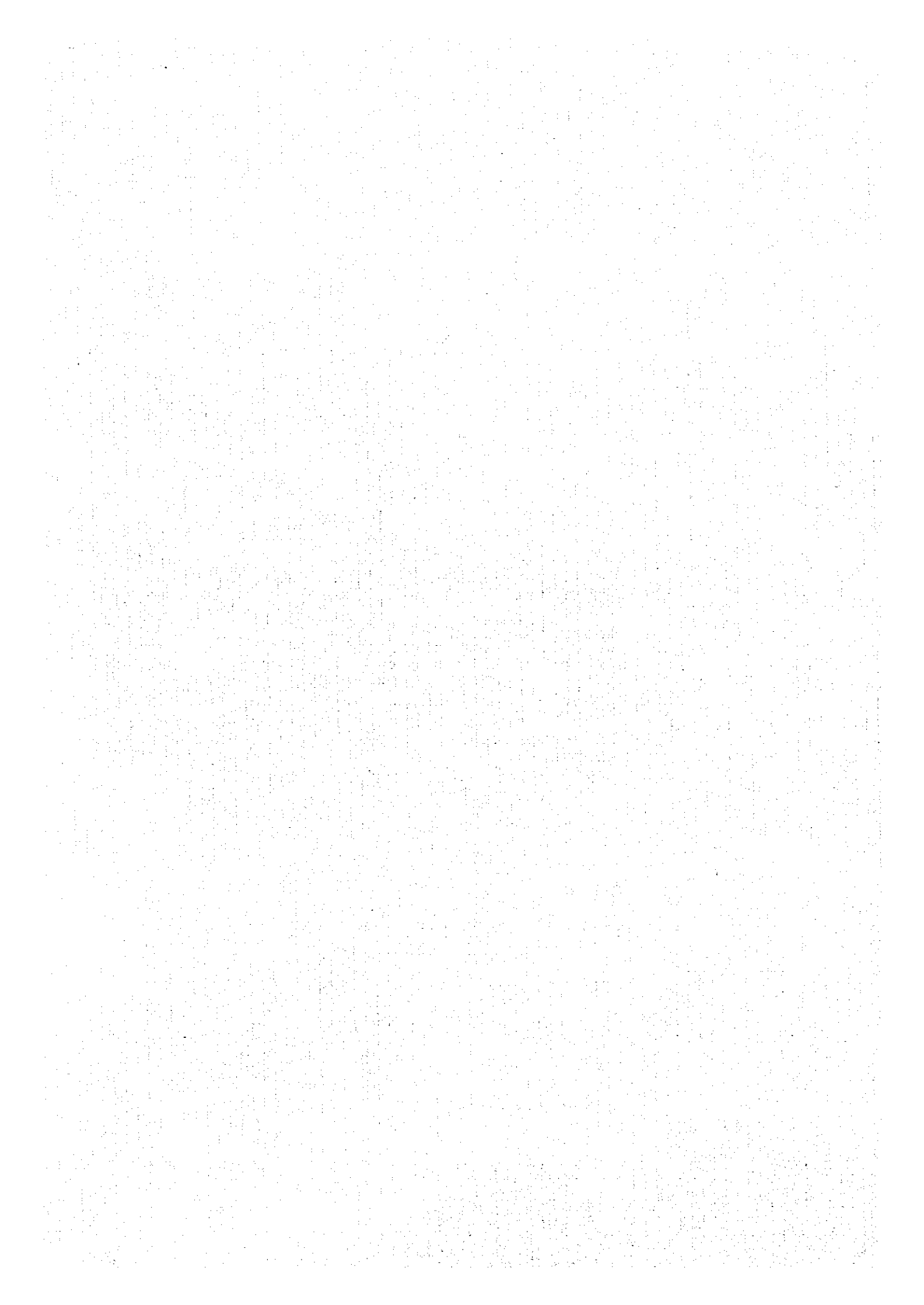
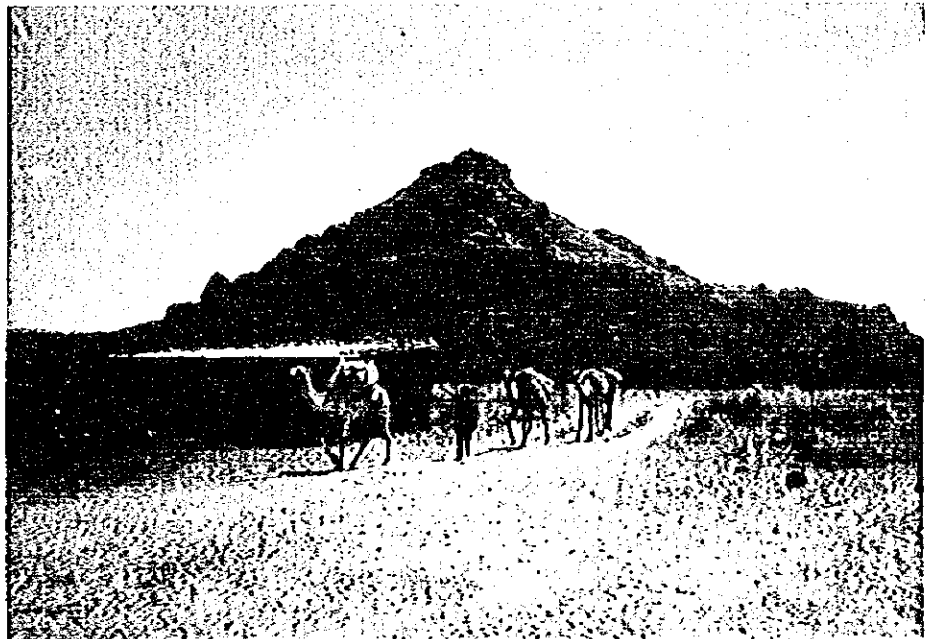


## 参考資料

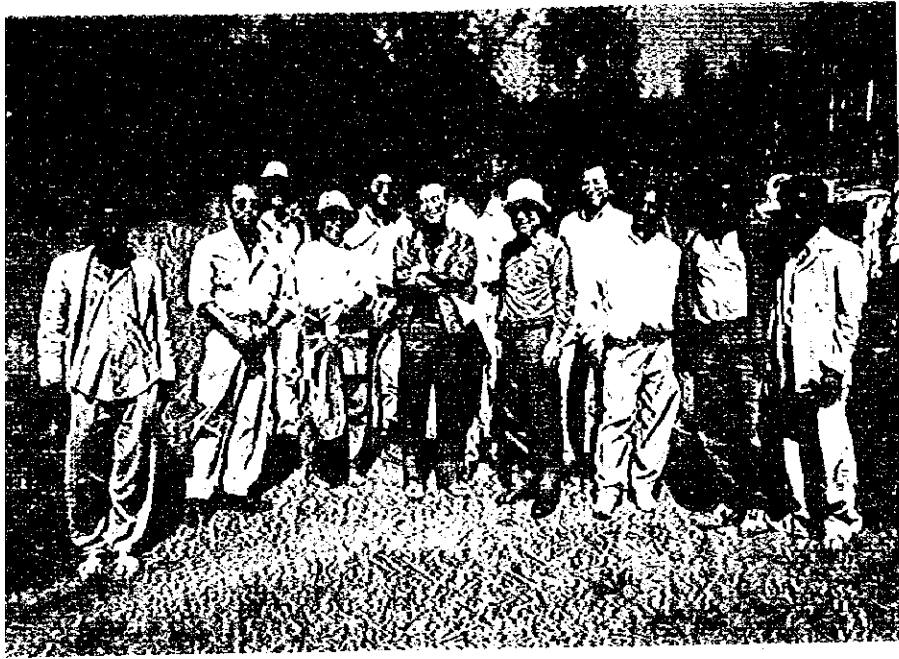




メケレ市内の巨木（イチジクの木）



アピアディの郊外



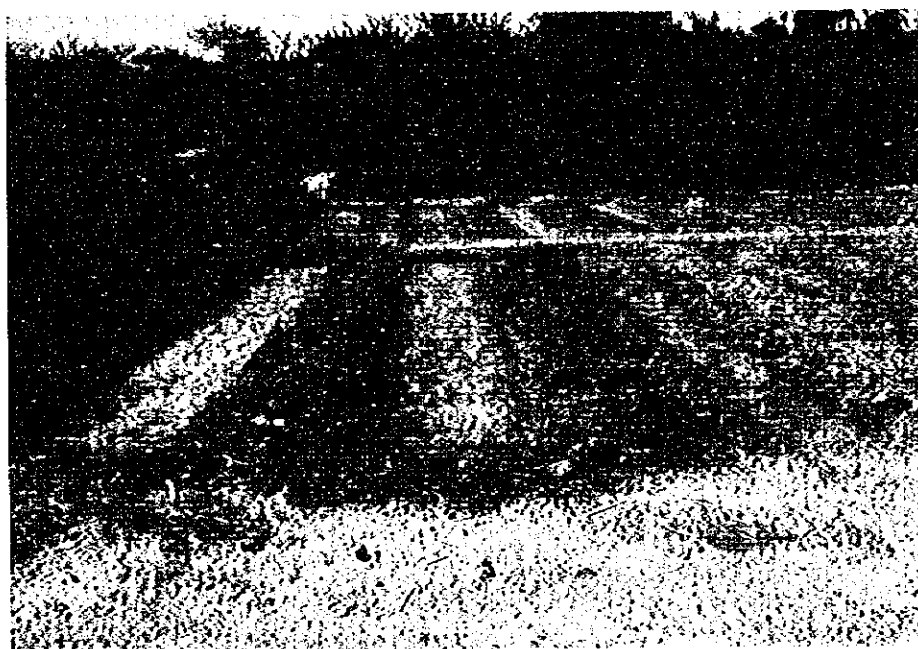
藤田朗子隊員の苗畑現場



西田尚隊員の測量現場



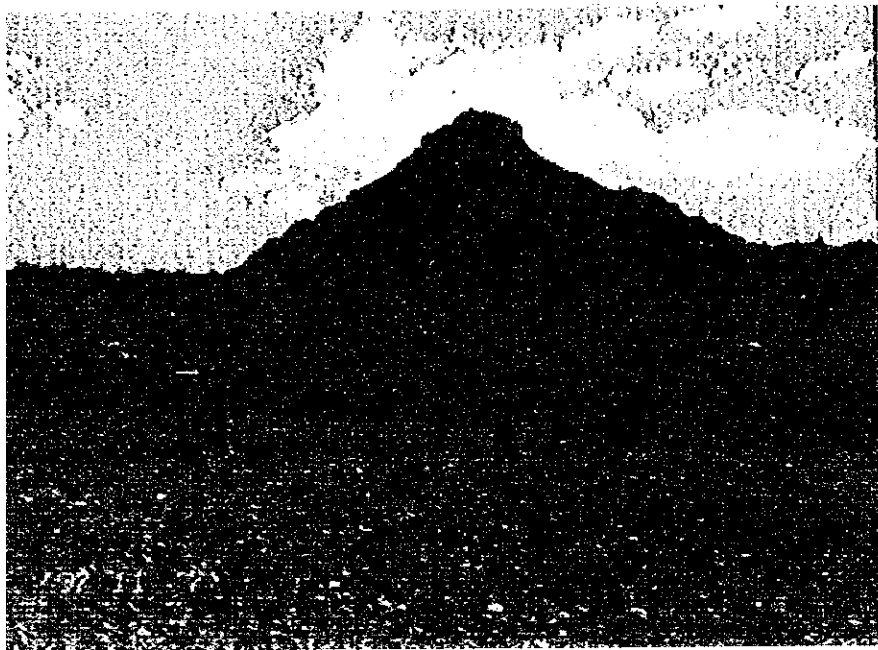
Tembien県の  
よく整備された苗畑



よく整備された苗畑。  
溝状に掘った部分に  
ポット苗を置いて、  
水温条件を少しでも  
有利にしようと図っ  
ている。



Abiadif村



囲い込み（エンクロージャー）により植生が回復しつつある地区。住民も積極的に協力している。



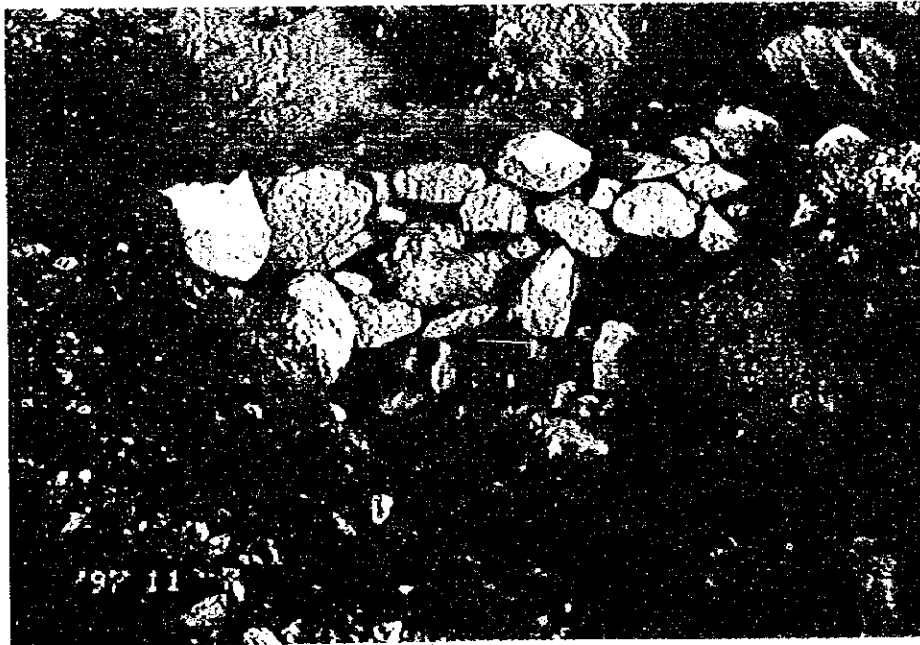
所々に保存されている大径木。このような樹木を母樹として、植林用苗木を増殖するとよい。



谷間の水はけのよい肥沃地に残されている大径木。住民にとって格好の緑陰樹となっている。植林用苗木の種子源としても重要である。



斜面につくられた植林のための半月状石積み。  
石積みの中に肥沃な土砂がたまり、水温条件も改善されるので、苗木の生長に有利となる。この凹地部分に、夜間、霧がたまり、苗木に水を供給する。



雨水表面流によるガリエロージョンを防ぐための石積み。

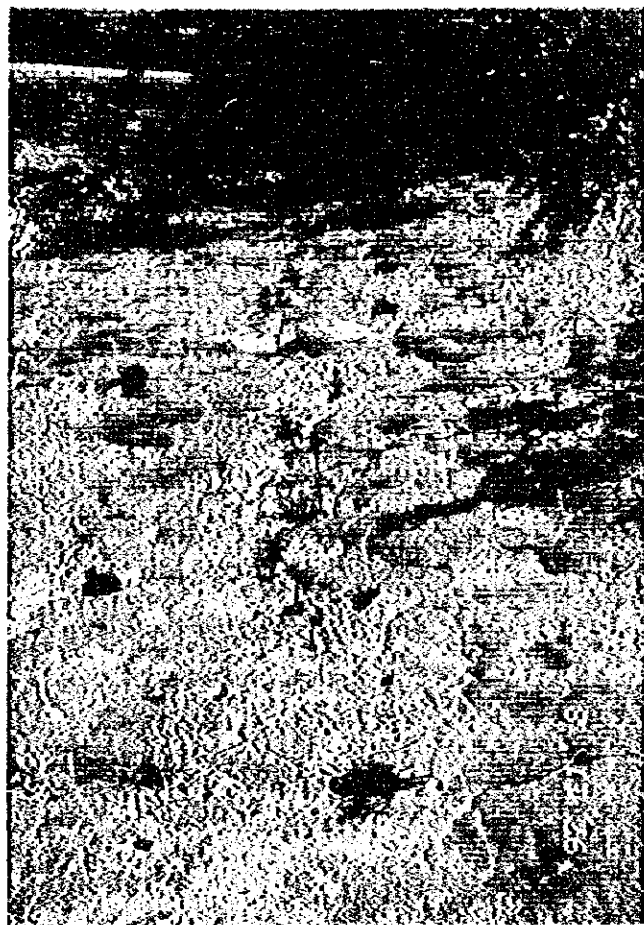


山腹の小溪流の浸食を防ぐための土留め。  
石積技術は高度なものがある。





等高線に沿った石積みによりシートエロージョンを防いでいる。石の隙間は透水通気性がよく、家畜も食べにくいので、植生の回復にも効果的である。



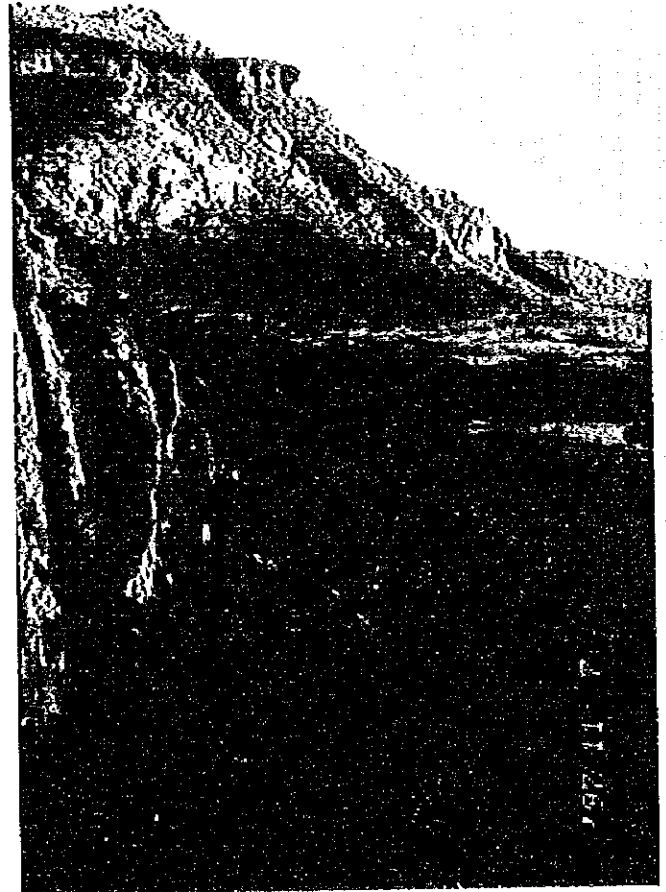
山の中腹にラテライトの古土壤（化石土壤）が層をなしている部分が崩れ、谷間を埋めた状態。そこに植林がなされているが、生長は不良。



斜面につくられた植林のための半月状石積み。石積みの中に肥沃な土砂がたまり、水温条件も改善されるので、苗木の生長に有利となる。この凹地部分に、夜間、霧がたまり、苗木に水を供給する。



夕陽を受けて赤く染まる岩窟教会

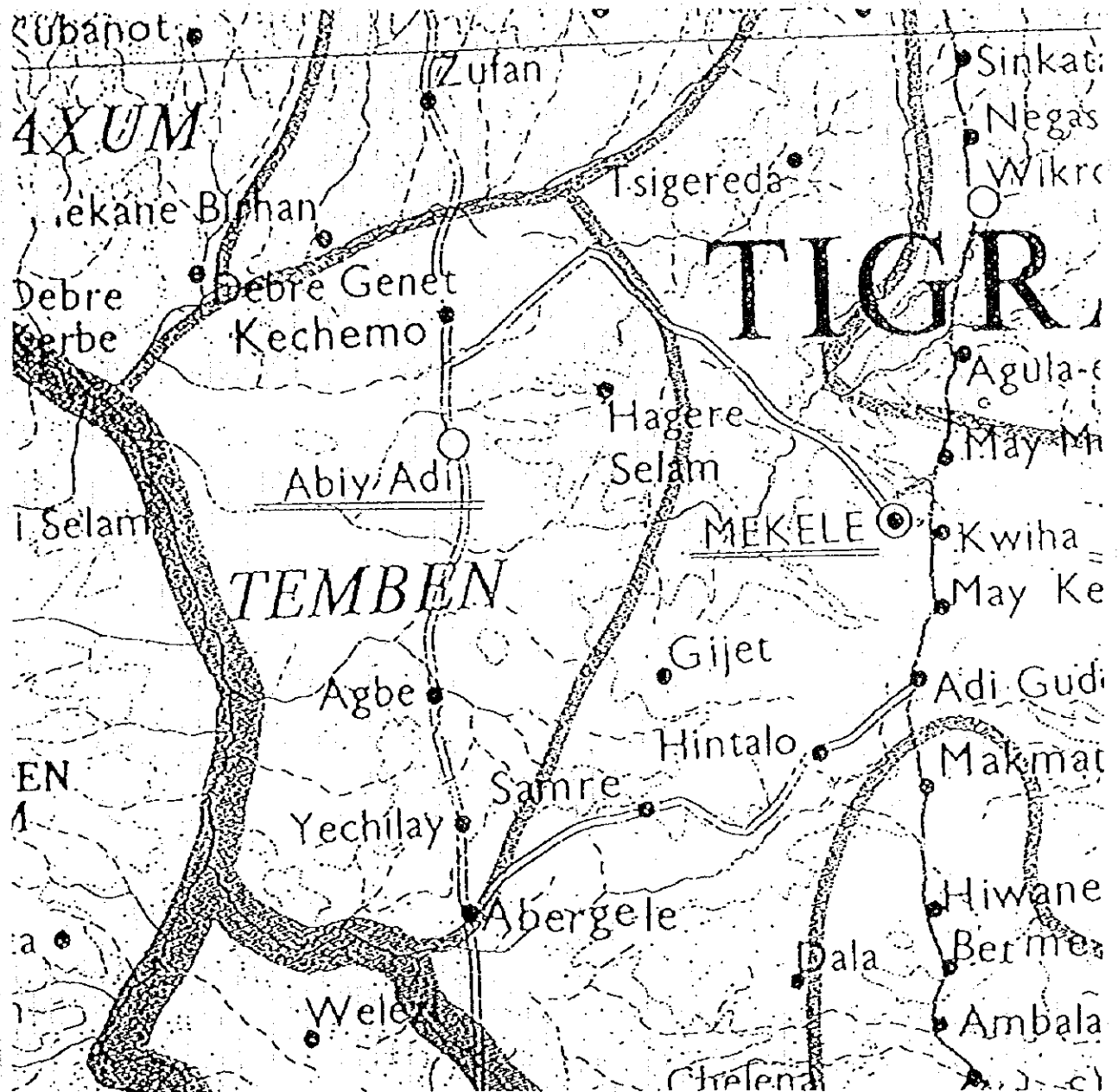


岩窟教会よりみた山麓の植生。  
宗教的理由からか、半乾燥地でも植生がよく残されている。等高線に沿った階段状石積みにより浸食を防いでいる。

テンビエン県位置図

緑の協力推進プロジェクトが活動するティグレ州テンビエン県は、ティグレ州州都メケレ市の西に位置している。その面積は約 43 万平方キロメートルである。

(出典：杉田英二専門家の報告書)



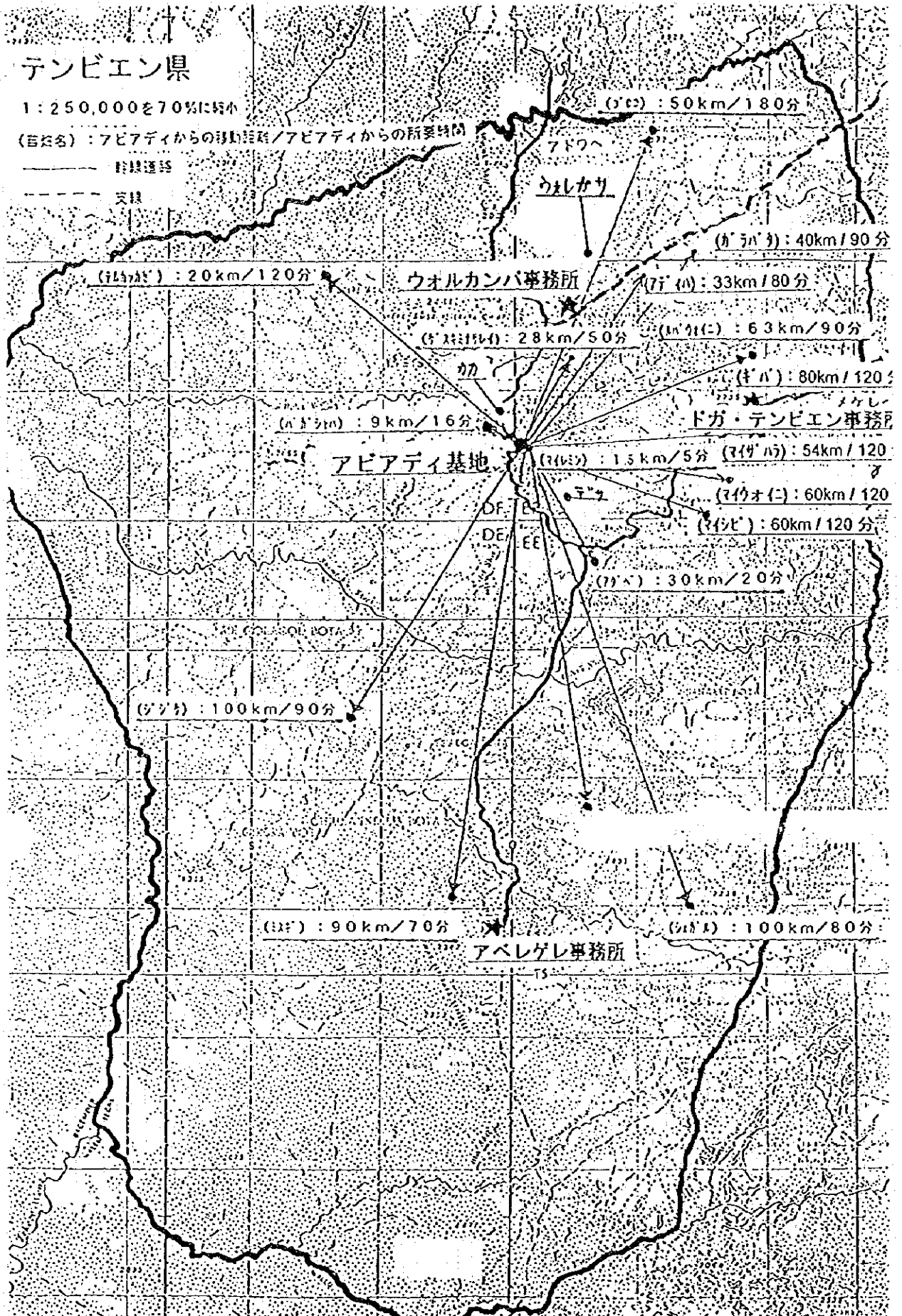
# テンビエン県

1:250,000を70%に縮小

(番号) : アビアディからの移動距離 / アビアディからの所要時間

—— 幹線道路

- - - 支線



参考資料(3)

エティオピア緑の推進協力プロジェクト  
中間評価に係る比較表

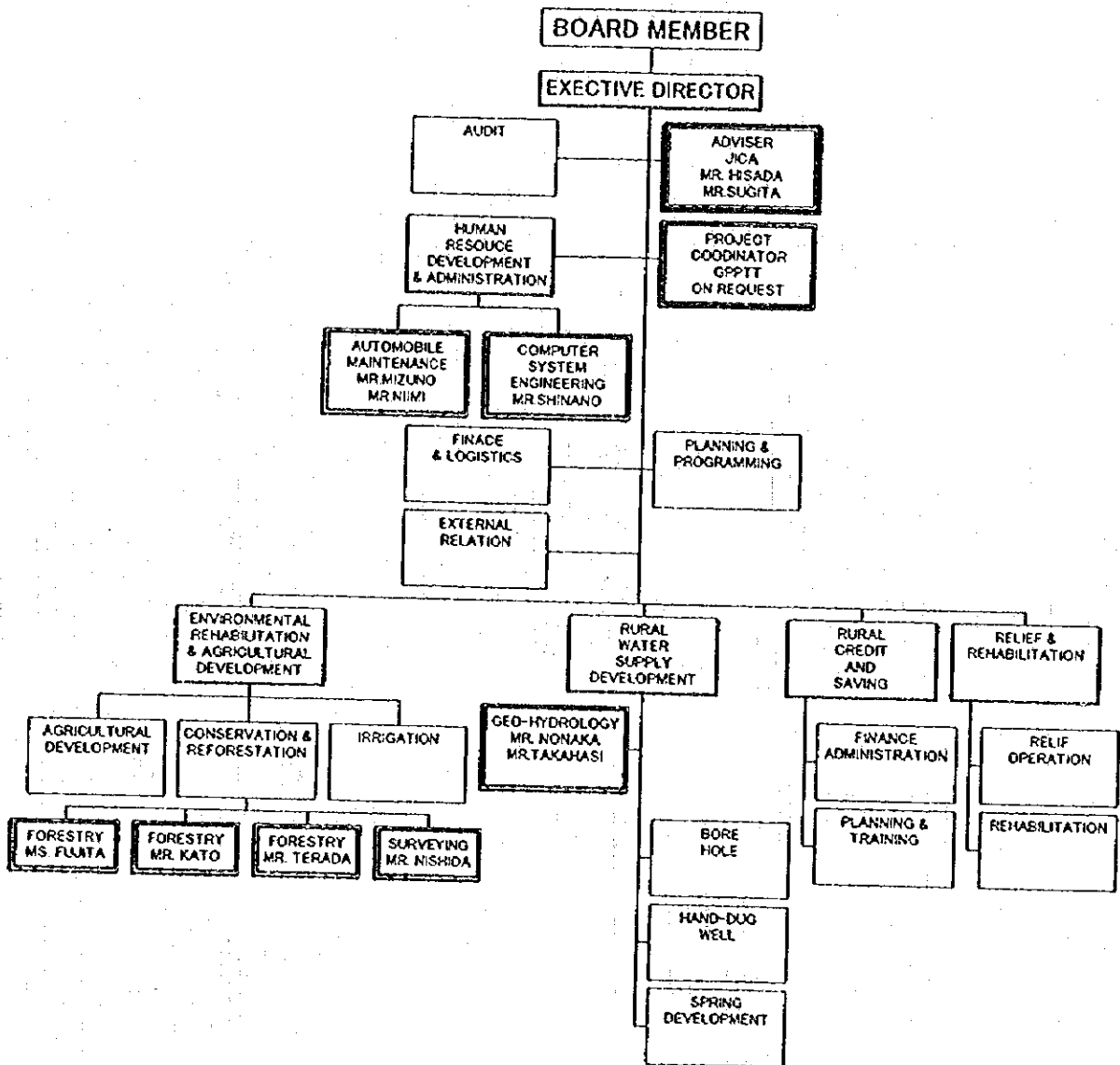
		これまでの経緯・実績	今後の計画
1	植林隊員2名 (先代) 94年7月～ 97年7月	1) 生活の基盤整備 2) 植林の基礎調査	(帰国済み)
2	植林隊員3名 (派遣中) 97年7月～ 99年7月(予定)	1) 生活体制の整備 2) 協力活動開始の準備	1) 基礎調査の継続 2) 苗畑技術の普及 3) 植林知識の啓蒙活動 *ア) 技術顧問室の活用 イ) 「エ」国内の既存技術の活用 ウ) シニア隊員着任まで、自主的にとりまとめを行なう。(事務作業、RESTや事務所との連絡等)
3	植林C/P	2名(週1～2回、 各日2時間程度)	3名(月～金、各日共全日) *RESTとの交渉の結果、この回答を得た。
4	測量隊員	「囲い込地」の面積の測量。 C/P有。	同左(継続)
5	地下水隊員	97年9月電気探査機材が到着。飲料水を目的とする、地下水開発業務。C/P有。	飲料水を目的とする、地下水開発業務を継続。(植林業務との直接の関連は薄い)
6	自動車整備	メケレの中央修理工場の整備(100余台修理可)。C/P有。 *アビアディには車両修理技なし。	メケレの中央修理工場で、予防整備の技術指導。(本プロジェクトの車両は3台のみ。植林業務との直接の関連は薄い) *RESTとの交渉の結果、アビアディに車両修理技を2名配置。
7	S/E	REST全体の財務・予算のOA化導入業務。C/P有。	同左(植林業務との直接の関連は薄い) *JICA事務所長は「プロジェクトから切り離し、個別隊員とすべし」との判断。
8	専門家	2名。(リーダー、植林技術各1名、それぞれ1.1月、1.2月に任期終了)	1名(派遣時期未定。98年度の早い時期か。)
9	シニア隊員	なし。	派遣時期は98年2月見込み。 取りまとめ、予算管理、RESTや、JICA事務所との連絡・折衝。

参考資料 (4)

H. REST組織図(専門家及び隊員の配置を含む)

(出典：杉田英二専門家の報告書)

RELIEF SOCIETY OF TIGRY &  
GREEN PROMOTION PROJECT IN TEMBIEN TIGRAY



参考資料(5) (出典: 杉田英二専門家の報告書)

1. カウンターパート配置状況

指導科目 又は 職種	専門家・ 隊員氏名	C/P 氏名	C/P 職位
総合的農業開発 プログラム (GPPTT リーダー)	久田専門家	Tekelwoine Assefa	REST 代表幹事
総合的農業開発 プログラム (GPPTT 植林)	杉田専門家	Kiflom Belete (1995 ~ 1997. Jul. 留学)	ERAD 部長
		Negash Berhe (1997. July ~)	
		Tsehaye G/Selassie	ERAD 再造林課課長
		Mesfin Debas GOITOM	ERAD 再造林課フォレスト
		Kasshun G/Michael	ERAD 再造林課フォレスト
植林	市原隊員(H7/1) 1997年7月任期満了 帰国	Mebrahtu Tsegay	ERAD テンビイン・コーディネーター
	溝口隊員(H7/1) 1997年7月任期満了 帰国	Waredekal Atsbaha	ERAD テンビイン・コーディネーター
	寺田隊員(H9/1)	協議中	
	藤田隊員(H9/1)	協議中	
	加藤隊員(H9/1)	協議中	
測量	西田隊員(H8/1)	Haile	ERAD 灌漑部門測量士 (短期任命)
地下水開発	野中隊員(H7/2)	Brehane Gebre	RWSD 部長
		Getachew Haile	RWSD 地下水探査技術者
		Abraham G/Selassie	RWSD 地質学技術者
		Kunom Asseta	RWSD 地質学技術者
自動車整備	村田隊員(H7/1) 1997年7月任期満了 帰国	Mengistab (~1996. Dec. 退職)	ガレージチーフエンジニア
	水野隊員(H9 緊急短期)	Woldu HAWAZ	総務課長
		Fireug Mariam (1997 Jan. ~)	ガレージチーフエンジニア
システムエンジニア	信濃隊員(H8/3)	Amir	計画調査部オペレーター
		Tschay Telda	財務部秘書

エティオピア緑の推進協力中間評価調査団  
表敬時の発言要旨

1. 浜田泰弘大使

- (1) エティオピアは森林率が1~2%と異常に低く、深刻な状況である。素人目に見ると、かつてこの国に豊かな森林があったとは思えないくらいである。
- (2) こうした意味において、JOCVの本プロジェクトの意義は深い。
- (3) 貴調査団の帰国前に、今回の中間調査結果を報告願いたい。

2. MEDaC

(二国間協力局長) Mr. Ato Admasu Abebe

- (1) 本件は1990年に開始され、3年経過したところである。JICA/JOCVのわが国における最大のプロジェクトであり当省としても常々関心を持って注目している。
- (2) 貴調査団がどのような評価をされるかについて承知致したく、調査終了後、是非調査結果をお知らせ願いたい。
- (3) 貴調査団には当省からも担当官を同行させる予定であったが、急な用件のために同行させることができなくなった。誠に遺憾である。

(調査団)

- (1) 本件のC/Pがパートタイムであって、不十分である。週5日・全日のC/Pが配置されるよう、貴省からRESTに対してご指導願いたい。

(二国間協力局長)

- (1) RESTはNGOなので当省から指示を出すことは難しいが、できるだけやってみたい。

3. 州政府代表

(経済開発アドバイザー) Mr. Ato Zemicael G. Medhin

- (1) ティグレ州内の各県ではそれぞれに植林の計画を実施している。その中でもテンビエン県ではJOCVに活発なご協力をいただいている。
- (2) 当州の植林技術の開発体制は遅れており、特に先般の内戦でほとんどゼロに戻ってしまった。土壌や種子を調査研究するラボラトリーの類もない。
- (3) しかしながら、伝統的な植樹方法はあり、その方式に頼っているのが現状であり効率は良くない。
- (4) こうした現状にあって、JOCVの協力には期待している。

4. REST代表

(理事長) Mr. Teklewoini Assefa

- (1) 各専門家・隊員共、熱意ある活動を行なっている。
- (2) JICA/JOCVとの協力作業は3年を経過した今もなお学習の段階が続いている。40を越える国々や機関からの協力/援助を受けているが、REST本部内にオフィスを構えているのはJOCVだけである。どのような協力関係を構築することができるかについて今後も模索してゆきたい。
- (3) 今回の中間評価調査では、実り多い調査をお願いします。



## 5. 農業省森林研究センター

(上級研究員) Mr. Ato Guilmabarcha

- (1) 当研究所は1975年に設立された。
- (2) これまで、主としてスウェーデンの援助を受け、種子貯蔵庫等を整備し、またスウェーデン人の専門家による技術協力を受けたが、現在は同国による協力は終了した。
- (3) 小職は、英国で林学の研究を行ない、ドクターの学位を得て10ヵ月前に帰国し、現職についた。
- (4) テンビエン県でのJOCVの隊員の皆さんが、植林技術上の疑問にぶつかった場合には、質問に応じる用意がある。
- (5) 特に、種子の選定についての質問については対応可能。
- (6) 土壌調査については、当センターでは現在、アジスアベバ地域の土壌調査を行っており、他の地域にまでは手がまわらないので、ご質問を頂いても対応は困難。

(メブラーテ所長)

- (1) 内戦以前には全国各地に 箇所の研究所の支所を持っていた。テンビエン県のメケレにも支所があったが、80年代の内戦により、それまでに蓄積したすべての資料が失われてしまった。
- (2) JOCVのプロジェクトのメケレにも可能な限り早い時期に支所を構えるべく、準備中である。
- (3) JICAとはこれまでにもご縁があり、南部地域地下水案件(開発調査)の際に、コンサルタントの来訪があり、可能な限りの対応をした。

以上

協力の事業系属

	1994年	1995年	1996年	1997年	1998年	1999年	2000年
短期緊急	5月～8月 森林経営						
個別専門家①	12月	2月		11月			
②	リーダー						
	12月	12月		12月			
	造林						
植林		7月 完成(%)		7月 追加(%)		7月	
①		7月 追加(%)		7月 追加(%)		7月	
②		7月 追加(%)		7月 追加(%)		7月	
③				7月 追加(%)		7月	
自助調整部①		7月 追加(%)		7月 12月	追加(%)	12月	
② (短期)				5月 水質	2月		
地下水開発		12月		12月	追加(%)	12月	
測量			7月 追加(%)		7月		
システムエンジニア				4月 追加(%)		4月	

## Joint Committee Meeting of Green Promotion Project in Tembien Tigray

11<sup>th</sup> November 1997

14:00 to 16:00.

REST Meeting Hall, Mekele

Agenda Topics		
<b>1. Opening the Joint Committee Meeting</b>		<b>Ato Tekleweine</b>
<b>Discussion:</b> Ato Tekleweine executive director of REST said in his opening speech for the Joint committee meeting of GPPTT since reforestation is the priority of the Region, we want to highlight the strength and weakness to correct the future intervention.		
<b>Conclusion:</b>		
Action items:	Person Responsible:	Deadline:
<b>2. Aim of Mid-term evaluation</b>		<b>Ato Yemane</b>
<b>Discussion:</b> Ato Yemane head of REST planning and coordination department said the aim of the evaluation meeting will address the performed activities, and then discuss whether the achievement is satisfactory or not, whether modification is needed or not and evaluate the project in terms of effectiveness, impact, efficient, sustainability and relevance.		
<b>Conclusion:</b>		
Action items:	Person Responsible:	Deadline:

### 3. Evaluation of Forestry section from December 1994 to November 1997

Ato Tsahaye

#### Discussion:

Ato Tsahaye suggested for the committee members whether discussing about the objectives was important or not. A suggestion not to discuss about the objectives since it was known earlier was forwarded and every one agreed upon the suggestion. He went on to report accomplishments.

#### Accomplishments/Achievement

1. Base line survey to assess the opportunities and constraints for future reforestation activities in the project area was conducted, a document was produced and a workshop(seminar) was given in this aspect.
2. Inventory survey of central tree nurseries in the project area was done and a report is produced.
3. Construction of a office, a guest house and a store in Abyi Adi.
4. Provision of materials for the project objective(tools equipments) was done.
5. Counterpart training in Japan was arranged and conducted.

He evaluated the impact as follows:-

1. Training of counterparts has helped to up grade the expertise and facilitated for the future project objective achievement.
2. Construction of offices, store and guest house has improved working atmosphere in the project area.
3. Provision of tools and equipment has assisted in maintaining to produce the quantity of tree seedlings planned.
4. The base line survey conducted has been started to be used as a working guide in the field.

He put his sustainability evaluation project as follows,

REST is working with the people(Target group), BAITO and BOANR based on the interest and need of the local community. For this reason the result is promising and sound. If GPPTT continues to achieve its purpose, it is inevitable to assist in attaining sustainability situation.

He also evaluated the project for its relevance as follows:-

1. The project has assessed the deforestation effect and need for reforestation activities and technical assistances.
2. It has identified the need for provision of tools and equipment.
3. Need for technical up grading though training and study tour for the project succession is reasonable.
4. Need for offices and store construction to facilitate the working condition is inevitable.

He also evaluated the project for its efficiency, that the precondition has been facilitated to ensure the capacity for the achievement of the project goals.

Finally Ato Tsehaye pointed out expectations as follows:-

1. Since the project objectives are not yet all started, all concerned bodies will work hard for the succession.
2. Dispatch of senior forester and continue dispatching other experts and volunteers.
3. Provision of a truck and additional vehicles.
4. Strengthen land survey and soil research and other data collection.
5. Identified suitable ordinary and fodder tree species for the project.
6. Preparation of tree species identification and description catalog.
7. Suitable tree seeds availability.
8. Increase provision of tools and equipment for reforestation activities.

Detail report is attached here with for reference

Supplementary points to initiate to work hard both REST and JICA/JOCV members for the achievement of objectives were forwarded.

#### Conclusion:

Action items:	Person Responsible:	Deadline:
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### 4. Evaluation of Surveying section from July 1996 to November 1997

Ato Tsahaye

#### Discussion:

#### Result

1. Provision of land survey materials for the project objective was done and surveying activity has been started.

The expectations for the future

1. Technical up grading through training.
2. Providing tools and equipments.
3. Continue dispatching of surveyor.

#### Conclusion:

Action items:	Person Responsible:	Deadline:
---------------	---------------------	-----------

## 5. Evaluation of Under ground water section from December 1995 to November 1997

Ato Birabane

### Discussion:

(Pular water supply Department)  
Ato Birhane head of REST RWSD mentioned some of the measure technical inputs important for the under ground water development as follows:-

1. Equipment necessary to assess the potentiality of under ground water to make feasibility studies.
2. Drilling machine.
3. Technical experts.

He clarified the provided materials for under ground water development from JICA/JOCV are two resistivity units and their accessories. This unit is important to assess the under ground water potentiality which also helps in minimising expenses or costs which without this equipment would otherwise end up inavailability of water after digging or drilling in to the ground which is an expensive lose. He went on explaining that one technical volunteer is dispatched whose contract has already terminated. He said it is difficult to measure as well to assess the effectiveness, impact and sustainability of the assistance since the arrival of the equipment is only 6 month.

He expected the resistivity unit provided, the expertise and the training given are all relevant. He said, however, the resistivity unit alone can not be adequate to assess the ground water resources.

He went on explaining that the assistance from JICA/JOCV for the development of under ground water is inadequate. He stated future expectation from JICA/JOCV in order to have full meaning of the under ground development component as follows:-

1. A drilling machine capable of drilling soft/hard formations.
2. Casing and well screens for the completion of water wells.
3. Power driver pumps and hand pumps for the extraction of ground water.

Detail evaluation report is attached here with for reference.

### Conclusion:

Action items:

Person Responsible:

Deadline:

## 6. Evaluation of Auto mobile maintenance section from December 1995 to November 1997

Ato Daniel

### Discussion:

Ato Daniel head of the human resource development(HRD) clarified the main objective of auto mobile maintenance in the GPPTT were:-

1. Improvement of Mekele garage.
2. Improvement of Abyi Adi garage.
3. Installation of garage.

He went on explaining that Mr. Murata, the former mechanic volunteer, mainly envoled in clearance of GPPTT materials and preparation for both garages improvement.

He went on clarifying that the inputs to GPPTT were as follows:-

1. Budget approval for the garage improvement.
2. Dispatch of technical volunteer.
3. Provision of garage tools/equipments.

He said the immediate out put were:-

1. Both garages are improved even though they are not completed.
2. Containers in the garage area are arranged properly to make wider space available for vehicles/car parking.
3. Working sites for cars prepared.
4. Provision of garage tools.

Ato Daniel said the improved garages can not be evaluated for sustainability but the endeavor is relevant.

He went on clarifying that the accomplishments up to now are appreciated and he added the expectations for the future are:-

1. Introduction of maintenance system.
2. Installation of equipments.
3. Training to auto mechanics.
4. Preparation of text book and maintenance manual.
5. Provision of additional garage tools and equipments.
6. Integration of both garages.
7. Dispatch of mechanic successors.

### Conclusion:

Action items:

Person Responsible:

Deadline:

**7. Evaluation of Computer system engineering section from December 1995 to November 1997 Ato Daniel**

**Discussion:**

Ato Daniel went on clarifying that JOCV has dispatched one volunteer as a computer engineer to GPPTT. He is in the process of requesting budget for the improvement. Ato Daniel said, however, generally it is too early to evaluate the output and effectiveness, impact and sustainability. He said more over there is a delay of action plan preparation for the computer engineering system improvement and utilization.

Ato Daniel went on explaining that the computer system engineering for improvement and utilization is relevant for REST which has got many computers and is in need for the computer system utilization.

He also added the expectation of computer system for the future as follows:-

1. Assessment of computer utilization and REST' s need.
2. Training for computer operators.
3. Enhance the utilization of computer.
4. Installation of net work system.
5. Preparation of text book for computer operators and over all computer system utilization.
6. Maintenance and installation of computer parts.

Detail evaluation report is attached herewith for reference.

**Conclusion:**

Action items:

Person Responsible:

Deadline:

## 8. Evaluation of the project by JICA/JOCV mission

### Discussion:

Mr. Okatsu clarified the objectives of the mission was to evaluate:-

1. The JOCV volunteers condition in the GPPTT.
2. The technical performances of the volunteers.
3. To understand REST' s opinion about the project evaluation.

### Evaluation of the volunteers

Mr. Okatsu said the volunteers, particularly the foresters are working well, despite the problem they have. He went on explaining that the mission has appreciated their commitment. He added, Mr. Horii advised them as follows:-

1. To use the basic survey result conducted by MUC.
2. To work for the establishment and achievement of the seed orchard objectives.
3. Work for the best of the nursery operations.
4. Follow up planting operation.

### Forestry/surveying

#### Basic survey

Mr. Okatsu said the basic survey result is good for the volunteers. He said they should follow up activities in the area closures, catchment plantation sites for some research works.

#### Nursery operation

He went on explaining that it is appreciated that the former forester volunteers have done nursery survey inventory in the project area. He said the new foresters should follow up activities and collect data for the standardization and technical up grading of nursery performances.

#### Planting operation

Mr. Okatsu said it is important to follow up the performances of plantation skills and some data collection for research purposes which would be helpful for future directions and implementations. He said it is also important to follow up the performance of seedlings based on land classifications.

#### Auto mobile Maintenance

He said their impression was good that is the mission has appreciated the utilization system of vehicles.

He said they appreciated both garages are installed and improved. He went on clarifying that the mission suggests a volunteer mechanic works in Abyi Adi garage. He reminded vehicles will get older and older when they stay. They will need maintenance.

#### Computer system engineering

He said the Computer system engineer should work for the net work system but he said this net work can not be done by one volunteer engineer. He reminded that the system engineer should get assistance from the task force team members of REST.

Mr. Okatsu also suggested that there should be a regular meeting of both REST and GPPTT staff members to solve problems and/or issues.

Mr. Okatsu after finalized the mission' s suggestions two point, were raised for discussion. These points were:-

1. Where should the volunteer Auto mobile mechanic work. (in Mekele or Abyi Adi garage) ?
2. Are counterparts of JOCV foresters going to be assigned or not ?

He also approved that under ground water volunteer will continue to work and electric resistant surveying should be started in the future for commercial forestry.

Mr. Okatsu approved the land survey should continue to survey area enclosures. He said besides this, topographic for nurseries and plantation sites should be done from now until the end of year 2,000

He stressed some points that he suggested most important points according to his expectation were:-

1. Not only materials but human relationship is very important.
2. It is important that all joint committee members support volunteers especially who live at Abyi Adi since the life at the Abyi Adi is hard and difficult.
3. Clarifying information of budget input obtained from other donors for this project other than JICA/JOCV is important.
4. The experts have done much for this project. This project is difficult from all JICA project in Africa. So the joint committee should appreciate the contribution of the experts.

### Conclusion:

Action items:

Person Responsible:

Deadline:

## 9. General discussion

Ato Yemane

### Discussion:

Mr. Hisada suggested that the Auto mobile mechanic(successor of Mr. Murata) should work in Abyi Adi garage. He went on explaining that the mechanic should not be over expected. He said it is impossible for him to work in both Mekele and Abyi Adi garages but he can work at Abyi Adi maintaining Wereda coordinator' s(REST) vehicles and the GPPTT vehicles. Mr. Hisada added in his explanation that Mr. Murata was requested for his suggestion about this case and he said Mr. Murata gave his suggestion that it is impossible to work in both garages but should work only in Abyi Adi garage.

An argument points were suggested from Ato Daniel and Mr. Mizuno.

The argument was if Mr. Murata' s successor is going to work only at Abyi Adi he will be idle since the vehicles to be maintained are very few and also he will face language communication problem.

On the other hand they said REST' s vehicles being maintained in Mekele garages are many. They said this garage needs more technical assistance than Abyi Adi. They went on explaining that if the mechanic is assigned in Mekele garage he will help in giving training for garage staff members and also preparing manuals. They said first Mekele garage should be up graded technically and materially and then Abyi Adi next.

Ato Daniel said one or two local junior mechanics can be assigned in Abyi Adi garage and the JOCV mechanic can visit this garage regularly, once a week or twice a week.

Mr. Hisada still argued that it is good if the mechanic concentrates working at Abyi Adi with few vehicles.

Ato Tekleweine explained that Abyi Adi will be the main station of GPPTT in the future. But it is difficult at present because the communication system is not yet developed. So spot service is good at the moment. He went on explaining that it was not a time of frustration but was a process that we should shape to our successor. He added REST is always requested by the community, zonal and regional BAITO, BOANR and others that how much aid is giving up to REST. He went on explaining that JICA is expected to give millions. But he said REST is telling or informing that this project is a special technical cooperation.

Ato Tekleweine expressed the advantage of this mid term evaluation is to see clearly what is done and what is not done. He said this will assist us to correct our weakness to proceed to words the achievements of the goal. He went on explaining that there is need for developing a logical frame work analysis which would help to follow up the achievements of the objectives before the end of the project life.

Ato Yemane gave his conclusion the aim of this mid term evaluation is for future learning of improving of our effects to the succession of the goal.

### Conclusion:

Action items:

Person Responsible:

Deadline:

## 10. Closing the meeting

Ato Tekleweine

### Discussion:

Ato Tekleweine was called upon to close the meeting and said the following points:-

1. We should be in light minded.
2. The short comings are now disclosed and should work hard for the succession of the project.
3. Every department should arrange for monthly meeting with volunteers.
4. Management will have every three month briefing or meeting about this project.
5. There will be general evaluation every six months.
6. Assist volunteers living at Abyi Adi and counterparts will be assigned soon.
7. Budget that comes to REST from donors are public. It is not secret. So this budget can be informed to Mr. Hisada in a management meeting.

Ato Tekleweine wound up his speech expressing the statement of expectations:-

1. This project will be linked with agro-forestry activity.
2. Research work is strengthened.
3. Senior foresters should be assigned if we were finally to evaluate the project achievement or accomplishment based on the logical frame work analysis.
4. Increased supply of tree seeds from abroad.
5. Sufficient tools are provided.

### Conclusion:

Action items:

Person Responsible:

Deadline:



**Green Promotion Project in Tembien Tigray, Ethiopia  
JICA/REST**

# **Nursery Inventory Survey**

## **Report**

**Tomofumi ICHIHARA (JOCV Forester)  
Naomi MIZOGUCHI (JOCV Forester)**

## **1. Introduction**

Reforestation activities including establishment of nurseries and seedling production by REST started in 1993 as one of Integrated Agriculture Development Program (IADP).

Green Promotion Project in Tembien Tigray, Ethiopia (hereafter referred as "GPPTT") started on December, 1994 under the cooperation of JICA and REST. GPPTT is trying to improve the reforestation techniques and forest recover Tembien area. Now there are 16 central nurseries and 50 community nurseries in the area. From now on, we are planning to improve the central nursery facilities and nursery operation techniques including the equipment provision.

For that reason, there was a need of collecting basic information all about them for the central nursery improvement. Therefore we implemented Central Nursery Inventory Survey from December, 1995 to May, 1997.

This report is summary of the result of the inventory survey. We hope that this report should be a useful guide for the next GPPTT activities, Improvement and Standardization activities for the central nursery facilities and operation.

## 2. REST Central Nurseries in Tembien Area under the Inventory Survey

As mentioned in the introduction, 16 REST central nurseries in Tembien area have been inventoried. These nurseries are considered being under the GPPTT activity observation.

Table.1 REST Central Nurseries in Tembien Area under the Inventory Survey

No.	Nursery Name	Wareda Name
1	Getsiky Meleslay	Keyih Tekhli
2	Adiaha	Keyih Tekhli
3	Galapada	Keyih Tekhli
4	Gororo	Kolla Tembien
5	Tinketkezze	Kolla Tembien
6	Begasheka	Kolla Tembien
7	Abi Adi	Kolla Tembien
8	Agibe	Kolla Tembien
9	Mesgi	Abergelle
10	Sheegaloo	Abergelle
11	Gigika	Abergelle
12	Maishih	Doga Tembien
13	Maizahla	Doga Tembien
14	Maiwoinii	Doga Tembien
15	Rubawoinii	Doga Tembien
16	Gereb giga	Doga Tembien

### 3. Concept of the Inventory Survey

Each nurseries has been inventoried and collected the information as follows:

#### A.) General Information

1. Nursery Number
2. Location
  - a. Wareda Name
  - b. Town Name
  - c. Nursery Name
  - d. Latitude (N)
  - e. Longitude (L)
  - f. Altitude (m)
  - g. Distance from Wareda Town (Actual Access Time)
  - h. Access Road (Seasonal or All Seasons)
3. Establishment
  - a. Agent (REST or Government)
  - b. Year (in European Calendar)
4. Area
  - a. Total Area (m<sup>2</sup>)
  - b. Productive Area (m<sup>2</sup>)
  - c. Seedling Beds (Trees)
  - d. Seedling Beds (Grass)
  - e. Extension Area (m<sup>2</sup>)
5. Staff
  - a. Foremen & Forewoman
  - b. Technicians
  - c. Casual Laborer
  - d. Total Payment for Casual Laborer / Year
6. Water
  - a. Source (Stream, Spring, Well, Others)
  - b. Distance (from the Nursery)
  - c. Seasonal or All Season
  - d. Quality

**7. Seedlings**

- a. Total Seedling Production
- b. Seedling for Individuals (Numbers)
- c. Seedling for Catchments Area (Numbers)

**8. Office & Equipment**

- a. Cost Expenditure for Equipment and Materials
- b. Office (Yes or Not. If yes, Size)
- c. Store (Yes or Not. If yes, Size)
- d. Watering can
- e. Pruning Scissors
- f. Wheel Barrow
- g. Measuring Tape
- h. Net for Soil
- i. Shovel
- j. Others (If any)

**9. Problems**

- a. Termite
- b. Water
- c. Tools
- d. Worker
- e. Shade
- f. Soil
- g. Cow Dung
- h. Labor
- i. Others

**B.) Operation**

**10. Tube**

- a. Size (Diameter)
- b. Size (Height)
- c. Color

**11. Shade**

- a. Material
- b. Height
- c. Shaded (%)

**12. Hardening Off**

- a. Duration (How long)
- b. Method (How to control)
- c. Method of Hardening Off

**13. Soil Mixture Ratio**

- a. Top Soil
- b. Red Soil
- c. Compost
- d. Cow Dung
- e. Sand
- f. Others (if any)

**14. Root Pruning**

- a. Timing (When)
- b. Frequency

**15. Watering**

- a. Duration
- b. How often
- c. Morning or Evening or Both
- d. Seedling Beds / Man \* day

**C.) Comments**

And we calculated and arranged those information to make comparison among the nurseries inventoried.

We finally summarized result and suggested the concept of the improvement activities of GPPTT.

#### **4. Result**

All collected information from the all nurseries are shown in Annex 1.

Aspect and specification of the nurseries are described as follows.

Nursery Number: 1

Nursery Name: Getsiky Meleslay

Wareda Name: Keyih Tekhif

#### Aspect & Specification

- This nursery is located at 28km far from Abi Adi and it takes 50 minutes' driving. Therefore it has a problem of transportation for nursery materials and seedlings when the plantation.
- They are taking water from the nearby river through about 500m-long diversion channel into the nursery. So it is under the influence of the river especially in the rainy season.
- Water reservoir was maintained in 1996.
- Although this nursery has wide area comparably among the 16 nurseries, seedling productivity is not so high and other area is not used effectively. It need to be considered more.
- Shape of the seedling beds and their block is well standardized for efficient operation.
- Inside of the office is not organized and documents are managed rough.

=> See the Annex 1 and attached photographs for details.



Nursery Number: 2

Nursery Name: Adlaha

Wareda Name: Keyih Fekih

### Aspect & Specification

- This nursery is located at 33km far from Abi Adi and it takes 60 minutes' driving. Therefore it has a problem of transportation for nursery materials and seedlings when the plantation. Some part in the access road is dangerous.
- Although this nursery has wide area comparably among the 16 nurseries, seedling productivity is not so high and other area is not used effectively. It need to be considered more.
- There is no place to keep soil and workers putting pots in the sun.
- Water is rich due to the diversion system but it sometimes overflows and damage the seedlings.
- Working environment is good with a lot of fruit trees planted.

⇒ See the Annex I and attached photographs for details.

**Nursery Number: 3**

**Nursery Name: Galapada**

**Wareda Name: Keyih Tekhili**

### **Aspect & Specification**

- **This nursery is located 42km far from Abi Adi and it takes 90 minutes' driving. Therefore it has a problem of transportation for nursery materials and seedlings when the plantation. Access road is dangerous.**
- **This nursery is the latest one in Tembien area, established in 1996. Therefore it is still on the phase of developing and organizing.**
- **Water reservoir should be equipped because workers transport water from a far river.**
- **Animals are easily intrude into the nursery because of no fencing.**

**⇒ See the Annex I and attached photographs for details.**

Nursery Number: 4

Nursery Name: Gororo

Wareda Name: Kolla Tembien

#### Aspect & Specification

- This nursery is located at 37km far from Abi Adi and it takes 90 minutes' driving. Therefore it has a problem of transportation for nursery materials and seedlings when the plantation.
- This nursery has a good water reservoir but it has begun to crack. So it needs to be repaired.
- There is no wheel barrow (all out of order). They are suffering from transportation of the materials.
- This nursery has a particular long-square shape compared with others. Workers have hardness for moving in the nursery.
- Size and shape of the seedling beds are not standardized.

⇒ See the Annex I and attached photographs for details.

Nursery Number: 5

Nursery Name: Timketkezzo

Wareda Name: Kolla Tembien

### Aspect & Specification

- This nursery is located at about 30km far from Abi Adi and it takes 70 minutes' driving. Therefore it has a problem of transportation for nursery materials and seedlings when the plantation.
- This nursery is surrounded by a small woods and a stream runs by the side of the nursery. It is a sort of good environment for workers' refreshment.
- Soil and other materials (grass for shade, cow dung etc.) should be transported from Abi Adi due to their poor availability. Facilities for materials management should be equipped.
- This nursery is on the slope and workers have to transport water from the down side of the slope. Water supply system should be equipped.

=> See the Annex 1 and attached photographs for details.

Nursery Number: 6

Nursery Name: Begashaka

Wareda Name: Kolla Tembien

#### Aspect & Specification

- This nursery is located near Abi Adi and transportation is comparably easy. Therefore it is easy to develop and improve the facilities and nursery operation.
- Water is dirty with algae and it makes the quality of water low. Workers are transporting water by manpower when the watering. Water reservoir should be quipped.
- Wheel barrows are in lack.
- Sometimes seedlings damaged by insects and animals. Fencing should be strengthened.
- Size of the seedling beds is not standardized.
- Effective shading place for potting is existing.

⇒ See the Annex 1 and attached photographs for details.

Nursery Number: 7

Nursery Name: Abi Adi (Mai Lemin)

Wareda Name: Kolla Tembien

#### Aspect & Specification

- This nursery is in Abi Adi and transportation is easy. Therefore it is easy to develop and improve the facilities and nursery operation.
- Most of equipment is out of order and it makes operation disorganized.
- Sometimes seedlings damaged by caterpillar and worms.
- Relationship between the foreman and workers is good and their attitude for development of the nursery is well grown. Foreman is trying to improve actively.
- Water reservoir has crack and should be maintained.

=> See the Annex 1 and attached photographs for details.

Nursery Number: 8

Nursery Name: Agibe

Wareda Name: Kolla Tembien

### Aspect & Specification

- This nursery is located just along the Mekele -Abi Adi main road. Therefore it is easy to develop and improve the facilities and nursery operation.
- Number of seedling production / productive area is extremely low. Damage by some animals and insects seems to be one reason. Therefore sure fencing is needed.
- Although it has wide area, most of them are not used effectively and there is no facility to keep soil and shading place for workers. So use of the area should be considered.
- From the point of view of area and location, this nursery should be the most important nursery as a target of the improvement activity and a model nursery.
- It is possible to establish a pilot forest in the extension area.

⇒ See the Annex 1 and attached photographs for details.

Nursery Number: 9

Nursery Name: Mesgi

Wareda Name: Tenqua Aberegelle

### Aspect & Specification

- This nursery is located at 40 km far from Yechila and the access road is very dangerous because it is partially dried river. Therefore it has a problem of transportation for nursery materials and seedlings when the plantation.
- This nursery has the highest seedling production in Aberegelle area.
- All kind of equipment are damaged and new equipment are in need.
- Rats intrude the nursery and eat the seedlings. Fence should be equipped.
- Facility for keeping soil is in need because soil available around the nursery is very sandy because it is near a river.
- Quality of the seedlings are not standardized due to rough shading.
- This nursery is lying on the flat area. So equipment with wheels seems to be effective for transportation of materials and seedlings.

⇒ See the Annex 1 and attached photographs for details.



Nursery Number: 10

Nursery Name: Sheegaloo

Wareda Name: Tenqua Aberegelle

#### Aspect & Specification

- This nursery is located at 10km far from Yechila and it is comparably easy to transport.
- This nursery is not so large and seedling production is on the standard level. But productivity of the seedlings (Seedling production / Productive area) is the highest in Aberegelle area.
- Size of the all seedling beds was standardized in 1996.
- Some trees were planted inside of the nursery and they are effective for shading for workers.

⇒ See the Annex 1 and attached photographs for details.

Nursery Number: 11

Nursery Name: Gigika

Wareda Name: Tenqua Aberegelle

### Aspect & Specification

- This nursery is located at 52km from Yechila and it takes almost 2 hours' tough driving. Even only transportation seems to exhaust us. It is quite hard to transport nursery materials and seedlings.
- This nursery is small and its seedling production is also small but productivity of the seedlings (Seedling production / Productive area) is the comparably high.
- Water reservoir is just a dug pond and it is easily get broken. Sure water reservoir should be equipped.
- Office is newly constructed but its equipment is in need.
- Seedling beds are reduced for rationality. But size of existing seedling beds are not still standardized.

⇒ See the Annex 1 and attached photographs for details.

Nursery Number: 12

Nursery Name: Maishih

Wareda Name: Doga Tembien

#### Aspect & Specification

- This nursery is located at 40km far from Abi Adi. Its access road from the main road is newly constructed in May, 1997. Therefore transportation and improve activity will be promoted from now on.
- This is a new nursery established in 1996.
- This nursery is small scale but distribution of facilities are well organized.
- All kind of equipment are in need.
- There is no office in this nursery. Therefore existing equipment are kept in the simple guards' house or daily removed to the foreman' s residence.
- Additional workers are in need and existing workers are suffering from transportation of water.

⇒ See the Annex 1 and attached photographs for details.

Nursery Number: 13

Nursery Name: Maizalila

Wareda Name: Doga Tembien

#### Aspect & Specification

- This nursery is located near Hagera Selam and access is comparably easy.
- This nursery has the largest seedling production and the high seedling productivity (Seedling Production / productive Area) in the 16 nurseries under this inventory survey.
- This nursery is surrounded by woods and workers can work beneath it.
- Water is taken through a long pipe from the water reservoir but it is highly damaged. Therefore water supply system should be strengthened.
- Office and storage should be constructed for organized management.
- Size of the seedling bed is not standardized.
- Quality and growth of the seedlings are not standardized due to rough shading.

⇒ See the Annex 1 and attached photographs for details.

Nursery Number: 14

Nursery Name: Maiwoni

Wareda Name: Doga Tembien

### Aspect & Specification

- This nursery located at 30km from Abi Adi But only walking (30 minutes) will lead us to the nursery from the main road. Therefore transportation of nursery materials and seedlings are quite difficult.
- Water is taken from a nearby spring through a channel. Establishment of a water reservoir will strengthen the water supply.
- Wheel barrow and sickle are in need.
- Additional manpower is in need.
- There is no office in this nursery. Therefore existing equipment are kept in the simple guards' house or daily removed to the foreman' s residence.

⇒ See the Annex I and attached photographs for details.

Nursery Number: 15

Nursery Name: Rubawom

Wareda Name: Doga Tembien

#### Aspect & Specification

- This nursery is located at 13 km far from Hagera Selam but it takes 30 minutes' driving. It is dangerous especially in the rainy season. So transportation of nursery materials and seedlings are difficult.
- Size of the seedling beds is standardized and distribution is organized.
- Hammer is in need.
- Water is taken from a river nearby by the workers. Water reservoir is simply dug pond and easily get broken. It should be strengthened.
- There is a lack of shade material (local grass). It is expensive and hard to provide from farmers. Therefore shading is not done well.
- Although fenced by hedge, rats intrude into the nursery and eat seedlings. So fencing is in need.

⇒ See the Annex I and attached photographs for details.

Nursery Number: 16

Nursery Name: Gerob giga

Wareda Name: Doga Tembien

#### Aspect & Specification

- This nursery is located at 30km far from Hagere Selam and near Mekele. It is easy to access this nursery even from the main road. It has no problem of transportation.
- Office and storage are well constructed and inside of them are also well organized and equipment are well kept.
- A epoch-making solar pump are equipped. But when the rainy season they have to remove it every time when raining to avoid damage from a flood. The removal make them stop the nursery operation.
- A generator is in need because the solar pump doesn't work in cloudy day.
- Sand in water from the river damages the seedlings when watering. Equipment for filtration is in need.

⇒ See the Annex 1 and attached photographs for details.

## 4.1 General Observation

- Nursery equipment are disorderly kept and managed in the storage. There are a lot of equipment which have already been totally damaged and become useless. Therefore there's need to improve the management of them.
- In general Documents are disorderly kept and managed in the offices. Therefore there's need to improve the management of them.
- Especially Maizahla nursery has no facilities to keep the documents and equipment like office and storage.
- Seedling growth is uneven because of coarseness of the shade mesh especially in Maizahla and Galapada nursery.
- Some seedlings are too much grown when the transportation to the planting sites. It is doubtful whether the timing of the transportation is right or not.
- There are no place or facilities to avoid sunshine. It seems that it is hard for the workers to work in the strong sunshine and operation itself is inefficient.
- It takes more time and labor to get and transport water in the nurseries without water reservoir because of depending on rivers as water resource. (They usually use buckets for transportation.)
- Peasant people usually like Eucalyptus species for the plantation in their resident compound.
- Survival ratio of the planted seedlings is not so high according to the GPPTT baseline survey report.
- 75 % of produced seedlings will be distributed for peasants and rest will be planted in the planting sites.
- They're measuring the ration of soil by using wheel barrows and making it uncertain.



- There's chronic lack of vehicles for transportation of soil, fertilizer and produced seedlings.
- Nurseries are located far from the planting sites.
- Seeds are kept in transparent or black vinyl bags hung on the wall. Some bags are titled in the seeds' name and others are not.
- There's lack of stationery in the offices especially in Galapada and Maishih nursery.
- There's lack of manpower especially in Galapada and Maishih nursery.
- Access roads to the nurseries are too rough and dangerous. Therefore there's need to maintain them especially to Galapada and Maishih nursery.
- Maishih nursery has no office, storage and water reservoir.
- 3 kg of flour and 120 ml of oil are paid for workers by "Food for Work". In some nurseries that payment is delayed by some months.
- Now cow dung is provided from farmers voluntarily in Doga Tembien. But those farmers are limited and it's getting difficult to provide it. Therefore budget treatment is in need.
- Foremen are not informed about pest control and disease well.
- Length of tubes are not standardized and there is loss. Therefore tube cutter should be equipped.
- In some nurseries diameter of tube was changed to smaller one to raise up the productivity of seedlings. For instance, in Abi Adi nursery it was changed from 5-10cm to 5-6cm in 1997. It increased the productivity for about 27,000 seedlings more.
- Gereb Giba nursery has a solar pump to take water from the river and a 8000 litter tank. But in cloudy day its power downs and it takes 2-3 days to fill the tank with water. In addition that, workers have to transport water by hands because a flood in rainy season damages the pump. If we equip the pump we should consider its power and maintenance. They are requesting for a generator for the pump.

## 4.2 Size of the Nurseries

Area of each nursery is shown as follows. Here productive area means surface of the seedling beds.

Table 2. Size of the Nurseries

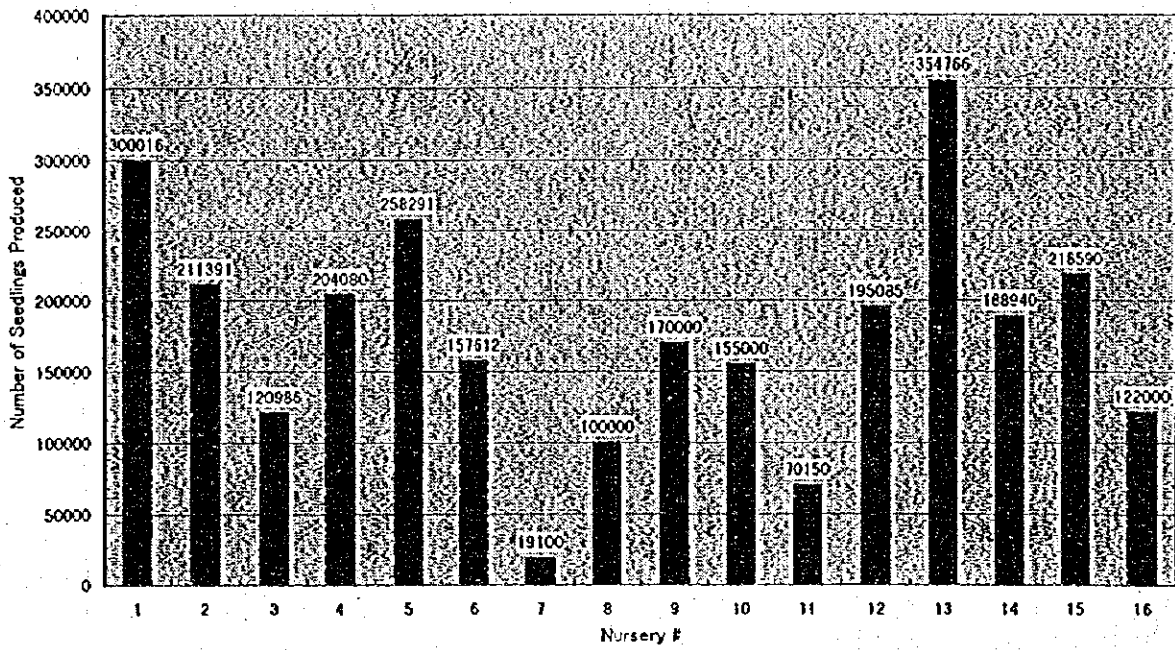
#	Nursery Name	Total Area (m <sup>2</sup> )	Productive Area (m <sup>2</sup> )	Pro. Area / Total Area (%)
1	Getsiky Meleslay	6800	957	14.1
2	Adiaha	2500	590	23.6
3	Galapada	1683	400	23.8
4	Gororo	2035	570	28.0
5	Timketkezze	9999	811	8.1
6	Begasheka	5395	1142	21.2
7	Abi Adi	2190	1158	52.9
8	Agibe	16305	1032	6.3
9	Mesgi	10000	630	6.3
10	Sheegaloo	12672	400	3.2
11	Gigika	2500	241	9.7
12	Maishih	4095	1375	33.6
13	Maizahla	10000	858	8.6
14	Maiwoinii	3205	520	16.2
15	Ruawoinii	10000	2304	23.0
16	Gereb giga	3300	840	25.5

As Table 1 shows, the size of productive area are different in each nurseries and vary. 9 nurseries have a productive area below 1000 m<sup>2</sup> and 5 nurseries have a productive area between 1000 m<sup>2</sup> and 2000 m<sup>2</sup>. Only one nursery has a productive area over 2000 m<sup>2</sup>. The average is 914 m<sup>2</sup>.

### 4.3 Possible Seedling Production

Total seedling production (Number of produced seedlings) in each nurseries in 1995/1996 in Fig 1. and target achievement are shown in Table 3.

Fig 1. Total Seedling Production in Each Nursery in 1995/1996



**Table 3. Total Seedling Production and Target Achievement in Each Nursery**

#	Nursery Name	Wareda Name	Target Achievement in 1996/1997
1	Getsiky Meleslay	Keyih Tekhli	270000
2	Adiaha	Keyih Tekhli	200000
3	Galapada	Keyih Tekhli	130000
4	Gororo	Kolla Tembien	211413
5	Timketkezze	Kolla Tembien	242030
6	Begasheka	Kolla Tembien	189413
7	Abi Adi	Kolla Tembien	189143
8	Agibe	Kolla Tembien	153030
9	Mesgi	Abergelle	100000
10	Sheegaloo	Abergelle	150000
11	Gigika	Abergelle	50000
12	Maishih	Doga Tembien	200000
13	Maizähla	Doga Tembien	280000
14	Maiwoinii	Doga Tembien	200000
15	Ruawoinii	Doga Tembien	260000
16	Gereb giga	Doga Tembien	270000
	Total		2299143

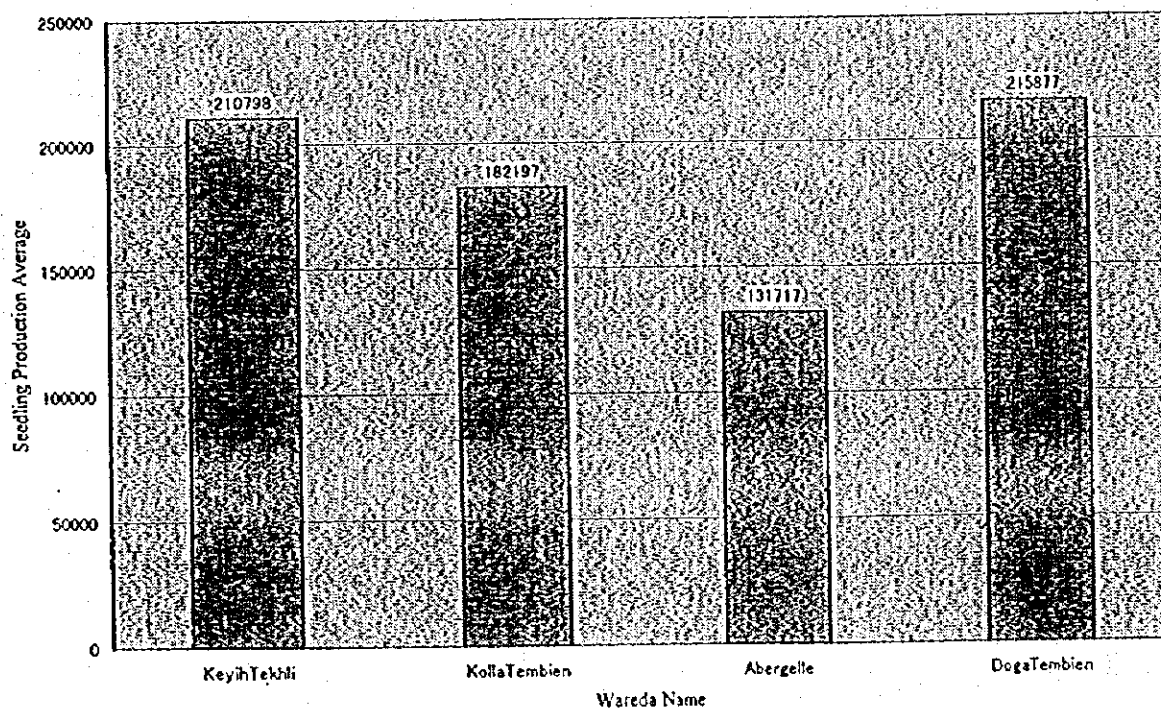
There are 4 wareda in Tembien area. Seedling production in each wareda is shown as follows.

Table 4. Total Seedling Production in Each Wareda in 1995/1996

#	Wareda Name	# of Nursery	Total Seedling Production in 1995/1996
1	Keyih Tekhli	3	632393
2	Kolla Tembien	5	910983
3	Abergelle	3	395150
4	Doga Tembien	5	1079381

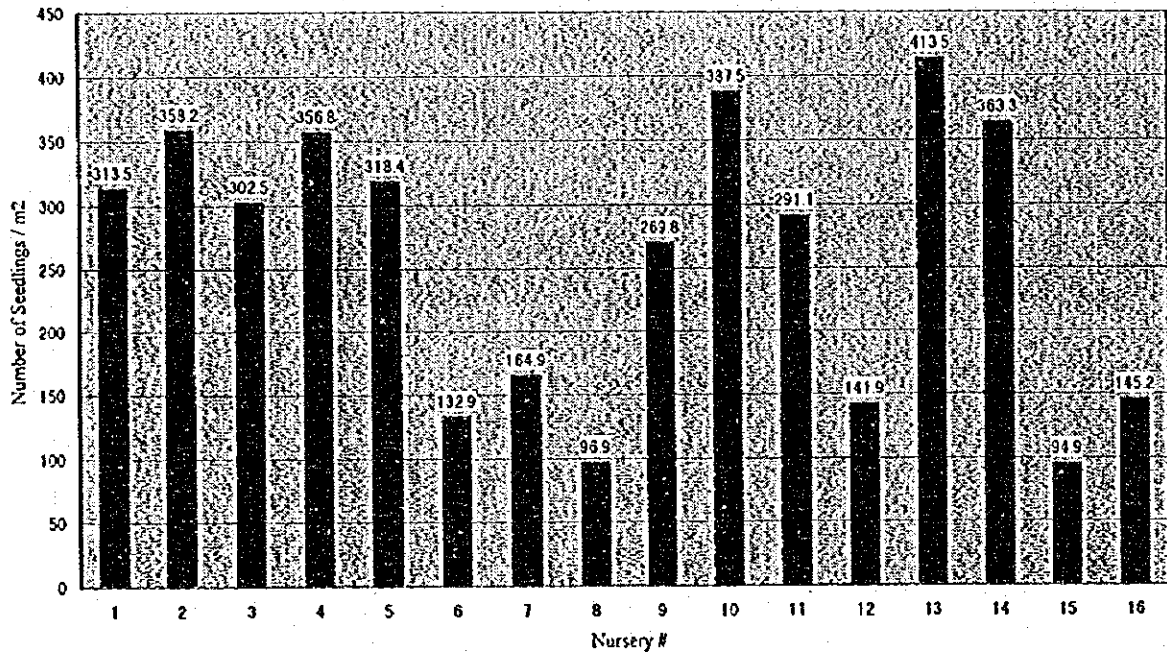
As Figure 2. shows, average seedling production (number of seedling produced / nursery) of Abergelle area is lower than others.

Fig 2. Seedling Production Average in Each Wareda  
(Number of seedling produced / nursery)



From the point of view of productivity, seedling production (number of Seedlings) / productive area in each nurseries are shown in Fig 3.

Fig 3. Seedling Production / Productive Area in Each Nursery



As Fig 3 shows, Maizahala nursery has the highest productivity (413.5 seedlings / productive area m<sup>2</sup>) and Ruawoini nursery has the lowest productivity (94.9 seedlings / productive area m<sup>2</sup>).

The average is 259.5 seedlings / productive area m<sup>2</sup>.

In most nurseries they are using tubes of 5~8 cm diameter. So we don't have to think much of the difference of the seedling number due to the difference of diameter.

Species produced in 1995/1996 and their number is shown as follows.

Table 5. Species and Total Production Number in 1996/1997

#	Scientific Name	Tigrigna Name
1	◆ <i>Acacia abyssinica</i>	Cheha
2	◆ <i>Acacia albida</i>	Aqba
3	<i>Acacia decurrens</i>	Acacha
4	<i>Acacia lahai</i>	Lehay
5	<i>Acacia etbaica</i>	Seraw
6	<i>Acacia melanoxylon</i>	
7	<i>Acacia saligna</i>	Lemlem akacha
8	◆ <i>Acacia seyal</i>	Cheha
9	◆ <i>Acacia tortilis</i>	Akiba, Aqba
10	◆ <i>Adansonia digitata</i>	Momret
11	<i>Albizia lebbek</i>	Nifasia
12	<i>Azadirachta indica</i>	Nim
13	◆ <i>Boswellia papyrifera</i>	Walba
14	<i>Casuarina equisetifolia</i>	Tsehede ferengi
15	<i>Chamaecytisus palmensis</i>	Tree lucern
16	◆ <i>Cordia africana</i>	Auhi
17	◆ <i>Croton macrostachylia</i>	Tambok
18	<i>Cupressus lusitanica</i>	Tsehdi
19	<i>Delonix regia</i>	Duredawa zaf
20	◆ <i>Dodonaea angustifolia</i>	Tahsas
21	◆ <i>Dombeya torrida subsp. Torrida</i>	
22	<i>Eucalyptus camaldulensis</i>	Keye bahir zaf
23	<i>Eucalyptus globulus</i>	Nech bahir zaf
24	<i>Eucalyptus grandis</i>	Keye bahir zaf
25	◆ <i>Ficus sycomorus</i>	Sagla, Shegla
26	<i>Jacaranda mimosifolia</i>	Jacaranda
27	<i>Leucaena leucocephala</i>	Lukina
28	<i>Melia azedarach</i>	Nim, Neem
29	<i>Moringa oleifera</i>	Shiferaw
30	◆ <i>Olea europaea var. africana</i>	Oleo africana

#	Scientific Name	Tigrigna Name
31	<i>Parkinsonia aculeata</i>	Syowit hegay
32	<i>Prosopis juliflora</i>	
33	◆ <i>Rhamnus prinoides</i>	Gesho
34	◆ <i>Sesbania sesban</i>	Seabania
35	<i>Schinus molle</i>	Tukr barbare
36	<i>Spathodea campanulata</i>	Cheke meblebal
37	<i>Spathodea nilotica</i>	Ababa zaf
38	◆ <i>Tamarindus indica</i>	Humer
39	◆ <i>Ziziphus mucronata</i>	Geba harmaz
40	◆ <i>Ziziphus spina-christi</i>	Geba

◆ Indigenous species



Fig. 4 shows the total seedling production for each species in 1996/1997.

As it shows, the 5 species most produced are

- 1) *Acacia saligna*
- 2) *Eucalyptus globulus*
- 3) *Melia azedarach*
- 4) *Dodonaea angustifolia*
- 5) *Eucalyptus camaldulensis*

*Acacia saligna* is a species most produced (516326). And *Eucalyptus globulus* is a species secondary most produced.

In total 652501 seedlings of *Eucalyptus* species which is 24.7 % of all are produced. In addition that, 644263 seedlings of *Acacia* species which is 24.4 % of all are produced. Almost half of seedlings produced are *Acacia* and *Eucalyptus* species.

Fig.4 Total Seedling Production for Each Species in 96/97 (1)

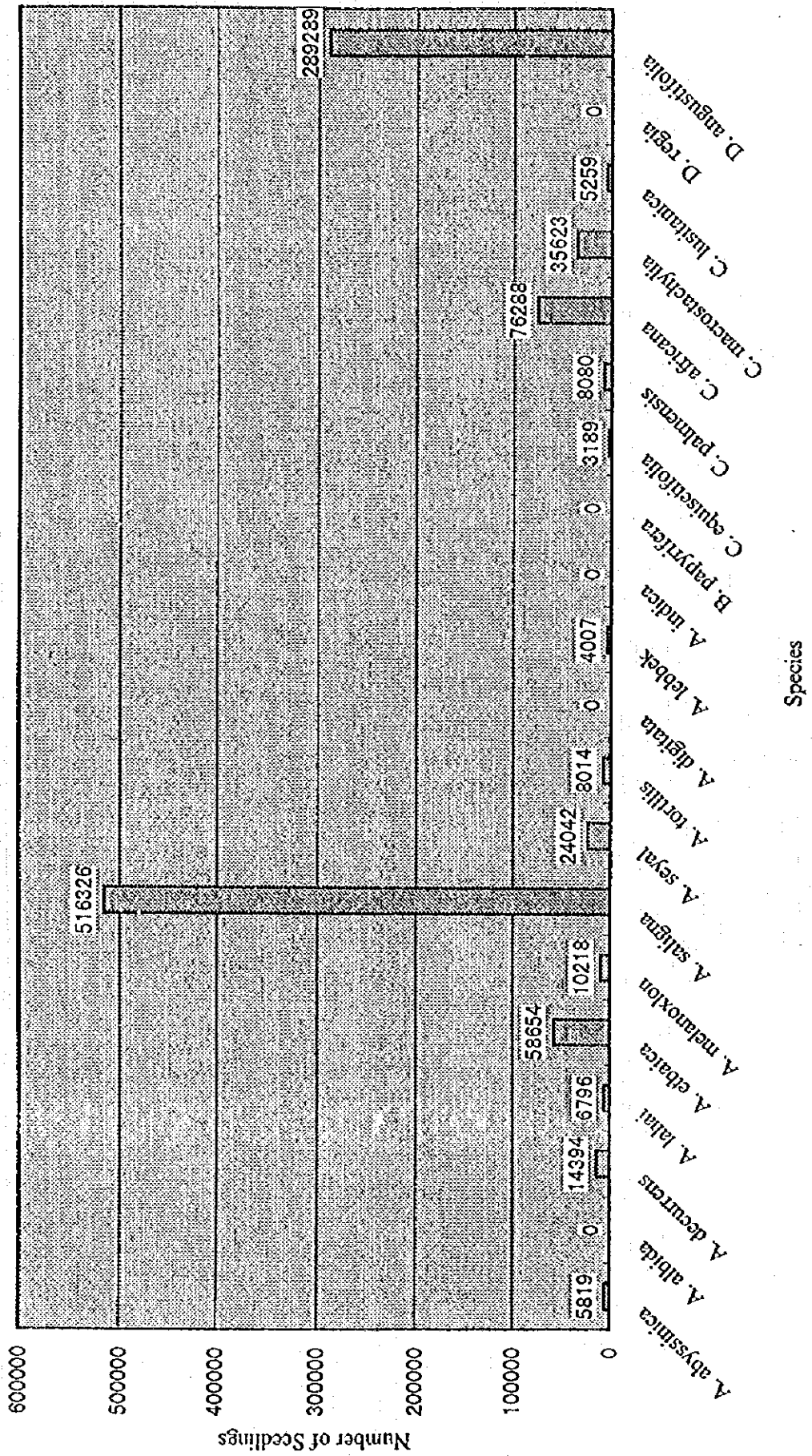


Fig.4 Total Seedling Production for Each Species in 96/97 (2)



## 4.4 Nursery Staff

### Composition and Aspect of Nursery Staff

- **Foreman :** Foreman is totally supervising the nursery operation and represent the nursery.  
1 for each nurseries  
They usually graduated grade 10 ~ 12 (High School) and have the experience of seedling production for 2 ~ 5 years.
  
- **Technician:** Technician is support the foreman and instruct the workers.  
2 ~ 3 technicians for each nursery.  
They also graduated 10 ~ 12 grade and have the experience of seedling production for 2 ~ 5 years.
  
- **Workers:** Employed by REST from nearby community, they are engage in the daily work for the seedling production in the nurseries.  
Number of the workers depends on the business of each operation. For example, 8 ~ 10 are employed when the preparation for the seedling bed and 30 ~ 36 are done when the potting.  
They are usually paid 3kg of wheat and 0.12 liter of oil / day as food for work, which was decided by WFP (World Food Program)

Nursery foremen and technicians are participating in the seminar held in cooperation with REST and BoANR once a year.

## 4.5 Nursery Operation

### -Size of the Pots

Using transparent and bottomless polyethylene tubes

Size when potting : Diameter 5~10cm · Height 8~18cm (different in each nurseries due to not standardized cutting)

### -Soil for Pots and Its Preparation

Using mixed soil of Forest Soil, Surrounding Soil, Cow Dung, Sand and Compost

Soil : Forest Soil is collected in closer mountain area and Surrounding Soil is done around the nurseries

Cow Dung : Cow Dung is purchased in Abi Adi or from peasants around the nurseries

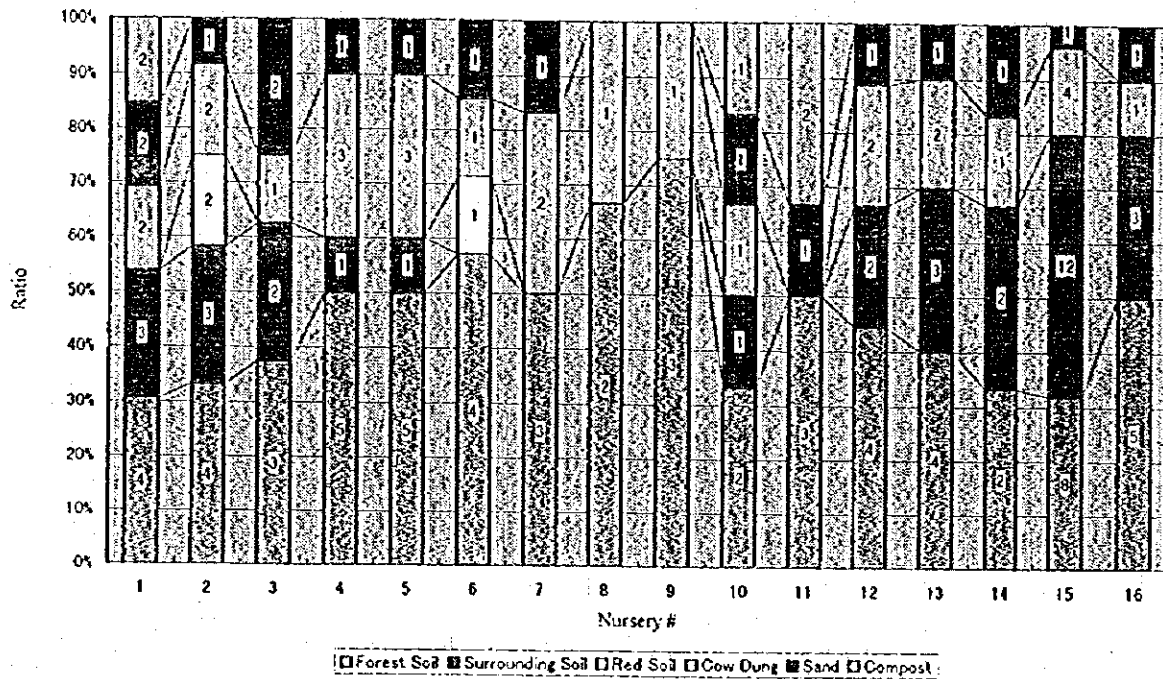
Sand : Sand is collected in rivers around the nurseries

Compost : Compost is produced in each nurseries originally

First of all, they sift those each materials and mix them according to the ratio. The soil mixture ratio is shown in the below-mentioned table. The difference of availability and properties of those materials in each nurseries causes different soil mixture ratio. When the mixture they use buckets or wheel barrows for measurements of the volume.

Soil mixture ratio are different in each nursery because of availability. They are shown as follows.

**Fig 5. Soil Mixture Ratio in Each Nursery**



As Fig 5 shows, there is no regulation for the soil mixture and it depends on improvisation for temporary availability and transportation.

In General, Main material is forest soil taken from places near each nursery. Some nurseries workers use surrounding soil, red soil, cow dung, sand and compost according to their situation.

The ratio of Adiaha nursery which has the highest point of seedling production / productive area is forest soil 33.3%, surrounding soil 25.0%, red soil 16.7%, cow dung 16.7% and sand 8.3%.

## 4.6 Tools and Equipment

For all the nurseries a complete inventory of tools and equipment has been excluded.

Total Number of tools and inventoried equipment are shown in Table 6.

Table 6. Total Number of Equipment

-->Nursery #   Item #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
1	9	10	10	5	10	24	5	10	10	24	8	9	6	7	7	18	172
2	10	10	5	6	10	2	2	5	5	11	5	3	2	7	6		89
3														1	1	2	4
4	3	1	1			1	2	2	2	2		3	3	1	2	4	27
5	3	1	1	1	2	1	2	1	1	2	1	2	1	2	1	1	23
6	13	15	7		10	15	12	10	15	12	10	8	5	5	8	7	152
7	2	15	5	9	11	22	5	14	3	9		7	2	4	6	3	117
8				4	2				1				1	1		2	11
9				4				2		2			1				9
10						4		1				2				1	8
11								2									2
12			8	1	2	3		1		1			3		3		22
13			8		17	27	14	16	4	5	8	15	17	15		3	149
14														1		1	2
15				17													17
16				11		22	4	9	5	21		3	4	3	3	2	87
17							1	4	3				2		3	3	16
18																1	1
19		2		2	2	2	3	4	2	2	1	4		4	3	1	32
20		1	1	1	2	1				2			1		1	1	11

To be continued to the next page

Nursery # Item #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
21				2		2	1	2				2		2	11	5	27
22		7		3			2					3	4	1			20
23				2	2	1	1	2	1							1	10
24	2		3			5	4	4	4	6			2		3	2	35
25					1	2								1			4
26								1	2								3
27							1					1	1	1	1		5
28				1	1		1	2									5
29																1	1
30									2								2
31			3			6	3	1			1	2	2	1			19
32						2		1					1	2	1		7
33				2		2		2									6
34				10													10
35								1	3								4
36								2	2								4
37		1								1			1				3
38	1	1				1	1	1	1	1					1	1	9
39															1	2	3

Item # and Items

1	Watering Can	2	Pruning Scissors	3	Hedge Scissors	4	Wheel Barrow
5	Measuring Tape	6	Shovel	7	Rake	8	Hammer
9	Nail Hammer	10	Small Hammer	11	Sledgehammer	12	Axe
13	Pick Axe	14	Cutting Ax	15	Hoe	16	Grasp Hoe
17	3-finger Hoe	18	Fork	19	Crow Bar	20	Saw
21	Bucket	22	Seedling Box	23	File	24	Sickle
25	Line Level	26	Slasher	27	Canvas Sheet	28	Weighing Scale
29	Sieve	30	Net for Soil	31	Plastic String	32	Nail Puller
33	Spade	34	Digging Hoe	35	Bow Saw	36	Calculator
37	Table	38	Chair	39	Shelf		



## 4.7. Office and Facilities

14 nurseries have their own office or storage. General office building usually has one office room and storage.

These offices are usually equipped one desk, chair, and coarse bamboo shelf only and they are not kept in order. In addition, foremen of nursery with no office are suffering from how to keep those equipment. They usually leave them beneath the shades or put them in the guards' house.

As mentioned in the last chapter, office and storage should be well-organized and strengthened as central part of nursery activities.

## 4.8 Location of the Nurseries

Tembien area has the area of about 1,000,000 km<sup>2</sup>

Most of the nurseries are located far from the main roads. Especially Galapada (Keyih Tekhli), Timketkezze (Kolla Tembien), Gigika (Abergelle) and Maiwoini (Doga Tembien) need 1 ~ 2 hours' drive or 30 minutes' waling. In addition that access roads are dangerous especially in the rainy season. It makes it difficult to transport nursery materials and sometimes give damage to the seedlings when plantation.

In the Annex 2, location map of the nurseries has been presented.

## 4.9 Water Supply System

There are two types of the Water Supply System.

- \* Transporting water by using buckets or watering cans from the water reservoir connected to nearby river with channel.
- \* Transporting water by using buckets or watering cans from the river around the nurseries directly.

Some nurseries have their own water reservoir in it but others don't. Even some existing water reservoirs has been cracked and getting weak. They should be repaired and strengthened.

## **5. Concept of the Improvement**

According to the result of the survey, the points and concept of improvement for nursery facilities in the fiscal year 1997/1998 should be mentioned as follows.

- 1) Provision of required equipment for nursery operation
- 2) Provision of shelves for organization of office work
- 3) Maintenance of existing offices and storage or new construction if no.
- 4) Maintenance of water reservoir

## 5.1 Provision of Nursery Equipment

Achievement and plan of GPPTT equipment provision from 1994 to 1998 is shown as follows

**Table 7. Equipment Provision of GPPTT**

● Fiscal year 1994/1995

#.	Item (Origin of Provision & Remarks)	Quantity
1	Wheel Barrow (Local : Made in China)	100

● Fiscal Year 1995/1996

#.	Item (Origin of Provision & Remarks)	Quantity
1	Watering Can (Third Country : Made in Sweden)	900

● Fiscal Year 1996/1997

#.	Item (Origin of Provision & Remarks)	Quantity
1	Hand Counter (Japan)	100
2	Seedling Box (Japan)	300
3	Small shovel (Japan)	200
4	Pruning Scissors (Japan)	100
5	Tape measure (Japan)	40
6	Weighing Scale / 10kg (Japan)	10
7	Weighing Scale / 20kg (Japan)	10
8	Diaphragm Sprayer (Japan)	5
9	Convex (Japan)	40

● Fiscal Year 1997/1998 (Plan)

#.	Item (Origin of Provision & Remarks)	Quantity
1	Tape Measure (Local : Made in Korea)	16
2	Calculator (Local : Made in Malaysia)	20

## 5.2 Construction and Maintenance

According to the concept 2), 3) and 4), 5 nurseries should be selected for the first improvement activity in 1997/1998. The reasons are

1. To be Comparably easy to access from Abi Adi.
2. To be functional even after the improvement activity as a model nursery.

Our achievement is to improve all of 16 nurseries to raise up the productivity and work efficiency until 2000.

**Table 8. Nurseries to be improved and its point**

#	Nursery Name	Office	Storage	Water Reservoir	Fence
1	Maizahala	Construction & Provision of Shelf	Construction & Provision of Shelf	Maintenance	Construction
2	Agebe	Provision of Shelf	Provision of Shelf	Maintenance	Construction
3	Mailemin	Provision of Shelf	Provision of Shelf	Maintenance	Construction
4	Gestki Mineselay	Provision of Shelf	Provision of Shelf		Construction
5	Bagashakha	Provision of Shelf	Provision of Shelf	Set up the Water Supply System	Construction

### 5.3 Improvement for Nursery Operation

From the result of this inventory survey report, experiments as follows should be suggested for further improvement for nursery operation.

- 1) Soil Analysis for Potting
- 2) Water Analysis for watering
- 3) Control Experiment for Shade

The reason and concept are described as follows.

- 1) Soil mixture ratio are different in all nurseries each other. They mix soil and other materials in improvisation according to the availability and favor.  
Exact data of soil has not been surveyed yet and relation between the appropriate mixture ratio and seedling productivity is still unclear. Therefore soil analysis is necessary for definition of it.
- 2) Exact data of water used in each nursery has not been surveyed yet. To define the appropriate quality of water, water analysis is necessary for definition of it.
- 3) Although shades made of local grass are used in each nursery, their quality is generally rough and low and it keeps quality of seedlings not standardized. In addition that, ratio of shading is also unclear. Therefore control experiment with different type of shading nets is necessary for definition of the appropriate shading ratio.

Equipment for those experiments are already requested by GPPTT in 1996/1997. They are shown in Table. 9 in the next page.

With these equipment, further improvement for nursery operation should be promoted for the future reforestation activities.

**Table. 9 Provided Equipment of GPPTT for Further Experiment and Survey**

◆ Fiscal Year 1996/1997

#	Item (Origin of Provision)	Quantity
1	Digital Luminance Meter (Japan)	1
2	Shading Net 40% (Japan)	1
3	Shading Net 70% (Japan)	1
4	Shading Net 80% (Japan)	1
5	Shading Net 50% (Japan)	1
6	Soil pH Meter (Japan)	3
7	Soil Auger (Japan)	2
8	Soil Hardness Tester (Japan)	2
9	Saline Tester (Japan)	1
10	Reagent for Saline Tester (Japan)	1