

**TERMINAL REPORT ON NATIONAL INSTITUTIONAL SUPPORT AND
FUELWOOD PLANTATION ESTABLISHMENT IN DESE
(UNSO/ETH/83/X01).**

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Foreword

Dese fuelwood project (UNSO/ETH/83/XO1, National institutional support and fuelwood plantation establishment in Dese) is one of the first three fuelwood projects funded through UNSO (United Nations Sudano-Sahelian Office), and executed by the Government of Ethiopia. The project document was approved and signed by the Government on 29 June 1984.

The plantation establishment activities were initiated in November 1984. Originally the project was planned for three years: 1984 – 1986, and after that a decision was to be made whether to continue to a larger second phase with a final target of 7500 ha of fuelwood plantations.

When the first phase of the project is now phased out, the plantation establishment will continue over a modified second phase under bilateral funding of FINNIDA (Finnish International Development Aid Agency). To bridge the possible gap between two projects the UNSO-funded Dese fuelwood project has been prolonged with 6 months, starting 1 January 1987. According to the revised project document the final project period of the Dese fuelwood project was therefore: 1 January 1984 – 30 June 1987.

This terminal report has been prepared at the end of the revised first phase. The report has been prepared according to the guideline in the original project document, "to set forth the major accomplishments, and experience gained". As for structure the UNDP format for terminal reports has been followed.

In Addis Ababa, 22 June 1987

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1 Development problem and immediate problems attacked

1 1 Development objectives

1 1 1 Self-sufficiency in energy resources

Biomass fuels are the most important energy sources in Ethiopia. As charcoal, cow dung and crop residues they are mainly used for cooking, to minor extent for heating and lighting up the highland houses. Although there is a remarkable potential of hydropower in the country, and fossil fuels are also likely to be found, the biomass will remain as the main energy source also in the future. Especially this will be case among the vast rural population.

Traditionally all fuel came from the forest. In the past when forests covered the Ethiopian highlands, fuelwood was abundant and no other types of household energy were needed. In the past the forestry was also sustained: the annual forest cut for fuelwood and other purposes did not exceed the annual growth of the forests, neither in a particular area nor in the country as whole.

Today fuelwood is no more abundant enough to meet all the household energy demand; fuelwood has now partly been substituted by other biomass-based fuels, mainly by cow dung and crop residues. It is estimated by the World Bank (Ethiopia ... 1984) that in a typical Ethiopian family an average equivalent amount of energy corresponding to 2 kg of air dry wood is needed per day per person (per capita). With this amount the family can sustain the traditional Ethiopian cooking, and has also the needed minor amount of fuel for other purposes like heating, lighting and small household industry.

Only part, about 40 %, of the daily energy requirement comes now from fuelwood. The rest is covered with cow dung, crop residues and some charcoal. Besides these biomass-based energy sources some liquified gas, kerosene and electricity are used in urban households, but in the context of the whole country their amount is tiny, under one per cent of the total household energy consumption.

A priority of the Government of Ethiopia is to become more self-sufficient in energy resources and production. Important resources in aiming at this target are the forests. As properly managed and utilized forests can provide fuel on a sustained, renewable basis. The indigenous forests of Ethiopia and the traditional way of utilizing them as fuelwood are no more capable to guarantee the renewable source of energy. Instead, the resource is now rapidly dwindling.

The massive and still continuing deforestation of Ethiopia has been catastrophic, besides ecologically also in economic sense. Particularly the poorer families have suffered because the major source of energy for cooking and heating is fuelwood. As a result of scarcity the fuelwood prices have gone up, and this trend is still continuing.

To solve this local and national energy crisis the Government has given high priority for reforestation the overcut areas. The overall principles of the Ethiopian

reforestation and energy forestry policy have been elaborated in the preparation of the ten years indicative plan for the period 1984/85 - 1994/95 (starting in 1977 Ethiopian calendar). Relating to fuelwood the plan indicates an objective to

"design and implement fuelwood projects in the effort to minimize the problems of fuelwood and construction materials shortages both in rural and urban areas".

Targetwise, the plan calls for an estimated 2.9 mill. ha of land to be planted both by the Government and mass organizations. Most of this reforestation would be for fuelwood.

1 1 2 Combat desertification

Equally disastrous as the deforestation is the related process of desertification. It is estimated that 42 per cent of the total land area in the country loses up to 2000 tons of topsoil per square km per annum. Some 2 billion tons of topsoil are removed from the highlands into the Blue Nile system each year. This applies in Awash river system as well, e.g. in the Borkana catchment in Wollo region, around the towns of Dese and Kombolcha.

It is believed that by reforesting the badly eroded mountain slopes the desertification and soil erosion can be stopped. This is a general hypothesis all over Sudano-Sahelian belt; this is also one of the key issues in the project planning of the United Nations Sudano-Sahelian Office.

1 1 3 Soil and water conservation

Reforesting marginal overgrazed pasture lands and exhausted, poorest crop lands on the mountain slopes is an important strategy of improving land use. Such lands are prone to continuous and gradually worsening erosion through soil wash and gully formation. There is evidence in Ethiopia, especially from Andit Tid soil and water conservation research station that through reforesting the bare highland mountains, as well as through introducing controlled grazing and letting grass vegetation recover, the formation of gullies can be stopped and the soil wash reduced to nearly nil.

On badly eroded watershed areas the conservation of water resources, both through rain harvesting and conserving the ground water, is difficult or even impossible to carry out. Fuelwood plantations as well as other forest plantations are known to hold groundwater from rainfall and regulate the flow and potability of water in river systems. Forest resources are an essential component of soil and water conservation and must be planned and managed in perpetuity.

1 1 4 Increased agricultural production

The present fuelwood demand cannot be fully satisfied with fuelwood proper. About

60 % of the wood need is covered with cow dung and crop residues. Burning of cow dung results in loss of soil fertility and in diminishing agricultural yields. Burning of crop residues has similar effect; it also reduces the availability of feedstock to draught animals. Declining yields and reducing oxen power in the agriculture have brought an overall threat to Ethiopian national economy.

The ultimate goal of energy forestry is to substitute all the burned cow dung and crop residues with wood from plantations. When fuelwood provides the energy for cooking and heating, dung and crop residues can be returned to the soil. This will result in enhanced agricultural crop yields, and in sustained soil fertility and structure. The use of crop residues as livestock feed will increase animal live weight and reduce grazing on poor lands. High grazing incidence is a potent factor in desertification.

1 1 5 Conservation of foreign exchange

The best substitute fuel for firewood in terms of cost and heat energy is kerosene. Use of kerosene in Ethiopia has the attendant problem of supply and distribution, and a financial burden on the user to purchase specialized appliances. To overcome these constraints a high expenditure of foreign exchange would be required annually and indefinitely. Contrary to kerosene fuelwood is renewable, traditional and local, and it makes only minor demand on foreign exchange for investment costs of equipment and infrastructure.

Even if kerosene is convenient for the users and, its supply would be adequate, and a steady distribution to the most remote areas in the country could be guaranteed, the kerosene might not be economic fuel for the country on a national scale. Recent analysis of the World Bank (Ethiopia ... 1984) concludes that if the convertible energy in the three possible options: biomass (fuelwood), kerosene and electricity is valued, the energy from biomass still remains as cheapest.

The substitution of imported fossil fuels for household use is not to be encouraged. Instead rural and smaller urban populations will continue to be dependent upon biomass fuels in the foreseeable future.

1 1 6 Increased employment

Reforestation and management of fuelwood plantations is labor intensive. The use of mechanized methods and machines is limited on Ethiopian fuelwood plantations to road construction and later to fuelwood transport. The employment effect especially in the establishment phase of the plantation is remarkable. The employment is also local since the manual skills of peasants can be fully utilized in nursery and plantation establishment work.

1 1 7 Basic needs satisfaction

The fuelwood projects identify the fuelwood as a basic need of lower income groups. Fuelwood is socially and traditionally acceptable. Fuelwood still satisfies a basic need of the society during the development of alternative fuels. Possible alternatives in Ethiopia are for instance geothermal energy and solar power. Compared to biomass energy they still need time consuming research and development. They would also need high technology, heavy capital investments, foreign skills and consequent dependence on available foreign exchange.

1 2 Immediate objectives

1 2 1 Original project document (UNSO/ETH/83/X01/A)

1 2 1 1 Strengthen Dese nursery

The objective for improving the nursery facilities in Dese was set at strengthening the existing nursery in Kombolcha town, from its present level of 1.5 - 2.0 million seedlings to a potential annual capacity of 3.5 million seedlings.

While building more nursery space the current output for the seedling production during the project (Phase I) was set only in total production of 0.42 million (Table 1).

Table 1. Original target of seedling production in the first phase of Dese fuelwood project (UNSO/ETH/83/X01/A)

Dese	1984	1985	1986	Total
Seedlings	0	210 000	210 000	420 000

Year 1 was to be devoted to infrastructure development and staff recruitment.

1 2 1 2 Establish 200 ha of fuelwood plantations

The output for the plantation establishment during the project (Phase I) was set in total area of 200 ha (Table 2).

Table 2. Original target of plantation establishment in the first phase of Dese fuelwood project (UNSO/ETH/83/X01/A)

Dese	1984	1985	1986	Total
Hectares	0	100	100	200

Year 1 was to be devoted to infrastructure development and staff recruitment.

1 2 1 3 Technical assistance

The output for technical assistance (with assignment of 24 man-months of forestry

administration expert) was set in production of instructions and manuals for fuelwood plantation establishment and administration, on the following topics:

- Planting and maintenance standards
- Fuelwood plantation management policies and procedures
- Uniform system of records, statistics and cost accounting

1 2 2 Project revision (UNSO/ETH/83/X01/B)

1 2 2 1 Increase in the plantation area

During the first phase of the project the 200 ha were considered as an initial step towards a full scale plantation programme with the final target of 7500 ha. The main part of the planting programme was to be carried out during the second phase of the project.

Early after initiating the project, an analysis of the situation in the Dese fuelwood project area, including Sulula and Ancharo blocks, revealed that the plantation establishment area of 200 ha in the original plan, could be substantially increased. Based on experience from the other UNSO fuelwood projects started in Ethiopia one year earlier it was learned that such an increase was possible using labor intensive plantations establishment methods already developed in the country. Another way to increase the plantation area was found as increasing the Government's contribution through payment of casual labor in food for work: in grain and vegetable oil.

The revised seedling production target was set in total of 3.2 million seedlings (Table 3).

Table 3. Revised target of seedling production in the first phase of Dese fuelwood project (UNSO/ETH/83/X01/B), million seedlings.

Dese	1984	1985	1986	1987	Total
Seedlings	0	0.5	1.7	1.0	3.2

The new plantation establishment target was set in 1200 ha (Table 4).

Table 4. Revised target of plantation establishment in the first phase of Dese fuelwood project (UNSO/ETH/83/X01/B), ha

Dese	1984	1985	1986	1987	Total
Hectares	0	250	750	200	1200

Year 1984 was for infrastructure development, year 1987 for 6 months extension of the project (see next chapter).

1 2 2 Extension of the first phase of the project

Due to financial and organizational rearrangements the second phase of the Dese fuelwood project could not be initiated as planned on January 1, 1987. The delay in starting the second phase would have caused a serious threat to already planted areas. They need in fuelwood plantation projects minimum of one year, preferably two years of management, especially guarding and weeding, in order to keep the plantation in proper condition. Also nursery production should continue for one or two years after finalizing the actual planting programme. Nursery production and additional seedlings are necessary to guarantee final output of quality forest by regularly replanting (beating up) the earlier planted areas. In Ethiopian ecological conditions (rainfall pattern, competition by weeds) beating up is usually needed at least once.

It was regarded necessary to extend the duration of the first phase of the project for six months starting on 1 January 1987 and ending on 30 June 1987. As an additional output for the original project the following targets were set

- management (guarding, weeding, replanting) of the established areas
- nursery production at level of 1.0 million seedlings (to allow for beating up 1985 and 1986 plantations and continue planting programme in 1987)
- soil cultivation for plantation establishment in 1987 at level of 200 ha.

2 Outputs produced and problems encountered

2 1 Outputs

2 1 1 Infrastructure

2 1 1 1 Nurseries

The original project document envisaged full nursery production only in one nursery, in Kombolcha town nursery. At the same time this nursery was to be strengthened to an annual production level of 3.5 million seedlings. However, due to changes included in the project revision, the strengthening of the infrastructure of the Kombolcha nursery was postponed to the second phase.

Due to organizational change in the Ministry of Agriculture (from Forests and Wildlife Conservation and Development Authority, FaWCDA into NRCDMD, Natural Resources Conservation and Development Main Department) the Kombolcha nursery could not be used as envisaged during the first phase of the project, i.e. to produce seedlings for fuelwood plantations only. The need for nursery space in the new organizational setup was higher than earlier. Therefore the nursery space in Kombolcha nursery was allocated in two halves, one for Dese fuelwood project, one for other NRCDMD activities. To carry out the plantation programme as targeted additional nursery space was allocated in the Dese town nursery in 1985 (for 0.4 million seedlings). For 1986 planting season the project built its own nursery in

Sulula town (for capacity of 1.0 million seedlings).

The output of the seedling production in the three project nurseries was 4.19 million seedlings (Table 5.)

Table 5. Seedling production in the first phase of Dese fuelwood project (UNSO/ETH/83/X01/A), million seedlings.

Dese	1984	1985	1986	1987	Total
Kombolcha	0	0.100	1.180	1.200	2.480
Dese town	0	0.400	0	0	0.400
Sulula	0	0	0.710	0.600	1.310
Total	0	0.500	1.880	1.800	4.190

For more details about seedling production (number of seedlings per species etc.), see Appendix A.

2 1 1 2 Roads

Although the forests roads are an essential output for a reforestation project, neither the original project document nor the project revision set any target for road construction. The need for forest roads, both at access and feeder road standards was envisaged to become actual later, during the second phase of the project.

Both the Sulula block and Ancharo block have good access from the main road and a reasonable access to the plantation areas through already existing gravel roads (partly of all weather standard). However, part of these roads had to be maintained and some new feeder roads had to be constructed to ensure transport of seedlings to plantation site. The access road to Ancharo town as well as existing roads in Sulula block were maintained manually (8 km). A new access road (5 km) from Ancharo town to Ancharo block was constructed (Table 6). All the road maintenance and road construction was carried out by manual methods.

Table 6. Road construction and maintenance (manual methods) in the first phase of Dese fuelwood project (UNSO/ETH/83/X01/A)

Dese	1984	1985	1986	1987	Total
Construction	0	5	0	0	5
Maintenance	0	8	0	0	8

For more details of road construction and maintenance, see Appendix A.

2 1 1 3 Buildings

The original project document envisaged building construction programme both at Kombolcha nursery (senior staff housing, office, machinery shed, potting shed, expansion of water supply) as well as building office space for the project headquarters. However, the project revision postponed these activities to the second

phase of the project.

The nursery capacity for the Sulula block was strengthened by building a new nursery in the Sulula town. The nursery establishment was completed during the period 1 November 1985 - 31 March 1986. The capacity of the nursery is 1.0 mill seedlings per year. Only minimum store space (for tools and seed) was constructed (one local house) in the nursery.

2 1 2 Plantation

2 1 1 1 Plantation establishment vs. original target

The original project document envisaged plantation establishment during the years 2 and 3 (1985 and 1986) of 100 ha + 100 ha, total 200 ha. Based on labor intensive methods 312 ha were planted already in 1985 (Table 7.)

Table 7. Plantation establishment in 1985 (original Project Document) in the first phase of Dese fuelwood project (UNSO/ETH/83/X01/B), ha.

Dese	1985
Sulula block	212
Ancharo block	100
Total	312

Remark. The plantation area has not been measured from the map. It is based on number seedlings planted on standard spacing.

For more details about the plantation establishment in 1985, see Appendix A.

2 1 1 2 Plantation establishment vs. revised target

2 1 1 2 1 Project revision

2 1 1 2 1 1 Reorganizing UNSO-inputs

In order to carry out the plantation establishment programme in a revised scale, the UNSO inputs had to be reorganized accordingly. The biggest change was to postpone the Construction of Buildings and Structures (budget line 43.0 "Premises") to the Second Phase of the project and to reallocate the corresponding funds to increased plantation programme. Minor other changes were also made in the other components (see Appendices B and C, original and revised Project budgets).

2 1 1 2 1 2 Request and use of WFP-grain

The increase in the plantation establishment area was made possible jointly by reallocating the UNSO inputs and by increasing the Government contribution. The

increased Government contribution was done as payment for casual labor in food for work: in grain and vegetable oil. The required amounts were allocated from WFP (World Food Programme) assistance to the Wollo region. The need and requested amount of grain and vegetable oil (Table 8) was calculated according to WFP norm: one man-day equals to payment of 3.5 kg grain + 0.12 litres of vegetable oil.

Table 8. Estimate of casual labor needed to carry out the increased plantation establishment programme in 1986.

Casual labor for	Workdays
Nursery, for 750 ha plantation	15,000
Pitting, 750 ha	60,000
Planting, 750 ha	18,000
Replanting, 15% of 1000 ha	12,000
Replanting, 15% of 1000 ha	3,600
Weeding, 1000 ha	24,000
Guarding, 1000 ha	2,000
Road construction, 8 km	16,000
Road maintenance, 6 km	3,000
Total	153,600

Payment in food for work of 153,600 workdays equals to 460.8 tonnes grain and 18,432 liters vegetable oil according to Ethiopian norms of the WFP programme.

The grain and vegetable oil were received from WFP through ministry of agriculture offices in Wollo. During the period November 1985 - May 1987 the casual labor was paid as 469 tonnes in grain and 18,363 litres of vegetable oil

2 1 1 2 2 Plantation programme 1986

The revised project document envisaged plantation establishment of 750 ha during 1986. Along the project revision, incorporation of WFP grain and extension of the project with 6 months the plantation establishment in 1986 was 663 ha (Table 9).

Table 9. Plantation establishment in 1986 (revised project document) in the first phase of Dese fuelwood project (UNSO/ETH/83/X01/B), ha.

Dese	1986
Sulula block	235
Ancharo block	428 ha
Total	663 ha

Remark. The plantation area has not been measured from the map. It is based on number seedlings planted on standard spacing.

For more details about the plantation establishment in 1986, see Appendix A.

2 1 1 2 3 Preparations for 1987 planting season

2 1 1 2 3 1 Plantation target for 1987

The plantation target for 1987 was set at 200 ha. Since the main emphasis during the phasing out period was seen to be in management: weeding and beating up, the target for new plantation establishment was set lower than originally envisaged (1000 ha for 1987 in the project plan for the second phase). Organizational setup for the second phase of the project was neither established at the end of 1986 when the magnitude for the plantation programme of 1987 had to be decided.

2 1 1 2 3 2 Nursery production

In the routine inventory of May 1987 the seedlings were in good condition, vigorous, and well in time to allow for successful planting in July 1987.

The nursery production in 1987 was 1.2 million seedlings (Table 5.) This is enough to cover beating up of the old plantations, establish 200 ha of new plantations as well as some enrichment planting in Sulula block. For more details about 1987 seedling production, see Appendix 1.

2 1 1 2 3 3 Ground preparation (pitting)

Pitting for the 1987 plantation area of 200 ha was started on 1 March 1987. The pitting continues over the phasing out of the project; by the end of June pitting had been done over 179 ha new hectares and 0.6 million pits were prepared for beating up the 1985 and 86 planted areas (Tables 10 and 11).

Table 10. Soil preparation (pitting) for plantation establishment of 1987 (revised project document) in the first phase of Dese fuelwood project (UNSO/ETH/83/X01/B).

Dese	Pits	Ha
Sulula block	65,000	26
Ancharo block	382,000	153
Total	447,000	179

Table 11. Soil preparation (pitting) for beating up of 1985 and 1986 planted areas (revised project document) in the first phase of Dese fuelwood project (UNSO/ETH/83/X01/B).

Dese	Pits 1987
Sulula block	226,068
Ancharo block	275,000
Total	601,068

In Sulula block a programme of enrichment planting for the older, unstocked plantations was started according to the Sulula forest management plan. For enrichment planting 50,551 pits were prepared by the end of June 1987. As new planted hectares it would correspond to about 20 ha, but in reality the area for enrichment planting is higher since there are already scattered trees in those areas.

2 1 3 Institutional support

2 1 3 1 Planning of fuelwood projects

2 1 3 1 1 Pipeline

The first three UNSO-funded fuelwood projects as well as the one started under African Development Bank are but the beginning of the larger fuelwood plantation programme in Ethiopia. It is the task of the fuelwood project coordinating office to prepare plans for new possible fuelwood projects to finally cover at least the most urgent need of fuelwood all over Ethiopia.

The urban centers in the need of fuelwood plantations have been identified by the Government (forestry) officials already before starting the present projects. The towns Addis Ababa, Nazret, Debre Birhan as well as Dese were picked from the first prepared pipeline of such needed projects. The pipeline has been continuously followed up and updated by the fuelwood projects coordination office (see appendix D). The next areas in the pipeline of new fuelwood projects are Awasa, Harrar, Asmara, Jijiga and Mekele.

2 1 3 1 2 Project documents

Related to the pipeline of the new fuelwood projects six project documents or proposals were prepared during 1985 -1986 by the fuelwood projects co-ordination office (Table 12).

Table 12. New fuelwood project documents prepared by the fuelwood projects coordinating office during 1985 - 1986.

Name	Ready	Total ha	Budget, mill. USD
Debre Birhan II	October 1985	2500	2.5
Dese II	January 1986	3000	3.5
Harrar, phase I	February 1986	2250	2.7
Fiche, phase I	February 1986	2250	2.7
Sodo, phase I	February 1986	2250	2.7
Blue Nile	August 1986	5000	5.1

Three projects out these six have now been funded: Debre Birhan phase II started in Jan 1986, Blue Nile started in May 1987 and the Dese phase II is to be started in July 1987.

2 1 3 2 Establishment of fuelwood plantations

2 1 3 2 1 Manual

A draft for manual on establishment of fuelwood plantations has been prepared. The manual has been continuously revised and updated based on new information gathered from the three projects. In the present form it consists of 120 pages. The final version of the manual will be printed by UNSO.

2 1 3 2 2 Work plans

A system for work plans and work records has been created. Work records and work plans have been reported and revised once in a 6 month period, and also attached to regular 6 months' reports to UNDP. A model work plan and a model work record are shown as Appendices E and F.

2 1 3 3 Management of fuelwood plantations

2 1 3 3 1 Management tables

The original project document envisaged a need of developing methods in growth assessment and forest management for *Eucalyptus globulus* plantations. This need was further elaborated in preparing the project document for Debre Birhan fuelwood project, phase II.

Based on measurements of existing *Eucalyptus globulus* plantation in the central highlands of Ethiopia a study of management tables was completed during the project. The following aspects for managing *Eucalyptus globulus* fuelwood forests were included:

- Volume tables for fuelwood sized stems
- Volume tables for pole sized stems
- Fresh and dry weight biomass tables for stems
- Fresh and dry weight biomass tables for branches
- Fresh and dry weight biomass tables for leaves
- Relascope table for stands
- Yield tables, site class classification system
- Yield tables, yield class classification

For further details on the management tables and yield forecasting, see Pohjonen and Pukkala 1987a. The management table manual has been sent for printing by UNSO.

2 1 3 3 2 Management plans

Based on management table study a system for management planning for *Eucalyptus globulus* was created. The system uses Sulula block in the Dese fuelwood project as a case study (Appendix G.). The developed management system is under further development in the other UNSO-fuelwood projects; to allow consistent management of fuelwood plantations the system can be applied in other fuelwood projects in Ethiopia as well. For further details on management planning see Pukkala and Pohjonen 1987a. The management planning manual has been sent for printing to UNSO.

2 1 3 3 3 Permanent yield sample plots

A network of 120 permanent yield sample plots has been created. The network covers all the UNSO-fuelwood project areas, as well as other growing sites of *Eucalyptus globulus* in the central highlands. Some plots of *Eucalyptus camaldulensis* were also included.

The network of permanent yield sample plots was used in collecting the basic growth data of *Eucalyptus globulus* needed in the management of fuelwood projects. The network has also been used in in-service training of the project staff.

A manual for regular measurement of these plots, as measuring the regular inventory data in the fuelwood projects has been prepared (Pukkala and Pohjonen 1987b). The manual will be printed by UNSO.

2 1 3 4 Fuelwood plantation establishment costs

Standardized system for monitoring the fuelwood plantation establishment costs has been created (see model form in the Appendix H).

Based on the costs follow-up, the cost breakdown of the Dese fuelwood project was calculated for 1985-1986 planting seasons (Ethiopian calendar years 1977-1978) (Appendix I). The establishment cost, Birr 912 per ha, in the Dese fuelwood project was modest, even after counting the incorporation of WFP grain and vegetable oil as additional input to the project. The modest cost per hectare can partly be explained by lack of funds for infrastructure development: no all weather roads were constructed, no building programme existed. The hectare cost does neither contain all the weeding data; the weeding still continued after the end of this calculation period (recording to end of Ethiopian calendar year 1978, i.e. to 11 September 1986). Moreover, the final figure for planted hectares may change when the proper forest management maps, based on new aerial photographs, are completed. All the established hectare figures are estimates based on the number of seedlings planted.

The employment effect in Dese fuelwood project was remarkable, 239 man-days per hectare. Counting on the missing, delayed weeding from this figure, the final

employment effect will raise to about 250 man-days per established fuelwood hectare. Excluding weekends and holidays from calendar year, this figure is very near to a round number: one man-year is needed per established fuelwood plantation hectare.

It should however be remembered that fuelwood plantation establishment cannot guarantee full time employment. Most of the work activities are seasonal, and the peak work periods are for pitting, planting and weeding. Fortunately in Ethiopian conditions they do not coincide with peak work periods in agricultural fields. Instead, establishment of fuelwood plantations and normal agriculture in the project and nearby areas, complement each other in work patterns. Labor availability was not a problem in the Dese fuelwood project.

2 2 Problems in producing the outputs

In general only minor problems were encountered in producing the outputs, especially if the main target of establishment of fuelwood plantations is concerned. The nursery production, soil preparation and the planting work are now well-developed in Ethiopia. Also ecological conditions in the highlands are usually favorable for successful planting. During the project years 1985 - 1986 the rainfall was abundant, both during the short and long rains. Provided the fuelwood plantation project is planned beforehand, the availability of land, staffing and funds are ensured in time, the plantation target for a 2-3 year project can well be over the 200 ha which were targeted for this project.

The Dese fuelwood project was a model project, as well as the other two UNSO-projects Nazret and Debre Birhan started around same time. Concerning the plantation establishment the first phase of the Dese project was designed to be very small: only 200 ha, and it was divided over two years (100 ha in 1985 + 100 ha in 1986). The targeted area was smaller than the corresponding first year targets for Debre Birhan (400 ha) and Nazret (700 ha).

Soon after the start of the project it was learned that the original plantation area can be considerably increased. Technically there were no problems, but the revised budget did no more allow for developing infrastructure for instance to build forest roads. Even if the available roads could be maintained to some extent using manual methods, and few kilometers of new road were built as well, the low standard of these roads created problems during the heavy rains. Some losses in the seedling transport were encountered.

The low standard of forest road resulted in difficulty to communicate and manage the work in the plantation areas. Especially supervision of the weeding was problematic. Lack of supervision in turn reflected in the survival rate of the seedlings after the planting period. The survival rate has been continuously lower in the Dese project (55 % after first dry season) compared to corresponding situation in Nazret (75 %) and Debre Birhan (85 %) projects. The lower survival rate has increased the need for beating up from the need anticipated in the original project document.

Compared to other UNSO-funded fuelwood projects the national staffing has also been lower in Dese. This has had also its influence on the management standard in the Dese fuelwood project.

Due to organizational changes in the Ministry of Agriculture and the Government purchasing procedures there was a considerable delay in the arrival of project vehicles. Instead of anticipated arrival time early 1985, the vehicles arrived in May - June 1986, i.e. for the last third of the project time table. Without good co-operation with the other UNSO-funded projects (two vehicles were borrowed from Nazret project for Dese project use) the plantation targets could not have been met.

3 Objectives achieved

3 1 Development objectives

The development objectives listed in section 1 are quite general and require longer time span than the 3-year period of the first phase of the project.

3 1 1 Self-sufficiency in energy resources

The established hectares help in aiming at self-sufficiency in energy production in the Dese area, but naturally no fuelwood has been harvested yet. The output of fuelwood in the future can be seen in the forest management plan of Sulula block. Contrary to other UNSO-fuelwood projects the Dese project has besides open areas also some old plantations within the project boundaries. Most of them have now already been coppiced once or twice. These areas have been brought under the Sulula block forest management plan, and they start to yield fuelwood immediately. According to the harvesting plan the output from these areas during the first 3-year period will be 2000 m³ fuelwood.

The harvest of these compartments can be started at least in training scale already immediately when the second phase of the project starts. The first areas planted by the first phase of the project come into harvesting (premature harvesting) stage later, during the period 1990 - 1992.

Besides these newly planted areas the Sulula block has a few compartments of older plantations.

3 1 2 Combat desertification

Although the Dese fuelwood project area does not belong to sites worst threatened by desertification, the phenomenon is there. The project area belongs to Borkana catchment, the river itself flowing finally to Awash river. In this catchment the topsoil wash has been as serious as in the Blue Nile system.

When the field work in the project was started at the end of 1984 it was in the middle of 1983-1984 drought period. The mountain slopes were bare, heavily overgrazed, and under threat of erosion when the rains were again to come. By excluding the grazing in the plantation areas recovery of vegetation was quick and soil wash was consequently stopped.

3 1 3 Soil and water conservation

The recovery of vegetation applies also in the soil and water conservation. As a matter of fact, the recovery has been that fast that it has created an unexpected need for additional weeding. Partly the recovery has of course been due to the change in climatic conditions: in rainy seasons of 1985 and 1986 the Dese project area and the Wollo region as a whole, got again normal amount of rainfall.

3 1 4 Increased agricultural production

Increased agricultural production comes through avoiding burning the cow dung and crop residues as fuel, as soon as the fuel from plantations becomes available. This effect might be expected in 1990's.

Another possibility to increase agricultural production is to include agroforestry activities in the project, for instance by incorporating nitrogen fixing trees in the crops - trees system. Such an activity was not included in the first phase of the project. Based on experience of growing *Sesbania bispinosa* as agroforestry tree in Sulula and Kombolcha areas, such a component was written in the plan for the second phase of the project.

3 1 5 Conservation of foreign exchange

No effect is seen yet. Use of kerosene in Dese area is not as common than in the surroundings of Addis Ababa and some other urban centers which have better transport access from the Assab harbor.

3 1 6 Increased employment

By nature the fuelwood projects are labor intensive, and on average about half of the funds are used for payment of casual labor. In Dese project the casual labor component has been even higher, since the capital investments for infrastructure were postponed to the second phase of the project.

The employment effect can also be measured as man-days needed for establishment and original management of one hectare. Based on analysis on cost breakdown and employment effect (Appendix I) it could be concluded that in the fuelwood project establishment phase about one man-year is needed per established hectare. Over about

1000 hectares established, the employment effect of about 1000 man-years was therefore created. This employment effect is due to be experienced in the second phase of the project, i.e. if annual target of 1000 ha is maintained, the employment effect will be continuously 1000 man-years (per year).

3 1 7 Basic needs satisfaction

The fuelwood remains socially acceptable in the Dese fuelwood project area. This can be seen in a continuous flow of fuelwood transported by pack animals and people to the market. The main fuelwood harvesting area for Dese town is Sulula area where some existing, earlier planted eucalypt forests are already under utilization. There is every reason to believe that the fuelwood starting to flow from the second phase of the project is welcomed among the poorer people both in Dese town and the rural areas in the Sulula and Ancharo block.

3 2 Immediate objectives

3 2 1 Original project document (UNSO/ETH/83/X01/A)

3 2 1 1 Strengthen Dese nursery

The original target to strengthen the Dese (Kombolcha) nursery to a level of 3.5 million seedlings per year was not materialized due to project revision and change in the project content. Instead a smaller new nursery was built in Sulula town. The nursery production in Kombolcha nursery has continued at level of about one million seedlings per year. This has covered only half of the existing space. The total capacity of the Kombolcha nursery is about two million seedlings.

Raising up the capacity of Kombolcha nursery to 3.5 million seedlings would need clearing some of the established arboretum area. So far such clearing has not been done. The future role and magnitude of Kombolcha nursery must be analyzed in the second phase of the project.

3 2 1 2 Establish 200 ha of fuelwood plantations

The original target of establishing 200 ha of new plantation was fulfilled already in the first year.

3 2 1 3 Technical assistance

The technical assistance was fulfilled in the planned way. The project expert came in November 1984, i.e. at the same time as the field activities were initiated. The two year contract ended in November 1986, but it was prolonged altogether with 9 months, to August 1987 to cover the extension and phasing out periods of the project.

3 2 2 Project revision (UNSO/ETH/83/X01/B)

3 2 2 1 Increase in the plantation area

The increase in the project area as envisaged by the project document was nearly fulfilled. 975 ha were planted vs. targeted 1000 ha in the project revision. Regarding the bottlenecks in infrastructure (roads, nurseries, vehicles) and national staffing (lack of supervisory staff, especially Wondo Genet graduates), the achievement is satisfactory.

3 2 2 2 Extension of the first phase of the project

The project was extended according to the project revision with 6 months covering the period 1 January to 30 June 1987. The project activities continued during the extension period. Nursery production continued without interruption. Field activities, however, were paralyzed between January to March 1987 before the additional funding for the 6 months extension arrived.

The management standard suffered from the late arrival (1 April 1987) of the funds for the extension period. The weeding was delayed, which lowered the survival rate of the 1986 planted areas. As the funds for casual labor arrived, more emphasis was given on weeding instead of continuing pitting of new areas beyond the target of 200 ha. At the end of the 6 months period there is still need of additional, intensified weeding as soon as the 1987 planting programme has been finalized.

4 Findings and lessons learnt

4 1 Starting a new fuelwood project

4 1 1 Land availability

Before a new fuelwood project can be started it is important to ensure the land availability in advance. Without taking necessary steps in this matter any reforestation project will run into difficulties. This lesson was learned especially in the first UNSO-funded fuelwood project, the Nazret fuelwood project, where the original target had to be lowered due to unforeseen problems in land availability. In Dese fuelwood project, especially in Sulula block, the land availability might also have been a problem, had the target area for plantations been bigger.

Possible problems in land availability can be avoided if certain steps are followed in the project planning phase. Guidelines are given in the following for this matter.

The fuelwood plantations will mainly be established on a land the control of which belongs to the peasants, to peasant associations. Even if agricultural lands are

avoided, and the trees would be planted on mountain slopes, land availability may become a problem. Usually these mountain slopes are grassland areas on which peasants let their cattle graze while all their fields are under agricultural crops.

Due to the long time span needed for a fuelwood plantation project, the question of land availability must be solved first. A careful assessment on the land availability should be taken. This assessment is carried out in three phases:

- Preliminary survey
- Assessment at headquarters level
- Assessment at site level

During the preliminary survey the proposed plantation site is studied by its ecological suitability (rainfall, altitude, terrain, previous and existing vegetation, expected growth in plantations), and by the prevailing or expected population pressure number of households, size of family, number of villages, area under agriculture, number of cattle).

If the ecological factors are favorable the next step is to make an account over socio-economic factors. A fuelwood project will have both positive and negative impacts on the social and economic life of peasants. Weighing them against each other is possible only if a socio-economic study is carried over the proposed area. Based on such a study an assessment on suitability of the proposed area for fuelwood plantation project can be done at Headquarters level (ONCCP, MOA, fuelwood projects coordinating office). If this assessment is possible the next step is to move into assessment at site level.

The question of land availability and selection of suitable plantation areas *in situ* is negotiated in co-operation and agreement with a local committee which has representatives from the local peasant association, from peasant associations at district (Woreda) level, from district (Woreda) administration, and from fuelwood projects administration (usually the local project manager).

The ensuring of land availability for fuelwood plantation project is a time consuming activity, which must be carried out in successive steps. Such steps are now followed in the fuelwood plantation coordination office in planning and initiating new fuelwood projects.

4 1 2 Planting target for the first year

An essential question in starting a new fuelwood project is to set a realistic planting target for the first year, manageable but still reasonably big. The first actual planting year of a new project will mainly be used for strengthening the existing infrastructure or building a new one. However, it is important to aim at planting even at experimental scale already during the first year (planting season). All the new fuelwood project activities are to be adjusted to the annual cycle, and this adjustment can be done in a smaller scale during the first project year. At the same time the new

staff gets necessary training for the proper first year large scale planting.

While the normal annual target of one fuelwood project might be at scale of about 1000 ha per year, the target for the first year is to be set remarkably lower. The experience from the first year of Dese, Nazret and Debre Birhan projects has shown that a suitable target for the first year could be one fourth or one third of the later annual target, i.e. 250-300 ha for the first year (Table 12.)

Table 12. Experience on the achievement of the first year planting target in Dese, Nazret and Debre Birhan fuelwood projects.

Project site	Target for 1 st year	Accomplished	Later target
Dese	100	312	1000
Nazret	800	570	1700
Debre Birhan	400	159	700

Remark: Dese and Nazret area figures are based on number of seedlings planted, Debre Birhan area has been measured from forest management map.

4 1 3 Minimum staff required

Trained manpower in Ethiopia is a limiting factor also in forestry. Therefore a realistic request for national staff must be defined when a new project is initiated. For the first year the staff can be lower than for the future, when the activities enlarge in their full scale.

The fuelwood project is headed by a project manager. The project manager has to take care of overall supervision in the plantation activities. He or she should have training in forestry, at least at diploma level, i.e. in Ethiopian conditions the project manager should be graduate from Wondo Guenet forestry training institute. In addition to formal training he or she should also have experience from practical forestry service over some years after graduation.

The project manager needs an assistant, a block manager, to take care of the everyday field activities. Also the block manager should have forestry training, similar to that of project manager, but the block manager can be younger, even freshly graduated. In the first year of project operations it is advisable to concentrate all planting activities in one block only. So, one block manager will suffice. He or she can also have the nursery under his or her supervision.

For field and nursery work the block manager must have foremen, one in the nursery and at least one, preferably 2-3 on the block. The foremen employ the casual labor and have the laborers under his or her supervision and responsibility. The foremen do not necessarily need any formal training in forestry, but practical experience in nursery and field activities is preferred.

For administrative activities the project manager needs an accountant, store keeper and secretary. A driver is needed for the minimum, one vehicle. As a whole, the

minimum permanent staff needed to start a new fuelwood project is 8 (Table 13).

Table 13. Minimum staff needed for the first year of fuelwood plantation project (based on experience of Dese fuelwood project).

Post	Number	Qualification
Project manager	1	Wondo Guenet, experience
Block manager	1	Wondo Guenet
Nursery foreman	1	Practical experience
Block foreman	1	Practical experience
Accountant	1	Qualified
Store keeper	1	Experience
Secretary	1	Experience
Driver	1	Qualified
Total	8	

It should be noted that this staff is minimum for the first year operation only. If the second year is to be operated at full scale concerning the nursery and two or three blocks the appropriate staff must be appointed well in time.

4 1 4 Minimum infrastructure

For successful first year planting the availability of nursery space is the most critical piece of infrastructure. Planting target of 250-300 ha requires 0.5-0.6 million seedlings. They can be produced in about 65-90 normal nursery beds (20 m x 1 m). Such a space should be available in a nursery not too far from the planting site.

At least one vehicle, preferably 4-wheel drive pick-up, is needed to run the nursery and field activities. For heavier transport, like for nursery soil, a possibility of temporary use of rented or borrowed truck should exist. A motor bike for block manager would be useful.

For office space one or two rooms are needed with the essential furniture. Also store room in connection with the office building or nursery is necessary.

4 1 5 Initial time table and workplan

The time table of fuelwood plantation activities is based on the annual cycle of wet and dry seasons. The peak of work is in July when the actual planting must be carried out. A successful work in July can be accomplished with a good seedling stock if a certain time is allowed for different nursery and field activities before that.

Based on experience from Dese, Nazret and Debre Birhan fuelwood projects, it is realistic to aim at plantation establishment in July if the funds and minimum infrastructure are available and the minimum staff employed around previous November. Based on that, a realistic time table and work plan for the first year can be set (Table 14).

Table 14. Time table and work plan for the first year plantation, provided that the funds, minimum staff and minimum infrastructure are available in November before the following planting season in July. Planting target is 250 ha.

Target period	Activity or task	Target amount
November	Recruit and appoint staff	8 persons
November – December	Nursery ground preparation	0.5 million seedlings
December	Seed collection	30 kg
December	Select plantation sites	250 ha
December	Plantation layout & design	250 ha
December – January	Nursery seedbed preparation	70 beds
January	Pot filling	0.5 pots
January – February	Seed sowing	20 kg
March	1 st seedling inventory	0.5 million seedlings
March	Pricking out, transplanting	0.5 million seedlings
March – June	Pittings	0.4 million pits
April	2 nd seedling inventory	0.5 million seedlings
May	3 rd seedling inventory	0.5 million seedlings
June	Transport seedlings to site	0.5 million seedlings
July	Planting	0.4 million seedlings

4 2 Managing a new fuelwood project

Maybe most important lesson learnt in the UNSO-fuelwood projects in Ethiopia is the strong emphasis needed for forest management. Even if this is a standard practice in all forestry countries, the matter cannot be overstressed. Too many older plantations in Ethiopia are now underproductive due to lack of regular monitoring, lack of management plans, and lack of needed activities to control the development of planted stands into their optimum state.

The forest management is needed in every stages of the fuelwood plantation project, starting from planning of compartments with selected species, planting in needed densities, weeding, replanting and guarding. The management is important also later to ensure harvesting to be done in an optimal manner, as well as to ensure vigorous coppicing of the harvested areas.

4 2 1 Need of weeding

When a new fuelwood project is started the areas selected for planting are usually bare: overgrazed, eroded, and without vegetation. In the beginning it is difficult to imagine how much weeding is needed after planting in such environment. The planting of the seedlings is followed by guarding, and full elimination of grazing of these areas.

In the Dese fuelwood project it was surprising to find out how quickly the eroded

areas recovered after planting and eliminating the grazing. The slopes without vegetation started to grow different weeds, even hay of about one meter long already during the first rainy season. Unexpected fast growth of weeds created unexpected need of weeding. Especially in Sulula block such a need was not foreseen when the project plans were prepared.

Sufficient funds and sufficient management must be allowed in fuelwood projects to combat the weeds immediately after planting. The weeding must be done preferably 3-4 times:

- 2-3 months after planting (after first heavy rains),
- during the first short rains
- September – October after the second heavy rains, and
- optionally during the second short rains.

Always in justifying the need the weeding, the basic weeding fact and guideline for eucalypts must be remembered: the growth of eucalypts is inversely proportional to the growth of weeds.

4 2 2 Need of beating up

Need of beating up is usually connected with excess growth of weeds. The weeds always kill some of the planted seedlings, leaving thus empty pits on the ground. The beating up is important to fill all the gaps in the plantation as soon as possible. The growth of eucalypts is quick from the beginning, and due to shading effect smaller seedlings cannot be planted under too much bigger trees.

First beating up should be done already during the planting year about one month after planting. At this time the dead seedlings can be counted, and planting big seedlings to empty pits is still recommendable. The full beating up should be carried out during the second year. The third year beating up might be too late, except areas where growth is poorer.

4 2 3 Need of guarding

To avoid grazing and uncontrolled fire, permanent guarding on the planted areas is needed. Even if *Eucalyptus globulus* seedlings are not palatable to cattle the young seedlings are slender and susceptible to trampling damage. A suitable need of guarding has been found to be one guard per 100 ha of plantation.

The guarding is needed permanently in the fuelwood plantations, but intensive it should be for about three years. After that the trees are big enough to resist cattle damage. After 3 years of time controlled grazing or silvipastoral methods can also be introduced.

5 Recommendations

5 1 Socio-economic survey

When Dese fuelwood project was planned the need for socio-economic study was not envisaged. Related to land availability such a survey would have been needed. It is therefore recommended that immediately in the beginning of the second phase of the Dese fuelwood project, a socio-economic study is made. The socio-economic study should concentrate in different aspects of the everyday life of and the future of the peasants now living in the project area. It would be recommendable to use the same study approach as in the corresponding studies in UNSO-fuelwood projects (see e.g. Poluha 1985).

Even if Dese fuelwood project has already been started three years ago, the socio-economic study has nature of baseline study, especially if the second phase is extended to planned new areas. The baseline study should be complemented by regular follow-up studies.

5 2 Staffing

The national staffing in the first phase of the Dese fuelwood project did not reach the level planned in the project document. Understaffing had no doubt its effect in managing the field activities. For the second phase of the project it is necessary to have the capable managerial staff appointed in due time. If the second phase is to be enlarged to cover three blocks and three nurseries, it will need 5 foresters with diploma training (Wondo Guenet graduates): project manager, 3 block managers and a nursery supervisor. Corresponding foreman staff as well as necessary administrative staff should also be appointed.

5 3 Consistent management

Fuelwood plantation projects in Ethiopia are now diversifying into at least 4 directions: UNSO, World Bank, African Development Bank and bilateral. Continuous change of information would be beneficial to the country. It has been the aim of the fuelwood projects coordinating office to develop standardized methods for plantation establishment and management. It is recommended that development of such consistent management methods will continue in all the fuelwood projects to ensure fulfilling the national objectives of these projects.

6 References

7 Appendices

- A. Dese work record 1 November 1984 – 30 June 1987
- B. Dese project budget, original (UNSO/ETH/83/XO1/A)
- C. Dese project budget, revised (UNSO/ETH/83XO1/B)
- D. Pipeline for new fuelwood projects
- E. Model work plan (6 months period)
- F. Model work record (6 months period)
- G. Sulula block forest management plan (model)
- H. Model form for costs follow up
- I. Dese fuelwood project costs breakdown