which will in turn contribute to increased productivity. Inoculums are internationally accepted biotechnologies with no significant environmental effects. Water harvesting techniques will be promoted. Also, the Project will promote such techniques as ploughing during the onset of the dry season using techniques such as tied ridges which help to retain moisture in the soil. In areas where soil crusting is a problem, tilling only those rows which are to be planted thereby also retaining moisture; through the promotion of minimum tillage techniques (shallow) which reduces evaporation rates and hence, minimum disturbance to the ecosystem (micro environment at the plot level).

Natural resource management techniques for reducing the Trypanosomosis problem which also affects the ability of the farmer to prepare his land by oxen will be discussed in detail below. Zero tillage and single-ox ploughing are a couple of the techniques presently practiced to withstand the impacts of Trypanosomosis. IPM techniques will also be introduced and promoted in tandem.

Teff and Wheat: the Project will assess the present use of inorganic fertilizer application and promote and/or develop guidelines on their optimum application and provide training in their application thereof including occupational health and safety issues; the Project will also assess the use of herbicides to control pests (e.g. shoot flies) and seek innovative ways to decrease the use of herbicides.

Irrigated Horticulture (Fruits & Vegetables): these two general commodities have associated environmental issues regarding water use, including, irrigation schemes though small-scale river diversions, construction of small ponds and shallow wells. While there is fertilizer use in this sector, there is wide variance in application rates (due to cost/benefit realities). The Project will promote appropriate watering schemes such as, inter alia, spot irrigation versus flood irrigation in order to minimize potential salinization problems. The Project will also introduce innovative institutional methods for irrigation equipment supply through cooperatives and the private sector at the village level, including the

need for equipment repair. Environmental effects of river diversion schemes, small pond construction, and shallow wells will be documented and mitigation measures promoted, and are further elaborated upon below. The introduction of IPM techniques will also be introduced.

Rain-fed Horticulture (Fruits): the Project will promote where feasible fruit production based on rain-fed water harvesting technologies. No environmental effects anticipated.

Rice: Production of rice requires well-controlled irrigation. Rice production in the Fogera PLS, for example, will need to address water shed management problems due to excessive flooding presently experienced; the use and application of GIS as a planning and mitigation tool cannot be understated. The Project will promote the introduction of new rice varieties and will also explore the option of introducing 'Azolla Anabaena Symbiosis', an aquatic, nitrogen-fixing plant which can be introduced in a small pond where it is multiplied and then transplanted to the rice growing fields where it will be multiplied and used as a natural nitrogen source for increasing rice productivity.

Dairy Production: – the Project will aim to increase the milk production and its marketability – through improved feed and feed conservation techniques and through better handling, processing and storage of milk production. This will include but not be limited to: introduction of improved forage seed; introduction of improved milk containers which increase the time for which milk will be kept cold; and the introduction of an improved hand operated butter churn. The Project will also strive to improve dairy production through management systems including appropriate private veterinary services, drug supplies, and the privatization of genetic improvement techniques, for example bull stations and artificial insemination (AI). The control and eradication of trypanosomosis will be an activity of paramount importance to the Project in the Dale and Fogera PLSs, which will impact on the ability of a farmer to plough land, inter alia.

There are several ways in which Trypanosomosis can be controlled – for example, the Sterile Insect Technique (SIT); the Sterile Tse Tse Fly Eradication Programs (STEPS); the use of Gamma Ray technology currently promoted by the Ethiopian Science and Technology Commission in conjunction with the International Atomic Energy Agency; or, less efficiently, through trapping the flies in traps.

Environmental effects associated with Trypanosomosis control are well documented and include: environmental effects from application of insecticides (however applied) on non-target organisms, water chemistry and people; consequences of decreases in the morbidity and mortality of livestock and on grazing pressure; changes in land-use and land-cover (which the GIS component of the Project will serve as an appropriate tool to record these); and, land

degradation, grazing pressure, and rapid population growth in the areas controlled.

The environmental effects of any Project-sponsored Trypanosomosis control program will be evaluated and documented, and shared with all stakeholders.

Meat Production: the Project will promote ways in which to fatten cattle, sheep and goats and produce appropriate (optimal) weight and size animals for market-based demand. This includes introducing improved forage seeds, feeding systems and Trypanosomosis control. Environmental effects associated with this activity will also be evaluated and documented, and shared with all stakeholders.

Skins and Hides Processing: this 'processing' is limited to individual farmer-level processing, whereby the farmer uses salt to cure skins/hides. There are no other inputs in curing or processing the hides, and as such there are no environmental effects attributable to this activity. Yet, the Project will promote ways in which skins and hides can secure better market prices through training farmers on less intrusive branding techniques (reducing scarring) and in the control of external parasites (e.g., ticks) through the application of acaracides and fumigation techniques in storage facilities. Environmental effects of pest control through inputs such as acaracides and fumigation practices will be reviewed, evaluated and documented.

Poultry Production: the Project will promote the privatization for the improvement of genetic stock. Also to be promoted will be the introduction of the 'hay-brooder', an on-farm technology to raise pullets to 20-week maturity, and the provision of support to privatizing the requisite drug supply (vaccines) including those which do not require refrigeration.

Poultry production activities under the Project are for small-scale 'backyard' poultry production. No environmental effects are anticipated.

Apiculture: the Project wishes to increase honey production and the marketing thereof. There will be no introduction of foreign bee species. The Project will explore harvesting, handling, and storage problems with the honey industry. The technology to be introduced will be the modern beehive together with the promotion of proper handling, (use of smoker and protective clothing) harvesting, and packaging techniques. Information dissemination on the environmental effects of pervasive pesticides and herbicides on bee mortality rates will be reviewed. Flowering plant species (bee forage) especially attractive to bees will be promoted. No environmental effects are anticipated.

Small-scale Aquaculture: the Project will explore options for introduction of small-scale aquaculture systems (Tilapia) in the Fogera-Lake Tana area. The suitability of connecting fish production with rice farming is well documented. Breeding programs have commenced under the auspices of ARARI (Amhara

Regional Agricultural Research Institute). A review and assessment of potential environmental effects and mitigation measures will be undertaken when this Project component is fully conceptualized.

To summarize, the IPMS Project will examine and document environmental issues associated directly or indirectly with Project activities. These include but are not limited to:

- Loss of gene pools (genetic erosion)
- Soil fertility and degradation
- Trypanosomosis (and other livestock management issues)
- Pest control methods
- Agrochemical Use
- Irrigation
- Soil and Water Conservation Methods
- Coffee Processing
- Aquaculture

For each of the ten (10) PLSs, the Project will write a "brief" on the principal environmental issues (see descriptions below) within the *Woreda*. The agro-ecological zones will be identified as will environmental problems associated with present agricultural production. The present farming systems for each of the agro-ecological zones will be evaluated, and where necessary recommendations made.

3.0 Environmental Indicators for the IPMS Project

The project will monitor changes in the key environmental indicators of genetic erosion, soil fertility, pest and disease control, use of agrochemicals, soil and water management, and processing. Data for these indicators will be collected as part of the performance measurement activity.

Certain specific characteristics of agriculture in relation to the environment distinguish the agricultural sector from the linkages between other sectors in the economy and the environment. Amongst the specific characteristics of agriculture in relation to the environment, three are of particular importance.

First, agricultural activities produce a diverse range of harmful and beneficial impacts on environmental quality. Farming can lead to a deterioration in soil, water and air quality and the loss of habitats and biodiversity. But agricultural activity can contribute to environmental benefits such as acting as a sink for greenhouse gases, conserving and also enhancing biodiversity and landscape.

Second, the relationship between agricultural activities and the environment is frequently complex and site specific. Agricultural activities can have impacts on the environment which are determined by different agro-ecological systems and

physical attributes of the land, the prevailing economic conditions and production technology, and farmers' management practices in relation to natural conditions.

Third, farmers' behaviour can be significantly affected by agricultural policies, in that they influence the level of agricultural production, its location, and the farming practices and management systems employed. Also, changes in environmental quality can trigger market and societal reactions which may in turn influence agricultural and environmental policy decisions.

There are a number of agri-environmental issues for which indicators might be developed, although it is not expected that the IPMS project will encounter extensive issues with fertilizer, pesticide and aracicides due to their limited use.

These include:

1. Agricultural nutrient use

An adequate supply of nutrients in the soil, particularly nitrogen, phosphorus, and potassium is essential to crop growth. Nutrients can be lost from the soil through crop production, leaching and soil erosion, inter alia. Deficiency of nutrients, however, can lead to the mining of nutrients and reduced soil quality. Soil nutrients can be replenished through the application of chemical fertilizer, and livestock manure. Other farming practices such as planting cover crops and the use of green manure also helps to mitigate the loss of nutrients and in cases replace nutrients.

Excessive soil nutrients in the soil can contribute to eutrophication, pollution of drinking water, soil acidification and climate change. Nitrogen and phosphate nutrients associated with fertilizer, manure and other humus material use and excess levels of these nutrients in soils, are of the greatest environmental concern.

A proposed indicator is fertilizer usage.

2. Agricultural pesticide use

Pesticides have contributed greatly to increased agricultural productivity and crop quality, but once in the environment can accumulate in soil and water, and damage flora and fauna as concentrations in food chains become high enough to harm wildlife. Pesticide residues also impair drinking water quality, contaminate food for human consumption, cause adverse health effects from direct exposure to farm workers.

A difficulty with establishing indicators that address the issue of agricultural pesticide use is that pesticides vary strongly in their degree of toxicity, persistence and mobility, depending on the type and concentration of their active

ingredients, and hence vary in the environmental risk they impose. The quantity of pesticides that leach into soil and water depend on, for example, soil properties and temperature, drainage, type of crop, weather, and application. Moreover, where pesticides are used in combination with certain pest management practices, such as integrated pest management, it may have little or no harmful impact on the environment, pesticide users, or food consumers.

A potential indicator could be the classifying of pesticide use data into different environmental risk categories, in quantity terms at the *Woreda* level.

3. Agricultural water use

Water shortage if not handled properly can be a major impediment to agricultural production and also damage aquatic habitats and wildlife. Agriculture uses water, aside from rainfall, supplied from both surface and groundwater sources. The need to maintain and restore the "natural" state of water resources is an integral part of water management and sustainable agricultural practices.

Equally, inappropriate land management practices, such as felling trees on agricultural land, can result in problems of "excess" water with rising water tables leading to salinization and waterlogging. With the higher demand for water from industrial and public consumers, in addition to agriculture, the growing competition for water resources is of great concerns.

Salinization is a proposed indicator.

4. Agricultural land use and conservation

Changes in agricultural land use may include land permanently retired from production and maintained for environmental conservation purposes. Moreover, while agricultural land use can lead to degradation of the environment, certain agricultural practices can also play a role in conserving natural resources, such as soil quality. For example, certain nutrient management practices can help to enhance soil fertility and soil structure; some cultivation practices such as irrigation practices, for example rice fields, can contribute to the stabilization of river flow, help prevent floods and improve the recharge of groundwater reservoirs.

Possible indicators to consider include: total agricultural land area in relation to the total land area; agricultural land per capita; agricultural land shifted to non-agricultural uses.

5. Agricultural soil quality

Degradation of soil results from erosion, chemical and physical deterioration. Soil erosion on-farm reduces land productivity, which partly depends on soil

structure and water-holding capacity; and off-farm erosion, affects air and water quality causing damage to aquatic habitats and human health. Erosion also impairs water storage capacity in rivers, lakes and reservoirs increasing flooding and damaging water systems.

Chemical deterioration consists of the loss of soil nutrients and organic matter, and accumulation of heavy metals and other toxic elements leading to salinization, acidification, and toxic contamination, while physical damage includes soil compaction and waterlogging.

Indicators could measure agriculture's impact on soil quality (nutrient rich or poor); the extent of soil degradation; and soil management practices.

6. Agriculture and water quality

The impact of agriculture on water quality mainly concerns the presence of excessive levels of nitrogen and phosphorus, active pesticide ingredients, and soil sediments. Excessive nitrogen and phosphorus levels from fertilizer use lead to eutrophication which can diminish fish populations. Toxic contamination of water from pesticide use can result from leaching or enter directly when spraying takes place to close to surface water.

Soil sediments, washed by wind and rain from cropland and overgrazed pasture, can lead to water turbidity and decrease the sunlight and dissolved oxygen available to aquatic plants and fish. Sediment run-off also decreases water storage capacity in lakes and reservoirs, clogs streams, and increases the frequency and severity of flooding.

7. Farm management

Farm management relates to farmer behaviour and technology uptake through a hierarchy of practices ranging from those specific to farm inputs, environmental media such as soil, and practices such as pest control, to whole farm management. Agri-environmental issues arise from the choice of management practices and technologies used by farmers in response to local conditions and the mix and level of farm output.

Indicators might include: pest management – the share of land on which integrated pest management practices are adopted; soil management – the share of land on which soil conservation practices are adopted including the use of appropriate tillage practices; irrigation management – the efficiency of water use on irrigated land in terms of the quantity of water used to produce a unit of agricultural output. There are no significant environmental effects expected.

These seven agri-environmental issues will be captured, as appropriate, in the environmental "briefs" of each of the ten PLSs.

4.0 Environmental Capacity Building Initiatives in the IPMS Project

The IPMS project will undertake a number of activities to build capacity in environmental awareness and in environmental assessment applications. The Project focus on building this capacity will be for the RDOs, and *Woreda*-level staff, FTC/DA and TVET staff who by extension, pass on the skills to the communities. It is envisaged that by the end of the Project, a large number of stakeholders will have benefited from increased environmental awareness and knowledge of environmental management strategies.

The following initiatives are planned:

- The preparation of environmental "briefs" for each of the ten (10) PLSs, which will then be distributed to the TVET and FTC staff and DAs. This information, (including information on the main environmental problems in each PLS) will feed into the Participatory Rural Appraisals (PRAs) which culminate in a site diagnosis and program design for each of the ten (10) PLSs.

- The Project will review and document and synthesize information on environmental issues linked to project activities in the agriculture sector. Based on these reviews, the Project will start to compile the pertinent information on the environmental effects (and mitigation measures) associated with productivity-enhancing technologies, and will be entered into the IPMS database.

- The development of an Environmental Assessment handbook and associated course delivery on EA (envisaged in the first quarter of Year 2005). Workshops will be held at the TVETs and selected FTCs. The handbook will be tailored made to reflect Project and stakeholders needs; and, it will also build on the information already in existence in Ethiopia. Case studies will be culled from existing local experience and when required, culled from existing literature in Addis Ababa.

- The National Agricultural Information Resource Center (NAIRC) to be established under the Project will benefit from the collection, purchase and cataloguing of journals, books et al on 'environment' and 'environment and agriculture'. The environmental "briefs", handbooks, and any screenings will also be deposited in the NAIRC.

- The Information Communication Network (ICT) will be developed with a mandate to include links to a number of environment sites. These sites will be linked to each of the PLS offices. Environmental documents prepared over the course of the Project will also be in electronic version allowing for the dissemination of the said material through the ICT.

- Capacity building at the Woreda/FTC community-level on NRM techniques will be undertaken in each of the ten (10) PLSs, with a focus on water resource management (including cooperatives, for example coffee processing cooperatives) These training exercises will be planned to ensure high-level participation by communities. Awareness of environmental issues will be promoted taking into consideration the traditional environmental knowledge (TEK) already practiced in these communities. One- to three- page fact sheets on environmental problems and mitigation measures will be developed for distribution to community members. Environmental activity reports will be inserted into the semi-annual and annual reports beginning at the end of Year 1.

- By the end of the Project, lessons learned on environment will input to the development of strategies, recommendations and policy options for improving agricultural productivity and production.

Lastly, environmental concerns related to the introduction of new technologies to farming systems will be stressed throughout Project implementation, especially in areas that have been identified as severely degraded. Other considerations will include technology suitability in varying environments, training on environmental issues in agricultural and livestock systems, the use of environmental indicators in farm-management systems and the application of environmental impact assessment as a tool to identify and mitigate environment effects.

ACRONYMS

AI	Artificial Insemination
CBD	Coffee Berry Disease
CEAA	Canadian Environmental Assessment Act
CSE	Conservation Strategy Ethiopia
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Authority
EPC	Environmental Protection Council
EPE	Environmental Policy Ethiopia
GIS	Geographic Information System
IPM	Integrated Pest Management
NGO	Non-Governmental Organization
NRM	Natural Resource Management
RCS	Regional Conservation Strategy
REA	Regional Environmental Agency
SEA	Strategic Environmental Assessment
SIT	Sterile Insect Technique
SOE	State of Environment
STEPS	Sterile Tse Tse Fly Eradication Programs
TEK	Traditional Environmental Knowledge