



**ENHANCING RURAL LIVELIHOODS  
IN MALAWI, TANZANIA AND MOZAMBIQUE**

**ANNUAL TECHNICAL REPORT: JULY 2005 TO JUNE 2006**

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*A Program Implemented by Washington State University and Total Landcare  
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## **EXECUTIVE SUMMARY**

In November 2005, Washington State University and Total LandCare received funding from Philip Morris International for a 5 year program to enhance the livelihoods of rural communities in Malawi, Tanzania and Mozambique where a large percentage of households live below the poverty line. The program involves an integrated approach to address diverse community needs for greater and more sustainable impacts arising from the synergy of diverse interventions. These include various forms of tree planting, conservation of natural resources, irrigation of high value food and cash crops, and provision of safe water and eco-sanitation.

### **Purpose**

The goal is to improve the livelihoods of targeted communities through the following objectives:

1. Improve the economic use and management of natural resources on a sustainable basis with reduced soil and forest degradation focusing on the following:
  - Various forms of tree planting concentrated at the household level for ownership.
  - Sustainable management of natural woodlands.
  - Fuel-efficient tobacco curing barns and kitchen stoves to reduce wood consumption.
  - Planting local bamboo to replace wood for many products and uses.
2. Increase and diversify farm productivity to improve household food security, nutrition, and incomes through low-cost, sustainable systems of irrigation linked to good markets.
3. Enhance village and household health standards by introducing safe water and sanitation.

### **Project Management and Extension Approach**

Programs in each country are managed and administered through WT Bunderson and ZD Jere with funds channeled via WSU. New personnel are being recruited to handle the expanded scale and geographic scope of the project. Other services are being supplied from TLC headquarters in Malawi to help with project setup needs in each country and to assist with field operations, training, accounting, reporting, monitoring and evaluation. The project is using an integrated approach to empower communities to take responsibility for improving their livelihoods through intensive training and extension services. Field technicians support and participate in the establishment and management of all practices with farmers so that activities are conducted correctly and in a timely manner. The appeal of this approach lies in the synergistic nature of the interventions promoted to ensure greater impact and sustainability.

### **Results to Date**

With the late start of the project in terms of the seasonality of forestry and irrigation, and with no physical and legal status to operate in Mozambique and Tanzania, activities concentrated on:

1. Organizational and procurement needs to establish effective operational frameworks in each country, including formal applications for registration in Tanzania and Mozambique.
2. Comprehensive assessments of forestry, irrigation and water potentials with reviews of tobacco programs, recommended improvements, site selection and areas for collaboration,
3. Results of a scaled-down program in Malawi with TLC's existing infrastructure included a) 1.55 million tree and bamboo seedlings, b) conserving 27 ha of natural woodlands, c) introducing irrigation to 1528 households; and d) improved wood stoves to 193 households.

## **2005/06 WORKPLAN RESULTS**

### **Introduction**

This report describes activities carried out between November 1 2005 and June 30 2006. The original timeframe of October 2005 – March 2006 was extended by 3 months due to delays in TLC's registration in Mozambique and Tanzania – delays that would affect Year 2 activities.

Approval and funding of the project was granted by PMI in November 2005. Bank accounts were established by WSU in Pullman and by TLC in Malawi to manage and account for project funds. A total of US\$1 million was received by WSU for the 2005/06 workplan against a budget of \$922,168. The balance of \$77,832 will be carried forward to Year 2.

Planning and implementation activities in Malawi were facilitated by TLC's existing infrastructure and staff. Adjustments were needed to accommodate the increased scale and geographic scope of this project. As specified in the 2005/06 workplan, field programs were limited to a scaled-down forestry and irrigation plan in Malawi. This was due to the late start of the project in terms of the forestry calendar, and the onset of irrigation season in May 2006.

The situation in Tanzania and Mozambique was quite different. With no physical presence or legal status in either country, planning and organizational needs had to be orchestrated from Malawi. This involved frequent travel to both countries using staff and resources from Malawi, as well as support and collaboration from the country offices of Universal, Alliance One and ATTT. As a result, activities centered on establishing 1) the infrastructure needed for planned programs in 2006/07, and 2) developing agreements for collaboration with tobacco companies.

### **Registration of TLC in Tanzania and Mozambique**

The process to register TLC as a non-profit, non-government organization in Tanzania and Mozambique was slower than anticipated due to Government bureaucracy. This involved:

- a) Submission of legal documents on TLC's constitution and board of trustees with details about TLC's status in Malawi, including copies of its registration and NGO licenses,
- b) Names, positions, functions and CVs of all trustees.
- c) Proposed plan of work and budget for 3 years.
- d) Letters of reference and support from PMI, relevant Government Ministries, and the Tobacco Authority in all 3 countries.
- e) Frequent communications by phone, mail and in person for explanations and notarized signatures on legal documents to clarify TLC's status and proposed plan of work.
- f) Fees to firms for assistance in legal and communication matters, and to the Government's Registrar's office for processing the applications.

The Mozambique application was approved by the Governor of Tete Province on August 15, but authority to operate is still pending. The Tanzania application had to be re-submitted with modifications on the constitution for conformity with the Societies Ordinance Act. Formal approval is expected from both countries by end of September, but further delays are possible.

### **Duty Free Privileges**

Once officially registered, TLC will submit applications as an NGO for duty-free privileges in both countries. However, the privileges extended to NGOs in Tanzania are under review due to documented abuses. This could delay the process, and affect the privileges granted.

## **Collaborative Agreements with Tobacco Companies**

Close collaboration between TLC, Universal Leaf and Alliance One is critical in all countries given the common goal of improving the livelihoods of people involved with growing tobacco and the related problems of deforestation. The opportunities for such collaboration are excellent as each party has unique contributions to make: TLC has vast experience in promoting forestry and irrigation at the village and household level, while the tobacco companies have extensive operational networks in each country with organized groups of farmers.

TLC's contribution to the partnership is as follows:

1. Technical reviews of tobacco forestry programs with recommendations to improve extension approaches, species selection, nursery operations, outplanting practices, tree management and harvesting (Bunderson 2004, Bunderson & Jere 2005; Bunderson 2006). This included recommendations on other interventions to tackle deforestation in ways that complement tree planting, notably:
  - Using bamboo to replace wood for many uses.
  - Managing natural trees and woodlands on a sustainable basis.
  - Promoting improved tobacco barns and wood stoves to decrease wood consumption.
2. Collaborative agreements on how to divide up the responsibilities for forestry in a mutually beneficial manner with mechanisms to share ideas, experiences and resources in order to promote harmony and synergy for greater impact.

On their part, the Tobacco Companies have offered assistance with field visits, transport and other logistics, access to facilities such as office and storage space, and collaboration in identifying suitable sites and primary societies (tobacco clubs) for the project to target as an integral part of their network.

**Annex 1** contains a summary of TLC's approach and recommended interventions.

## **Site Selection and Feasibility Assessments**

Feasibility assessments of forestry, irrigation, water and sanitation were conducted in each country with an evaluation of suitable sites for each intervention (see Bunderson 2006). This led to the development of country-specific workplans and budgets (see Volume II of this report).

Site selection in all the 3 countries was done in consultation with key tobacco companies to ensure good collaboration in major tobacco growing areas:

1. **Malawi:** Districts selected increased from 6 to 8 as follows: Rumphi and Mzimba (North); Kasungu, Dowa, Lilongwe and Dedza (Central); Machinga and Blantyre (South).
2. **Tanzania:** Urambo and South Nzega in Tabora were selected based on the following:
  - ◇ These are important tobacco growing areas with potential for expansion.
  - ◇ Support for forestry, irrigation, water and sanitation is urgent in these areas.
  - ◇ All 3 companies have a strong presence in Tabora, including the headquarters of ATTT.
3. **Mozambique:** Selected sites were chosen in consultation with Mozambique Leaf Tobacco Company (MLTC), and fall within a key tobacco area along the Mozambique-Malawi border encompassing the Districts of Angonia, Macanga and Chifunde of Tete Province.

## **Staff Recruitment**

1. **Malawi:** 3 Forestry Technicians were recruited in November 2006. Additional staff were recruited in May 2006, specifically a Project Manager, 4 Forestry Technicians and 3 Irrigation Technicians. All technicians have been posted to specific district sites. The Project Manager is based at the TLC Headquarters in Lilongwe and is responsible for supervising field activities in all 8 districts.
2. **Tanzania:** Interviews were held with 8 candidates in Tabora to recruit 1 Project Manager, 3 Forestry Technicians, and 1 Irrigation/Water Engineers. 20 other applications are under review for additional interviews. Recruitment will proceed with clearance for ATTT to manage the staff on behalf of TLC until registration requirements are complete.
3. **Mozambique:** Of the 10 candidates interviewed, 4 will be recruited soon. In addition, a TLC technician from Malawi will be relocated to Mozambique. As an interim measure, the program is being managed from the Malawi office through MLTC and World Agroforestry Center - Mozambique (ICRAF).

## **Office Construction**

Rather than renting offices, a decision was made to build small field offices within the compounds of Tobacco Companies to facilitate communications and collaboration. It will also save the cost of renting offices over the long-term. Offices have been completed in both countries: within the ATTT headquarters at Tabora in Tanzania, and within the compound of Mozambique Leaf Tobacco Company at Village Ulongue in Mozambique. The Tobacco Companies will provide access to a range of facilities at nominal fees for electricity, water, email, workshop services, and warehouse space for storing goods.

## **2005/06 FIELD RESULTS - MALAWI**

**Table 1** shows results against targets with detailed narratives as follows:

### **Training**

The following training courses were conducted:

- A 5-day irrigation training course for 10 project staff and 18 counterparts from Government and NGOs. Topics covered included: assembly, use and maintenance of irrigation equipment; plot layout; river diversion; vegetable nursery management; crop husbandry; extension approaches; and smallholder micro-financing.
- A 5-day forestry and ecological sanitation course for 10 project staff and 24 Government and NGO counterparts. Topics included: site/catchment planning procedures; soil and water conservation, nursery management and outplanting; agroforestry practices; kitchen mud stoves; and ecological sanitation.
- Practical training courses for communities at selected villages in all district sites. Topics included leadership skills and group dynamics; development of village-based action plans; nursery management and outplanting; conservation of village forest areas; kitchen mud stoves; irrigation technologies and crop husbandry practices.

**Table 1: 2005/06 Field Results for Malawi Program**

	Target	Result	% Achieved
<b>Participation</b>			
Districts (#)	6	7	117
Villages (#)	300	452	151
Participating households (#)	7,500	8,185	109
% Female participation	35	61	174
<b>Forestry Program</b>			
Nurseries (#)	300	302	101
Bamboo Seedlings (#)	100,000	116,561	117
Tree seedlings (#)	1,900,000	1,454,236	77
<b>Outplanting &amp; Conservation of Natural Trees</b>			
Homesteads/Farms/Boundaries (# trees)	1,600,000	671,690	42
Communal Lands (# trees)	200,000	566,667	283
Live Barns (# trees)	25,000	0	0
Stream Banks and Soil Fertility (# trees )	75,000	78,243	104
Bamboo Planting (#)	100,000	101,759	102
Fruit Trees (#)	300	300	100
Natural Tree Regeneration/Protection (ha)	60	27	45
<b>Improved stoves</b>			
Villages (#)	25	25	100
Households (#)	250	193	77
<b>Winter Irrigation *</b>			
Treadle Pumps			
Clubs (#)	200	103	52
Households (#)	1,500	747	50
<b>Stream Diversion</b>			
Sites/Clubs (#)	52	43	83
Households (#)	500	781	156
<b>Water and Eco-Sanitation **</b>			
Shallow Wells with Hand Pumps		Targeted for 2006/07 (see proposal) due to needs for thorough feasibility assessments and time required for the shipment of handpumps from India	
Villages (#)			
Households Impacted (#)			
Shallow Wells Installed (#)			
<b>Eco-Sanitation Pit Latrines</b>			
Villages (#)	0	10	Not Planned
Households Mobilized (#)	0	53	Not Planned

\* Winter irrigation results are lower than targeted because the program started only in May 2006 but will continue to November so results will increase.

\*\* Water and eco-sanitation activities are targeted for 2006/07 and the equipment needed will be purchased in late 2006 using funds carried forward from 2005/06.

## Forestry Program

1. **Resources and Staff:** Resources were purchased with the recruitment of 3 new Forestry Technicians to ensure implementation of a tree program this season
2. **Site Selection:** Sites were selected in the Districts of Kasungu and Blantyre involving the participation of over 452 villages and 8,185 farmers (see **Table 1**). Results exceeded targets due to increased demands by communities as well as dedication from TLC field staff.
3. **Tree Nurseries:** 302 nurseries were established with 1,454,236 seedlings (**Table 1**). Numbers were reduced from the original target of 2 million due to the following factors:
  - ◇ The late start of the forestry season (nursery operations need to commence in August/September for seedlings to be ready for outplanting in December).
  - ◇ Poor rains limited water for nurseries, and caused serious food shortages, especially in Kasungu sites. This affected nursery work due to low nutrition and energy levels, not to mention the time devoted searching for food.
4. **Tree Outplanting & Management:** 1,316,600 trees were planted, representing 91% of the seedlings raised. Factors stated above affected the planting rate, but the results are satisfactory under the circumstances.
5. **Natural Tree Regeneration:** Villagers were encouraged to designate village forest areas for conservation as part of their heritage and to provide a wide range of woodland products. A total of 27 hectares were demarcated for this purpose against a target of 60. The area is expected to increase since most villagers have expressed great interest in this practice.
6. **Planting of Local Bamboo:** Based on successful research by TLC on using seed for propagating bamboo, 116,561 seedlings were raised from which 101,759 were outplanted. This result demonstrates a high level of interest by farmers, although performance after outplanting needs to be monitored before this program is scaled-up.
7. **Improved Wood Stoves:** By the end of June 2006, 193 households in 25 villages were using improved kitchen mud stoves against a target of 200. Kitchen mud stoves are in high demand among villagers, especially women. TLC is working with the GTZ-funded Program on Biomass and Energy Conservation (PROBEC) to evaluate a wide range of low cost stoves. These include the kitchen mud stove, "changu", portable clay stoves and household rocket stove. The "changu" stove has a fuel saving efficiency of over 70%. Key to the promotion of the stove is the concept of good kitchen management which includes sanitation, ventilation and preparation of nutritious food.

## Irrigation Program

Good progress has been achieved with the irrigation program in all sites as described below.

1. **Treadle Pump Irrigation:** TLC is promoting a new pump called "MoneyMaker Plus" manufactured by Kickstart, an NGO based in Arusha, Tanzania, with other plants in Kenya and mainland China. The pump is popular among farmers, especially women as it is easy to operate. A total of 747 households were participating in treadle pump irrigation by the end of June 2006 (**Table 1**). More households are very interested but distribution was hampered by delays in shipping pumps from Tanzania. This was caused by the cumbersome procedure of transferring funds in foreign currency out of Malawi. The arrangement has since improved as payment is being made by WSU direct to the vendor.

2. **Stream Diversion:** A total of 43 sites involving 781 households were participating in stream diversion by the end of the reporting period. The sites are served by canals totaling 35 km in length which irrigate a variety of crops. As shown in **Table 1**, this was the most successful program for the year. The practice is low cost in terms of equipment and materials, although farmers must invest considerable labor to construct the canals and layout their gardens.

## **Safe Water and Ecological Sanitation**

1. **Safe Water:** Clean water is clearly an urgent need in all district sites as most water points are either contaminated or too far from human settlements. The project is addressing this problem by introducing covered shallow wells equipped with hand pumps that are easy to install and maintain by the villagers. Two strategies will be used: The first is to rehabilitate existing hand-dug wells that have a good supply of water but which are not properly protected. The second strategy is to identify sites suitable for installing new wells.

The program is currently conducting feasibility surveys during this dry season to determine the quantity, quality, depth and reliability of water for meeting village needs. To keep costs low, pumps are being ordered direct from manufacturers in India as opposed to purchasing the same model from Malawi suppliers who markup the price by as much as 100%. The plan is to establish 80 wells across project sites during the 2006/07 season.

2. **Ecological Sanitation:** This technology complements the provision of safe water to reduce health risks from common water-borne diseases. The approach involves training local artisans to build dome-shaped concrete slabs for covering the pits. Villagers pay the artisan for the slab, the cost of which is about US\$5. The business generated helps to promote the technology.

This intervention is planned for 2006/07 to provide time to train field coordinators, a process now been completed (see training above). To-date, 10 villages have been identified and 53 households mobilized for constructing eco-pit latrines.

## **Maize Planters and Liming Program**

Funding for this program is provided through WSU for implementation by Alliance One International with contracted tobacco growers. The aim is to improve tobacco and maize yields as well as labor efficiency and crop spacing as part of the program on good agricultural practices (GAP).

During the 2005/06 season, the project made payments to Alliance One International for this program totaling US\$ 18,804 for Tanzania, US\$ 86,274 for Malawi and US\$ 28,979 for Mozambique (see **Financial Expenditure Report** below).

A full report of the program and its results is to be supplied by Alliance One International.

## **REFERENCES**

Bunderson, W.T. 2004. Tanzania Leaf Tobacco Company: Trip Report on TLTC'S Reforestation Program. December 2004.

Bunderson, W.T. and Z.D. Jere. 2005. Project Proposal submitted to PM International for Enhancing Rural Livelihoods. August 2005.

Bunderson, W.T. and Z.D. Jere. 2005, 2006: Trip reports on MLTC's reforestation program. (May, August and September 2005; January, March and April 2006)

Bunderson, W.T. and Z.D. Jere. 2005. Trip Report to Tanzania November 25-December 2 2005. PMI Project Report on Enhancing Rural Livelihoods. December 2005.

Bunderson, W.T. 2006. Trip Report to Tanzania January 22-27, 2006. PMI Project Report on Enhancing Rural Livelihoods. February 2006.

Bunderson, W.T, B. Bijl and J. McGill. Assessments and recommendations for 2006/07 programs of forestry, irrigation and safe water in the Tabora Region of Tanzania. PMI Project Report on Enhancing Rural Livelihoods. May 2006.

## **ANNEX 1: INTERVENTIONS TARGETED**

### **PROJECT APPROACH AND EXTENSION STRATEGY**

- ❖ TLC uses an integrated approach to empower communities to take responsibility for improving their livelihoods through intensive training and extension services. Field staff will support and participate in the establishment and management of all practices with farmers so that activities are conducted correctly and in a timely manner.
- ❖ The appeal of this approach lies in the synergistic nature of the interventions promoted to ensure sustainability. In this context, communities and households benefit directly through increased crop and wood yields, more productive use of labor, and opportunities to increase incomes by developing enterprises from agricultural and natural resource products. The results will lead to growing demands among communities within and outside project sites to participate in different components of the program under the following strategy:
- ❖ Improve efficiencies by the following practices:
  - Combine tree and bamboo seedlings in the same nurseries with similar management techniques – sowing, watering, weeding, thinning, root pruning, hardening etc.
  - Locate tree nurseries next to tobacco seedbeds for easy access to water and irrigation equipment (treadle pumps/watering cans), labor efficiency in watering and caring for seedlings, and supervision / monitoring by field staff.
- ❖ Establish collaborative agreements with interested Government entities and Tobacco Supply Companies in targeted areas to support and complement extension services.
- ❖ Liaise with Government Agencies on the need to revise / strengthen policies and related enforcement on a) indiscriminant cutting of indigenous trees, and b) land tenure issues that promote shifting cultivation and related impacts on deforestation.
- ❖ Programs will be serviced by forestry and irrigation technicians, each responsible for a concentrated cluster of clubs and households to facilitate training and extension support:
  - Each forestry technician will coordinate the production, planting and management of trees by clubs and households, initially involving 500,000 trees with 2500 farmers, each growing an average of 200 trees. Over time, this number will grow to 300+ trees/farmer as they become experienced in management.
  - Irrigation technicians will be responsible for extension and training support farmers organized in groups for watering their tobacco seedbeds and tree nurseries, and for irrigating food and cash crops during the winter or off-season. They will also identify and rehabilitate shallow wells and installing new ones to provide safe water with an aggressive campaign to promote eco-pit latrines.
- ❖ Intensive support will be provided for 1-2 years with the aim of developing the capacity of communities to become self-sufficient. Thereafter, support will be scaled down to an advisory level with communities responsible for maintaining and expanding the program.
- ❖ The scale of the program will be expanded by leveraging the resources of selected NGO partners who are interested in receiving technical/training support from TLC.
- ❖ Impacts will be greater and more visible due to the synergistic effects of involving the collaboration of many villages and traditional leaders under a common goal.
- ❖ Results will attract interest from other service providers and neighboring communities.

## **FORESTRY PROGRAM**

Forestry interventions proposed are those in high demand with proven results from past WSU and TLC projects, among which include: the Malawi Agroforestry Extension Project (MAFE), the Village Irrigation and Forestry Project (VIFOR), the Agroforestry Partnership Project (APP), the Community-Based Forestry Project (COBAF), the Chia Lagoon Watershed Management Project and the Integrated Child Labor Elimination Project (ICLEP).

The challenge of deforestation will be tackled on 5 fronts:

1. Tree planting with a focus at the household level to promote greater interest and ownership for meeting wood requirements for curing tobacco as well as fuel and building material for domestic uses.
2. Bamboo planting to replace wood for tobacco sticks, roofing material on barns and houses, granaries, and other domestic uses.
3. Improved tobacco barns for curing and grading.
4. Improved kitchen stoves for cooking and heating.
5. Sustainable management and use of natural forests and trees.

The first 2 of these (tree and bamboo planting) do not have immediate effects on deforestation due to a lag time of 3-6 years between the time of planting and harvesting. Planting programs are also expensive and prone to high risk due to drought, disease, fire, damage from termites and animals, and poor management at various stages of the cycle – species selection, nursery care, time and method of outplanting, protection and harvesting.

In contrast to the above, and contrary to prevailing perceptions, the last 3 interventions can have immediate and dramatic effects on reducing deforestation. The reasons are simply due to impacts from lower rates wood of consumption, less destructive methods of harvesting trees, and practices to encourage tree regeneration.

A brief description of each intervention is provided below.

### **1. Tree Planting**

Communal approaches to tree planting have a history of failure in Africa, and therefore will receive limited attention in this program. Based on this and the need to foster ownership over the program, tree planting will focus at the individual rather than communal level where ownership and access to the trees is unclear. This approach is supported by the interests expressed by most farmers interviewed over the past 12 months. It also allows outplanting in a manner that fits within the work schedule of the farmer.

Details on species selection, nursery practices, outplanting techniques and recommended types of tree planting are provided below.

#### ***General Management***

- **Focus on Individual Planting:** The concept explained above will not only promote ownership and responsibility among communities for sound forestry practices but it will also reduce or eliminate the high cost of managing central nurseries.

The move to farmer or group owned tree planting programs has numerous benefits:

- Farmer ownership will lead to better care and attention in planting and management.
  - Nursery labor and transport costs will decline by transferring these to farmers.
  - Damage and losses from transporting seedlings over long distances will decline along with subsequent handling problems.
  - Farmers will have greater flexibility to outplant at convenient times.
  - Water supply problems will ease by operating small vs. huge central nurseries.
  - Recycling poly-tubes will be easier when done individually.
- **Promote demonstration farms and model farmers:** These are excellent ideas to promote good practices, but to be effective, attention is needed to ensure that the practices demonstrated are of the highest possible standard.
- **Forestry Technicians** should each start their own demonstration program by selecting a club in each area to establish a nursery next season. Initiate the process by sensitizing clubs as soon as possible.
- **Involve Leaf Technicians** with tree planting by Contact Farmers to assist in providing training and sound extension messages to other farmers.

### **Species Selection:**

Reduce or eliminate all Eucalyptus and Australian acacias (*A. crassicaarpa* and *A. mangium*) from the program due to susceptibility to drought, termites, pests, fire, and livestock. Other concerns with these species include a) the spreading infestation of blue gums by a new chalcid wasp, b) negative impacts of Eucalyptus trees on soil nutrients and water, and c) the inability of the Australian acacias to coppice, which means that replanting is needed after every harvest. Although these species are very fast growing under the right conditions, they require much care and attention. Under typical smallholder conditions in East and Southern Africa, we need trees that require little care and attention – i.e. “low maintenance species” because that is the reality on the ground.

Based on these problems, the need is to target species that have proved to perform well under a wide range of conditions with low levels of management. The most desirable species are fast growing trees that coppice well, produce good fuel, are compatible with crops, and protect the integrity of the environment – its, soils, water, flora and fauna.

Species with these traits include *Albizia lebbeck*, *Senna siamea* and *Acacia polyacantha*. If adequate quality seed can be sourced, TLC also advocates *Azadirachta indica* (neem) and *Albizia procera*. While promoting these trees as core species, a range of other promising trees can be compared with them in selected trials. All things being equal and taking into consideration all sites regardless of management problems, such as poor or late outplanting, the ranking of tree species is as follows:

- ***Albizia lebbeck* and *Senna siamea*** – both species showed reasonable rates of survival of 60-90%, fast growth, drought tolerance, and resistance to disease, termites and other pests. *Senna* is also unpalatable to livestock. Both species are well known and liked by farmers.

- ***Acacia polyacantha*** – showed high rates of survival of 70-90%, drought tolerance, and resistance to disease, termites and other pests. Early planting of healthy seedlings led to excellent survival and growth. The main problem observed is die-back of the main stem from seedlings that had overgrown in the nursery. The result leads to new shoots at the base, which need thinning. This problem can be managed at the nursery by the following measures: a) eliminate all shade from time of sowing; b) maintain frequent root pruning of once per week; c) harden the seedlings early (after the 1<sup>st</sup> month) by reducing watering rates and levels, without causing the plant to wilt. The aim is to produce a seedling about 30 cm tall with a stem diameter of 0.5-0.6 cm.
- ***Acacia crassicarpa*** – low to moderate rates of survival (20-70%, with low resistance to termites, drought and fire. The main problem with *A. crassicarpa* is heavy damage from termites.
- ***Eucalyptus species*** – low rates of survival, varying from 5% to 90%, averaging 40-50%. Main problems are susceptibility to drought, fire and livestock, and low resistance to termites, pests and diseases, which includes infestation by the blue gum wasp (chalcid).

### **Management of Nurseries**

- **Size of Seedlings:** Overall, many seedlings planted were small, suggesting late nursery establishment or replanting due to the late rains, possibly combined with poor nursery soils and management. Small and/or young seedlings raised in small tubes are more vulnerable to damage during transport, and will be less able to cope with harsh conditions when outplanted in the field.
- **Root pruning** was generally well done, but for *Acacia polyacantha* and *Albizia lebbbeck*, root pruning needs to be carried out weekly e.g., every Monday.
- **Hardening off:** Seedlings need to be properly hardened during the last month in the nursery so that they are well equipped to withstand hot, dry conditions when outplanted. Key guidelines are 1) do not use shade in nurseries, 2) reduce watering gradually from twice per day to once every 2 days. If the rains are late and seedlings become overgrown, cut watering to the bare minimum (without causing damage) and root prune more frequently – this is basically the same principle used for tobacco nursery seedlings.

### **Type and Location of Outplanting**

- **Homestead Planting:** Planting trees on boundaries and in small woodlots around homesteads is highly popular since proximity to the home allows for proper tree care. A variety of exotic and indigenous species will be targeted for different uses: fuelwood, building material, timber, fruits, shade, medicines, oils, animal fodder and income.
- **Interplanting with Crops** is recommended for the first 1-2 seasons to ensure good survival and growth from the care and attention given to the crop - benefits include uptake of fertilizer applied to the crop, and protection from weeds, animals and fire. After the trees are well established, crops can be moved to other land. This practice improves labor efficiency in managing trees, and optimizes use of scarce land. Harvesting wood can begin in year 6 in a sequential rotation linked to the year of planting. The need for replanting is low due to the good regenerative abilities of the species selected.

## **Outplanting Practices**

- **Late planting** was a common problem but caused in large part by the late onset of the rains, and aggravated by the difficulties that farmers face in balancing priorities to plant their food and cash crops vs. trees. Seedlings planted early suffered severely from the subsequent dry spell, while those planted in March have little time to develop a root system strong enough to withstand the coming dry season. Timely planting is the **single most important factor** affecting tree survival and growth.
- **Deformed roots:** J-shaped roots were frequently observed, especially among blue gum seedlings, resulting from bending the roots when transplanting - either from seed beds to nursery pots, or from pots to field pits when outplanting. The result leads to poor root development with increased risk of mortality, especially after dry spells.
- **Pit size:** Pitting was too small and shallow; most holes appeared to be made with one whack of a jembe. Pits should be at least 30 cm in diameter and 30 cm deep. This is a **vital factor** for good survival and growth.
- **Heeling in and Removal of Tube:** Many seedlings were not heeled in properly to remove air pockets for good root-to-soil contact – the results cause roots to dry up with at risk of death. Removal of the tube from the seedling is critical. This is best done by 1) placing the seedling in position within the pit, 2) filling soil half way up the pot, and 3) pulling the tube over the seedling. This keeps the root ball intact.
- **Infestation of the new gum wasp** (chalcid species) was observed among young blue gums. This is a serious problem that may become more acute as the pest multiplies. It causes the formation of galls in young leaves and shoots, which retards growth and development, with the risk of mortality among young seedlings. Gall-infestation from this wasp is most severe in *E. camaldulensis*, but was also observed in *E. tereticornis* and *E. grandis*. *E. citriodora* appears resistant to the wasp, perhaps from its lemon aromatic compounds, but this resistance may change as the wasps find other hosts.
- **Mortality rates:** In the areas visited, mortality rates of outplanted seedlings this season ranged from 30-60%. Mortality of seedlings planted the year previous ranged from 40% to over 95%. The best survival was observed in lowland areas where there was better soil moisture and lower risk of termites.

## **Losses and Damage from Transport with Company Trucks:**

Aside from the high and unsustainable costs of using company trucks to transport seedlings from nurseries to outplanting sites, the resulting losses and damage are substantial:

- **During transport:** Seedlings suffer considerable damage from transport on rough roads and for long distances, especially from a) drying winds, and b) loss of soil from the tube which has a major impact on the plant when outplanted from desiccation and loss of root mass.
- **Delayed outplanting after transport:** Transported seedlings suffer more set-backs waiting to be outplanted from sitting unattended for lengthy periods of time, often under trees with heavy shade – these seedlings need regular watering, weeding and sunshine. Seedlings should be well-watered on the day of transport, which should be timed so that outplanting can be done under good conditions (wet soils) as soon as possible after delivery, preferably on the day received.

## **2. Planting Local Bamboo**

Bamboo is intended to reduce pressures on natural woodlands by offering a ready supply of light construction materials for houses, farm sheds, flue barns, and other domestic uses. The choice of species is a local bamboo (*Oxytenanthera abyssinica*) which has more solid stems relative to the exotic bamboos. Although small in diameter, the stems of this species are relatively strong, making it valuable in many local construction needs, as well as for making mats, baskets, and furniture. Local bamboo seed will be provided by TLC as part and parcel of normal nursery activities for raising trees. Propagation by seed in Malawi and Mozambique has yielded excellent results as a low cost, non-destructive method of propagation. The bamboo is targeted a) to reduce deforestation by replacing use of wood from trees in constructing barns and houses, as well as for tobacco sticks, b) to increase incomes among communities, c) to protect vulnerable river banks, and d) to replenish the declining supplies of bamboo.

## **3. Improved Tobacco Curing Barns**

This program will be involve a research component in Malawi to evaluate wood use efficiencies and costs of rocket barns relative to traditional and Brazilian slot barns. Other factors to be investigated include management requirements and a comparison of wood qualities of different tree species. Research will be implemented by ARET in Malawi with direction from TLC. The field program in Tanzania will be implemented directly by ATTT based on results from research and demonstration trials mounted in different tobacco growing regions.

## **4. Improved Wood Stoves**

The use of woodfuel in rural areas is by far the largest form of wood consumption. Consequently, a strategy is needed to reduce wood consumption through more efficient methods of using it, or by providing alternative sources of energy. The latter at present is not plausible in rural areas due to cost and supply problems for alternative fuels. Given the realities of the situation, our strategy involves introducing simple fuel-efficient stoves into the targeted communities using models that can be made by one adult in 1-2 hours with local materials.

Demonstrations by field coordinators will be used to increase public interest in wood stoves, and to train women how to construct them with local materials. The current model recommended reduces firewood use by over 50%. This equates to 1.5 m<sup>2</sup> for an average-sized household per annum. In terms of labor, this saves half a day per adult every 5 days. This allows women to engage in other more productive chores around the house or farm, and increases school attendance by girls. Research will be conducted to improve the wood use efficiency of these stoves, as well as to attach a simple chimney to eliminate smoke from the kitchen.

## **5. Sustainable Management of Natural Woodlands and Trees**

Many communities have expressed strong interest in this concept because indigenous trees and their products are disappearing from their culture and environment.

Managing natural woodlands and trees have many notable advantages:

- There is no need to undergo the huge expense and effort of raising, transporting, outplanting and protecting seedlings produced in nurseries.
- Natural trees already have strong and well established root systems that can easily weather low and erratic rainfall. This means there is little or no fear of setbacks from poor or untimely outplanting.

- Natural trees are well adapted to the ecology with inherent resistance to drought, fire, browsing, pests and diseases.

A 4-point plan is outlined in below to manage a) native trees on farms, and b) woodlands.

### **Native Trees on Farms:**

- 1. Clearing New Land for Cultivation:** Cultivation by most smallholder farmers involves land clearing with excessive felling of trees. With appropriate selection and spacing, a number of native trees can be left on these farms with positive effects on the soils, crops wood supply, and the general environment. The best trees to retain on farmland are fast-growing trees that coppice well and are compatible with crops. These include but are not limited to species of *Acacia*, *Albizia*, *Bauhinia*, *Brachystegia*, *Combretum*, *Markhamia*, *Pericopsis*, *Pterocarpus*, *Terminalia* and *Ziziphus*. The density of trees to leave depends mainly on tree size:

- ◇ large trees: 40 / ha (15-18 m apart, equidistant)
- ◇ medium trees: 60 / ha (12-15 m apart, equidistant)
- ◇ small trees: 100 /ha (10 m apart, equidistant)

### **Managing Trees on Farms:**

- ◇ Thin out coppice shoots to 1-2 main stems.
- ◇ Prune branches for wood rather than cutting the tree down.
- ◇ Use wood from large dead trees (standing ring-barked trees or felled trees on the ground) rather than burning or leaving them to rot in situ. Such trees are often not used because they are too large to transport or difficult to cut into smaller pieces.

- 2. Existing Cultivated Land:** Although under cultivation, trees have a natural propensity to regenerate on farmland. This can be promoted as follows:

- ◇ Select and protect 60-100 coppicing trees per ha, evenly spaced at 10-15 m apart.
- ◇ Thin the shoots from each plant to 1 or 2 dominant stems to promote vertical growth. This avoids development of low bushy growth which makes cultivation difficult, and produces low quantities of wood.
- ◇ Trim the selected saplings as they develop in size

Thinned shoots and trimmings can be collected for wood or other uses.

### **Managing Natural Woodlands:**

- 3. Regeneration on Fallow or Abandoned Land:** Many areas are abandoned or fallowed when people move, or when the soils have been depleted. These areas have high potential for tree regeneration. Follow the practices under (2) above to encourage wood production, to provide valuable wood for domestic or farm use, and to promote fast tree growth by reducing competition for space, light, nutrients and moisture.

- 4. Managing Natural Woodlands:** Many of the principles above apply here as follows:

- ◇ Harvest wood whenever possible by collecting dead wood or by pruning branches rather than cutting down the tree (see point 3 above).

- ◇ In dense stands, selectively thin out scrubby or malformed trees to give space for the development of the better stronger trees.
- ◇ Trim shoots of young regenerating trees to promote vertical growth (see point 2 above)
- ◇ If a tree is cut, leave at least one the same size under the rule “take one, leave one”.
- ◇ Encourage communities to form bye-laws to guard against indiscriminant tree cutting.

## **IRRIGATION PROGRAM**

During the current workplan, TLC will support new communities in the implementation of two systems of irrigation as described below. In addition, old sites will be expanded by provision of extra resources by TLC through linkages to micro-financing institutions to provide inputs, spare parts and other materials. The two systems to be promoted are:

### **Treadle Pump Irrigation**

The project will expand the area under treadle pump irrigation in Malawi and Mozambique where the program was started during 2005/06 workplan by provision of more treadle pumps and input packs. In Tanzania, the program will target a new area around Tabora whose potential was recently assessed by a team of experts from Malawi led by Trent Bunderson. TLC will continue to promote the MoneyMaker Plus treadle pump manufactured by Kickstart. The pump is robust, easy to operate by one person and has relatively high output. For the 2006/07 workplan, the project plans to distribute up to 2,000 pumps in all the three countries. This is expected to impact over 12,000 people. TLC will also continue to provide extension support to old clubs in terms of training, provision of market information and linkages to markets and micro-financing institutions.

### **Stream Diversion/Water Harvesting**

TLC will continue to assist farmers in the identification, design and layout of stream diversion systems, including expansion of existing ones. Stream diversion is a low cost system with few inputs and highest return on investment. The greatest challenge is to ensure that farmers follow best practices in the sharing and managing water resources as well as protecting streambanks. TLC will provide support to targeted communities to address this challenge.

Promotion and expansion of irrigation in the project sites will employ the following strategies:

- Include sites under projects funded by PMI/TEAM which have high potential but do not have an irrigation component. For Malawi, this will cover sites under the Community-based Forestry Project (COBAF) and TEAM Tree Project. The aim is to add value to such programs, while at the same time exploit opportunities for scaling up the interventions.
- Build capacity of new and old irrigation club members through training in irrigation system set up, operation, maintenance and good crop husbandry practices; supporting them in following a crop calendar that takes into account market supply and demand, glut periods, incidence of diseases, crop performance; integrated pest management; marketing skills and record/book keeping. In addition, farmers will be trained in water resource management, streambank protection, soil fertility maintenance, water rights and bye-law formulation/enforcement.
- TLC has established a centrally administered revolving fund which will cater for expanding the irrigation program within the existing sites and beyond. The aim is to make the program self-sustaining well beyond the current phase of funding by PMI.

- Each club will be encouraged to establish its own revolving fund to act as a backup for providing soft loans to members to pay for additional or extra-curricula costs such as inputs, spare parts, hoses and transport.
- Explore potential for linkages with rural-based banking institutions such as Opportunity International Bank of Malawi (OIBM) to provide loans for inputs and other costs. Ultimately, farmers will be responsible to source irrigation equipment on their own from private dealers and pay a full market price without having to rely on Government or NGOs for free issues or subsidies.
- Explore opportunities with local agro-dealers to support village-based shops to stock irrigation equipment, spare parts, fertilizers, seed and other inputs.
- Assist farmers by linking them to markets and market information.

### **SAFE WATER AND ECOLOGICAL SANITATION**

Water, sanitation and hygiene have important impacts on both health and disease. Contaminated drinking water combined with poor sanitation contributes to outbreaks of diseases, particularly dysentery and cholera. TLC will address these issues through the introduction of covered shallow wells equipped with a hand pump that is easy to install, operate and maintain by villagers. The problem of poor sanitation will be addressed through a simple technology of digging a pit 1 m deep by 60 cm in diameter covered with a dome-shaped concrete slab. A temporary structure is erected around the latrine for privacy.

Promotion and expansion of safe water and ecological sanitation in the project sites during the current year will employ the following strategies:

- Assess potential sites for installing shallow wells, including rehabilitation of old ones through lining of shallow well walls and installation of hand pumps. TLC will collaborate with local organizations and individuals involved in the sector in the planning and implementation of the program.
- Identification of villages and households to participate in the construction and use of ecological sanitation latrines. This will involve selection and training by TLC of local artisans who will be responsible for building the slabs and promoting the technology in the surrounding villages. Villagers will be required to pay a fee at 50% of the cost of the slab.