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**Ethiopian Agricultural Research Organization  
Debre Zeit Agricultural Research Center**

**Project Inception Workshop**

**on**

**The Rehabilitation  
of  
Hora-Arsedi Lake  
Catchment**

**(Proceedings)**

*Betre Alemu and Mesfin Abebe (Editors)*

**Debre Zeit,  
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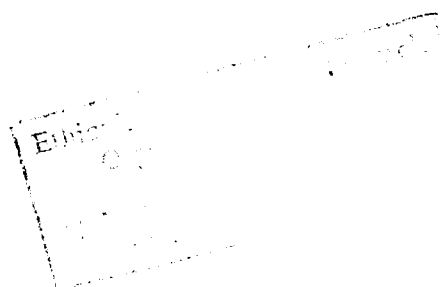
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## List of Participants

No	Name	Position	Organization
1	Ato Adugna Hudera	Field Assistant	EARO/DZARC
2	Ato Amare Amenu	Field Attendant	EARO/DZARC
3	Ato Asress Boru	An elderly resource person	Kebele 15 Resident
4	Ato Berhanu Mamo	Representative	Adaa-Liben Woreda Administration
5	Ato Betre Alemu	Head, Forestry Research Program	EARO/DZARC
6	Ato Demeke Eshete	Head, Social Division	Bishooftuu Municipality
7	Ato Eshetu Chequala	Chairman	Kebele 15 City Dewelers Association
8	Ato Gashaw Mekete	Expert	Adaa-Liben Woreda Dept. of Agriculture
9	Ato Kebede Tekse	An elderly resource person	Kebele 15 Public Administration
10	Ato Mantegaftot Zeleke	Technical Assistant	EARO/DZARC
11	Ato Tariku Tadesse	Head, Natural Resources Division	Adaa-Liben Woreda Dept. of Agriculture
12	Ato Teklu Erkossa	Head, Soil and Water Research Program	EARO/DZARC
13	Ato Teklu Tesfaye	Head, Research and Extension Division	EARO/DZARC
14	Ato Zewdu Belay	Expert	Adaa-Liben Woreda Dept. of Agriculture
15	Dr Mesfin Abebe	Soil Scientist	AUA/DZARC
16	Dr Seid Ahmed	Director	EARO/DZARC
17	Miss Maartje	Student/Netherland	EARO/DZARC
18	W/o Radiate Melesse	Expert	Adaa-Liben Woreda Dept. of Agriculture

## ACRONYMS

<b>AAU:</b>	Addis Ababa University
<b>AUA:</b>	Alemaya University of Agriculture
<b>DZARC:</b>	Debre Zeit Agricultural Research Center
<b>EARO:</b>	Ethiopian Agricultural Research Organization
<b>GTZ:</b>	German Development Co-operation
<b>MOA:</b>	Ministry of Agriculture
<b>R&amp;D:</b>	Research and Development



## **Acknowledgement**

The German Development Cooperation (GTZ) within the Federal Ministry of Agriculture funded the indigenous tree species research-cum-rehabilitation project activities in the Hora-Arsedi Lake Catchment. The Debre Zeit Agricultural Research Center (DZARC) of EARO played a front-line role in the execution of the project through its Forestry Research Program. This was undertaken in close collaboration with the Woreda Administration, Municipality and Woreda Office of Agriculture. Therefore, the Forestry Research Program of DZARC wishes to acknowledge them all with thanks for their keen interest in the rehabilitation of the Hora-Arsedi Catchment. Accordingly, the sponsorship of this workshop by GTZ and DZARC is appreciated with gratitude. The workshop spotlighted the inception of the project in a participatory manner. The active involvement of participants enabled for a substantial contribution with commitment on the follow-up on project activities in a coordinated manner. Hence, these are highly acknowledged.

The Editors

## FOREWORD

The number "eight" shaped twin crater **Hora Arsedi** Lake in Bishooftuu is one of the scenic lakes in Adaa-Liban of Eastern Shoa, Oromiyyaa. With an estimated total catchment area of some 82 hectares at 1985 m asl, the crater and the Lake have a wealth of biodiversity. Among these are: a) the variegated diverse indigenous and exotic flora; and b) the host of terrestrial and aquatic fauna including a variety of birds and small game animals. What also stands out with prominence to make it unique is the immense significance attached to it as a shrine since antiquity where it figures prominently in the lives of the monotheistic Oromos. It has also acquired importance to the tens of thousands members of the many nations and nationalities who make annual pilgrimage from several hundred miles throughout the year. Specifically, they flock in mid-September to congregate around the lake under the comfortable shade of the impressive huge sycamore to pay tribute to Waaqqaa - God the Sublime - at the time of the IRETCHAA. What is also confirmed is the therapeutic value of the lake. Accordingly, these believers truck several miles to dip their livestock and take a bath in its alkaline waters.

Despite some minuscule uses for recreation, fishing and water supply the many great potentials of the lake and catchment have not been fully realized or meaningful exploited in an environmentally friendly manner. In this context, it is now painfully recognized that there is not only low regeneration of the natural forest and stagnant level of planting, but there is now severe degradation of the catchment due to irrational exploitation of the forest for domestic use. The poor management and gradual wearing down of the forest structure is now followed by accelerated and severe soil degradation processes. Hence, these have caused excessive run-off and siltation of the lake with accelerated volume displacement. This led to the enhanced encroachment of the lake into the forested shoreline with subsequent slough-off and subsidence of land. The phenomenon is a major menace given the rapid disappearance of the once beautiful shore with multi-coloured variegations of both exotic and indigenous species. In addition, the inadequate attention for environmental concerns within this fragile eco-system has brought about the ever-increasing pollution from sewage and contamination by chemicals from the waste waters of the tannery on the mouth of the crater. These not only pose major threats to the sanitary use of the lake but have become threats for its very survival. One of the signs is the glaringly witnessed high algal bloom from eutrophication.

The workshop and the field trip organized on July 6, 1999 underscore that much effort has been invested in eco-system conservation within the Adaa - Liban with particular focus on the several crater lakes in and around the town. For instance, the Ministry of Natural Resources Development and Environmental Protection embarked upon re-forestation and soil conservation schemes with some successes. But these were not sustained due to lack of funds. It was to fill this gap that the Forestry Research Program of DZARC prepared a project proposal (see Annex) for a dialogue with Ato Kidane Mengistu, a Forester with the Forestry and Wildlife Department, the Ministry of Agriculture. Through his relentless effort as an advocate of eco-systems conservation, some fund was acquired from the office of Dr. George Kaisberger, the Forest Management Advisor of the GTZ and a long time admirer of the natural resources around Hora Arsedi. The fund is meant for the rehabilitation of the catchment and the crater lake for their sustained utilization, aesthetic or otherwise.

This has sprinkled some ray of hope. The workshop, therefore, is an attempt to involve the local government and interested parties. As a first step, it highlights some of the hitherto efforts. It further attempts at sensitization of the local community around the crater for a participatory planning as stakeholders. This is because their vested interest can be ensured only with the sustainability of the lake and its catchment. Given their mandates, the Woreda Administration, Municipality and the relevant Departments could then provide the necessary and effective leadership in the synchronization of the environment-and-development initiative, including the appropriate monitoring and evaluation task. With their commitment and track record on the burning issue of natural resources development and environmental protection, there is now the firm conviction that the stakeholders and partners would continue to play the vanguard role in the sustainability and efficient utilization of the finite but renewable natural resources of the crater lakes around Bishooftuu and not just Lake Hora Arsedi only.

**THE EDITORS**  
July, 1999

## **I. Opening Address**

*Dr Seid Ahmed, Director, DZARC*

### **Dear Workshop Participants and invited guests:**

On behalf of the DZARC and myself, I wish to thank you all for giving due attention to our invitation and participate in this timely and important issue - "The Rehabilitation of degraded hillsides of the Hora-Arsedi Catchment using indigenous tree species." At the end of the day, this project inception workshop is expected to come up with a co-ordinated working mechanism. The workshop is organized by the Forestry Research Program of the DZARC (EARO) under the sponsorship of GTZ within the MOA.

At this juncture, because the DZARC is a stakeholder in the project and a co-sponsor of the workshop, it is befitting if I say a few words about DZARC, the first agricultural research center of the country which was established 46 years ago in 1953. Nationally, DZARC co-ordinates research on several crops including tef, wheat, chickpea, lentil and some horticultural crops. In addition, it conducts eco-regional research in animal sciences, forestry, soil and water, socio-economic and extension. With this endeavour, about 43 improved crop varieties were released to farmers and other end- uses. These include 6 chickpea, 6 lentil, 8-bread wheat, 13-durum wheat, and 10 tef varieties. In addition, 72 improved varieties of horticultural crops were released. Several agricultural technologies were also obtained and are being used to increase the production and productivity of the country. For instance, a study carried out some years ago indicates that more than 95% of the farmers around Adaa Liben woreda are using improved varieties from the Center. With regard to natural resources conservation and environmental protection, soil and water, and forestry research programs are underway towards improved drainage of Vertisols, rehabilitation of degraded hillsides, conservation of indigenous tree species, maintenance of soil fertility, and on other relevant fields of study.

The DZARC is situated at the mouth of the Hora-Arsedi Crater. Accordingly, it has been quite some time since DZARC was concerned with the vegetation and soil degradation of Hora-Arsedi and other surrounding lakes. We have closely observed the conservation efforts in the Hora-Arsedi Catchment by the former Ministry of Natural Resources Development and Environmental Protection and the Woreda Department of Agricultural. Actually, both the physical and biological measures were impressive. Thousands of seedlings have been planted with micro-basins built around the different tree species to increase their survival and growth. Terraces and check-dams were also constructed with supplemental biological measures. After all these efforts, however, the problem of vegetation degradation and soil erosion is currently severe because of inadequate monitoring to sustain the effort. If synchronised attempts are made, however, we can boldly achieve sustained utilization, besides its economical and cultural significance. The lake and its catchment could be used as a model to demonstrates the results of research and development efforts of both DZARC and the other stakeholders.

### **Dear Workshop Participants,**

To arrest degradation of catchments, the endeavour of one organization or individual will not result in long term solution. As we will be doing today, it is very important that concerned governmental organizations and resourceful elderly individuals come together and discuss ideas to reach at co-ordinated feasible and sustainable solution. I assure you that the DZARC will continue to support the initiative. Therefore, I kindly request you all to actively participate and arrive at a useful long-term solution. Thank you in advance for your participation.

## **II. Natural resources, the environment and development at Hora-Arsedi**

*Dr Mesfin Abebe: Soil Scientist, Alemaya University*

Long-term development and alleviation of poverty, the great challenges facing Ethiopia, could not be achieved without conservation of natural resources. Development and environmental protection, hence natural resources conservation, are two sides of the same coin. In this conjunction, it is worth noting that the "twin" Hora Arsedi Lake and its catchment offer great potentials with important renewable natural resources. The lake has products and services which could be exploited without severely affecting the environment. For instance, the water resource and the catchment provide diverse flora and fauna. These not only constitute sources of biodiversity but they also offer recreation, and source of income from the production of the delicious *Telapia* spp. Yet, many development endeavours currently underway are at the expense of the natural resources base. Sadly, there is now destruction of natural resources and damage to the environment but this received little attention in the development planning of the catchment and Lake Hora-Arsedi. As a case in point, several commercial investment projects could be cited that had disregard for environmental concerns. These have caused significant damage to both terrestrial and aquatic life around and within the Lake. Among others, this has also been attested even in 1999 by the Steering and Technical Committees which were established by the Addaa-Liban Woreda Administration. Representatives were drawn from most government institutions, the leadership from concerned adjacent Town Dwellers Associations (Kebele) and appropriate professionals from universities (AAU and AUA) and research centers (EARO). The findings revealed that the lake is highly polluted and contaminated so much so that the water is non-potable. It is also strongly recommended not to be used for swimming. Chemicals like chromium could find their way in the honey-combed strata of the lake from a newly built tannery just beyond the rim of the crater, and from the sewage affluent diverted from the town of Bishooftuu and surrounding catchments. As a consequence, the long-term irreparable danger to the underground water resource and the contamination of the current water supply from Godiinoo can even be a nightmare! Therefore, with increased algal bloom and eutrophication, the possible death of the lake is high. The writing is on the wall unless remedial steps are taken. There are, however, sufficient resourceful professionals and government agencies in Bishooftuu who could promote the sound management of natural resources in harmony with our development needs. Their training, experiences and wisdom could be commanded for a synchronised and efficient, hence, sustained utilization of the natural resources in and around Bishooftuu. Accordingly, the lake needs a co-ordinated effort of all stakeholders, including the community, for the sustained conservation and utilization of its natural resources through environmentally friendly investment.

As a first step, I appreciate the initiative that DZARC took through this workshop to strengthen the co-ordinated effort among concerned stakeholders. I also acknowledge Dr George Keisburger of the GTZ (MOA) for the initiative he took in identifying and funding the project. As a corollary to this, environmental conservation committee should be strengthened and institutionalised at community level for effective follow-up. This should comprise of concerned stakeholders such that the development efforts would go parallel with conservation of natural resources and the environment. This is very crucial if future generations are to inherit a healthy environment, which is not compromised but one which would promote the improvement in quality of life.

Thank you.



## II. Reminiscence on Hora-Arsedi Lake and the Catchment

### *Ato Asress Boru - An Elderly Resource Person*

The Fookaa (now Kebele 15) has a long history and some of us have been here long enough to witness the unfolding of events. Therefore, I am indeed grateful to the Almighty for this ripe old age of seventy-nine to witness the revival of interest in our natural resources around the Hora Arsedi Lake. I am also happy to have been invited here and have the opportunity to make reflections hence share my views with such young people who might use the wisdom to the best advantage in the rehabilitation of the lake and its environs.

For a start, I support the plan you have formulated to plant indigenous trees. You should, however, identify those which can withstand the degraded soil condition. More importantly, I hope that your efforts would be sustainable because we Ethiopians are often accused of initiating but not finalizing activities or schemes. I hope that you, the young generation, would have a better performance record than that has been the case in the past. As I am given the chance, I feel it would be proper to exploit the opportunity by relating the historical background of the lake and the catchment with your plan. To begin with, it was Negadras Tessema Eshete who started development works in Hora-Arsedi Lake. He had the vision of attracting tourists even before the Italian occupation i.e. prior to 1940! During the Italian occupation, Italians have highly used the lake to exploit the fish and for military training. Had they stayed longer, they also had plans to use it for tourist attraction. Ethiopian's dug very big ditches and canals which are still visible.

Contrary to what might have been circulated, it is not the Italians but an agricultural development agent called Ato Mekonen who was instrumental in the establishment of the Hora Ras Hotel. At that time it was not as sophisticated as the current one, which shares the catchment and gets considerable income from tourists. After liberation, Ato Mekonen returned and started development work around the lake. Boiled seeds of *Acacia* species were sown directly in the hillside<sup>1</sup>. This was done to soften the seedcoat. Several tree species were also included in this endeavour. These have survived and the hillside is now rich in biodiversity. It may be difficult to imagine but during the time of Emperor Haile Selassie I, the lake was even protected from birds so that they may not pollute it!! Hence, they were provided with feed and water away from the lake. The Oromos were also very careful so as not to pollute the lake due to the respect they have for natural resources and because of the Ireechaa Ceremony. This place of worship is believed to cure diseases of both humans and livestock. Thus, no one was allowed to cut trees from the catchment or wash clothes at the lakeside. This was the extent of care that was accorded to the lake and the catchment several decades back!

Now the hillside is highly degraded. We have destroyed the vegetation and many of the trees have been cut for our immediate uses. We have diverted dirty water into the lake and the lake is polluted with raw swage so much so that we no more dare drink or bath in its waters. Honestly, cattle are better than human. Cattle leave dung that ameliorates the soil, but we humans have only degraded the landscape. Therefore, the local population has to be protected by the local government. Conservation of the catchment by the public administration and all concerned would benefit primarily the local people and generally the nation. Thank you.

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<sup>1</sup> The amount of indigenous knowledge that this ancestors had is amazing. The Editors

## IV. The Role of Stakeholders in Agricultural Research and Development

*Ato Teklu Tesfaye, Head, Research and Extension Division, DZARC*

**Introduction:** The basis of Ethiopian economy is the agricultural sector, on which more than 85% of the population are engaged. It accounts for 45% of the country's production and more than 90% of the export earning. However, the sector could not still satisfy the food demand of the population, which almost reached 60 million and increases at 2.9% per annum. Yet, out of the total food produced in the country, more than 94% is by the subsistent farmers and the rest by co-operatives and state farms. Though there is no precise figure about the country's land use, a study made by the Ministry of Agriculture in 1979 revealed approximate useful figures. Accordingly, 51% of the land is used for grazing, 14.8% for perennial and annual crops, 3.6 for forest, 8.1 is covered by bushes and shrubs, 3.8 is marginally productive, and the rest 18.7% is unproductive.

The physiography of the country is diverse ranging from 126m below sea level to 4460m above sea level. This has enabled the cultivation of 146 crop species. Of the country's land cover, 56 % is believed to be cultivated. Out of this 16.4 million ha, 95% is found above 1500m elevation. The other 61% are below 1500m-elevation being dry, but provide incenses and feed for livestock. Despite the fact that the country is wealthy of water resources, very little has been used. Out of the total 2.4 million ha potentially irrigable land, only 4% is under irrigation. The country has nine big lakes and other small ones. Eight of the big lakes are in the Rift Valley and they provide 30,000-40,000 metric tone fish, which are not fully exploited.

Although the country is endowed with rich natural resources, decades of environmental destruction due to deforestation and consequent soil erosion has led more than 2 million ha to be irreversibly degraded. It has also caused incidence of drought and on set of desertification. Unless steps are taken, with the current trend, 22% of the country's land cover will be out of production within 10 to 40 years. The growing food demand of the ever-increasing population and the slow growth of production and productivity of the agricultural sector have not enabled to achieve food self-sufficiency. The country depends on food import and aid, especially during disaster periods. Therefore, improvement of the agricultural sector is the primary alternative. Hence, after the **Agricultural-Development-Led-Industrialization (ADLI)** policy, the focus has been on increasing the production and productivity of small holder farmers.

**2. Institutions of Major Role in Rural Agricultural Development:** As professionals in the field agree, for rural agricultural development to be sustainable, strength in one or two institution is not sufficient. All concerned stakeholders need to be involved in a co-ordinated fashion. The base for sustainable development, therefore, is the initiation and co-ordination of professionals and experts involved in the field. Although the composition of stakeholders may vary in different localities, the following are considered to be the basic ones in rural agricultural development.

- 2.1. Agricultural research centres
- 2.2. Agricultural extension service giving agencies
- 2.3. Agricultural input suppliers
- 2.4. Marketing and credit service agencies
- 2.5. Rural infra structural development agencies

- 2.6. Policies on natural resources conservation
- 2.7. Rural agricultural development beneficiaries, and
- 2.8. Administrative organisations

In the following sections why and how those institutions need to be involved are highlighted.

**2.1. Agricultural Research Organizations:** In a society of traditional farming, utilization of agricultural technologies is minimal. But, for rural agricultural development the need for new agricultural technologies is very high. In this regard, the role of agricultural research organization will be significant to generate new improved technologies for fast change. In agricultural research, the importance of indigenous knowledge becomes highly acknowledged. Further, results of participatory agricultural research were adopted faster and utilized sustainably. Reliable rural development is expected from such kind of co-ordinated agricultural R&D endeavour.

**2.2. Agricultural Extension Service Agencies:** The major objective of extension is to cause attitudinal change in the society. The contribution of extension in the processes of R&D is very high in the evaluation, generation, and adoption of technologies. However, for an extension system to be evolved and proper one be identified it requires defining objectives, end-users, organisation or institution, and communication methods to transfer the information. Through the implementation of those definitions, extension will contribute significantly for sustainable rural agricultural development.

**2.3. Agricultural Input Supplying Agents:** Unless there is reliable supply of agricultural inputs the role of both research and extension is limited. Hence, to utilize technologies of research results, organized agricultural input suppliers are required. Otherwise it is like being in short of seeds after land has been prepared. Thus, organized agricultural input suppliers need to be evolved in development and research activities.

**2.4. Marketing and Credit Service Agents:** In every development activity, especially in subsistence farming systems, strengthened marketing systems and credit service have significant role. A good marketing system enables price of inputs and products be controlled and encourage farmers endeavours. Development that is based on technology needs good marketing system to exchange the final products and inputs. Credit service could also promote investment, and hence improve the livelihood of smallholders. Both market system and credit service have inter-related effects. Promotion of one will have limited effect on development without the other. Because the role of both in development is very high, organised institutions are required to deal with these important issues.

**2.5. Rural Infrastructure Development Agents:** These include road, drinking water supply, health services, schools etc. and have great importance in development endeavours since they determine the adoption. Therefore, infrastructure development agents need to be involved in R&D efforts to achieve sustained results. For instance, without laying sufficient road network, development of the agricultural sector through improved research technologies and supply of agricultural inputs will not be significant.

**2.6. Natural Resources Conservation Policies:** Natural resources conservation policies are required to achieve sustainable rural development. Development that is the result of research results could also cause degradation of natural resources unless proper conservation policies

are formulated and implemented. That is why R&D activities should give attention to degradation of natural resources. Hence, policy makers have a substantial role in rural development and agricultural research activities.

**2.7. Beneficiary Society:** The final goal of every R&D is to improve the livelihood of the beneficiary society. To achieve this, the society has to be involved in R&D activities. The need for the participation of people in R&D is now being recognized. Equally, in the utilization of agricultural technologies, people have to be involved in the planning, implementation, follow up, and evaluation of results. This becomes true especially with efforts to increase the rate of technological adoption and achieve sustainable development. Hence, the new approach of community participation in R&D need to be promoted and adapted. This is particularly important in natural resources conservation and environmental protection.

**2.8. Administrative Organizations:** In the conservation of natural resources, administrative organizations as representatives of the society, have great role in the enactment and implementation of rules and regulations. Natural resources conservation and environmental protection in particular need regulations, which are enforced by those administrative organizations. No less important, results of R&D endeavours will be in vain without the support of administrative organizations, which are required to provide the necessary rules and regulations and to work with the society for its practicality. The participation of the society in the enactment of rules and regulations is also equally necessary. Religious leaders and elders have a constructive role to play in this aspect by providing rich indigenous knowledge. In general, unless the natural resources are properly conserved, the environment will not sustainably support people's livelihood.

**3. Summary:** The above institutions and others are required to execute their responsibilities in a rather participatory fashion to achieve sustainable development. Strengthening of agricultural research will not only cause the deemed development unless the other concerned stakeholders are engaged in the process. With our surrounding taken as a system, the need for systems management become crucial where R&D should be seen as a system. If we agree with a systems approach, whether in our day to day activity or rehabilitation of the degraded Hora Arsedi Lake catchment through the use of indigenous tree species, it must be borne in mind that it is not only the activity of researchers and policy makers which would bring about the intended output, but our collective responsibility as concerned stakeholders. It is for this reason that the famous rural development scientist James Fairhead in 1990 noted:

" Do people "know", "believe", "think" or "suppose" all this and how much disagreement is there? How do we all come to "know", and how do we become confident in what we know? Who talks to whom and what?"

Thank you.

## V. Biological and physical Measures in the Rehabilitation of Hora-Arsedi Catchment

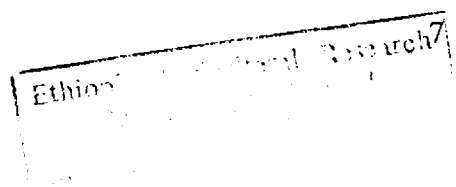
*Ato Betre Alemu; Head, Forestry Research Program, DZARC.*

I am grateful to you, the workshop participants, for the focused attention you gave to the degradation of the Hora catchment and avail yourself to issues on ways of taking meaningful action towards its rehabilitation. I feel that it is this group which has both the capacity and responsibility to rehabilitate such a useful natural resource. Without the involvement of every one of us, it would hardly be possible to make sound development and sustainable utilization of both terrestrial and aquatic resources in and around the Hora Arsed Lake Catchment.

The Hora-Arsedi Lake is several meters deep and the catchment is around 82 ha. The Hora Ras Hotel, Ethiopian Air Force, Debre Zeit Agricultural Research Center and owners of private mansions/villa, utilizes the catchment. Low-income households also inhabit some parts and the rest is communally owned. Despite the efforts of concerned Woreda government offices, there has been little headway at the sustenance of hitherto development. Added to this, the depth of Hora Arsed Lake decreases every year due to diversion of sediment loaded water from such catchments as Belbela and drainage/sewage water from the town of Bishooftuu (Debre Zeit). On the other hand, the width of the Lake increases due to displacement volume from the sediment load. This displacement of the Lake added to contaminated/polluted water from the town and the environmentally unfriendly tannery nearby (with prospect of chromium contamination) has endangered the sustenance of plant and animal life in and around the lake. As matters stand currently, the water, subsequent to laboratory analysis is considered to be non-potable and with its potentials to cause infection, regarded as hazardous to swim in.

It is also in this part of the catchment that the Oromo Geddaa related holy shrine of the Waqaafettaa found. Here, monotheistic Oromos and non-Oromos sit under the shade of a sycamore tree to pay tribute to their one and sublime Waaqaa/God. While this is a daily ritual, the annual colourful ceremony of Irreecha is held in September with pomp and great festivity. Yet, the increased displacement of the lake's shoreline has consequently threatened the sycamore and the tens of indigenous trees planted by concerned lovers of *universal nature*. Therefore, among other things, the effect of the drainage and sewage water from all catchments to the lake need to be studied and appropriate corrective measures taken to prolong the life of the lake and the rich biodiversity in and around it. Even a glance look at the catchment reveals that the communally utilized part of the lake in particular is highly degraded. This is due to the vicious circle of the development, environment and poverty merry-go-round. Among these are: illegal cutting of trees, livestock grazing, and consequent soil erosion. Despite the fact that it is highly degraded, it still has significant potential for recreation and other economic and social uses.

Cognizant of this potential danger, the former Ministry of Natural Resources Development and Environmental Protection had a professional group who made a comprehensive study of the lake and its catchment. Towards its rehabilitation for sustained utilization, several seedlings were planted, micro-basins built for the seedlings, and terraces constructed. However, the initial success was not sustained and indeed was far below expectations due to several reasons. The major one is the lack of consistent follow-up to guard against illegal tree harvesting, livestock grazing and trespassing. This means that unless steps are taken for proper utilization, the existing use of the lake for recreation and fishing will be endangered.



I feel that a limit to the pollution of the environment and damage to natural resources should be set during the approval of investment projects. This is exercised in other projects of Oromiyaa. The Debre Zeit Municipality and Adaa-Liben Woreda Administration should also be aware of such irreversible environmental damages and take appropriate action. Professionals in the Bureau of Agriculture and the Debre Zeit Agricultural Research Center should continue to provide technical advises. Moreover, the community at large should be made aware of the current undesirable trend on the environment within the catchments such that it would co-operate in the protection and wise use of the catchment. Had there been such an institutionalised co-ordinated mechanism among all the responsible and concerned stakeholders, it would have offered a long lasting solution to the degradation of the catchment. Hence, we need to work towards coordination and institutionalization of our conservation effort. We have now taken the first steep through this workshop to ensure sustainable rehabilitation of the catchment to conserve the lake and the whole ecosystem.

Besides the precondition of co-ordination, technical mechanisms of rehabilitation need to be looked into and get considerable attention. Both biological and physical conservation measures are needed to make effective rehabilitation of degraded areas. The primary and basic conservation measure is to establish proper use the catchment. This requires defining local regulations to protect the area from improper uses as it is being done in this workshop. To ensure this, the area needs to be fenced and guarded also to increase the regeneration of the natural vegetation of the area. In spite of that the privileges of the surrounding local communities will be assured by providing them products of the area like feed and wood at reasonable price. Terraces and Cut-of-Drains are necessary to minimize soil erosion and for safe water drainage. Microbasins are also important for soil and water conservation, and better establishment and growth of trees. More importantly, tree planting is the required to achieve sustained rehabilitation. The current undertaking focused on indigenous tree species that have the following advantages than exotic ones:

1. There is no sufficient study on the adaptation and environmental consequences of exotic tree species in Ethiopia. Hence, care need to be exercised not to plant them for at least non-commercial forest production.
2. Due to evolutionary natural selection, indigenous tree species fit the prevailing condition of the locality and do not cause considerable environmental problem. For instance, due to prolonged dry season on several occasions as the one this year, several exotic tree species as *Eucalyptus camaldulensis* and *Cupressus lusitanica* have died. However, most indigenous species, with their natural adaptation mechanism as lateral roots growth and less moisture requirement for such adverse conditions, have survived. Among these species are *Ficus sycomore* and many *Acacia* species, found within the catchment.
3. The economic significance of many indigenous tree species is also relatively better. Species like *Cordia africana* which currently are sparse in the catchment have sufficient growth rate and better wood quality. Furniture and construction pillars made from wood of indigenous tree species are preferred and highly valued. These can even be embarrassed with the scheme of agro-forestry around the homesteads.

4. Indigenous tree species have been excessively exploited and this has affected the sustenance of ecosystems and people's welfare. Thus, rehabilitation and afforestation/re-forestation projects should use indigenous tree species to conserve genetic diversity and ecological inter-relation within the ecosystems.
5. With the advent of hitherto rehabilitation efforts, there was ample evidence that several species of mammals and birds made their comeback into the catchment. Hence, with the catchment as source of recreation, establishment of indigenous tree species to which the local people are acquainted in terms of products and services would go a long way where these faunas would figure prominently. They could attract foreign and local tourists because these are not common in many landscapes. There would be the snowballing effect from the added income that the community would acquire and hence ensure the sustainability of the enterprise.

With these justifications, a participatory and sustained approach for natural resources conservation and environmental protection at catchment scale were envisaged. As it is indicated on the project proposal (see Annex), the Debre Zeit Agricultural Research Center has plans to conduct research and rehabilitation activities in close co-operation with the local concerned stakeholders. These activities are summarized as evaluation of:

1. Indigenous tree species for their adaptation;
2. Soil and stone micro-basins on the establishment of promising indigenous tree species;
3. Water requirement of adaptable tree species during the long dry season in highly degraded hillsides, and
4. Terraces for soil and water conservation.

We understand that our research and rehabilitation endeavours will not be successful without the involvement of all concerned. Thus, I kindly request your consistent effort and collaboration to revert the damage on the natural resources of the catchment. Thank you.

**P. S.**

*Based on information from Ato Betre Alemu, it is now known that in the short time that elapsed between the workshop and the publication of this proceeding, three research trials have been initiated in the catchment. The activities are: A) research trials and B) development, which are discussed as follows:*

#### **A. Research Trials**

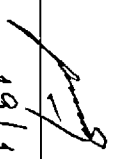
##### **A.1. The role of area closure for natural vegetation regeneration of Hora-Arsedi Catchment**

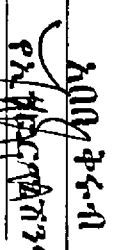
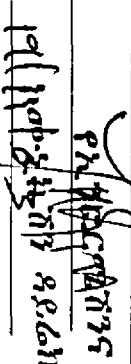
The objective of this study is to evaluate the potential of degraded areas for natural vegetation regeneration. *After the required support from the concerned stakeholders was ensured, research and development works were started in the catchment. The experimental field was first fenced tight with Euphorbi to protect against illegal entrance of both livestock and humans. The stems can survive both during the dry and regenerate in the main growing season. However, to sufficiently protect the research site, about 5,000 seedlings of Dovyalis abyssinica (Koshim or Kie-apple) were planted. Necessary measures upon any illegal trespassing and livestock grazing are promised to be made by the Kebele 15 Public Administration. Temporarily employed guards are protecting the site from illegal actions on the R&D site.*

የሠራተኛው ስም: ሰማኛው ማናዎ  
 ሙያ: የሴንቴርማሽን ሳብሙያ

የሴንቴርማሽን ኮሙኒኬሽን ዳይሬክቶሪት  
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የሴንቴርማሽን ገቢ	የሴንቴርማሽን መሰብያ	ክፍያ	ታይዥ
የቡድን ምርመራን የሚያስፈልግ ሜዲያዎችን (social media) በመጠቀም ህጋዊ ማድረግ (በሴንተርቶቶ የላይን ግብርት በሙሉ ምርመራ ቡድንን ማግኘት)	የተዘጋጀና የተከናወነ online የሥራ ስፈዳ መሰረት ተሟልቶ ገቢ ተገኝቶ	15	40
ቀደም ሲል የታተሙ የላይን ህትመት ስፈዳዎችን ማድረግና ማድረግ የተደረጉ ህትመት ስፈዳዎችን online በተጠቃሚዎች ማቅረብ	ሥራ ስፈዳ የተደረገ ህትመት ስፈዳዎች የተጠቃሚዎች ቁጥር	30	200
ከሴንተርቶቶ በተጠቃሚዎች የሰው-ሰው ምኅንጫ ማስገባትና ማስፈጸም	የተሰጠው የተሰጠው የሰው-ሰው ምኅንጫ ገቢ (በደት 5 በቀን)	15	50GB
በሴንተርቶቶ የሚታተሙ የሰው-ሰው ምኅንጫ ማስገባትና ማስፈጸም	የተሰጠው ሴንቴርማሽን ስፈዳ ስፈዳዎች ገቢ (በደት 5 በቀን)	10	100
ከሙሉ የሚገኙ የሴንቴርማሽን ስፈዳዎች ምኅንጫ ማስገባትና ማስፈጸም	የተሰጠው ሴንቴርማሽን ስፈዳ ስፈዳዎች ገቢ (በደት 5 በቀን)	10	100
ከላይ ውስጥ የሴንቴርማሽን ስፈዳዎች ምኅንጫ ማስገባትና ማስፈጸም	ሙሉ ደንብ ተገቢዎች ገቢ በቀን	10	120

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The existing condition of the natural vegetation was assessed by laying representative circular sample plots. Data were collected on the frequency and growth of naturally growing woody plants. The potential of the site for natural regeneration will also be assessed studying the species and frequency of woody plants in the soil seed bank.

### A.2. Adaptability evaluation of indigenous tree species

The main objective of the study is to evaluate and identify adaptable indigenous tree species to the prevailing conditions of the hillside. Accordingly, eleven indigenous tree species were selected for evaluation in this experiment. The criterion for selection was whether the study site is the natural growing zone of a species or not. These species are listed below with their scientific and vernacular names (Amharic and Afaan Oromoo) as follows:

Table: List of indigenous tree species and their vernacular names

Scientific Name	Amharic	Afaan Oromoo
<i>Acacia abyssinica</i>	Bazar Girar	Deree, Dodoti
<i>Acacia seyal</i>	Wachu	Waachu
<i>Allophylus abyssinicus</i>	Embus	Abaara, Aarejee, Diruubaa, Kekayi, Seho
<i>Cordia africana</i>	Wanza	Wodeessa
<i>Dodonea viscosa</i>	Kitkita	Ittachaa
<i>Ekbergia capensis</i>	Sombo	Dudunaa
<i>Galineria saxifraga</i>	Sole	Adamoo, Diduu, Mixxoo, Sarbandaii
<i>Juniperus procera</i>	Tid	Gaatiraa
<i>Olea africana</i>	Weira	Ejersa
<i>Podocarpus falcatus</i>	Zigba	Birbirsaa
<i>Prunus africana</i>	Tikur Inchet	Bouraiio, Burrayaa, Homi, Mukoraja

Randomized Complete Block Design (RCBD) with three replications was used to layout the trial in the field. Those species were planted with plant spacing of 2.5 by 2.5m. Twenty-four plants were included in one plot. Each plot had a size of 150m<sup>2</sup>. In sum, about 0.5ha land was used for this trial. Soil microbasins were built for all the planted seedlings. Data is being collected on survival percent, height and collar diameter.

### A.3. Evaluation of different microbasins for soil and water conservation, and performance of *Cordia africana*

The objectives of the study are to study the impact of different microbasins on conservation of soil and water, and assess the role of those microbasins on the performance of *Cordia africana* seedlings. The seedlings were prepared using normal practices in the nursery starting from the first week of April 1999, which is three months ahead of the planting period. Randomized Complete Block Design (RCBD) was used to lay out the field experiment and analyze the data in the future. Three treatments were used in the study: Stone-microbasin, soil-microbasin, and the normal planting hole as control i.e. 30 cm wide and 30cm deep). The spacing between each

planting hole was 2.5 by 2.5m. Each plot contained 25 planting holes. Each treatment was replicated three times. Each block (replication) had different slope of 26.7%, 29.7%, and 46.8%. The total area of the experimental plot is about 0.15ha.

After each planting hole was laid in the field, the microbasins were prepared by cutting soil from the upper part and filling it to the lower part. In such a way horizontal level for each microbasin was established. For soil-microbasins only the cut and fill of the soil was used to construct them. Small stones were used to construct stone-microbasins and while the soil was leveled in the internal area. Both of the stone and soil microbasins were prepared as 60cm wide and 30cm deep.

Data continued to be collected on height of accumulation of soil in each planting hole, soil moisture level, and growth performance of *Cordia africana* seedlings (collar diameter and height) every month.

### **B. Development activities**

- About five hectares of land was covered by different tree species mainly *Cordia africana*, *Acacia abyssinica*, *Acacia seyal*, *Prunus africanus*, *Podocarpus falcatus*, *Galinieria saxifraga* and *Dodonea viscosa*. In sum, about 6, 000 seedlings of indigenous tree species were planted for rehabilitation of the degraded parts of the catchment.
- For permanent fencing of the R&D site, about 4, 000 seedlings of Kie-Apple were planted to cover three-kilometer long livefence. In addition, about 3km long temporal fences were constructed using stems of Kie- Apple.
- About one kilometer long soil bund terrace and Cut-of-Drain was constructed to conserve the soil and water, and minimize formation of gullies.

In summary, the project is being implemented as planned. As also noted, almost all the budget allocated for the last season was utilized. Therefore, it would be appreciable if the remaining budget of the project is transferred as soon as possible to ensure follow-up of the activities. With the improved natural resources conservation technologies generated, we have the conviction that this project could be used as a model for future rehabilitation of degraded catchments in the country, especially in the crater lakes of the Rift Valley.

The Editors

## **VI. Discussion**

**Ato Teklu Erkossa** (Head, Soil and Water Program, DZARC)

The earth had survived good on its own. Humans' mismanagement, however, is destroying the natural resources of the earth. We should give attention and develop techniques to use the earth without destroying its natural resources. Otherwise, the next generation will not be able to inherit productive and conducive environment. Many people are not aware that they are damaging the environment while they utilize natural resources. There are still many who don't care for the environment, since they think that they themselves, and their children's welfare will not be affected. For instance, leather factories around Bishoftuu are diverting chemically contaminated and polluted water to natural lakes. These individuals should be made aware of the status of natural resources and consequent effect upon the welfare of future generations. Despite that, there is no adequate information about natural resources as capability of responsible organizations is limited or they do not see the importance of such information. We ourselves become convinced about the threat to natural resources and the consequences on people's welfare from concerned experienced professionals. Thus, it is high time that government give sufficient attention and took practical actions to conserve endangered natural resources.

The elderly resourceful fathers have told us how much they cared for the environment, but now many are damaging it. I think what this shows is that we have to consult such line references in our R&D endeavours to exploit their rich knowledge and experience. We should convince one another about our plans and interests through participation. Therefore, stakeholders have to be involved in designing how they should make development work while at the same time conserve natural resources.

**Ato Kebede Teksse** (Elderly Resource Person)

During the old days, we had protected the catchment. We have religious belief that, if some body cuts certain trees he could die or be sick. I believe that indigenous tree species will survive better on such degraded hillsides. We should work together to protect the catchment. The local people should be told about the problem of environmental pollution and the demand for conservation.

**Ato Tariku Tadesse** (Head, Natural Resources Division, Adaa Liben, Dept. of Agriculture)

We understood that degradation of natural resources in the Hora-Arsedi Catchment, in particular, and other catchments of the several lakes, in general, is very severe. State forests and communal hillsides are also being destructed mostly illegally. Our effort to rehabilitate natural resources was considerable, but we lack sufficient budget and facilities to expand our endeavour and hence follow-up initiatives. We also lack information and technologies in the field of natural resources and environmental aspects. Although, short-term successes could be achieved without consulting and/or involving stakeholder, it could not be sustained long. There should be co-ordinated effort among owners, authorities and the surrounding communities concerned with natural resources and environmental issues. I appreciate the initiation of the DZARC for

rehabilitation of Hora-Arsedi Catchment. We shall also contribute our best for successful implementation of the plans. I think those research programs of DZARC dealing with natural resources of the Woreda should consult us so us they will bring meaningful and sustained achievements.

**Ato Gashaw Mekete** (Expert, Adaa-Liben Woreda, Department of Agriculture)

Had the earth got the power, her punishment on human being would have been so severe when we look at how drastic we damage her. Particularly, this generation is irresponsibly destroying the environment. Many of the damage are illegal, or at least not properly planned. Due to degradation of the hillside and illegal diversion of dirty water, the environment of the catchment is severely damaged. Swimming in the lake now causes itching and other disease. There are also biting organisms, which dominate the lakeshore. The lake's salinity has significantly decreased, which had enabled to cure skin disease of livestock.

Efforts have been made by the former Ministry of Natural Resources Conservation and Development and other organizations by planting trees and constructing soil conservation structures. I too had a role. Regrettably, however, the initiatives were not sustained due to lack of consistent follow-up. The current initiative is appreciable. We should keep on working together. I am personally willing to contribute what I can for the conservation of the catchment.

**Ato Zewdu Belay** (Expert, Adaa-Liben Woreda, Department of Agriculture)

I have been engaged in conservation and development of natural resources in the Agricultural Department of Adaa-Liben Woreda since a decade ago. During my career, I was rather annoyed at the consistent destruction of forests, degradation of hillsides, and contamination/pollution of natural lakes. As responsible professional, we have been doing our best to revert the situation. We have planted significant number of seedlings in Yerer and Derie- Gerbicha State Forests. We have also constructed terraces and microbasins in the catchments of Hora-Arsedi, Bishoftuu and other lakes. We have almost covered all areas of the cathments of the two former lakes using seedlings of promising tree species. We have also established two committees for conservation of natural resources in the Woreda. The one was dealing with Hora-Arsedi Lake Catchment and the other for all natural resources in the Woreda. Both of them, however, were not effective as expected mainly because of lack of adequate support from their respective organizations.

All these efforts, accordingly, did not cause sustained results. Destruction of state forests and degradation of catchments is continuing more than before. We lack sufficient budget and facilities to continuously follow-up and protect our initiatives. Although, we planted trees and constructed soil conservation structures, it was very difficult to make consistent monitoring for sustained results. Hence, after immense efforts for the establishment of vegetation and soil conservation measures in Hora-Arsedi Lake Cathment, we transferred our responsibility to the Bishoftuu Municipality which is primarily responsible.

The initiatives presented in this workshop are encouraging. The DZARC has developed important plans to carry out both R&D that would help to effectively conserve the natural resources of the Hora-Arsedi Catchment. I appreciate that those responsible and concerned in this workshop. This signifies that the inception of the project would allow co-ordinated effort. This should continue during all stages of the project to achieve sustained conservation results. We are ready to contribute our best for such interesting and viable effort.

**W/O Radiate Melesse** (Expert, Adaa-Liben Woreda, Department of Agriculture)

Conservation of natural resources and protection of the environment are very challenging problems in many regions of our country. It is a great loss that is particularly happening in the Hora-Arsedi Catchment. I feel the main problems are improper use of communal properties and allocated land with out sufficient care for conservation of natural resources. Individuals and organizations should feel responsible and give attention for such threatened and useful resources. In this specific case of the Hora-Arsedi Catchment the owner and responsible organization is primarily the Bishoftuu Municipality. I can understand the Municipality has tremendous administrative and other priority tasks. However, if sufficient attention is given to pollution/contamination of the lake and degradation of the natural resources in the catchment, a lot could be done. As it is discussed in this workshop, there are several government agencies operating in the town that can provide significant contribution. Such organizations, students and the local community should be constantly made aware of environmental problems and be co-ordinated for effective rehabilitation of natural resources.

## VII. Closing Remarks

*Ato Berhanu Mamo*

*Representative, Ada Liben Woreda Administration*

- ◆ Dear Dr Mesfin Abebe  
Board member of EARO
  
- ◆ Dear Workshop participants,

We have been trying to enhance development, and hence address the improvement of people's livelihood. However, knowingly or unknowingly we are causing considerable damage on natural resources and the environment. It is a great challenge to attain development without damaging the environment or threatening privileges of future generations. As I understood, degradation of the Hora-Arsedi Lake Catchment is mainly caused by local people's destruction of the forest for subsistent demands and improper development plans. This workshop signifies that we are highly damaging the catchment, and hence we should work together to properly make development and start conserving its natural resources.

I, therefore, appreciate to the concern and initiatives of the DZARC and organizers of the workshop to make stakeholders aware of degradation of natural resources, participate stakeholders, and develop practical working plans for rehabilitation of Hora-Arsedi Lake Catchment. The German Development Co-operation (GTZ) is acknowledged for providing attention to degradation of natural resources and sponsor part of the project. I appreciate and thank all the workshop participants and their respective organizations for the active participation and laying the basis for future co-ordinated efforts for rehabilitation of the Hora-Arsedi Lake Catchment. Above all, I would like to express my gratitude to the elderly resourceful fathers for sharing with us their past experiences and suggestions for future wise use of the catchment.

At this junction, I would like to summerize the important points that have been raised in this workshop and consolidate ideas on how we proceed ahead to address the issues. The role of DZARC in agricultural development of our Woreda and the nation is very significant. Dr Seid Ahmed, the Director of DZARC has highlighted the agricultural technologies released from the Center and how much significant they are in improving production and productivity of the agricultural sector. He has also indicated how substantial they are dealing with conservation of natural resources and their concern for the future.

I particularly appreciate the initiative of Dr. Mesfin Abebe about the rehabilitation of the Hora Arsedí catchment. He has raised our awareness on the damage caused so far on the environment. The research centre's Research and Extension Division Head has also described the role of participation of stakeholder in R&D. Now we know which of them and how they should be involved in such endeavours. I am also convinced that it is such co-ordinated effort, which can bring meaningful sustained resolution to the problem. The centre's short-term plan to rehabilitate the degraded hillsides of the catchment using indigenous trees was also described in clear and understandable words. We have also made open discussion where we learnt a lot from resourceful elderly individuals and professionals. I feel that at this stage we have achieved the following important targets from the workshop:

1. Concerned stakeholders have got substantial knowledge on how much the catchment and the environment are being degraded.
2. Initiative have been shared among the stakeholders and,
3. Implementation mechanisms have been laid out

Such development and conservation endeavours are timely and very important. These need to be strengthened more than before with the same spirit as we defend our territorial integrity from Eritrean aggression. I, therefore, kindly request you to give considerable attention to the rehabilitation of the Hora-Arsedi Catchment and work together.

Thank you.

## VIII. ANNEX

### THE SUSTAINABLE REHABILITATION OF LAKE HORA ARSEDI CATCHMENT

#### (BISHOOFTUU)

#### PROJECT PROPOSAL

##### 1. BACKGROUND AND JUSTIFICATION

The **Hora Arse**di, composed of the number "eight" shaped twin crater lakes, is among the biggest and scenic lakes in Adaa-Liben Wereda of Eastern Shoa, Oromiyyaa. It is located within the town of Bishooftuu (Debre Zeit) at an elevation of 1985 m asl with an estimated total catchment area of some 82 hectares. Due to the less intense weathering, one finds an intermingled conglomeration of igneous materials mainly ash and basalt. This stretches to the peak but in places some sedimentary material of alluvial and fluvial origin are found where the young soils could possibly be classified as Inceptisols or Entisols. These have very little agricultural potential given the uneven topography with vertical slopes and undulating escarpments. The vegetation within the catchment is predominantly savannah type where elephant grass, *Acacia* species and *Ficus vasta* dominate. What stands out with prominence to make surrounding unique is the fact that the Lake has immense significance attached to it as a shrine since antiquity and figures prominently in the lives of the monotheistic Oromos. Equally, it has acquired importance to members of the many nations and nationalities who flock in tens of thousands from several hundred miles and make annual pilgrimages throughout the year, but more importantly in mid-September to congregate around the lake and under the comfortable shade of an impressive huge sycamore to pay tribute and homage at the time of the ERETCHAA.

The crater and the lake have also acquired added significance given the wealth of biodiversity among which are: a) the variegated diverse indigenous and exotic flora that surround the lake; and b) the host of terrestrial and aquatic fauna including a variety of birds and small game animals. Despite these possibilities, the many great potentials of the lake have not been fully realized not to speak of a meaningful exploitation. Notwithstanding, some minuscule efforts are underway to use the lake and the surrounding for some recreation, fishing, water supply etc. Since the lake is naturally stocked with *Tilapia spp*, the Ministry of Agriculture sporadically harvests the newly hatched fingerlings for stocking lakes, ponds etc. throughout Ethiopia. However, the irrational exploitation of the forest resources for domestic use, has given way to grazing to take its toll of pressure on the remaining vegetation within the lake area. In addition, the ever-increasing pollution and contamination of the lake has not only posed a major threat to its sanitary use but has become a menace for its survival in view of prospective eutrophication as is now witnessed through by the high algal bloom.

Realizing the severe degradation of the catchment, including the low regeneration of the natural forest, the stagnant level of planting, poor management and gradual wearing down of the forest structure followed by severe soil degradation processes, the then Ministry of Natural Resources Development and Environmental Protection embarked upon both physical and biological conservation measures as of 1991/92. This continued up until 1996 through food for work. Consequently, the performance of both physical and biological conservation structures and measures have been beyond expectations. Hence, the sedimentation of the lake was reduced with a



minimized displacement volume. Equally important, there have been resurgence of wild flora, promising survival of the many planted tree species, and the return of many fauna to the vicinity. This, indeed, has been instrumental for the awakened eco-tourism with resounding success. However, because resources were limited, the efforts were not sustainable. Consequently, not only is the development work retarded/stopped, but an accelerated damage is now manifested on both hitherto and current developments. This has resulted in waste of scarce resources, and the depletion of forest around the lake has endangered the valuable water resource, caused erosion with considerable losses of land which has adversely affected the local communities.

The excessive run-off and siltation of the lake with accelerated displacement volume has led to the enhanced encroachment of the lake into the forested shore-line and the subsequent slough-off and subsidence of land. In general, a great part of the forest within the crater lake is degraded and exploited. This constitutes a major menace given the rapid disappearance of the once beautiful shore with the multi-coloured variegations of both exotic and indigenous species give the inadequate attention for environmental concerns within this fragile eco-system. Therefore, these would requires immediate focused action towards their rehabilitation in concert with the efforts of both the Bureau of Agriculture (Oromiyyaa) and that of the Debre Zeit Municipality. There is, however, the need to fully recognize that such development initiatives aimed at the conservation, maintenance and sustainable utilization of the ecosystem calls for a participatory approach. Then, the community directly affected by activities around the lake should be recognized as a stakeholder and treated as such by all concerned. This is imperative if past efforts and future developments are to be environmentally friendly and sustainable. This means that it must not only be consulted but must also plan the development and utilization of the resources within the catchment and the lake. Such a scheme should also provide for an incentive mechanism to insure the responsible and sustainable utilization of the catchment by the stakeholders meaning members of the community whose life would be adversely affected otherwise.

Accordingly, in addition to the local community around the crater, several establishments such as the: Hora Ras Hotel, DZARC/EARO, Faculty of Veterinary Medicine, the Ethiopian Air Force, residents and investors etc. currently utilize the catchment. These could be organized for the sustainable utilization of the lake. Given their vested interest and their mandates the Woreda Administration, Municipality and the relevant Bureaus would provided the necessary and effective leadership in the synchronization of the environment-and-development initiative. It is also envisaged that the appropriate monitoring and evaluation task would be taken up by a body organized into a steering and technical committee and play a lead role in the administration of the start-up resources.

## **2. OBJECTIVES:**

**2.1. Research:** The main actors here would be the relevant institutions in the areas of agricultural and natural resources who would:

- identify effective vegetative conservation measures in combination with mechanical structure to reduce the siltation of the lake;
- assess the potential of the remaining vegetation on moderate slope areas for natural regeneration; and
- provide sustainable way of utilization of crater lakes for multipurpose uses.

**2.2. Development:** This would be accomplished through participatory development to:

- help reduce pollution, contamination, soil erosion and siltation of the lake;
- better manage and utilize the remaining natural resources of the area according to the need of the stake holders
- provide incentives and employment and income opportunities for the local communities from the utilization of the resources within the area as per systematic management plan;
- promote respect and reverence for nature through a recognition of the inter-dependence that exists even in such a micro-ecosystem, and hence enhance aesthetic value for a fuller and richer spiritual life of the community;
- provide awareness sensitization through an exemplary sustainable development through the provision of leaflets, flyers, fact sheets, recreational facilities for visitors etc. and finally,
- establish an environmentally friendly and sustainable utilization mechanism for the resources in the area for the improvement in the quality of life of the community;

### **3. INSTITUTIONAL FRAMEWORK:**

An administrative **Steering Committee** with defined terms of reference would be establishment from among the stakeholder institutions and comprise of the institutional heads with the Wereda Council as chair.

In addition, the project will have a **Technical Committee** with a team of experts from the Alemaya University of Agriculture, the Debre Zeit Agricultural Research Center, and relevant bureau from the Ada-Liben Wereda such as Agriculture, Health etc. the Faculty of Veterinary Medicine, the Air Force and the adjoining community represented through their Kebele's development committee etc. This would be lead by a representative from the Ada Wereda Department of Agriculture.

### **4. STRATEGY:**

- establishment of a steering and technical committee from among the stakeholder institutions and the community with defined terms of reference;
- assessment of the project area and other features to designate and lay out research sites, protection sites, recreation sites, water points and other uses;
- develop a management plan for the catchment and the lake aimed at an increased supply of fuel wood, feed fish etc. for the community;

## **5. EXPECTED OUTPUTS:**

**5.1. Short-term:** Arrest of the ever increasing soil degradation and protect the lake from siltation through effective conservation measures such as:

- compilation of the data from the surveys carried out so far by different institutions and based on which conduct necessary survey and mapping of the project area, demarcate boundaries, study the flora and fauna, especially the vegetation composition;
- raising, in the first year, of about 120,000 drought tolerant seedlings (especially indigenous) to cover 50 hectare;
- raise some 50,000 seedlings every year thereafter and construction corresponding soil bund terrace (three km) and micro-catchments for the said number of seedlings;
- multiplication of the tested and established vetiver grass;
- prepare a total of about 4.5 km gravel road and 4 water points.
- enhance the potentials for increasing employment to members of the community around the lake; and
- expand infrastructure development, such as access roads, recreation sites, water points etc;

**5.2. Long-term:** The environmentally friendly and sustainable utilization of the eco-system for the improvement in the quality of life of the community through the;

- maintenance of the area and depth of the lake through sustainable development of the catchment by promoting natural regeneration, planting of drought tolerant species and constructing physical conservation structures in concert with the stake-holders; and
- develop a participatory scheme for the environmentally friendly, sustainable conservation and utilization of this Rift Valley crater lake with lessons to be drawn for similar schemes.

## 7. Working Plan

**Table: Work plan for sustainable Rehabilitation of Hora-Arsedi Lake Catchment**

Items	Year 1	Year 2	Year 3	Year 4	Year 5
1. Preparation <ul style="list-style-type: none"> <li>• Surveying and mapping</li> <li>• Awareness raising</li> <li>• Co-ordination and institutionalization</li> </ul>	_____				
2. Fieldwork <ul style="list-style-type: none"> <li>• Nursery Operation</li> <li>• Fencing and guarding</li> <li>• Physical conservation</li> <li>• Biological conservation</li> <li>• Fencing</li> </ul>	_____				
3. Field maintenance <ul style="list-style-type: none"> <li>• Weeding and cultivation</li> <li>• Levelling</li> <li>• Replacement planting</li> <li>• Guarding</li> <li>• Road maintenance</li> </ul>	_____				
4. Data collection	_____				
5. Supervision	_____				
6. Report writing <ul style="list-style-type: none"> <li>• Proceedings of workshops</li> <li>• Annual report</li> <li>• Journal</li> <li>• Manual</li> <li>• Bulletin</li> </ul>	_____				

Note: Dotted lines indicate the implementation period of the activities.