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MID-TERM PROGRAM EVALUATION CONSULTANCY REPORT OF MODULE 3: PROFITABLE AND ENVIRONMENTALLY SOUND FARMING SYSTEMS REPLACE SLASH-AND-BURN AGRICULTURAL PRACTICES AT THE LANDSCAPE SCALE

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EXECUTIVE SUMMARY

The Ecoregional Initiatives program (ERI) of USAID Madagascar (program implemented by Development Alternatives Inc.) promotes ecoregional conservation and development along forest corridors in the provinces of Toamasina (Ankeniheny-Zahamena) and Fianarantsoa (Ranomafana—Andringitra—Pic d'Ivohibe). The goal is to conserve and sustainably manage the remaining rainforest and to improve the livelihood of rural population living in its proximity. A wide variety of interventions are designed to reduce deforestation and to promote alternatives to slash-and-burn agriculture (*tavy*) introduced through the Koloharena (KM) farmer's movement. Within the five integrated results modules (ecoregional planning, community-based natural resources management, alternatives to slash-and-burn agriculture, socio-organizational support to rural associations, and strategic communication), the technical agricultural development resides with the third module, alternatives to slash-and-burn, the review of which is the purpose of this consultancy.

BACKGROUND

The objective of the Module 3 is the *replacement of slash-and-burn (tavy) practices at the landscape level through profitable and environmentally sound farming systems*. ERI promotes the development of 'sedentarized' agricultural systems that offer increased agricultural production on lands outside of the current primary forest with the aim to replace the slash-and-burn agricultural system along the threatened forest corridors. In view of achieving this objective, this module is building on three pillars (i) environmental protection and increased agricultural productivity; (ii) income generation and (iii) food security.

This is a review of ERI's third module at mid-term or after nearly 2 years of project implementation with the objective to evaluate the agricultural intensification strategies and activities in order to provide recommendations on ways to improve program performance. A number of conclusions and recommendations are hereby summarized that are further elaborated in the main text.

The mission was carried out from May 9-30, 2006 in the Fianarantsoa and Toamasina provinces of Madagascar. During this period, another consultant, M. Pierre Thévenot, conducted an evaluation of the institutional context surrounding the agricultural and rural development activities of the ERI program.[1] ERI regional program technicians accompanied the team throughout the length of this consultancy and thereby provided a rich background of information and ideas.

[1] Pierre Thévenot, « Situation du Mouvement Kolo Harena de la vulgarisation faite par ses membres paysans et du Programme ERI », Programme ERI/USAID Madagascar, juin 2006.

CONCLUSIONS

APPROACHES AND ZONES OF INTERVENTION

- **On the Right Track:** ERI is on the right track with the adoption of a range of approaches that allows the program to respond to the specificities and challenges occurring in its zones of intervention. These include the Agroecological approach, the Agricultural Niche orientation, the Farmer-to-Farmer extension system, Appreciative Inquiry, and Development Pathways. In addition, the multidisciplinary approach from policy work, to community based natural resource management, to agricultural intensification, and to rural community organization provides the program great strength. The program is not only on the right track it is also extremely innovative. The project is successful in its implementation given the fact that KH members are increasing and that landscapes are visibly changing under the adaptations of innovations.

- **Innovative Agroecological Approach:** ERI's agroecological approach has evolved since the LDI project (predecessor Landscape Development Interventions program of USAID Madagascar). From LDI's focus of developing alternatives to tavy based on intensified lowland rice production, perennial cash crops and complementary activities around the homestead, ERI has broadened its approach and has committed to work in all the landscape niches, including the uplands. Uplands are the most fragile among the agroecological niches and it is the niche where tavy is practiced, thus has a strategic position within the farming system. Achieving sustainable upland management is judged to be critical in view of tavy reduction at the landscape level.

- **Readjustment of Zones of Intervention:** ERI's reconsideration of its zones of intervention is commended. This refers specifically to the decision of the ERI regional office in Toamasina to open new zones in proximity of the forest corridor and close other zones that are of great distance from the forest.

- **Uniqueness of ERI Approaches in Madagascar:** ERIs approach to work on both fronts securing land tenure of forest resources (Module 2) and agricultural intensification (Module 3) is unique within the range of Madagascar development programs. The combination of these two instruments may be among the most efficient ways to combat tavy.

TECHNICAL CONCLUSIONS

The ERI program strives to promote agricultural innovation in various agroecological zones ranging from lowlands to up-land agricultural zones. General observations and recommendations are the following:

The ERI program strives to promote agricultural innovation in various agroecological zones ranging from lowlands to up-land agricultural zones. General observations and recommendations are the following:

- **Lowlands and Baiboho Agriculture Zones:** Adoption of lowland improvement techniques, especially SRI/SRA and fish production is well underway in the intermediary and commercial agricultural zone but not as important in the deforestation zone. With the establishment of fishponds, especially in Fianarantsoa, the landscape is visibly changing. With the mastering of fingerling production by Koloharena farmers, scaling up of fish production is occurring. SRI/SRA is also adopted by non-KH farmers, for instance through the mechanism of the Farmer Field

Schools. It does not seem that ERI is able to capture all of these dynamics of scaling up. ERI's orientation towards diversification of lowlands and baiboho is applauded. This can be economically important to farmers providing a wider range of products for commercialization and for food security.

- **Upland Agriculture Zones:** ERI is on the right track with the development of upland agriculture. Among the more important innovations are: (i) the introduction of improved varieties of root crops, (ii) the promotion of crops that are adapted to degraded upland soils (Jatropha, ginger) in combination with soil protection and soil restoration measures, (iii) the testing of soil improving cover crops and shrubby species, and (iv) the development of ecological upland rice. Currently, the various innovations, although successful by themselves, are not well integrated. It will be a major challenge for ERI to develop sustainable and economically viable upland cropping systems.
- **Home Garden Agriculture Zones:** Home garden systems have received much attention during LDI and by ERI in collaboration with the BAMEX project. Much effort has been put into the diversification with promising cash crops. Some successful commercialization stories have emerged. Nevertheless commercialization opportunities need to become available at a larger scale and cover a wider variety of products.
- **Forestry Nurseries:** ERI's focus to work on decentralization of nurseries is commended. ERI has fostered collaboration with a range of partners that are engaged in reforestation. But, the non-availability of germ plasm (in general and quality seeds) is a major constraint for developing a culture of diversified tree cultivation.
- **Technical Quality of Interventions:** The technical quality of the promoted agricultural innovations is generally good. This is proven by the number of techniques that are already adopted and well integrated within the farming system. The challenge remains with the follow-up on technical development that happens at the farm level. Currently there is a lack of sufficient numbers of ERI technical staff to assure technical quality in the field. Too much responsibility for technical oversight is given to the Koloharena Paysans Vulgarisateurs. The consequence is that the full potential of the proposed technical innovations do not have sufficient program impact, for instance, on the translation into productivity increases.
- **Program Decision Making Processes:** ERI's decision-making process of choosing techniques for dissemination is not always clear, and seems sometimes 'opportunistic.' This can have a positive outcome by taking full advantage of the technical capacity that exists in the respective regions. On the other hand, when depending on third parties, ERI confronts difficulties in guaranteeing desired implementation objectives. Dependency on third parties for implementing parts of the agriculture program contributes to compartmentalization of project activities and thus misses out on realizing an integrated farming systems approach.

EXTENSION AND COMMUNICATION CONCLUSIONS

- **Farmer-to-Farmer Approach:** The farmer-to-farmer approach with its three channels of Koloharena House (Maison Koloharena), Demonstration fields and Farmer field schools, is a very powerful approach and can play a major role for scaling up, but the opportunities need to be seized. Farmers are much engaged and motivated to explore technical innovations through these extension channels, but ERI is so far not able (mostly due to staff constraints) to provide a good technical follow-up. Also ERI staff does not seem to have a well elaborated concept on how to follow-up on farmer innovations and how to capture and disseminate this new knowledge.
- **Communication Strategy:** The development of an improved communication strategy is of critical importance at this stage of the program. Well designed communication tools used in relation with the FFS, demonstration plots and KH houses, can play a significant role in the scaling up of the program activities.
- **LADIA/CDIA:** Out of LADIA's (former CDIA) four objectives, which are (i) training, (ii) presenting technical innovations on its farm, (iii) accommodating researchers for their field research, and (iv) producing high quality animal and plant germplasm, only the first objective of training seems to be well underway. The Center seems to lack guidance as not many activities concerning the other three objectives are happening.
- **Producer Capacity Building:** The implementation of producer capacity building (to maximize profits and meet market quality, volume and scheduling requirements) has experienced a few innovative and promising partnerships and initiatives. A larger scale impact has not yet materialized and it seems that this component has not yet fully taken off. This is to a large part due to lack of effective collaboration between ERI and BAMEX. The program has recognized this problem and is currently designing a new partnership arrangement.
- **ERI Staff Capacity:** ERI has an exceptional staff that is committed to the program's mission. Unfortunately staff number is too small for the ambitious program, and the entire staff is overworked. Main impact can be loss of the overall quality of the program implementation and the missing out on scaling up opportunities.

RECOMMENDATIONS

INTERVENTION ZONES AND PROJECT MONITORING

- **Refine zoning within farming systems:** In addition to distinction between the eastern and western corridor side, it is proposed to differentiate between farming systems of the deforestation zone, intermediary zone of subsistence and cash crop farming, and of the commercial agriculture zone. In line with ERI's reconsideration of the delimitation of the project intervention zone, it is recommended to drop the sites in the commercial agricultural zone, due to its lesser pressure onto the forest, and to reinforce the presence in the deforestation zone. As the farming systems in the deforestation zone and intermediary zone are rather different, the distinction would support ERI in its efficiency.
- **Work in all Landscape Niches:** It is recommended that ERI continues to work in all the landscape niches, and explores more vigorously the technical opportunities to create direct alternatives to tavy

(sustainable cultivation of upland crops without the use of fire) and the management of soil fertility, especially in the uplands.

- **Monitoring and Evaluation:** Monitoring and evaluation of project results should be directly tied to tavy. The reduction of tavy can have multiple reasons not all of which necessarily indicate a shift towards more sustainable farming practices. It is therefore recommended that tavy fields be monitored through high-resolution satellite imagery. These images can additionally be used when working with stakeholders and policy makers. Preferably, the monitoring of tavy through images should be accompanied with in-depth studies that explore farmers' motivation and reasoning for their practices (tavy or non tavy).

TECHNICAL RECOMMENDATIONS

- **Integrated Crop Rotations:** Technical refinements concern the development of integrated rotations in lowlands and uplands, where cover crops and improved fallows play an important role and where application of organic and inorganic fertilizers should be well targeted in order to maintain and increase land productivity. ERI has successfully worked on many system components, but a good integration is still lacking. ERI should focus on this integration in view of developing sustainable and economically viable upland and lowland cropping systems.
- **Diversification of Technical Propositions:** Proposed techniques for the different niches will vary between the three identified zones (deforestation, intermediary and commercial agricultural zone). For instance, the approach to develop lowland exploitation in the deforestation zone needs to be revisited, fine-tuned, and be guided by a local diagnostic, as farmers have hardly the habit to use this niche (especially in Toamasina).
- **Interventions in Baiboho:** Proposed interventions in the baiboho should make best use of this niche, as it is among the most fertile but smallest niches in the farming system. The planting of cash or food crops should be well targeted and play a complementary role in the farming system responding to periods of economic hardship and food insecurity. This niche can also be used for quality seed production.
- **Promotion of Organic Agricultural Products:** ERI should pursue the option of developing organic agricultural products for commercialization. It is not recommended that ERI subscribes for the moment to the entire zero tillage technical packages that are promoted in Madagascar because of its heavy reliance on herbicides, but rather that ERI integrate the parts of cover crop management without the use of this environmentally questionable input.
- **Soil Fertility Management:** Soil fertility management is one of the main challenges for ERI, especially for the uplands. Guided by principles of effective nutrient management, ERI could try to elaborate for each of the niches a soil fertility management concept that takes into account the existing resources, optimizes knowledge-based management interventions and evaluates from where and what type of external inputs might be needed to 'jump start' the system or to achieve a desired production level. These concepts can be developed by technicians and then be discussed and adapted by the farmers. This also integrates the notion of longer term planning at the field level, which will have an overall beneficial impact for different types of land use planning efforts that ERI undertakes under Module 1 and 2. It also incites farmers to think beyond the yearly planning which is often still prevalent.

- **Home Garden Interventions in Two Zones:**
  - *Cash crop tanimboly:* Technical advice should target improved management of cash crops, which includes appropriate spacing, pruning, tree fertilization, and soil cover management. Men traditionally manage these tanimbolys.
  - *Nutrition garden tanimboly, which are located around the homestead:* Focus of advice should be oriented towards food security: e.g. association of annual food crops in the understory (beans, vegetables), integration of small animal husbandry, in addition to bee-keeping, fruit trees, medicinal plants, artisanal plants for weaving etc. Technical advice should be addressed to women and opportunities for cash income identified. The concept of nutrition garden refers to a specific design of species composition in order to provide food for the household (vegetables, fruits) all year long. This is done by selecting species that fruit or mature in different times during the year.
  - *Seed Shortages:* In order to respond to the shortage of seeds in general and of quality seeds more specifically, and in order to maintain and increase agricultural biological diversity (crops, trees and animals), it is recommend that ERI pursues the strategy to (i) undertake an inventory on existing indigenous germ plasm, (ii) obtain improved germ plasm with the research and private institutions in Madagascar, (iii) promote tests of comparisons between indigenous and improved varieties, and finally (iii) encourages the multiplication of the desired varieties and species through the KH farmers in decentralized seed gardens. Seed multiplication should become a priority for the KH houses as well as for LADIA.
  - *Native Forest Biodiversity:* Native forest biodiversity could be increasingly promoted within the agroforestry systems, as the microclimate and environment is suitable for many indigenous species. Useful indigenous plants could be cultivated for instance for medicinal purposes, wood, fiber, food. In addition these plants help preserve the indigenous soil micro-fauna, are a resort for insects and birds that can play a role in regulating pests and diseases. It also helps preserve the rich indigenous knowledge farmers have living close to the forest, but which tends to get quickly lost once the landscape is deforested.

- **Financial Farm Level Analysis:** A farm level financial analysis should accompany the technical recommendations in order to identify bottlenecks as well as investment opportunities. In parallel to technical follow up, costs and benefits should also be monitored in parallel with each of the promoted techniques. It would also be useful to monitor labor availability across the seasons (simple charts can be established by Paysans Vulgarisateurs and integrated into considerations by project agronomist) permitting to provide technical input in adapting a certain techniques to farmers' labor availability.

- **Consideration of Land Tenure Issues:** ERIs efforts to remain aware of land tenure issues and contribute to the debate are applauded. ERI could get more involved in the search for opportunities within the traditional land tenure niches and thus craft sustainable land management arrangements especially for the uplands. Traditional upland tenure rights are often individualistic but there is a high community solidarity aspect to sharing land. It can be likely that new sustainable upland management models could be developed through discussions and agreements at the community level (that nevertheless respect the individual access rights).

EXTENSION AND COMMUNICATION RECOMMENDATIONS

- **Farmer-to-Farmer Approach:** ERI's farmer-to-farmer approach is very dynamic and successful in its implementation. Koloharena and non Koloharena have begun to participate in the opportunities opened up to them by linkages to the ERI program. This is a critical time for the ERI and the KH movement, in respect to sustainability and scaling up. Within the various extension channels ERI should mainstream strategies to address and involve non-KH farmers. Communication tools play an important role (video, radio, technical leaflets, posters etc).
- **Farmer Field School:** The Farmer Field School approach has shown to be a powerful extension tool within its first season of implementation. ERI is advised to refine its strategy in order to take full advantage of the innovative dynamics that have been created through the farmer-field school. This includes technical follow up during FFS, orientation in the beginning of a season of (new) technical options, presentation of results at the end of a season to a larger audience (preferably at the community level including KH and non KH farmers), organize exchange visits to maximize learning opportunities, assist farmers in preparing their own technical sheets, and use radio and video media to disseminate experiences.
- **LADIA/CDIA:** The activities of the agricultural training and demonstration center LADIA (ex-CDIA) should be revived in order to respond to the objectives and the potential of the center. Technical innovations should be reintroduced on its farm, be labeled and accompanied by a technical leaflet. The center should also reengage in applied research and in the multiplication of germplasm for the region (trees, animals, cover crops etc). In addition, a variety of agricultural produce transformation should be undertaken, which can be used for trainings while at the same time creating income for the center.

CASH CROP COMMERCIALIZATION AND TRANSFORMATION RECOMMENDATIONS

- **Support from BAMEX:** Stronger support from BAMEX is needed and should become more field based and responsive to local constraints and opportunities.
- **Choice of Cash Crops:** The selection of cash crops for commercialization should respond to embedding the commodity chain development within a landscape approach responding to a certain number of agroecological criteria. Important criteria refer to the respect of sustainable production of the commodity (protecting the natural resource base), for the produce to have good storing and transformation properties, a high price/weight ratio, and respecting the local priorities. In addition, a combination of short and long term cycle products is ideal.
- **Crop transformation and processing:** On site agricultural produce transformation should receive increased attention by BAMEX and ERI. Agricultural transformation allows farmers to add value, often reduces the weight of the produce and improves preservation. It also allows farmers to create several products from the same crop and thus contributes to risk reduction. Small distilleries associated with the KH cooperatives for instance would allow processing a large band of products that are part of the farming system (e.g. cinnamon, clove, ginger, Ravinsara, Eucalyptus etc)

FOOD SECURITY RECOMMENDATIONS

- **Overlooked Crops:** In order to promote food security and improved nutrition at the household level, ERI could take better advantage of what already exists and improve its impact. More

specifically, many associated crops and fruit trees can be found within the farming system that are often overlooked when thinking about commodities and large scale production.

- **Inventory of Food Plants in Farming System:** It would be valuable to inventory the food plants within the farming system, and promote their improved use according to their seasonality and nutritional value. Training of culinary options and seed production could be provided. This merges with the concept of nutrition garden. According to timing when crops or fruits are mature, a garden can be designed that allows harvesting yearlong food plants permitting a healthy nutrition for the family. These activities should be undertaken with the women.

AGRICULTURAL AND CONSERVATION POLICY RECOMMENDATIONS

- **Biodiversity Restoration within Rural Production Landscapes:** A considerable shift in the thinking of the conservation community in Madagascar is urgently needed. The focus should move away from the emphasis on protecting uniquely the biodiversity within the primary habitats towards a strategy of protecting, restoring and benefiting from the biodiversity that exists within the rural production landscapes—a territorial area that makes up 90% of the country's surface. ERI would be very well positioned within the Malagasy conservation and rural development communities to play a leader role in urging to rethink the past paradigms of conservation.
- **Improved Monitoring of Tavy Dynamics:** Given the complexity of the tavy phenomenon, the urgency to find sustainable solutions, and ERIs very unique position to work successfully with the tavy farming communities, the project is in a good position to provide national leadership based on its valuable field experiences. ERI needs to invest further resources to improve monitoring on tavy expansion or reduction, and analysis of the underlying influences and driving forces (political, economic, climatic, availability and implementation of technical alternatives). ERI is in an excellent position to fuel pragmatically and openly the national debate with its valuable on-the-ground insights.
- **ERI involvement in policy debates:** Many national policies and decision-making processes influence rural development. USAID Madagascar should continue to encourage ERI to engage in the national policy debates, especially in regards to infrastructure (road and railroad maintenance, small-scale irrigation infrastructure), land tenure, seed and germplasm services, and rural security.
- **Carrot and Stick Approach:** To increase the efficiency of implementing alternatives to tavy, it would be valuable if ERI could be more proactive in using a 'carrot and stick' approach with regards to halting the expansion of tavy. This would entail providing greater leadership to coordinate the:
  - Promotion of agricultural intensification (carefully adapted to local farming system specificities)
  - Provision of land tenure security of forest land through the instruments of GCF and GELOSE and
  - Support the reinforcement of forest control, which can be integrated with the SAPM/NAP activities associated with putting in place new protected areas along the forest corridors of Toamasina and Fianarantsoa.

OBJECTIVES OF THE CONSULTANCY

The overall objective of this consultancy was to foster reflection, dialogue, and debate on ways to improve the performance of the ERI agricultural intensification and diversification program (Results Module III). In addition, it was requested that the consultant stimulate internal program reflections on ways to improve agricultural intensification and diversification as alternatives to slash-and-burn agriculture but within the context of limited personnel and financial resources. The three objectives were:

Objective 1: To review ERI Fianarantsoa and Toamasina Module III (Alternatives to Slash-and-Burn) agricultural intensification strategies and activities in order to provide recommendations on ways to improve program performance.

Objective 2: To exchange technical information and ideas between tropical farming systems specialist and ERI technical staff (senior agronomists, ERI Regional Coordinators, ERI field agents, and Koloharena association technicians and paysans vulgarisateurs).

Objective 3: To provide USAID Madagascar and members of the Ecoregional Alliance with technical recommendations on ways to advance agro-ecological development interventions.

The terms of reference for the consultancy can be found in Annex 1. A three-week visit to Madagascar from May 10 to May 31 2006 included visits to the field sites in Fianarantsoa from May 11 to May 18, and to Toamasina from 19 May to May 26. May 27 to May 31 was spent in Antananarivo. On May 29 a one day workshop was held with mostly USAID partners and Ministry of Agriculture representatives where preliminary results were presented and reflections on identified key issues undertaken. The mission program in reported in Annex 2.

1. PROGRAM OVERVIEW AND POLICY CONTEXT

1.1 PROGRAM OVERVIEW

The Ecoregional Initiatives program (ERI) of USAID Madagascar promotes ecoregional conservation and development along forest corridors in the provinces of Toamasina (Ankeniheny-Zahamena) and Fianarantsoa (Ranomafana—Andringitra—Pic d'Ivohibe). The goal is to conserve and sustainably manage the remaining rainforest and to improve the livelihood of rural population living in its proximity. A wide variety of interventions are designed to reduce deforestation and to promote alternatives to slash-and-burn agriculture (tavy) introduced through the Koloharena farmer movement.

The ERI program is a 4-year project that started in August 2004. Development Alternatives, Inc. is the contractor. ERI is a follow-up program to the Landscape Development Interventions program (LDI), a project of Chemonics International that intervened in the same project zone from 1998 to 2003 and the Programme de Transition Eco-régionale (PTE) from January to September 2004. PTE was designed to ensure smooth transition of the interventions implemented by LDI until the ERI program became functional. The ERI programs consists of five integrated results modules: (1) ecoregional planning, (2) community-based natural resources management, (3) alternatives to slash-and-burn agriculture, (4) socio-organizational support to rural associations and (5) strategic communication. The program is carried out by a small regional office staff in Toamasina and Fianarantsoa with coordination facilitated by the national office in Antananarivo. The national office serves as a liaison between the sphere of national policy debates and the grassroots level concerns. Sub-contracts are extended to partner organizations to carry out a wide range of activities associated with these module activities.

1.2 ERI'S CONTRIBUTION TO THE USAID MADAGASCAR MISSION

The ERI program is an important pillar in the implementation of USAID/Madagascar country program. The USAID Madagascar program's overall goal is sustainable and inclusive economic development, which contributes directly to the national policy framework. In order to achieve this overall goal, USAID works with 4 Strategic Objectives (SO): democracy and governance (SO4), health, population and nutrition (SO5), environment and rural development (SO6), and economic growth (SO7). These mirror various policy and programmatic priorities shaped by the national agenda of Madagascar. ERI's contribution to the USAID mission is to support the Strategic Objective 6, which consists of the conservation of biologically diverse forest ecosystems. The SO6 is designed to improve sustainable natural resource management and environmentally sensitive development in priority ecoregions.

USAID has supported Madagascar over the past 13 years to protect its exceptional natural heritage. The program pursues a multi-faceted and integrated approach. Main foci of the program are biodiversity conservation, forest management, alternatives to slash and burn practices, private sector

partnerships, and environmental governance. The framework Nature, Health, Wealth and Power assists the USAID country program to articulate linkages among sectors that are translated into on-the-ground activities. Implementation of multi-sector development activities at the commune level is promoted through the approach of Kominina Mendrika (KM) that is aimed to mobilize all commune players to engage in development activities. The KM approach launched by the SantéNet project (sub-constractor Chemonics International) helps the commune with self-development by focusing on health of community members, improvement in quality of life through income generating activity, and natural resource management. USAID created the Ecoregional Alliance, a coordinating structure that regroups USAID implementing agencies and partners. It is an important tool to build cooperation between the USAID projects. ERI's role is essential in this initiative. In Fianarantsoa and in Toamasina, ERI is delegated as the coordinator of the Ecoregional Alliance and has invested considerable financial resources and staff time in organization the coalition of USAID partners. Next to ERI, the most important partners are JARIALA, MIARO, ANGAP, DGEEF, TANY MEVA, MISONGA, ONE, BAMEX, WCS, SANTENET, VOAHARY SALAMA, CRS, ADRA, and CARE.

1.3. ERI AND THE NATIONAL POLICY CONTEXT

The ERI program has been designed and is shaped in response to the major national policies prepared by the Government of Madagascar over the past eight to nine years. The national policy context under the Ravalomanana presidential regime is evolving and changing rapidly. A fair treatment of the current dynamics surpasses the mandate of this consultancy. This section is therefore limited to a short overview of the most important policy linkages.

The overarching government policies and strategies are Madagascar Naturellement (2004), the Poverty Reduction Strategy Paper (2000-2006), and the Madagascar Action Plan (MAP (2007-2011). Madagascar Naturellement is the statement of the country's development vision for 2020. It states that Madagascar will be a newly industrialized country with maximized competitiveness by 2020. The core of growth will be derived from the country's unique natural resources and from the transformation of its natural products. A broader impact of growth and a progressive redistribution of its benefits will help reduce poverty substantially. The Madagascar Action Plan (MAP) is a 5-year implementation program that sets out a "roadmap" for achieving the goals in accordance with Madagascar Naturellement. The MAP is a direct follow-on from the PRSP (Poverty Reduction Strategy Paper) and covers the period 2007-2011. The MAP outlines eight specific areas of focus; (i) good governance; (ii) educational transformation; (iii) health and family planning; (iv) infrastructure; (v) rural development; (vi) the economy and the private sector; (vii) environment; and (viii) national solidarity.

ERI is responding to the raised challenges and priorities of the government. It contributes directly to the implementation of the National Environmental Program Phase III (2003—2008), the National Program for Rural Development (2005) and the Durban Vision (2003). This is done directly through the on-the-ground activities of the program. In addition, ERI provides support to capacity building and facilitates the dialogue at the regional level to foster an improved understanding of the evolving policy context. More specifically, ERI contributes to the execution of the Environmental Program 3 (EP 3) framework. At the local and regional level this concerns interventions under sustainable development (1.1.), the sustainable management of forest ecosystem and water resources (1.2.), and the positive behavioral change towards the environment (2.1.) through the support of environmental communication and education (2.1.2.b and c). At the national level, the National Coordinator

regularly participates in meetings of the National Environmental Action Plan's (EP3) Comité Conjoint which is the platform that brings together various implementing partners like government agencies and donors, the Durban Vision Group, establishing the new Protected Areas System in Madagascar, the network for Transferts de Gestion des Ressources Naturelles Renouvelables (TGRNR), the EP3 Communication Commission and the Tavy Working Group.

The Programme National de Développement Rural (PNDR) (or National Rural Development Program, NRDP) is centered around five strategic axes: (1) to make the institutional framework more effective by completing public administration reform and decentralization; (2) to facilitate access to capital and production factors; (3) to improve food security and production through increased productivity, diversification, and risk management; (4) to promote improved natural resources management; and (5) to develop markets and promote a value-chain approach by encouraging public-private partnerships. ERI's contributes to all of the strategic axes of the PNDR through its integrated program. The ERI Module 3 contributes specifically to the last three of the five axes. Moreover, the ERI program has been working with various regional partners to promote wider understanding of the PNDR through workshops and has actively participated in meetings organized by the regional authorities.

In September 2003, the president Marc Ravalomanana announced his commitment to triple Madagascar's protected areas in five years at the World Parks Congress in Durban, South Africa. Named "The Durban Vision", the plan would increase the country's protected habitats from 1.7 to 6 million hectares—or from 3 to 10 percent of nation's surface area. Another major success was the creation of the country's new System of Protected Areas of Madagascar, or SAPM (often referred as well as the Nouvellse Aires Protégées/NAP), which redefines and simplifies the legal process used to create a protected area. Under the more flexible SAPM/NAP, varying degrees of sustainable resource use can be permitted in new sites, contributing to poverty reduction and sustainable development. Over the past two years, the government and donors have worked under tight deadlines to identify new protected areas and place them under temporary management regimes. The ERI national coordinator is participating actively in the Durban Vision Group. Both of ERI's regional offices are engaged through Module 1 to facilitate the identification of New Protected Areas (NAP) sites.

1.4. ERI AND THE REGIONAL POLICY CONTEXT

The creation of the new administrative structure of the "Régions" and the associated Plan Régionaux de Développement has added another level of institutional complexity to the ERI program. The 22 Régions have designed and prepared regional development plans that spell out to a considerable degree the principles of agricultural and rural development. These documents influence to a certain degree the way in which ERI carries out its programs. The degree to which ERI considers the plans in its internal planning varies from region to region depending on the ability of the Chefs de Régions to incite donor financed programs to follow the policy guidelines. As already mentioned above, ERI provides support to the regional and communal planning. The program advocates and facilitates the integration of an ecoregional vision and approach into the planning processes. This is done with the perspective of sustainable management of the natural resources and the protection of the forest corridors.

2. ERI'S INTERVENTION ZONES AND FARMING SYSTEM CHARACTERISTICS

2.1. ERI'S INTERVENTION ZONES

The ERI program interventions are focused in two parts of the country—the Ankeniheny-Zahamena forest corridor that straddles the eastern range of mountains in the Toamasina province and the Ranomafana—Andringitra- d'Ivohibe forest corridor in the province of Fianarantsoa that similarly covers the north-south mountain range. Both of the two forest corridors are among the few forests remaining in Madagascar that connect a variety of vegetation types. The corridor in Fianarantsoa, for instance harbors the vegetation types from lowland rainforests (400-800m a.s.l.), to medium altitude rainforests (800-1200m a.s.l.) to highland forests (1200-1600m a.s.l.) and to montane sclerophyllous forests (>1600m a.s.l.) (Humbert, 1955). The high degree of species diversity and endemism calls for urgent protection of these reduced forests.[2] The level of species diversity is similar in the other forests of the project zone. Located on mountain tops and covering the north-south escarpment ridges, these largely intact primary forests harbor water sources for the adjacent regions, providing agricultural irrigation water and drinking water for urban areas.

THE ANKENIHENY-ZAHAMENA CORRIDOR

The Ankeniheny-Zahamena corridor has been declared a protected area on Dec. 30, 2005 by the Malagasy Minister of Environment, Water, and Forests. The corridor is one of the priority conservation zones of Madagascar, due to its rare lowland forests, medium altitude forests, and its high biodiversity. The corridor has a surface of 510,000ha and connects the following protected areas (from north to south): National park of Zahamena, the Special Reserve Mangerivola, the National park of Mantadia and the special Reserve of Analamazaotra. The corridor is situated within the three regions Atsinanana, Alaotra- Mangoro, and Analanjirofo, the five districts Ambatondrazaka, Moramanga, Brickaville, Toamasina II, Vavatenina, and is part of 30 communes.

[2] For instance within the Andrigitra National Park, over a thousand plant species have been inventoried, of which 184 species of Pteridophytes (with 38% being endemic to Madagascar), 631 dicotyledons, 240 monocotyledons, and two gymnosperm species (Roger, 1996; Lewis et al., 1996 cited by the webpage http://www.wildmadagascar.org). In addition, the park harbors 106 birds, 34 reptiles, 55 frogs, 54 mammals (13 lemurs, 11 rodents, 16 insectivores, 11 bats, 7 crustaceans (crayfish).

The LDI/PTE program had worked in 8 of these communes during the phase of the second environment action plan (PE2). ERI has now expanded this number to 16. Although ERI will not be able to work in all the 30 communes due to financial constraints, efforts will be made to reach as many communes as possible. The selection of the new intervention zones was based on over 10 criteria, among which was the threat to forest resources, biodiversity priority, access, and distance from the forest corridor. Based on this analysis, ERI considers withdrawal from zones that are far from the rainforest and where a direct impact on the forest is not very likely. This concerns for instance the communes in the Vatomandry area and the western side of the Lac Alaotra. At the same time, ERI is exploring the questions of expanding into new key corridor communes, for instance the commune of Didy. ERI has subdivided the zone in 8 strategic intervention zones, 4 of them were already part under the LDI program and 4 zones are new (Figure 1).

RANOMAFANA—ANDRINGITRA CORRIDOR

The Ranomafana—Andringitra d'Ivohibe forest corridor, close to 200 km in length, is located on the rocky slopes of eastern Madagascar separating the coastal lowlands of the East from the highlands of the West. It is framed by protected areas that include the Ranomafana National Park to the north and the Andringitra National Park in the south, and extends even further south then the Special Reserve of the Ivohibe Peak (2658m).

While the ERI program strives to serve the interests of the entire 31 communes situated along both sides of the 200km corridor, the first year's priority was to consolidate activities in the 12 communes where LDI and PTE have previously worked (Figure 2). But, at the same time, the ERI program is progressively and strategically expanding into other communes along the corridor. Expansion strategies are largely determined by the demands expressed by nascent Koloharena associations and mayors of adjacent communes. Besides, ERI is experiencing considerable demand from communes outside of the corridor zone. ERI is trying to institute a 'franchise' system whereby experienced Koloharena with particular agricultural and organizational domains are encouraged to respond to demands for technical assistance. In addition, ERI tries to create linkages with other organizations and the private sector that can provide supportive functions in the development process of these communes.

FIGURE 1: TOAMASINA STRATEGIC INTERVENTION ZONES

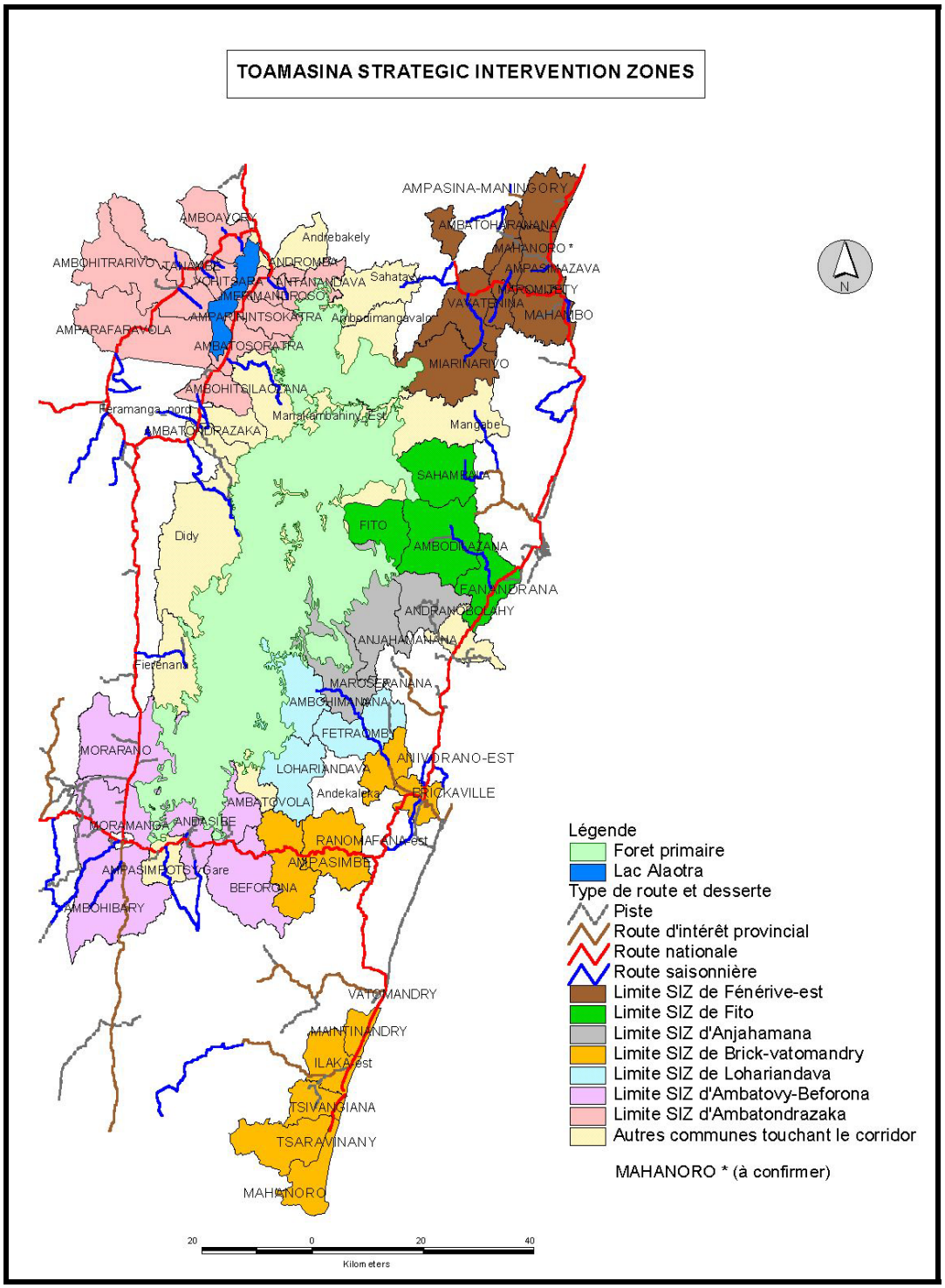
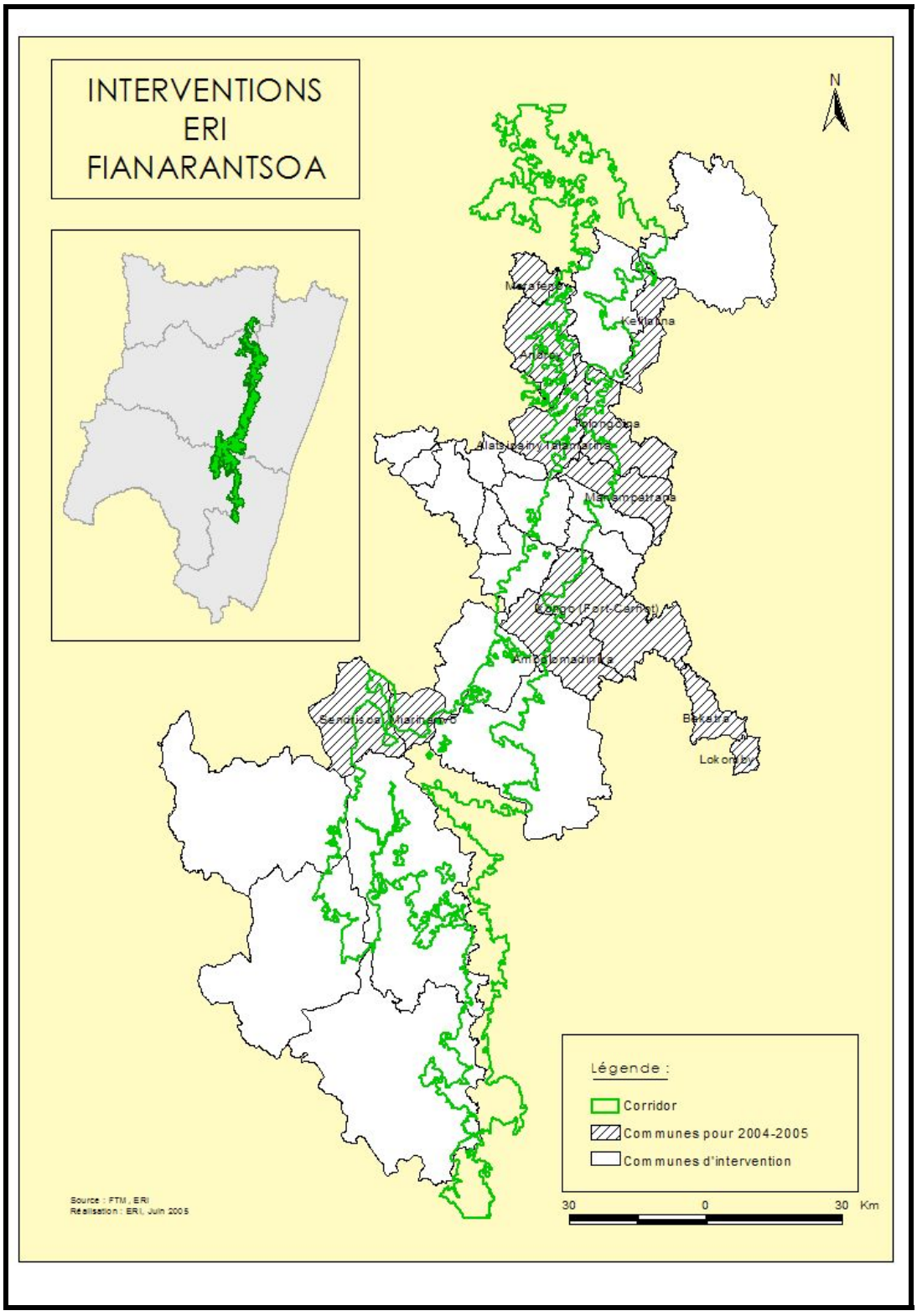


FIGURE 2: FIANARANTSOA STRATEGIC ZONES OF INTERVENTION



2.2. THREATS TO THE CORRIDOR

Although much of the remaining forest corridors are located today on steep escarpments, deforestation remains a significant problem. Deforestation rates within the Fianarantsoa forest corridor were estimated for the past 10 years to be 1% per year on the western side and 2% per year on the eastern side (Freudenberger, 2005). However, some debate surrounds this figure as new studies sponsored by the JariAla/USAID Madagascar project in collaboration with the national forestry service seem to suggest that rates of forest conversion may be even less. Concerning the Mantadia-Zahamena corridor, Woodwell et al (2004) estimated that with no further intervention, forest loss due to tavy may be 18% of the corridor surface area between 2004-2024 (0.95%/yr). New analysis of forest conversion rates should become available in early 2007.

The threats to the corridor are multiple. Among the most important are deforestation for slash-and-burn agriculture (tavy), timber and forest product extraction, mining, cattle grazing and uncontrolled fires. In addition, population increase of up to 3% per year is accelerating the pressure on the natural resources of the forests.

The type and seriousness of the threats varies according to the localities around the forest corridors. In the Ranomafana-Andringitra forest corridor, for instance, threats to the forests on the highland northwestern corridor area are caused primarily by farmers clearing valley bottom lands. These rice lands carved out of swamps not only alter a unique ecosystem but also are associated with clearing of neighboring land for up-land rice cultivation. Neighboring forest products are also collected, like pandanus and crayfish, by villagers settling near these newly cleared rice lands. The southwestern part, characterized by very low population densities, is threatened by illicit wood and precious stone extraction. This area is also known for high rates of cattle theft and rural insecurity. The southeastern corridor part is characterized by its absence of roads and isolation from markets. This is the area with substantive lowland forests that are highly threatened. Due to its isolation, it is very difficult for development programs to intervene in the zone and reach the population that practices slash and burn agriculture. In the northeastern part of the corridor, the forest is protected through the Ranomafana national park that plays an important role in the local and regional economy. This zone is also benefiting from the FCE railway, which allows evacuation of export products such as banana and coffee. This region also benefits from project interventions in agricultural diversification and GELOSE and GCF community resource management initiatives. (Freudenberger, 2005). An overview of the most important driving forces of tavy in the project zone is provided in Figure 3.

FIGURE 3: ROOT CAUSES OF TAVY

Reasons and extent of tavy can be multiple and vary according to localities as seen above. In the project area the most important driving forces are summarized hereafter:

Tavy for food security is based on the production of food crops, most importantly upland rice in isolated areas where soils are supporting a slash-and burn agricultural system. These isolated areas are often characterized by

- An environment of steep slopes and narrow valley bottoms, that restricts the extension of lowland rice cultivation.
- Lack of infrastructure and market access, which favors food production over cash crop production
- Cyclone dangers (provoking high rainfall, inundations, landslides) that can destroy infrastructure (roads, bridges, irrigated rice fields), and thus favors the cultivation of uplands and food crops.

Tavy for land reclamation: as soils degrade with the current farming practices, farmers move to the forest boundaries to claim more land through deforestation. Sometimes the extent of deforestation can become 'irrationally' large but is justified by farmers to secure land for the next generation.

Tavy and forest destruction for cash income In proximity to the forest borders, farmers engage in cash income activities to complement their food production. These can be:

- Illegal forest product extraction (wood, NTFP, mining, animals)
- Charcoal production in forests (often a precursor to tavy)
- Deforestation for cash crop such as sugarcane (Fianarantsoa). The production of illicit local alcohol 'toaka gasy', sold to urban areas, is well hidden in the forest environment and can be a good cash source.

Tavy due to the collapse of transport systems, infrastructure and market access. Farmers that shifted their agricultural production focus from food to cash crops, but are confronted by market accessibility problems, can be forced to return to their strategies of food production, tavy cultivation and thus deforestation. This would also incite the landless and poorer people to look for land in the forest, who were previously employed in the market oriented agricultural economy.

Tavy due to lack of technical alternatives. Although farmers are aware of the unsustainability of the tavy practice with its negative impacts on forests, water and soils, the lack of technical alternatives does not facilitate a change towards more sustainable practices.

2.3. FARMING SYSTEM CHARACTERISTICS

FARMING SYSTEM OF THE EASTERN SIDE OF THE FOREST CORRIDOR (FIANARANTSOA AND TOAMASINA)

For both forest corridors, the eastern side is characterized by a humid tropical climate with low to medium altitudes up to ca 700 m above sea level. Annual rainfall is abundant and can exceed 3000 mm. The terrain is characterized by steep slopes and narrow valleys. The soils have a weak natural fertility, with moderate to high acidity (pH 3.5—5) and aluminum saturation between 60-90%. Nutrient contents, especially phosphorus, are extremely low in surface and sub-soils. Nutrient leaching through erosion processes can also be significant, especially when ashes are part of downhill runoff during the tavy field preparation. Landslides are among the most predominant forms of erosion. The population is dispersed in remote areas with weak transportation and infrastructure system. (See Table 1).

TABLE 1: BIOPHYSICAL CHARACTERISTICS OF ERI ZONES

	Ranomafana—Andringitra Corridor		Ankeniheny—Zahamena Corridor	
	East	West	East	West
Altitude (m. a.s.l)	<600	>900	<700m	1200 - 1300
Rainfall (mm)	>2500	900-1100	>3000	1400
Dry season (month)	2	5	2	5
Relief	Steep slopes	Larger lowlands	Steep slopes	Large lowlands, lavaka
Soil fertility	Weak	Weak	Weak	Weak
Accessibility	Isolated	Medium	Isolated	medium
Crop potential	Cash crops	Food crops	Cash crops	Food crops
Ethnic group	Tanala	Betsileo	Betsimisaraka	Sianaka/Bezanozano

The traditional agricultural system is based on slash-and-burn practices for upland rice cultivation. Primary forest or secondary fallow vegetation is cut and burned and rice planted for one year, often followed by one year of manioc or sweet potatoes before left to fallow. With increasing pressure on the natural resources, fallow periods have been decreasing in the Fianarantsoa as well as in the Toamasina areas from 10 years to currently 5 to 3 years, which is not enough time to restore soil fertility sufficiently, leading to a consistently progressing upland degradation phenomena.

Food crop production is based on rice as well as on manioc, and sweet potato. Other food crops are often associated within the tavy field. They are maize, different grain legumes and beans, sesame, melons, peanuts, voanjo, leafy vegetables. Next to fruits from their home gardens, farmers collect also wild food plants from the forest especially during the hunger period. Lowland rice cultivation exists more frequently in the Fianarantsoa area then in Toamasina. The influence of the Betsileo on the Tanala agriculture has been important. During the time when coffee prices were high, Tanala could buy rice or hire Betsileo to work their rice paddies. Although this is currently not so much the case anymore, lowland rice cultivation has become part of the Tanala farming system complementing the upland rice harvests. In the Toamasina area, the Betsimisaraka do not easily engage in irrigated lowland rice cultivation. The shift to the lowlands can mostly be observed in landscapes where uplands become too degraded to sustain tavy rice production.

The eastern side of the corridor has a great potential for cash crops. Most of them are associated with agroforestry systems thus favoring the preservation of the natural resource base. Among the most common crops are coffee, banana, cloves, and litchi. Good growing conditions exist for pepper, vanilla, cinnamon, next to fruit trees such as citrus, annona, jack fruit etc. Ginger is another important cash crop cultivated on tanety land.

Cattle are not widespread in this area and most essentially used for traditional sacrifices. Manure is not used for fertilization. Local chicken and pork production are found more frequently.

The traditional land tenure situation varies according to landscape niches. They are often clearer regulated in lowland areas then in upland areas. In uplands the use right to land is often attributed to the person who deforested the plot. This ownership is usually respected, but the owner is often willing to allow farmers to crop some of the land for a year. It is often the case that once land is improved, for instance by installing irrigation canals, installing agroforestry systems or even by planting shrubs on contours, the land becomes more secured for the person who improved it. Neighbors respect that plot

as individual property. Unimproved upland tanety areas, on the other hand, maintain a status of possible access for outsiders, which can make the planning at the village territory difficult.

Pressure on the forest remains high, as young farmers migrate to the forest in search for agricultural land. Once a homestead is established, farmers try to increase their land each year and keep deforesting (1-2 ha/year), in order to accumulate land for their descendents.

FARMING SYSTEM OF THE WESTERN SIDE OF THE FOREST CORRIDOR (FIANARANTSOA AND TOAMASINA)

The western side of the forest corridor is considerably drier then the eastern side and the altitude higher. The relief is less steep and larger lowland areas are used for irrigated rice cultivation (See Table 1). Cropped uplands are often concentrated to the lower parts of the hillside, whereas the upper parts are not used for cropping purposes anymore. Vegetation re-growth is slower on this side of the corridor and after a few cultivation cycles, uplands transform into pseudo-steppes, which are periodically burned producing low quality grazing lands. Reforestation becomes an important activity to cover the daily needs for fuel and service wood.

If farmers possess cattle, manure is often used to fertilize the cropland. In the Fianarantsoa area, cattle theft remains a very large problem. This contributes to a de-capitalisation of the rural economy, in addition to the direct negative impacts on the farming system where agriculture-livestock integration is hardly possible (unavailability of cattle for manure production, rice field preparation, transport). In the Lac Alaotra region, on the other hand, cattle production is widespread. Cattle grazing on bare hillsides is a major threat to biodiversity and upland restoration efforts, as annual fires are used to rejuvenate the pasture vegetation. Also due to low pasture productivity in the immediate surroundings of the villages, cattle herds are often taken far away to the forests for grazing (Lac Alaotra).

Erosion can be a significant problem in this zone. In parts of Toamasina, *lavaka* erosion is a main threat to agricultural investments in lowlands (rice fields and infrastructure) but also for the uplands. In addition, sheet erosion is provoked with each rain event on the large surfaces of degraded pastureland. This is due to exposed surface soil between the tuffs of grasses.

The western corridor side has a high potential for food crop production. Next to lowland rice, off-seasons crops such as potato and vegetables show high productivity. Other crops with good productivity are sweet potato, manioc and maize (Lac Aloatra). Farming is often more intensified then on the eastern side, with farmers having been exposed to improved techniques, improved varieties and fertilizers, although these inputs are rarely available. Agriculture is not very diversified and farmers remain often very poor due to small productive surface areas and low productivity of their land. More recent major diversification efforts (supported by ERI) concern fish production in ponds and Jatropha tree plantations. The expansion of fish production in ponds in the lowlands has started to obviously alter the landscape.

The threat to the forest is less pronounced than on the eastern side. If farmers colonize forests, they usually install lowland rice fields in the valley bottom and clear some of the land for their homestead and for a few surrounding fields. Thus the dimension of destruction is smaller compared to the eastern side.

3. ERI'S APPROACHES, STRATEGIES, AND FIELD INTERVENTIONS TO DEVELOP ALTERNATIVES TO TAVY

This chapter provides an overview of ERI's technical approaches and strategies and summarizes the field interventions undertaken over the past two years under Module 3. ERI requested this overview for this consultancy with the aim to provide outsiders a rapid overview of the program.

3.1. BACKGROUND

ERI's primary mandate is embedded within the USAID strategic objective (SO6) to conserve *biologically diverse forest ecosystems*. The conservation community in Madagascar largely ascribes to the notion that the forest corridors may be conserved if food security is assured for communities in proximity to the primary forests. This is also one of the underlying premises of ERI's intervention in rural areas. More specifically, ERI's goal is to *conserve and sustainably manage the rainforest corridors Ankeniheny-Zahamena and Ranomafana- Andringitra and to improve the livelihood of rural population living in its proximity*. To this end, a wide variety of interventions are designed to reduce deforestation and to promote alternatives to slash-and-burn agriculture (*tavy*) introduced through the Koloharena farmer movement.

Within the five integrated results modules (ecoregional planning, community-based natural resources management, alternatives to slash-and-burn agriculture, socio-organizational support to rural associations, and strategic communication), the technical agricultural development resides with the third module, alternatives to slash-and-burn, the review of which is the purpose of this consultancy.

The objective of the Module 3 is the *replacement of slash-and-burn (tavy) practices at the landscape level through profitable and environmentally sound farming systems*. ERI promotes the development of 'sedentarized' agricultural systems that offer increased agricultural production on lands outside of the current primary forest with the aim to replace the slash-and-burn agricultural system along the threatened forest corridors. In view of achieving this objective, this module is building on three pillars (i) environmental protection and increased agricultural productivity; (ii) income generation and (iii) food security, which are reflected in the three components of the module.

- **Component 1:** Promote development and adoption of improved agricultural technologies and practices within integrated management of farming/natural resource systems
- **Component 2:** Enhance producer capacity to maximize profits and meet market quality, volume and scheduling requirements
- **Component 3:** Improve food security, nutrition and overall health

First, ERI's *agroecological approach* will be explained and an overview given of realized activities since the beginning of the project in 2004. Secondly, ERI's *implementation approach* will be presented, including the extension system, collaboration arrangements, capacity building and communication strategy.

3.2. AGROECOLOGICAL APPROACH AND PRACTICES

With the above described mandate, and with the characteristics of the intervention zones that influence agriculture, ERI has not adopted a conventional agricultural approach that is dependent on inputs such as chemical fertilizer and pesticides, hybrid seeds, fuel powered machinery, high volume cash crop production, specialization of the farming system towards a few crops.

ERI has developed an innovative agricultural approach (Figure 4) that integrates following characteristics that are further discussed below:

- Synergies between agriculture and biodiversity conservation
- Low external input agriculture
- Agricultural intensification and diversification based on agroecological principles
  - Balance between food and cash crops
  - Careful transition into market economy
  - Organic agriculture
- Recognition of agroecological niches
- Landscape vision
- Farmer-to-farmer extension system

General Characteristics of Intervention Zones

Environmental and biophysical characteristics

- Extremely high biodiversity and high degree of endemism
- Diverse ecosystems
- Low natural soil fertility
- Forests maintain important watershed functions (water sources that feed the region)

Agricultural characteristics

- Traditional farming practices
- Subsistence farming
- Good potential for high value cash crops and niche products
- Comparative advantage of agroforestry systems compared to annual field crops

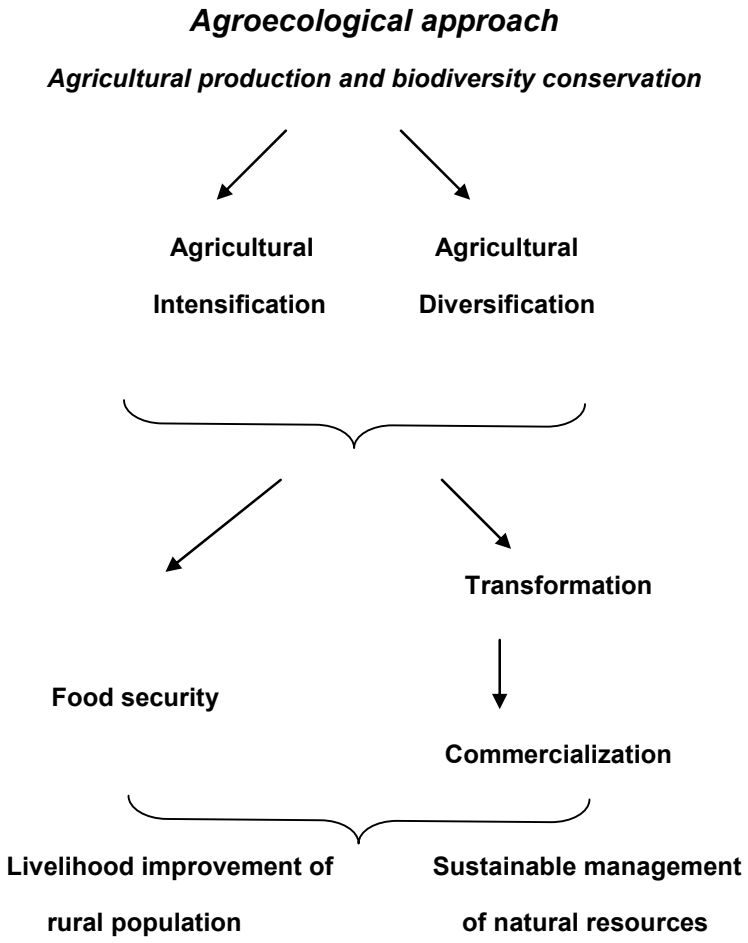
Socio-economic characteristics

- High poverty level
- High rate of analphabetism and low general education level
- Isolation:
  - transport infrastructure (e.g. roads) is often weak,
  - distance to markets can be far
- Fragile market conditions (price fluctuations, instability of markets)
- Dispersed settlements
  - Individual households and hamlets dispersed along forest border

Socio-political characteristics

- Absence of governmental extension service
- Relationship between population and government can be difficult and is often not transparent for outsiders (e.g. lack of government support, illicit forest activities)

FIGURE 4: AGROECOLOGICAL APPROACH ADOPTED BY ERI



SYNERGIES BETWEEN AGRICULTURE AND BIODIVERSITY CONSERVATION

ERI promotes agricultural development that is in synergy with biodiversity conservation and with the protection of the natural resource base. This follows the approaches and principles of agroecology, ecoagriculture, and sustainable land management (see Table 2 for further explanation).

FIGURE 5: AGROECOLOGY - ECOAGRICULTURE - SUSTAINABLE LAND MANAGEMENT

ERI's agricultural approach as described has much in common with the approaches of Agroecology, Ecoagriculture and Sustainable Land Management. The conceptual frameworks and principles of these three approaches are mostly congruent with ERI's endeavor to develop an efficient approach to respond to the environmental, social and economic challenges of the project zones. Thus, ERI does not feel the need to specifically subscribe to one of the approaches, but is open to integrate insights and guidelines developed by the three approaches that best respond to the local reality of the project zones. ERI overlooks some of the turf-war, for instance between proponents of Agroecology and Ecoagriculture that flared up in 2004 (see bibliography). The terminology of 'agroecology' is preferred as reference to the science of agroecology and its definition (see below), but not as exclusive commitment compared to the other approaches developed. More information (references and web-links) is available in the bibliography section.

Agroecology

The science of agroecology, which is defined as *the application of ecological concepts and principles to the design and management of sustainable agroecosystems* (Gliessman, 1998), provides a framework to assess the complexity of agroecosystems (Altieri 1995). Agroecology goes beyond the use of alternative practices to develop agroecosystems with minimal dependence on high agrochemical and energy inputs. It emphasizes complex agricultural systems in which ecological interactions and synergism between biological components provide the mechanisms for the systems for their own soil fertility, productivity and crop protection (Altieri and Rosset 1995).

The ultimate goal of agroecological design is to integrate components so that overall biological efficiency is improved, biodiversity is preserved, and the agroecosystem productivity is self-sustaining (capacity is maintained). The goal is to design a quilt of agroecosystems within a landscape unit, each mimicking the structure and function of natural ecosystems.

http://www.agroecology.org/

http://www.cnr.berkeley.edu/~agroeco3/index.html

Ecoagriculture

Ecoagriculture is referring to land-use systems designed to produce both human food and ecosystem services, including habitat for wild biodiversity. Ecoagriculture upholds the vision of rural communities managing their resources

Sustainable Land Management

Sustainable land management (SLM) is defined as a knowledge-based procedure that helps integrate land, water, biodiversity, and environmental management (including input and output externalities) to meet rising food and fiber demands while sustaining ecosystem services and livelihoods. SLM is necessary to meet the requirements of a growing population. Improper land management can lead to land degradation and a significant reduction in the productive and

service (biodiversity niches, hydrology, carbon sequestration) functions of watersheds and landscapes.

In layman's terms, SLM involves: Preserving and enhancing the productive capabilities of land in cropped and grazed areas—that is, upland areas, downslope areas, and flat and bottom lands; sustaining productive forest areas and potentially commercial and non- commercial forest reserves; and maintaining the integrity of watersheds for water supply and hydropower generation needs and water conservation zones and the capability of aquifers to serve farm and other productive activities.[3]

Low external input agriculture

ERI promotes a low external input agriculture, by introducing technologies that are based on improved know-how (e.g. SRI/SRA) and take best advantage of the system's own productivity (e.g. composting). This is complemented by the introduction of improved tools, and small-scale transformation machines. High input agriculture is not suited for the project region, partially due to the sporadic and irregular availability at the local level of fertilizers and pesticides and their high prices. ERI is convinced that much production increase can be gained simply by minimizing the losses from the system (such as nutrients, carbon, water and biodiversity) by striving for the preservation of the natural resources and by improving the management of ecosystem components and services (for instance through soil protection and efficient nutrient recycling).

Agricultural intensification and diversification

Agricultural intensification and diversification aim at food security, as well as at the economic and ecological improvement at the farm level. ERI's intensification and diversification is based on agroecological principles such as enhanced nutrient recycling, soil protection, diversification of varieties and species, and enhancing beneficial biological interactions and synergies among agrodiversity components. ERI's strategies for implementation are, for instance, agroforestry systems, mixed cropping that combines food and cash crops with cover crop legumes and /or tree and shrub species, crop and livestock (including fish) integration, and the introduction of perennial crops. More specifically, ERI promoted on the eastern corridor side the introduction of perennial crops into the existing farming and agroforestry systems such as vanilla, improved varieties of bananas, pepper, cinnamon, Jatropha, among others.

With increased crop and animal diversity, or **agrobiodiversity**, farmers suffer less from price fluctuations or yield drops of a single crop. Diversity provides a buffer that reduces the vulnerability to shock events such as climatic, political or economic perturbations. Agrobiodiversity can also help to create a more balanced ecosystem, to shield against pest and disease problems, and to create favorable conditions (through rotations, intercropping, relaycropping etc) for maintaining healthy soils, and for recycling nutrients on the farm. In addition, diversified food production can offer a more diverse diet that contributes to a healthy nutrition.

Balance between food and cash crops

ERI favors achievement of a balance between food and cash crop production and supports a careful transition of the currently more subsistence-oriented farming systems towards market-oriented

[3] See for further literature, World Bank, 2006, "Sustainable Land Management."

agricultural production. Thus, improved food crop production aims to address food security and a healthy nutrition throughout the year, including the hungry season. Improved cash crop production attempts to achieve increased income, but should also reduce or minimize risks during the commercialization process. Ideally products should receive some transformation at the farm level, creating added commercial value. Ultimately, revenue creation should directly benefit the households and not be absorbed at the intermediary level during the commercialization process.

Organic agriculture

ERI is in favor of the promotion of organic agriculture, especially for cash crops that can be marketed internationally. This seems obvious and interesting, as the current agricultural practices in the project zone use hardly any pesticides. Nevertheless, the choice needs to be made and defended, now that newly developed and proposed techniques of *Semi Direct* (e.g. by GSDM, TAFA Madagascar) do use pesticides as part of their technology packages.

Agroecological niches

A distinguishing feature of ERI's agricultural approach is that intensification and diversification interventions are tailored to discrete agroecological niches within the farming system. Even though an enormous amount of landscape diversity exists between the temperate high plateau and the lowland tropical zones, the agricultural landscape is formed by similar niches. They are: lowland (rice) fields, elevated borders to rice fields or *baiboho*, homegardens, uplands or *tanety*, reforestation plots, secondary forests, and primary forests. ERI develops and promotes for each of the niches a menu of agricultural innovations that can be further adapted and developed through the farmer-to-farmer extension approach.

Landscape vision

The agroecological approach enables ERI to go beyond the plot, niche and household level, and to maintain a landscape and territory vision, in order to account for dynamics and factors that determine the protection/health of the larger ecosystem and the primary forests. It is also at this level, where Module 3 has an important interface with Module 1 (Ecoregional Approach to Conservation and Development Adopted and Implemented by Multiple Actors in Priority Ecoregions) and Module 2 (Community Based Natural Resource Management Improved and Expanded to Protect Forest Corridors).

3.3. AGRO-TECHNICAL INTERVENTIONS SINCE 2004

This section provides an overview of ERI's agricultural activities since the beginning of the project in September 2004 for the three components of the third Module.

Component 3.1. Promote development and adoption of improved agricultural technologies and practices within integrated management of farming/natural resource systems

This component targets the full panoply of techniques suitable to intensify and diversify the agricultural system. The following table (Table 2) and text summarizes, which improved techniques and practices were introduced into the different agroecological niches.

TABLE 2: OVERVIEW OF ERI INTRODUCED TECHNIQUES AND PRACTICES

Niches	Fianarantsoa	Toamasina
Lowland rice	▪ SRI/SRA ▪ Off-season crops: potato ▪ Fisheries ▪ Rice-fisheries ▪ Water pump, improved weeder	▪ SRI/SRA ▪ Off-season or winter crops ▪ Potato seed production
Baiboho	▪ Fisheries ▪ Improved banana varieties ▪ Vegetable production ▪ Food crops: Vit A rich sweet potato, beans ▪ Composting/ organic matter for fertilization	▪ SRI/SRA ▪ Winter crops ▪ Vegetable production ▪ Sugar cane ▪ Banana ▪ Improved seed production of rice, maize and beans
Household gardens	▪ Local chicken husbandry ▪ Honey production ▪ Artisanal plants (weaving) ▪ Nurseries at household level ▪ Vegetable production, sweet potato ▪ Moringa, Papaya	▪ Local chicken husbandry ▪ Vegetable production ▪ Fruit trees ▪ Tree nurseries ▪ Composting ▪ Trees for service wood
Upland fields/ fallows	▪ Jatropha ▪ Manioc and food crops ▪ Cash crops (coffee, ginger, vanilla) ▪ Soil erosion control (vetiver, Tephrosia ▪ Biomass banks	▪ Soil erosion control and soil restoration (direct seeding) ▪ Improved fallows ▪ Food crops: Manioc, rice, mais ▪ Cash crops: Jatropha, litchi, clove, vanilla, cinnamon, coffee, ginger
Reforestation plots	▪ Exotic and indigenous reforestation species (Eucalyptus, Pinus, Cassia, Ravintsara etc. ▪ Agroforestry: Coffee, papaya, Albizia, mulberry, Moringa ▪ Nurseries (27) with 560,000 plants ▪ Fire-break establishment	▪ Improved seed production for agroforestry species ▪ Decentralized nurseries ▪ Exotic and indigenous species plant production and reforestation

Low-land rice fields

Among the most promising lowland technologies is SRI (*Système de Riziculture Intensive)* as well as SRA (*Système de Riziculture Ameliorée)* that allows to double or triple rice yields without depending on outside inputs such as fertilizers or improved seeds. SRI is a methodology for increasing the productivity of irrigated rice by changing the management of plants, soil, water and nutrients4. SRI has already been promoted under LDI, and is known to many KH farmers in the region. ERI focuses its work on water control, improved weeding, compost application to increase soil fertility, plowing methods and selection of varieties. Fish production is another very promising farming practice and has been promoted especially in the ERI Fianarantsoa area. Fish ponds are constructed in lowland fields or Baiboho. Another technique, raising fish in association with a rice crop (associated rice-fish production), is also disseminated. Farmed species are Royal Carp and Tilapia. Some of the farmers have specialized in raising fingerlings and learned even how to induce two fingerling spawnings of Royal Carp. ERI also supports off-season cropping of vegetables, beans, potatoes and other crops such as peanuts. This allows farmers to achieve higher overall output from their rice fields. In addition, applied compost or fertilizer can benefit multiple crops with its residual effects. ERI has introduced new tools and small machinery into this niche. The treadle pump allows irrigating elevated fields or draining waterlogged areas. The new conical weeder model increases labor efficiency significantly over the older promoted models.

Baiboho

Baiboho refers to the narrow band of land between rice fields and the tanety uplands. This niche can be intensively cultivated during the rainy and dry season and contributes significantly to improved nutrition and income. ERI encourages the diversification of crops in this niche, thus providing farmers with new options. For instance, ERI introduced improved varieties of taro, yam, potatoes and vitamin rich orange sweet potatoes. ERI also offered training in new bean cultivation techniques. A thousand banana plants of new Panama bacteria resistant varieties were distributed across the zone and KH members are currently multiplying these new varieties for other farmers. Farmers also establish fishponds in this niche.

House-Hold Gardens

This niche consists of various types of agroforestry systems based on banana, coffee and fruit tree cultivation associated with cash or annual food crops. Its composition varies according to farmers' preferences and location specific specialization. Soil fertility is higher in this niche compared to upland fields due to the addition of manure, household wastes, protection of soil surface trough mulching and shady conditions. ERI promotes a diversification and intensification of this niche by introducing new tree and cash crops such as *Moringa olifera*, coffee (*Robusta* in the East, *Arabica* in the West), bananas, litchi, vanilla, papayas, and higher yielding varieties of fruit trees. A limiting factor remains the availability of quality seeds and grafting materials. Bee keeping is actively encouraged and farmers usually build hives in the immediate vicinity of the household. Small-scale animal husbandry is also supported through vaccination programs and some selected breeding of local chicken for which a local and regional market exists.

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[4] See for further information, http://ciifad.cornell.edu/sri/

Uplands

The majority of uplands in the project zone are comprised of degraded fallows or grasslands. Soil organic matter is often depleted and soil fertility exhausted. Soil restoration is sought through erosion control measures combined with soil quality improvement. This includes *Vetiver* bunds or agroforestry shrubs planted on contours, the planting of cover crops, and the installation of biomass banks with *Tephrosia*, *Flemingia*, and *Crotalaria*. ERI started also testing various cover crops species in Toamasina. Adoption of soil restoration techniques appears often to be slow, if farmers do not perceive any direct economic interest. The challenge lies in finding crops and techniques that can persist on degraded land. One of the entry points that ERI has identified is the introduction of *Jatropha curcas* in various agroforestry constellations. *Jatropha* adapts well to various degrees of soil degradation and challenging environmental conditions. This allows extending the productive land surface available to a household. Other impediments to improve productivity of this niche refer to land and tree tenure constraints and the lack and high costs of seeds of soil-restoring plants.

Reforestation Plots

Over the years the ERI program has worked closely with rural associations to set up village and association tree nurseries of indigenous and exotic species. Rates of reforestation should be considerably higher, but the Koloharena confront difficulties in obtaining high quality seeds. ERI is introducing a training program to help farmers collect forest species seeds. Survival rates of planted trees vary considerably depending on the capacity of households and associations to protect trees. In addition, land tenure constraints are often a disincentive to community woodlots.

Secondary forest-fallow

Secondary forest zones are some of the most threatened fallow areas due to progressively declining fallow periods in the project zone. The secondary forest fallows often represent the last soil fertility reserves. They are under high pressure to be used for upland rice cultivation via slash-and-burn practices. ERI tries to support the integration of these areas under GCF and GELOSE contracts (Module 2) to provide the vegetation a chance to regenerate.

Primary forests

ERI interventions focus primarily in working with a variety of partners to establish new protected and sustainable-use areas under the new *Systèmes d'Aires Protégées de Madagascar* (Module 1) and to support the establishment of community resource management agreements (GCF and GELOSE) in and along forest corridors (Module 2). Resource management plans are associated with these agreements and ERI tries to provide technical and financial support to the implementation of these community initiatives.

Component 3.2: Enhance producer capacity to maximize profits and meet market quality, volume and scheduling requirements

This component evaluates and disseminates appropriate production and marketing techniques for selected cash crops. This includes the promotion of agricultural mechanization, food processing techniques, plant management to improve product quality, and the support to develop commercial partnerships between agro-industrial actors and small producers. Capacity building of farmers to maintain successful business relationships with private sector is also targeted. The main domains of activities are:

Identification of commodity chains and buyers

ERI works with BAMEX in identifying promising value chains for the different locations of the project zone. In Fianarantsoa 13 commodity priority chains are identified whereas in Toamasina they are 15, respectively (Table 3). ERI is also engaged in testing new ideas for market opportunities. For instance, ERI is encouraging the PARAPHARMA firm to invest in converting the eastern side of the corridor into an ECOCERT certified pesticide free zone. This would allow for the sale of a wide variety of commodities (vanilla, coffee, cinnamon, ginger, pepper, cloves) to the European organic market.

TABLE 3: PRIORITY COMMODITY CHAINS IDENTIFIED BY BAMEX

Fianarantsoa		
1. Jatropha	6. Vanilla	10. Dry season vegetable
2. Banana	7. Rice	11. Local chicken
3+4. Coffee (Robusta, Arabica)	8. Beans	12. Fish
5. Ginger	9. Potato	12. Honey
Toamasina		
1. Litchi	6. Rice	11. Cinnamon (EO)
2. Pepper	7. Onion	12. Eucalyptus (EO)
3. Cinnamon	8. Potato	13. Ginger (EO)
4. Ginger	9. Gourmet Coffee	14. Clove (EO)
5. Jatropha	10. Geranium (Essential Oil—EO)	15. Ravintsara (EO)

Support KH in negotiation and preparation of contracts with private sector

In a second step, BAMEX supports ERI in identifying buyers and business partners. ERI and BAMEX support KH to prepare contracts with private companies. This includes facilitation of meetings and improvement of farmers' skills in contract negotiation. It enables farmers to avoid or reduce the numbers of intermediaries, and thus increases their profits. Two examples are:

- A contract between the D1 Company and the 6 KH Cooperatives in Ambatondrazaka was set up to produce *Jatropha curcas* on 300 ha. BAMEX identified this commodity chain and the buyer (D1). The ERI Program ensures the technical support to the farmers for Jatropha production through services provided by the Marotia association.

- An exclusive contract was established between Faly Export and Koloharena farmers in the Vatomandry, Ranomafana Est, Brickaville and Maromitety areas for litchis from 3,000 trees.

Transformation

In contrast to LDI and PTE, ERI is investing in collaboration with BAMEX in the expansion of food transformation technologies and agricultural equipment. BAMEX is initially testing the technologies and equipment to find out how much value is added to the agricultural commodities. ERI's role is then to disseminate the promising technologies, such as the Jatropha oil press (Bielenberg handpress), back-pack carried honey extractor, and dryers, among others. ERI is also working with FAO and the private sector to expand the use of 'conical weeders' and treadle water pumps. Both of these technologies could considerable reduce labor costs and contribute to increased yields. Given the lack of rural credit in most areas along the forest corridor, ERI is trying to expand the concept of renting farm equipment at a reasonable price through the Agricultural Supply Centers.

Component 3.3: Improve food security, nutrition and overall health

Integration of population, health and environment

The objective of this component is to improve food security, general nutrition and health of the Koloharena farmers, including the reduction in length of the hungry season. This objective is embedded within the larger concept of integrating population, health and environment issues which is also supported by the Ecoregional Alliance and by the Kominina Mendrika approach. ERI is collaborating closely with SanteNet, Voahary Salama in issues such as community potable water initiative, introduction of vitamin rich foods (i.e.: orange sweet potatoes, papaya, Moringa), and a campaign on the impact of expansion of HIV-AIDS on agriculture and environment. In addition, training will be provided in domains such as culinary art, promotion of vegetable gardens and improved nutrition in general.

Importance of rural markets and transport systems

The vitality of rural markets, price dynamics for crops and essential commodities (PPN), and the rural transport system are determining to a large extent the overall food security situation in the project zone. ERI tries to support farmers' capacity to work with the market dynamics in order to reduce their vulnerability. For instance, the establishment of village granaries enables KH cooperatives to collect rice and market it when prices are favorable. The fragility of rural transport systems is causing currently deep concern in view of developing a local and regional economy. This concerns the major roads, bridges, the FCE railway and the Port of Manakara. Although much funding has been attributed in the past years to rehabilitate these major transport ways, they are currently at great danger of collapsing again due to mostly political reasons. This would have a dramatic impact on

food security, as food prices are expected to rise sharply and farmers may take refuge in the primary forest to practice tavy. ERI Fianarantsoa tries to devise with the Chef de Region and Chef de District a regionally based road maintenance initiative. For more detailed information on the relationship between infrastructure and deforestation.

FIGURE 6: RELATIONSHIP BETWEEN INFRASTRUCTURE AND DEFORESTATION

The relationship between deforestation and infrastructure can be very complex and can result in two outcomes: i) increased pressure on natural resources and forests due to evacuation potential through well functioning transport system, or ii) reduced pressure due to possibility to evacuate alternative agricultural products that are not based on destructive forest management (such as tavy, NTFP or wood extraction).

Many studies show that extension of infrastructure, in combination with other causes, contributes to deforestation. For instance, Geist and Lambin (2001, 2002) showed, that in 72% of 152 cases in a sub-national study, deforestation was influenced by infrastructure extension. In Madagascar this relationship was also shown by Green and Sussman (1990). Deforestation of the eastern rainforest between 1950 and 1985 was most rapid in areas with low topographic relief and high population densities. Immigration and the creation of new settlements were supported by infrastructure. In addition, the 'open' access regime to forests and natural resources favored the process of land reclamation through deforestation.

In a recent study by Deeg and Freudenberger (2000), the aspect of transportation availability in proximity to the Fianarantsoa forest corridor on the environment was investigated. The study showed that the positive impact of the railway and open roadways is much higher then the negative impact for forest product exploitation. Moreover, the railroad has advantages over roads, as goods can be transported at a lesser cost then with trucks over roads, and railroad transport is more independent on the seasons and allows an important exchange between cash crops leaving the area and food crops, especially rice, arriving at location. This allows farmers to invest in cash crops such as banana and coffee. In case of railroad disruption, access to markets become irregular and more expensive, imported food will be more sparse and more expensive, forcing farmers to engage anew in slash and burn agriculture and migrate towards the forest. In such a case, other efforts that are under way, such as landscape planning, support to the communal development plans which includes landscape planning, as well as GELOSE and GCF concept will most likely fail.

It is to note, that the availability of alternative techniques to tavy are a precondition that farmers can take full advantage of the improved transportation services and commercialize products that stem from sustainable farming practices.

3.4. IMPLEMENTATION APPROACH

FARMER-TO-FARMER EXTENSION APPROACH

The government of Madagascar's rural extension system and agricultural research structures are no longer operational in rural areas due to the collapse of the *Programme National de Vulgarisation Agricole* (PNVA). Government policy implicitly leaves agricultural extension to the realm of the non-governmental organizations and the private sector. Thus, USAID projects have set up over the years a "farmer-to-farmer" extension system whereby a network of *Paysans Animateurs* and *Paysans*

Vulgarisateurs foster the adoption of innovative agricultural intensification practices through several mechanisms.

The agricultural extension system currently supported by ERI consists of the following elements:

THE COMPONENTS OF THE APPROACH

Agricultural Technicians: The ERI Toamasina and Fianarantsoa programs each engage directly five to six agronomist field agents to live in remote rural areas along the forest corridor. Recently, both programs have instituted a new system whereby ERI sets up a performance based contract with the Koloharena federations or cooperatives that allows the Koloharena to hire, fire, and manage their own agronomists. In Fianarantsoa, 18 agronomists and socio-organizers are managed collectively by the commune and the federation of Koloharena to provide agricultural extension training courses and services to the farmer's movement and indeed the entire commune. In Toamasina, the field agents working via contracts with Koloharena Cooperatives are less numerous, but slated to expand to 11 in 2006. ERI provides periodically refresher courses and extension materials to these agents. These technicians provide also training to the *PV* and *PA*.

Paysans Vulgarisateurs (PV) and Paysans Animateurs (PA): The LDI and PTE programs of USAID Madagascar instituted a system of village based agricultural advisors and rural organizers who extend new information and techniques to the Koloharena members. Currently there are 404 registered *Paysans Vulgarisateurs* and 114 *Paysans Animateurs*. Certified jointly by the Ministry of Agriculture and the Ministry of Water and Forests, these village extension agents are remunerated through various arrangements in cash or kind by the Koloharena cooperatives and federations.

Agricultural Supply Centers (Centres d'Approvisionnement Agricole): These small farmer-run stores are operated by the Koloharena rural cooperatives. The stores sell seeds, fertilizers, tools, mosquito nets, condoms, and other items of interest to the rural community. The centers manage a small credit system in some cases and serve as important clearing houses for information sharing. Throughput is relatively small because of the low purchasing power of rural communities. The cooperative hopes to extend the market range of the supply centers but is limited by a lack of capital.

LADIA former CDIA: The CDIA (Centre de Diffusion et d'Intensification Agricole) is a unique pioneer center in Madagascar with a 5 ha integrated agricultural systems 'farm'. It plays the roles of providing trainings, of presenting technical innovations on Center's fields, of welcoming researchers who would like to do field research, and of producing high quality animal and plant germplasm for the surrounding population. The CDIA was created by LDI in 1999 and has changed its name to LADIA « Lapa Ara-Drafitra Ivoaran'ny Ambanivolo » in 2006. This was done with the aim to get more local farmer level ownership of the Center.

CHANNELS OF IMPLEMENTATION OF THE FARMER-TO-FARMER APPROACH

The ERI program recognizes that agricultural innovation depends to a large degree upon the exchange of information and ideas between farmers and the scientific community. However, the decline in the capacity of the FOFIFA agricultural research institute to carry out and disseminate agricultural research hinders the dissemination of new ideas.

ERI is interested in alternative applied research and extension systems and searches for ways to encourage endogenous agricultural innovation. In addition, ERI encourages private company

extension systems that provide good agronomic advise and that allow farmers to improve quality and quantity of their products and thus can achieve a better price. These extension systems have the advantage of potentially become perennial and go beyond the project lifetime. The farmer-to-farmer extension approach is implemented through three channels: the Kolo Harena House (Fianarantsoa), on-site demonstration fields (Fianarantsoa and Toamasina), and farmer field schools (Tamatave).

Kolo Harena House (Maison Koloharena): The Koloharena farmers construct a small and very simple building or center on a privately or communally owned field that becomes a place of encounter for KH and non KH farmers. On the field several types of agricultural activities are undertaken. These can include demonstration sites or field tests of new techniques or varieties, the multiplication of germplasm of specific crop varieties or agroforestry trees, the production of trees in a nursery, and production of fingerlings. All germplasm is distributed to KH members and other interested nonKH farmers. The KH house can also be used for training or as a FFS site.

Demonstration Sites: On a demonstration site new techniques are shown or tested, which are introduced by the ERI technicians. Some of the demonstration sites are situated around the KH houses whereas others are widely distributed across the village territory. ERI pays for seeds and inputs and KH farmers provide labor for planting and cultivation and assure the maintenance of the crop. ERI technicians provide technical training and incite farmers to undertake observation during the maintenance work, which is followed by a discussion. The PVs often install a 'model site' on their own farm, replicating the new techniques and adapting them according to their individual inclination. For these private sites, the farmers take charge of the seeds and inputs.

Farmer Field School (FFS): In the 2005/2006 cropping season a total of 135 FFS were taking place in the Toamasina region. A group of farmers (KH and non KH), with a maximum of 25 farmers, decides on a technical topic they like to study during an entire cultivation cycle (e.g. cropping techniques, fertilization). The farmers install a field together and observe a chosen technical aspect in comparison to a control treatment. The group meets twice a month in the field where subgroups are formed for field observations. Under the guidance of a discussion facilitator (one of the farmers) the sub-group findings are discussed among all participants. The observations and eventual conclusions are noted in a booklet. A technician (PV, ERI technician) is present as an observer and as a resource person, in case technical questions arise that surpass farmers' knowledge or to stimulate the discussion with additional information.

These three extension approaches complement each other well and provide a certain flexibility according to issues, needs and initiatives of farmers.

- The KH house (*Maison Koloharena)* allows for several types of services at a centralized location and can serve important functions within the local farming community such as germplasm multiplication or training location.
- The demonstration sites can be multiple and dispersed across the village territory, thus giving a wider exposure to the larger farming community (compared to the KH house). These sites allow undertaking of applied research (e.g. testing of new techniques or germplasm), without farmers having to take the risk
- FFS provide farmers the opportunity to study a technical issue of special interest together. In addition it empowers farmers and increases their confidence of being innovators.

COLLABORATION NETWORKS

ERI maintains a multifaceted network of partnerships and affiliations. To provide a fair portrait of these collaboration arrangements exceeds the capacity of this consultancy. Given the limited staff numbers, ERI developed a working strategy that engages partners in the execution of the program activities. This is a very organic and dynamic process and is constantly evolving. Success of this approach can to a large part be attributed to the longevity of ERI staff that upholds an institutional memory and that learned to develop a management style that translates in fruitful outcomes. The following provides only an illustration of the breadth of collaborations with research and development institutions, the private sector, NGOs and the Ecoregional Alliance members.

Agricultural research and development institutions

- FOFIFA: (farmer seed production, potato and sweet potato)
- FIFAMANOR: (Vitamin A rich sweet potato)
- DRDR (Direction Régional du Développement Rural): Agreements were signed for technical support from
- FAO: ERI received several low-cost treadle pumps and technical assistance for testing in the baiboho and lowland rice field zone.
- CNCC/STABEX: Nine large tree nurseries (50,000 seedling capacity) were established on eastern Fianarantsoa corridor side in collaboration with KH members.
- CNRF (Centre National de Semances Forestière): provided farmer training in forest species seed collection and in the marketing of forest seeds.

Private sector and NGOs

- Contract with American firm “Coffee, Corridor, and Spices” (CCS) to train KH farmers of Tolongoina and Manampatrana to collect and market high quality Robusta coffee. Technical assistance included high quality production techniques such as coffee tree maintenance, wet-processing, etc. Arabica coffee was introduced on the western corridor side and contracts were established to sell the production to CSS.
- Contract was established with the POOL Company and KH farmers in Ambatovy to plant 4 ha of improved *Spunta* seed potatoes.

- Training was provided to KH farmers on litchi maintenance and production techniques in collaboration with CTHT and Faly Export
- NGO Marotia offered training and technical support on the production of *Jatropha* seedlings in Ambatondrazaka

Ecoregional Alliance members

- SANTENET: *Moringa olifera* tree, papaya and other fruit trees were promoted that provide highly nutritional food
- BAMEX and CRS/Title II supports the program by identifying new market opportunities and in establishing contracts between the private sector and KH members.
- JARIALA: Policy support for various dossiers such as community level reforestation, forest zoning, management options for pine plantations in the Fianarantsoa and Moramanga regions
- Title II/CRS: Joint training and implementation of agricultural activities (ie: Keliliana dam near Ranomafana)

SPATIAL AND PARTICIPATORY ANALYTICAL TOOLS

ERI has introduced two new analytical tools: *Appreciative Inquiry*—a set of questions and participatory analytical tools designed to help stakeholders identify opportunities for livelihood improvement. These tools have been tested in several communes along the forest corridors to determine whether and how local communities can identify new livelihood opportunities and take concerted actions to capture new possibilities.

Out of this exploratory analysis, ERI has been introducing *Development Pathways*—a set of spatial tools based on Geographic Information Systems to help local level decision makers clarify where and how to channel investments and land use decisions. Although these tools seem very powerful, ERI confronts problems in their optimal use, due to high costs especially in the interpretation of the geographical information data and in the time it takes to carry out truly participatory assessments and community dialogue.

COMMUNICATION, INFORMATION SHARING AND CAPACITY BUILDING

ERI dedicates an entire module (Module 5) to communication, education and outreach. Capacity building is among the main pillars of the program. With ERI's bottom-up approach and farmer-to-farmer extension, capacity building efforts are directed towards the farming community, Koloharena members and the *Paysans Vulgarisateurs* and *Paysans Animateurs*, who are the main actors to promote and follow up on agricultural innovations. ERI also provides quality training to his staff at all levels, in order to keep up with the challenges of the evolving program. The CDIA plays an important role, as it provides a good 'infrastructure' for trainings.

ERI takes on many innovative instruments in its communication efforts and is paying much attention to revising and adjusting its communication strategies with the dynamic evolution of the program. Among the communication tools are (i) the production of technical material and notes on agricultural intensification (technical notes, leaflets, posters), (ii) promotion and discussion of agricultural innovations through radio programs, (iii) promotional events (for instance open doors at LADIA) that

are broadcasted through newspapers, TV and radio stations. In addition, ERI started to set up (iv) listening groups, and (v) is interested in increased and targeted use of audio-visuals, especially in view of reaching a broader audience (non Koloharena farmers) at the community level, which is essential for scaling up.

4. ANALYSIS, CONCLUSIONS AND RECOMMENDATIONS

4.1. ANALYSIS OF ZONING OF FARMING SYSTEMS AND ALTERNATIVES TO TAVY PROMOTED

PROGRAM OBJECTIVES, INDICATORS AND BACKGROUND

The objective of the Module 3 is the *replacement of slash-and-burn (tavy) practices at the landscape level through profitable and environmentally sound farming systems*. The global indicator for Module 3 is the *reduction of slash-and-burn practices in communes of intervention.* The indicator is defined as a 50% decrease in the rate of primary forest loss (newly created tavy in primary forest) in strategic communes of intervention versus control sites.

Slash-and-burn agriculture or tavy is the traditional and predominant land use practice of eastern Madagascar. Primary forest or secondary vegetation is cut, burned und upland rice is cultivated for one season, followed by a root crop such as manioc or sweet potato. As elsewhere in the world, tavy can be sustainable under conditions of low population density and abundant land, yet as early as 150 years ago and continuing today, tavy was recognized as the principal cause of deforestation and subsequent upland degradation. Between 1950 and 1985, it is estimated that half of the then remaining eastern rainforest—7,600,000 ha, or 68% of the original forest—was reduced to 3,800,000 ha or 34% of the original (Green and Sussman, 1990). Today, deforestation continues apace even though the forest remnants are among the most critical of the 25 global biodiversity hotspots.

Intensive tavy practice not only leads to forest and biodiversity loss, it severely degrades local and regional ecosystems. Frequent fires accompanying shortened fallow periods favors nutrient loss from tavy systems, which impacts significantly on agricultural productivity. With rapidly declining yields on uplands, young farmers often see as only option to extend their lands into the rainforest. The two phenomena deforestation and upland degradation are intrinsically linked as they issue from the same cropping system, the tavy system. Thus, this will also influence the proposal of alternatives. With the rapid decline of the last remaining rainforests *and* of upland productivity, it is therefore of ultimate urgency to develop farming alternatives that allow farmers to live well off their land and improve their livelihoods while sustainably managing and protecting the natural resource base at the landscape level.

WHAT ARE THE ALTERNATIVES?

The reduction of expansion of agricultural lands threatening priority ecosystem and the development of alternatives to tavy was among the main objectives of LDI, the precursor to ERI, that started in 1998 and worked along the two corridors in the same sites. LDI's approach to develop alternatives to tavy was based on a three-pronged farming systems model. It included

- Intensified rice production in the lowlands
- Perennial cash crops in the hillsides

- Complementary activities around the homesteads.

The LDI program was designed to incite farmers to shift their interest from rain-fed rice on hillsides to perennial cash crops as a way to reduce tavy (LDI, 2001). The annual upland agricultural system that produces food crops (rice, manioc, beans, sweet potato) was mostly ignored during the LDI period, but has received more attention during ERI. The program has extended its approach to the different agroecological niches that include all landscape segments along a catena from lowlands to rainforests and identifies interventions for all the niches, including the uplands. The inclusion of uplands is welcomed, as uplands are the most fragile among the agroecological niches. Sustainable upland management is found to be critical in this analysis in view of tavy reduction at the large scale. The analysis that follows will go in more detail at various locations.

THE ZONING OF FARMING SYSTEMS FOR PROJECT INTERVENTION

The ERI program continues working in the intervention zones of LDI though some adjustments have unfolded. Initially, the program concentrated its efforts in consolidating LDI and PTE achievements. In a second step, ERI started expanding into new areas. As mentioned under section 2, ERI Fianarantsoa was working during the first year of implementation in the 12 communes where LDI was intervening, out of total 31 communes around the Ranomafana-Andringitra corridor. ERI Toamasina has expanded its range of intervention from originally 8 LDI communes to 16 communes out of 30 communes that surround the Ankeniheny-Zahamena corridor. ERI Fianarantsoa is similarly working in 22 communes though with various degrees of intensity. The expansion of the program into remote areas of the forest corridor is welcomed, as explained in more detail below.

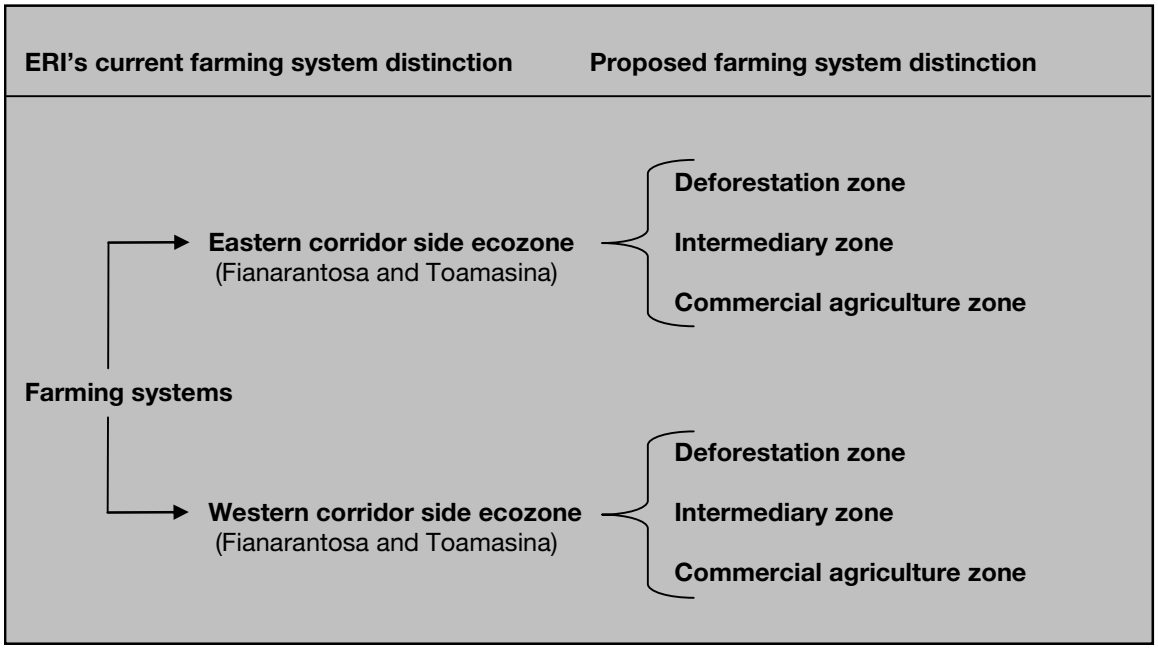
The farming systems within the intervention zone vary considerably. The most obvious differences are between the farming systems on the eastern and western side of the corridor. The two sides vary in climatic conditions, altitude, farming traditions and ethnical groups. The program has this well taken into account and has tailored its interventions to the specific characteristics. The farming systems on the eastern side of the corridor, in Toamasina and Fianarantsoa, on the other hand, are fairly similar. This permits the two regional sub-programs to benefit substantially from each other. The same is true for the western side of the corridor.

In this analysis an additional level to distinguish farming systems within the eastern and western corridor farming systems is proposed (see Table 1). Three farming system zones can be recognized within the eastern and western systems that are correlated to the distance to the forest boundary. They also relate to the evolution of the farming system from the traditional slash and burn practices towards a commercialized agriculture. With ERI's successful presence and interventions in the region, the proposed distinction would allow the program to further fine-tune and clarify its approaches, to increase the efficiency of its support, and to improve the response to local needs and opportunities. The three proposed zones are:

- Deforestation zone,
- Intermediary zone of subsistence and cash crop farming
- Commercial agriculture zone

A more detailed description follows. A schematic presentation can be found in diagram below.

FIGURE 7: PROPOSED DISTINCTIONS IN ERI AGRICULTURAL ZONES



Zone 1: Deforestation zone

Tavy is the prevalent farming practice in the deforestation zone, where primary forest is cut and burned for upland rice cultivation followed by manioc or sweet potato. The agricultural practices are traditional and the farming objective is food production. The farming system shows little diversification, lowlands are often not utilized, and cash crops are limited to a few speculations such as coffee and banana. Farmers often engage in (illegal) forest extraction, which does rarely help alleviating the high poverty level of that area. A major constraint for this farming system is the evacuation of products due to the remoteness and absence of infrastructure. Farmers often carry their produce for many kilometers on their backs to get to a road or market place.

It is often young farmers in search for new and still (relatively) fertile land that settle in dispersed pattern within the forests with the aim to deforest a contiguous extensive surface over the years that can be claimed their land (this refers to the traditional land tenure customs, but as the government is often absent in these area, traditional rules and laws determine the land use). In addition, deforestation happens often beyond the forest boundary, in order not to be noticed easily from the outside. Land appropriation, and living the life of the ancestors are among the driving forces for this farming style. Rice self sufficiency is desired in order not to be too dependent on the cash economy. These farmers have hardly been in contact with extension services, and education level is low. Farmers tend to be suspicious against outsiders and fear repercussions against their actions (tavy, illegal forest extraction)

If land appropriation is not a primary concern and if farmers have sufficiently available fallow plots with good soil fertility, they prefer to do tavy on fallow land. It takes less work and soils are more homogenous then on newly deforested plots. Yields are usually best on fields one to two cropping/fallow cycles after deforestation, but thereafter decline rapidly. With the each burning event, eighty to ninety percent of the plant nutrients stored in the vegetation get lost during a burn, depleting the nutrient pool in soils and vegetation that should be available for the next crop. With the loss of soil

organic matter, soils harden, the rooting zone becomes thinner, soil surface temperatures rise, which has a negative impact on soil water holding capacity, soil microorganisms, and belowground biodiversity. This prompts farmers to continue deforestation. These dynamics result often in complete conversion of forests to agricultural land. Once the forest has mostly disappeared from the farming or village territory and upland fallows are degrading, the agricultural system is shifting to what we find in the second zone.

Zone 2: Intermediary zone of subsistence and cash crop farming

Whereas the deforestation zone is characterized by subsistence farming, a few kilometers in distance to the forest, the farming system changes into a mixture of subsistence and cash crop farming. The tavy system is in transition to sedentarized agriculture. Forests have mostly disappeared in the immediate surroundings and farmers who decide to stay need to start to diversify. This because the tavy on the degrading fallow lands will not produce a good rice harvest anymore.

Agricultural diversification is initiated in various agro-ecological niches, especially in the lowlands, baiboho and the agroforestry tanety system. It is still a subsistence farming system, but commercialization of a variety of produces is increasing. Road infrastructure has become a bit improved compared to the forest zone and evacuation of products via roads and markets becomes possible, although distances can still be very high, and road conditions can be very difficult. Undoubtedly, the interest in cash crops is increasing.

As uplands degrade and their productivity declines, the future for the young farmers who inherit a portion of the family land, depends very much on the possibility to change farming practices away from tavy towards practices that allow maintaining soil productivity and achieving satisfactory yields. If farmers do not have access to such alternatives, there is a big chance that young farmers start migrating to engage in deforestation. Thus, the shift away from tavy is not a ‘volontary’ one, but is due to advancing upland degradation, farmers don’t know how to cope with.

Zone 3: Commercial agriculture zone

This third zone can be found in Ambatondrazaka, Toamasina, in some parts along the railway FCE and in proximity of the town of Fianarantosa. In this zone, agricultural intensification has already advanced, but the production potential of the area is hardly achieved. This is due to lack of available inputs, and water management problems in the lowland areas. Farmers specialize in a few crops that are commercialized in large quantities. Farmers are often well trained, and have advanced technical knowledge that is comparable to the trained Paysans Vulgarisateurs of the project.

The main activities in the agroecological niches for each of the three farming systems and zones is shown in Table 4 below.

TABLE 4: MAIN ACTIVITIES IN AGRICULTURAL ZONES

Niches	Deforestation Zone	Intermediary Zone	Commercial Agriculture Zone
Rainforest	Forest product extraction Charcoal production Tavy (rice, manioc, sweet potato)	---	---
Secondary Forest	Forest product extraction Charcoal production Tavy (rice, manioc, sweet potato)	--- (some reforestation)	--- (Reforestation)
Tanety Uplands	Tavy (rice, manioc, sweet potato and associated crops to rice)	Some tavy, manioc, sweet potato, ginger, pineapple	No crops, unproductive pasture
Homegardens	Banana (coffee)	Banana, coffee, fruit trees such as litchi, oranges, clove, cinnamon, pepper, vanilla	Fruit trees, banana
Baiboho	---	Vegetables, banana, fish	Vegetables, banana
Lowlands	---	Irrigated rice, fish, off-season crops (potato, vegetables)	Irrigated rice, off-seaon crops (potato, vegetables)
Other characteristics			
Market access	Great distance, transport on person's back	Medium reliable still fragile access to roads and markets	Good access to markets
Farming system's main attributes	Food self sufficiency (rice), non-diversification	Subsistence and cash crop production, diversification	Cash crop (rice) production, specialization

PRESSURE ON THE FOREST

The evaluation of what pressure is emanating from these three zones is important and was done by ERI Toamasina helping them to redraw their intervention zone.

For the commercial agriculture zone (or zone 3), pressure onto the forest is very unlikely, given the distance to the forest and the specialization of the agricultural system, which is very different to the tavy system. ERI's consideration to withdraw from this region is therefore justified.

The pressure from the intermediate zone (or zone 2) can be defined as indirect, as farmers living in this zone are not actively engaging in deforestation. But if their farming situation becomes too desperate, farmers retreat to the forest. This migration can also quickly unroll if infrastructures are destroyed or market access is cut, forcing farmers to become food self-sufficient again. This is a consequence of not being able to sell cash crops and not being able to cope with increasing food prices.

The pressure from the deforestation zone (or zone 1) is direct. As already described earlier, deforestation, especially on the eastern side is very rapid, as one farmer can cut 1 to 2 hectares a year. The dispersed pattern of settlement favors in addition the fragmentation of the ecosystem, an additional downside for biodiversity.

DIRECT AND INDIRECT ALTERNATIVES

Alternatives to tavy can also be direct or indirect. The approach LDI has chosen and ERI to a large part are indirect alternatives. As described above they should incite farmers to shift their interest from rain-fed rice on hillsides to perennial cash crops and irrigated lowland rice as a way to reduce tavy.

Direct alternatives are directed to develop upland rice cropping systems without soil degradation. Under the current burning frequency, this would mean to develop systems without the use of fire. As of now, there has not been any technical development beyond the research stage that has been disseminated to and adopted by the rural farming communities.

ALTERNATIVES TO TAVY FOR THE DEFORESTATION ZONE AND FOR THE INTERMEDIARY ZONE

The farming system in the deforestation zone is based on food production and upland cropping. The development of direct alternatives is therefore of strategic importance. Fireless upland management for food crops would allow stopping or slowing the rapid degradation process of the uplands and therefore immediately taking the pressure of the primary forest. The promotion of indirect alternatives has to be carefully tailored to the preferences and possibilities the farmers for changing their farming practices. As labor allocation for the crops is very different then what we find in the intermediary zone, proposals need to fit in with the existing dynamics of the system and slowly shift towards a more sedentarized agriculture. The development of the cash crop economy needs to consider the transportation constraints and remoteness of the area. Products that can easily be stored and have a high price/weight ration are of advantage. Commodities that are dependent on the forest ecosystem or agroforestry system are of preference, such as honey production or agroforestry cash crops such as cinnamon, pepper, vanilla, clove, coffee.

In the intermediary zone, offered alternatives should be both direct as well as indirect. Most of ERIs technical innovations are indirect alternatives, such as improved lowland rice cultivation, fish production, off-season cropping, cash crop development and reforestation, to mention the most important ones. Tavy is practiced on fallow land in this zone. This is of concern, as the current fallow tavy practices are driving the upland degradation process until land becomes unproductive. Thus, direct alternatives to tavy are important in order to prevent complete degradation and to maintain some agricultural productivity. As farmers in this zone are aware of the gravity of degradation, they may be more interested in testing and developing direct alternatives then farmers from the deforestation zone. On the other hand, the challenge to regain land productivity is higher then in the deforestation zone, as some soil restoration processes have to be initiated, which either involves time or some inputs. As uplands occupy most of the landscape surface, the development of direct alternatives is important, which increases the overall farming system productivity. ERI has started to invest in upland restoration through cover cropping and agroforestry techniques.

It is therefore recommended that ERI may consider rethinking its approaches and technical recommendations for the deforestation zone and the intermediary zone separately and that ERI continues to explore more vigorously the technical opportunities to create direct alternatives for the deforestation and for the intermediary zone. A short overview of the different strategies and proposed technical interventions according to zones and niches is provided in Table 5 below.

TABLE 5: OVERVIEW OF PROPOSED TECHNICAL INTERVENTIONS FOR THE DEFORESTATION AND INTERMEDIARY ZONE AND THE AGROECOLOGICAL NICHES

Niches	Deforestation Zone	Intermediary Zone	Commercial Agriculture Zone
Rainforest	GELOSE, GCF	--- (GELOSE, GCF)	Not recommended to be pursued by ERI anymore
Secondary Forest	GELOSE, GCF	--- Reforestation	
Tanety Uplands	Rotations of food crops, cash crops (ginger), improved fallows (and fertilization)	Soil restoration through improved fallows, cover crops, biomass banks, food and cash crops	
Home gardens	Cash crops that are in sink with NR protection, high price/weight ratio, easily stored (eg cinnamon, pepper, vanilla, coffee, clove etc)	Diversification of cash crops, improved product quality and increased transformation at farm level. Nutrition garden as a second concept	
Baiboho	Fish, food crops (vegetables, non irrigated rice)	Food and cash crops, seed multiplication, hungry season crops	
Lowlands	Fish, food crops (vegetables, irrigated and non irrigated rice)	Intensification SRI, SRA, integrated fish/rice production, off-season crops (cash and food)	
Summary of priorities of intervention	Food security is still the priority in addition to a slow introduction into market economy with products that protect natural resources and that are light in weight, have a potential of transformation, and are easy storable.	Healthy balance between food and cash crop production, improved quality of commercialized products, transformation of products.	

EXPECTED PROGRAM OUTCOME

The expected outcome of the program is the reduction of tavy. It is not very clear how the project is going to measure it. There is no baseline data available in the work plan. The JariAla project will be providing the project with hectares lost to tavy for 2005 using LandSat imagery, but that resolution will not be good enough to distinguish dynamics at the plot level.

The reduction or increase in tavy should ideally be accompanied by an analysis that explains the reasons. The reduction of tavy can have multiple reasons not all of them do necessarily indicate a shift towards more sustainable farming practices. This is important to keep in mind, as it may influence the long-term outcome of deforestation. For instance, if forest controls increase and farmers are threatened with jail, deforestation may be reduced during that time. The farmers in the deforestation zone will cultivate their fallows during the time of severe control. But tavy practice on fallows is degrading rapidly the uplands. If the forest restrictions are lifted after a few years, farmers will return to the forest and look for new land. This has its reason to a large extent, because they were not able to pursue a sustainable upland cultivation system on their fallow land.

It is recommended that tavy fields are monitored through high-resolution satellite imagery. These images can additionally be used when working with stakeholders and policy makers. Preferably, the monitoring of tavy through images should be accompanied with in-depth studies that explore farmers' motivation and reasoning for their practices (tavy or non tavy).

4.2. MODULE 3 COMPONENT ANALYSIS AND RECOMMENDATIONS

COMPONENT 3.1: PROMOTE DEVELOPMENT AND ADOPTION OF IMPROVED AGRICULTURAL TECHNOLOGIES AND PRACTICES WITHIN INTEGRATED MANAGEMENT OF FARMING/NATURAL RESOURCE SYSTEMS

The analysis and recommendations will focus on the techniques introduced into the various niches, technical themes that cut across all the niches, the efficiency of farmer-to-farmer extension approach and the role of the CDIA.

Agricultural innovations in the agroecological niches

Lowlands

Strong points:

- Techniques of SRI and SRA are known to the farmers across the ERI intervention zone. They know the techniques well, and have undertaken many different local adaptations according to their possibilities. There was a very high increase in SRA/SRI in one season, certainly a reaction to high rice prices, but also indicating that farmers do know these techniques and apply them as appropriate. SRA/SRI were important themes in FFS during the 2005/2006 season. Some of the FFS concentrated on advanced fine-tuning of the techniques, whereas others were held as an introduction for farmers who have never done it before. Transfer from KH farmers to nonKH farmers has been noticed during our field visits. Scaling up is taking place. Is ERI tracking these dynamics?
- Fish production has created much interest with farmers and adoption of this new speculation is significant as landscapes are visibly changing. This can be observed especially in the Fianarantsoa area where ERI invested much effort in its promotion.
- Some farmers have specialized in the **production of fingerlings** which is technically more demanding, but they seem to control it already well and are able to deliver fingerlings to KH and non-KH farmers in their area. This also indicates development towards sustainability and on-going and future scaling up of activities.
- The rice-fish association system has also found uptake with farmers in Fianarantsoa. This system is further to be promoted especially where farmers do not possess much lowlands and where land is scarce to give up for a fishpond.
- Off-season cropping has recently spurred much interest by farmers. ERI is responding to these interests and providing support through training, seed testing, and is working on collaboration arrangements with research institutions and the private sector.
- Adoption of improved techniques is well underway in zone 2 and 3, but not as important in zone 1.

To be improved:

Fish production should be promoted with greater emphasis in the Toamasina area. This is an important new production opportunity for food security (protein) and income generation.

Approach to stimulate interest in lowland exploitation needs to be fine-tuned in zone 1, especially in the Toamasina area, where tavy agriculturalists rarely use lowland fields. It can be expected that lowland rice cultivation will yield resistance as long as upland tavy fields are still productive. The challenge will be to find entry points where tavy farmers become interested in more sedentarized farming practices. The installation of fish ponds as permanent structures may be a good starting point to introduce farmers to lowland management. As the technical package and labor requirement for irrigated lowland rice is rather demanding for farmers who have not practiced irrigation before, the use of lowland fields could be stimulated through the promotion of non-irrigated rice, e.g. with the Sebota variety, or through off-season crops. A good local diagnostic is necessary, to really understand where farmers would be interested in investing in a new cropping system. The technical development in the deforestation zone should be a stepwise process, departing from farmers' possibilities and interest.

Establish an integrated concept of managing a rotation based on rice production, off-season crops addressing integrated pest management and various options for fertilization, such as compost and/or manure application, green manure cultivation and targeted chemical fertilizer use. The concept of green manure cultivation as a fallow concept in one of the seasons would contribute to improve soil fertility without having to transport compost or manure to the location. Monitoring of performance of proposed rotations would allow producing practical guidelines that are of direct relevance to farmers. Diversification of off-season crops should also be targeted towards improving food security during the hungry season and should either contribute to healthy nutrition or to income creation in times of greatest need (goal of component 3.3.). Recommendations should therefore directly respond to household needs (which should be studied through the cahiers de ménage).

Although ERI is not allowed at the time of this report to invest into irrigation infrastructure due to MOBIS contractual issues, technical advise to farmers for irrigation water management should be provided in order to improve the use of SRI techniques, which is often constrained by water management issues. Technical advise on traditional irrigation infrastructure can also be of value, especially in zone 1, where irrigation is still at a small scale. ERI should also continue to facilitate partnerships and interactions between farmers and donors to improve small-scale irrigation infrastructure. Potential donors could be identified through the National Program of Watershed Management and Irrigation Improvement (BV-PI).

Baiboho

Strong points:

- A wide variety of techniques have been proposed and implemented in the relatively small niche of the Baibhoho, among which are the establishment of fish ponds, vegetable production in wet and dry season, vitamin A rich sweet potato introduction and multiplication, introduction of resistant Banana varieties for multiplication, and promotion of agroforestry.

To be improved:

- Baiboho represent one of the most fertile locations within the farming system. In addition soil water availability is often high allowing to cultivate during the dry season. These characteristics make this niche highly valuable and its utilization should be well targeted. Baiboho should rather be used for:

- Cash and food crops that can fulfill important roles during the hungry season, e.g. vegetables, beans
- Seed production: Baiboho is the ideal location with its fertile soils to produce seeds for a variety of crops (e.g. potato, vegetables) during the dry season (less pest and disease pressure during the winter, isolated location protects from cross pollination).
- Maintaining soil fertility level should be integrated and principles of soil fertility management (see below) should be followed.

- Although the multiplication of disease resistant banana varieties is well suited for this niche, the cultivation per se of banana should not be recommended. This also applies to agroforestry systems. Although banana prefers this niche due to humid soils, they should rather be planted on the tanety field where much unused land is available. Once the banana and tree crops are established (which may take a bit longer then on the baiboho), the agroforestry system will restore the soils and become a productive system, and protect the location from erosion, soil degradation and cautions farmers to use fire close-by. At the same time, the baiboho can be used for annual production. Thus there is a gain in total productive land surface for the farmer.
- Similarly, fish ponds may rather be implemented in rice paddies instead of baiboho, if water control is not the determining factor. Theoretically it should be possible to make up the rice production through increased yields from SRA/SRI, or if farmers do not want to give up a rice paddy plot, fish can be associated with rice. This would favor the overall diversification and productivity of the farming system.

Tanety

It is recommended to distinguish in this niche between three sub-niches: Tanety—fallow vegetation and annual crops, Tanety—agroforestry plots, and Tanety—reforestation plots:

Tanety—fallow vegetation and annual crops

Strong points:

- Improved varieties of sweet potato,
- Integration of soil erosion control through contour planting with Vetiver, leguminous shrubs such as Tephrosia, Crotalaria Cajanus, Gliricidia,
- Tamatave: Introduction of cover crops has started last year (species), direct seeding on dead and live cover, introduction of forage plants cover crops: Mucuna, Dolichos, Niebe, combined with herbicide usage to kill off the fallow vegetation plus NPK as well as Urea
- Jatropha introduced on degraded hillsides (also goes under agroforestry)
- CDIA has developed an 'ecological upland rice' without burning. Good yields can be obtained when rice is planted after the ginger crop, which was amended with guano-phosphate. This is an important innovation, as so far upland rice without burning has not produced satisfactory results. Guanophosphate allows for soil pH correction, increase of phosphorus availability and is known to remain many years reactive in the soil. Farmers are more inclined to invest in an amendment for a cash crop, then for upland rice alone. Based on farmers and CDIA's observation, rice thrives well

after ginger crop. A problem with this rotation could be soil erosion. After the ginger harvest around June, the soils should not be kept exposed until rice planting in November. Ideally, a cover crop (Mucuna, or) or improved shrubby fallow (Crotalaria, Tephrosia) should be planted immediately after the ginger harvest, that covers quickly the soil and protects it from erosion. In any case, application of mulch and organic matter remains critical to maintain the productivity potential of the soils.

To be improved:

- Interventions and strategies should preferably differ according to the 3 zones
  - **Zone 1:** The technique of 'ecological upland rice' could be introduced into this zone and tested and adapted with farmers within a rotation concept. Improved fallow (Crotalaria, Tephrosia) will play a critical role, as they are able to accumulate nutrients much faster then the natural fallow vegetation and therefore restore soils more quickly.
  - **Zone 2:** Degradation of uplands is already advanced. The challenge is to restore soil fertility, followed by its maintenance and improvement. Fire-less upland management is prerequisite for any technical development. Cover crops, improved fallows, fodder and biomass banks are important techniques to restore these soils and their organic matter content. Other organic matter resources should be integrated such as chicken and cow manure. The use of soil improving plants diminishes labor input compared to the transport and application of farm manure. Given the labor shortage during certain times in the year, the recommendations for improved techniques should be adapted and take into account the windows of available labor.
  - **Zone 3 and zone 2** (western side of the corridor): Some zones are characterized by highly degraded uplands, that don't support any crop production anymore, but are used as pastures that are annually burned. These fields are highly prone to soil erosion with each rain event. The stopping of fire use is very important and seeding of improved grass species such as Bracchiaria may improve pasture productivity and keep soils protected.
- The concept of rotation should receive specific attention according to the different zones. As most of the soils need to be restored, a long-term approach of this restoration process is indicated (think it through over to 2 to 3 rotations at least) allowing gradually elevating the productivity level of a field. Relay-cropping (which can be defined as the seeding of one crop into another standing crop) should also be carefully considered, as it allows to keep the soils covered at most times, and can substitute for herbicide use for cover crop establishment. An example could be the seeding of a cover crop into rice or corn after the last weeding. This allows covering the ground and by the time of the harvest, the cover crop is already established.
- Covercrops, improved fallows and the fertilization should receive high priority.
- For all the cover crops and improved fallow species seed availability is the major constraint and thus impedes farmers initiatives if they like to test and adapt the newly proposed technologies. Establishment of seed gardens is essential and should be decentralized as possible (KH houses), which has already been started by ERI.
- Land tenure questions have to be included and are preferably discussed at individual, but also at the community level (village). It is recommended to work with the traditional land tenure regulations

and look for opportunities within these regulations for improved management of the uplands. In a second step, land tenure can then be treated in collaboration with module 2.

Tanety—agroforestry systems

Strong points:

- These systems are often dominated by cash crops, where ERI puts much effort in the diversification with promising crops jointly identified with BAMEX for commercialization. These include among others Robusta and Arabica coffee, vanilla, clove, pepper, litchi, banana. This niche harbors also fruit trees for self-consumption or local marketing (such as oranges, jack fruit etc), and often some indigenous forest species are present that regenerated naturally or that farmers transplanted. Composting has been introduced into this niche that produces much biomass and has an optimal environment for compost production. In addition, plant nutrient content in this niche is higher then for instance of degraded fallows, and thus produces a higher quality compost.

To be improved:

- This tanimboly agroforestry system may coincide with the homegarden next to the homestead or may be located further away from the homestead. In that case, it is recommended to distinguish between **cash crop tanimboly** and **homegarden tanimboly (Nutrition garden)**
  - *Cash crop tanimboly*: Technical advice should target improved management of the cash crops, which includes appropriate spacing, pruning, tree fertilization, and soil cover management. Men traditionally manage these tanimbolys.
  - *Nutrition garden tanimboly*: Focus of advice should be oriented towards food security, where annual food crops can be associated in the understory (beans, vegetables), where small animal husbandry can be integrated, in addition to bee-keeping, fruit trees, medicinal plants, artisanal plants for weaving etc. Technical advice should be addressed to women and opportunities for cash income identified. The concept of nutrition garden from ICRAF fits well with this niche. Nutrition gardens are specifically designed in order to provide food for the household (vegetables, fruits) all year long. This is done by selecting species that fruit or mature in different times during the year.
  - Biodiversity within these agroforestry systems could be increasingly promoted as the microclimate and environment is suitable for many indigenous species. Useful indigenous plants could be cultivated for instance for medicinal purposes, wood, fiber, food. In addition these plants help preserve the indigenous soil microfauna, are a resort for insects and birds that can play a role in regulating pests and diseases.
  - Seed availability and quality germplasm is a major constraint for the cash crops as well as for the fruit trees. Grafted fruit trees should be the norm, allowing achieving improved quality and advancing first fruiting for several years. (e.g., mango trees that bear fruits in 3 years instead of the usual 7 years).
  - Increased technical support should be provided that is ideally linked to obtaining a product quality that is desired in the market chain. As seen in the example of Faly Export, simple technical advise of tree pruning and fertilization improved the size of the litchi fruit rapidly to an

international desired size and allowed obtaining a higher price. A further consequence is that the reputation of Madagascar litchi on the international market is improving.

Tanety—reforestation

Strong points:

- Introduction of a wide range of reforestation species (indigenous, exotic, horticultural species, Jatropha). There is an overlap with the productive agroforestry cash crop systems, which is to be welcomed.
- ERI puts much emphasis on nursery establishment and management:
  - Collaboration with larger scale STABEX nurseries; one nursery per commune is installed in the Fianarantsoa region.
  - ERI supports decentralized nurseries in villages, often associated with the KH houses. This is welcomed, as transportation of plants in rural areas can be one of the most constraining factors in plant dissemination.
  - Collaboration with partners is well underway, so for instance with in Tamatave for larger reforestation activities (Financing could be leveraged from Tany Meva)

To be improved:

- Multiple uses of indigenous species to be considered and integrated into the promotion of species for reforestation
- Introduce species with high performance that are not yet widely known or used. A very profound problem in Madagascar is the lack of a variety of reforestation species. This creates a vicious circle, as farmers will not ask for species they do not know. Introduction of a larger variety of species would therefore be an important contribution to the farmers but also to the larger East coast and highland areas.
- Improve germplasm quality, fruit tree grafting etc. (see below under seeds).
- Apply an agroforestry approach to reforestation, for instance mix of species according to needs, fill small niches within landscape that would benefit from tree cover (protection of water courses, hill tops etc)
- Discuss land tenure and reforestation at the village level and identify opportunities that are beneficial to individuals or the village community and fulfill an ecological function within the landscape.

Primary forest

Strong points:

- In villages visited, ERI is putting much effort in assuring that the approach at the village level with COBA and KH are similar.
- ERI's commitment to establish GCF and GELOSE in the project zone is an essential contribution in tackling the tavy problem from various angles.

To be improved:

- Module 2 and 3 should continue with and reinforce the collaboration especially in view of landscape management planning to use and protect the natural resources optimally. Conservation and agricultural production approach need to be well integrated, which could be done through the Development Pathways approach.
- The integration of useful rainforest species into the agricultural landscape would be desirable, as it may help to reduce the pressure on the forest while at the same time increase biodiversity within the rural landscape.
- Monitoring of tavy via satellite pictures at plot level would be a very powerful tool as basis of discussion with farmers. Especially during the consultations of SAPM, the new protected area delimitation, where ERI takes part in. A good balance between the reinforcement of deforestation laws and the promotion of alternatives to tavy should be supported by ERI.

Proposed criteria for commodity chain selection

- Economic criteria: economic impact on household, price, and stable market (BAMEX-criteria)
- Local market should be prioritized. This adds to risk reduction for farmers
- Sustainability requirements for production should be respected (Soil management, no pesticide use, agroforestry systems prioritized)
- Produce should conserve well and be easily stored
- A high price/weight ratio is preferable (reduces transport costs, diminishes constraints on transport availability)
- Transformation potential on site should be high
- Local and regional priorities should be taken into account (PCD: Plan Communal de Développement, and PRD: Plan Régional de Développement) priorities
- A combination of short and long term cycle products should be strived for

COMPONENT 3.2: ENHANCE PRODUCER CAPACITY TO MAXIMIZE PROFITS AND MEET MARKET QUALITY, VOLUME AND SCHEDULING REQUIREMENTS

Continuous support and exploration is needed to facilitate partnerships between the KH and the private sector. ERI should support the partnership arrangements, where the private sector also commits to training, technical advise at the field level and has some long-term development commitment as for instance the case of Faly Export. Stronger support from BAMEX is needed and should become more field based and responsive to local constraints and opportunities.

The question to follow either a **commodity chain or a landscape approach** when selecting and developing a crop for commercialization should not be an either-or question. The approach should respond to both by embedding the commodity chain development within a landscape approach responding to certain number of agroecological criteria. For the selection of a commodity chain, it is advised to differentiate between the deforestation and the intermediary zone, and take into account the local context. This would involve a participatory consultation with the population for crop selection. At least 3 to 5 crops should be proposed at the local level. Proposed criteria for crop selection can be found in the textbox.

On site transformation should receive increased attention by BAMEX and ERI. It allows farmers to add value, often reduces the weight of the produce and improves preservation. It also allows farmers to create several products from the same crop and thus contributes to risk reduction. Small distilleries

associated with the KH cooperatives for instance would allow processing a large band of products that are part of the farming system (e.g., cinnamon, clove, ginger, Ravinsara, Eucalyptus etc).

Commercialization strategies should preferably take into account farmers' demand for short cycle cash income opportunities. This request can also be supported through technical innovations that can speed up the cycle of production, for instance short cycle varieties, grafting of fruit trees etc.

Risk management is a very critical aspect in economic development. Commercialization to local markets can reduce the risk that may occur with regional, national or international markets in case of contract problems or frequently occurring transport difficulties (dysfunctional transport ways, cyclone damage, breakdown of vehicles or trains, collectors do not show etc). Contract farming for specialized farm products as offered by BIONEXX for Artemisia (although partnership is still in its beginning stage) or LECOFRUIT for various products can be advantageous for farmers if the production and business deal is successful. On the other hand, in case of problems, vulnerability of farmers is high, as they may not find another outlet.

COMPONENT 3.3: IMPROVE FOOD SECURITY, NUTRITION AND OVERALL HEALTH

ERI is on the right track with this component with the strategies of increasing food production, improving commercialization opportunities and by collaborating with many partners that target more specifically the health sector, and work on related issues such as drinking water, hygiene, medical service.

ERI could take a bit better advantage of what already exists and improve its impact. More specifically, many associated crops and fruit trees can be found within the farming system that are often overlooked when thinking about commodities and large scale production. Many of these crops are not cultivated in separate fields but are associated, for instance, with upland rice fields or homegardens. Some examples are: a variety of different legumes and beans such as the common bean, niebe, tsiasisa (Vigna unguiculata) etc., sesame, melons, cucumbers (cash crop in hunger season), sugar cane (production of sugar possible with sugar press), peanuts, voanjo, mais, sorgho, pineapple, traditional leafy vegetables (sometimes weeds), fruit trees such as mango, jack-fruit, bread fruit, avocados, annona sp., Japanese plum (Eriobotrya japonica), citrus trees, such as oranges, and for instance some very old varieties with high medicinal values that were introduced with the first immigrants and can today be found in the forests.

It would be valuable to inventory the food plants within the farming system, and promote their improved use according to their seasonality and nutritional value. Training of culinary options and seed production could be provided. This merges with the concept of *nutrition garden*. According to timing when crops or fruits are mature, a garden can be designed that allows harvesting yearlong food plants permitting a healthy nutrition for the family. Most of these activities should be undertaken with the women. This may be a good entry point to additionally develop income generating activities (vegetable gardens, small livestock husbandry).

4.3. RECOMMENDATIONS ON CROSS-CUTTING THEMES

In addition to the technical recommendations for each of the agroecological niches, a few cross-cutting recommendations can be added:

SEEDS

Farmers often plant a number of varieties of a crop. Local varieties have the advantage to be adapted to soil and climatic conditions and represent an important living reservoir of the crop's gene pool. But often, this cultivated and existing diversity is not well known outside of the farming community. Without awareness about the existing diversity, it is not possible to evaluate improved germ plasm in a way that takes into account the farming system's existing resources. There is even a danger to replace some valuable local resources with 'improved' varieties. Thus, evaluation of improved varieties should be done in comparison of the existing gene pool.

Within the project zone, there is a recognized lack of available seeds and germ plasm of species and varieties of food and cash crops, trees and soil improving plant species, which is slowing down the progress of technical development. Much improved germ plasm exists already in Madagascar and lies with the research organizations such as Fofifa, Fifamanor, CTHT, and SNGF. It is a unfortunate reality that the existing germ plasm is often locked up within these institutions. The challenge is therefore to obtain some of the improved germ plasm, test it and compare it to the native germ plasm, and in a third step, institute at a decentralized and local level seed multiplication, for instance with the Koloharena houses, the KH cooperatives or interested individual farmers.

ERI is well positioned to play a central role in this process. ERI could support this endeavor by starting out with an inventory and short description of the existing variety of **germ plasm for each of the crops** based on farmer interviews. This can be done through the project's field agronomists and does not need to many resources. Nevertheless, if the opportunity arises, this could represent a good student research topic. In a second step, ERI should facilitate seed exchange and distribute germ plasm to the KH associations for testing and multiplication. ERI has already taken on that role (e.g. sweet potato, banana varieties) and it is recommended for ERI to continue playing this crucial role. ERI should encourage KH associations to establish seed gardens, provide them with technical advice and support the distribution or small commercialization of quality seeds throughout the project zone.

ORGANIC AGRICULTURE VS. ZERO TILL AGRICULTURE WITH PESTICIDE USE

ERI should keep a vision in pursuing the pathway of organic agriculture in respect to the technical development and the exploration of market opportunities, which in the long run may be more beneficial to farmers. With currently very little pesticide use in the project zones, organic farming and tapping into niche markets should not present a big obstacle.

Zero tillage in association with cover crops has been heavily researched in the past years by CIRAD and by GSDM (Groupement Semi Direct de Madagascar), which is a consortium of organizations, such as Anae, Fafiala, Fifamanor, Fofifa, Tafa, AVSF, Interaide, SDMad, and Verama. Research on zero tillage, direct seeding and cover crops has created a wealth of information for each of the agroecological zones of Madagascar.[5] The research recommendations integrate the use of herbicides in order to control ground cover before the establishment of a subsequent crop in the rotation.

Although the research is providing very useful information for the cropping systems of the project zone, it is recommended to pursue the development of rotational systems with cover crops without the usage of herbicides. It would be important for the remote zones close to the corridors to develop

[5] For more information see: http://www.cirad.mg/fr/gsdm.php

improved cropping systems that pursue low external input principles (as described before). This should be possible and technical packages should be adjusted by adapting, for instance, time of planting (use of relay cropping techniques), association of plants, the use of mechanical control, the choice of the cover crop or fallow species.

Thus ERI should integrate the techniques of cover crops but should not subscribe, at this time, to a zero tillage philosophy. It would be more appropriate to develop rotations together with the farmers that integrate soil improving plants, even if the production level is inferior to the GSDM promoted packages that include pesticides and fertilizers.

Another risk that needs to be considered is that with the remoteness of the project zone, the risk for unreliable delivery of pesticides is very high. Thus the cropping system should not depend on such an outside factor in order for the technique to perform accurately. In addition, the health hazards that these products represent are of considerable concern (from storage to application).

SOIL FERTILITY MANAGEMENT

The main theme that ERI Toamasina has committed to as the major challenge for the year 2006 is: *to reinforce the technical capabilities of all agricultural actors in order to increase and maintain soil fertility, especially on tanety lands*. This analysis agrees that soil fertility management should be a priority and it has not yet received the attention by LDI nor by ERI it deserves.

Five key principles of sustainable agriculture for the humid tropics have been developed by R. Bunch[6] with his colleagues over the past 20 years. They can provide ERI with some good guidance on how to tackle soil fertility management challenges across the niches. The principles (detailed explanation can be found in the publication) are:

- Maximize organic matter production
- Keep the soil covered
- Zero tillage
- Maintain biological diversity
- Feed plants through the mulch

Another set of useful generic practices and principles for effective nutrient management and sustainable cropping is provided in the World Bank (2006) publication on Sustainable Land Management, p. 36f[7]. These principles refer to agroecologically less favored areas, where farmers can use a variety of risk-minimizing strategies based on biological sources of nutrients, adapted crop varieties or species, and integrated land and water management. These practices are (detailed description for each practice can be found in the publication):

- Minimize soil erosion

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[6] http://www.agroforestry.net/overstory/overstory20.html; http://www.newfarm.org/features/1002/roland_bunch/index.shtml

[7] World Bank. 2006. Sustainable Land Management, page 36-37 : accessible as e-book : http://siteresources.worldbank.org/INTARD/Resources/Sustainable_Land_Management_ebook.pdf

- Recycle organic nutrients
- Enhance biological sources of nutrients
- Compensate for nutrient loss
- Select and use adapted and efficient species
- Optimize fertilizer-rainfall interaction

It would be a very useful exercise for ERI to try to visualize all the principles within the different niches for zone 1 and 2 separately and design what the technical messages should look like for a best integration of the principles into the current farming system. A next step would be to look across the niches, identify how the interactions between niches can be optimized and reinforced for instance via biomass transfer (including composting) in order to transfer and apply nutrients targeted in space and time towards a crop (e.g. tree fertilization, application of manure to seed pockets). The concept of the rotation enters here, which should ideally include food crops, cash crops, leguminous and soil restoring fallow species, and if available some targeted fertilization.

The combination of organic and inorganic fertilizer has often proven to obtain the best results in yield increase in the tropics, especially on nutrient deficient soils. As the soils in the project region are acidic and especially P deficient, the sole application of plant material through mulching, composting and crop residue recycling will hardly be enough to restore soil nutrient pool sufficiently to raise the productivity level of the soil. The application of lime or guano-phosphate will help to achieve a pH correction (which is also one of the main impacts of the tavy ashes) that will allow macro and micronutrients in the soil to become plant available. Chicken and cow manure application can also increase nutrient availability in the soils that can last several seasons. Other organic matter utilization as fertilizers can come from product processing at the farm level, for instance the use of the high mineral content Jatropha oil cake or coffee pulp as fertilizer.[8]

As chemical fertilizer distribution and availability is very sporadic in Madagascar, it is wise to develop a soil fertility management strategy that is not dependent on inorganic fertilizers but combine plant biomass and animal manure to slowly raise or maintain the productivity level of the soil. If inorganic fertilizers are available, sometimes a fraction of the recommended dose in combination with organic matter application can help to 'jumpstart' the soil system and make nutrients available for plants.

ERI should consider doing a few nutrient tests on soils, compost and manures in order to assess what the limiting elements are and how they can best be supplied to the agricultural system. This was apparently done during LDI, thus it would be worthwhile to revisit the outputs of that investigation. Targeted collaboration with the technical services and research organizations should help ERI to develop a more systematic approach to the soil fertility question. (Universities, Fofifa, Fifamanor, DRDR, AHI[9]). Technicians could be invited to a one-day workshop where rotations and fertilization strategies are designed for each of the niches. A good information base should be made available before the workshop (soil quality, farmers' rotations, cropping calendars, available cover crops and

[8] Radio interview with an innovative farmer (country not indicated) who doubled sweet potato yields with the application of coffee pulp as fertilizer http://www.farmradio.org/english/radio-scripts/67-3script_en.asp. Coffee pulp is rich in potassium, which is desired by the sweet potoato, or root crops in general.

[9] http://www.africanhighlands.org/madagascar.html

their growth habits etc). The outcome of the technicians' workshop can be discussed farmers and further adjusted. A testing of the proposed technical interventions can then be undertaken with the KH farmers (at the KH houses, on demonstration plots or with interested individual farmers).

A key issue that should be considered in parallel when developing new technical ideas, are the costs involved that incur at the farm level. This concerns especially the labor cost and labor availability across the seasons. A financial farm level analysis should accompany the technical recommendations, in order to identify bottlenecks as well as investment opportunities.

BIODIVERSITY

The restoration and maintenance of agricultural and natural biodiversity are intrinsic to the agroecological concept and enriches the rural landscape with many ecological functions. The strategies to maintain biodiversity within the agricultural system are to a large extent similar to the soil fertility management principles that were introduced above. This creates a desirable win-win situation. Among the strategies to restore agricultural diversity in time and space are: Crop rotations, polycultures, agroforestry systems, cover crops, and crop/livestock mixtures. (Altieri, online resource[10])

Given the richness of biological diversity in the project zones, and given farmers' knowledge of hundreds of indigenous plants for multiple purposes, it is highly recommended to integrate the concept of indigenous plant cultivation within the farming system, which allows maintaining the indigenous knowledge, provide farmers with valuable products, and allow biodiversity to play regulatory ecological functions.

The believes that Malagasy farmers do not have an in-depth and extended knowledge about the forest resources and biodiversity (due to the more recent settlement of the island compared to the longlasting co-habitation of people with forests in other tropical countries in the world), could not be confirmed by an ethnobotanical study by Styger et al. (1999)[11]. During the study, the authors noted that many of the conservation and botanical experts in Madagascar underestimated the existing indigenous knowledge significantly. Nevertheless, the study has shown that with the disappearance of the forests, the indigenous knowledge base gets also lost very quickly.

A considerable shift in the thinking of conservation community in Madagascar is urgently necessary from protecting biodiversity within the primary habitats towards protecting, restoring and benefiting from this rich potential within the rural production landscapes, which make up almost 90% of the country's surface. ERI would be very well positioned within the Malagasy conservation and rural development communities to play a leader role in urging to rethink the old paradigms of conservation.

In addition, at the local level, ERI could contribute of inventorying native and agricultural biodiversity and assess the options how the rural population can better benefit from these biological resources (see discussion above) . As for the promotion of native forest species, a balance needs to be found between the investments in studies, seeds, trials of planting indigenous species (which can be quickly high without achieving satisfactory results) and the successful integration of these plants into the farming

[10] http://www.agroforestry.net/overstory/overstory95.html

[11] Styger, E., Rakotoarimanana, J.E.M., Rabevohitra, R. and Fernandes, E.C.M. 1999."Indigenous fruit trees of Madagascar: potential components of agroforestry systems to improve human nutrition and restore biological diversity." *Agroforestry Systems* 46 (3): 289-310.

system. Close collaboration with farmers is needed and a good sensible response to farmers' preferences and ideas should be strived for. A number of inventories and experiments of planting indigenous species outside of the forest environment have been undertaken. Dan Turk, for instance planted a wealth of indigenous trees in the early nineties in Ranomafana, which has consequently been managed by Fofifa. I am not aware, if any publication has come out of this experiment. Currently, the BioCarbon Fund Project in Andasibe may have the most up-to-date experience on the cultivation of indigenous species.

Indigenous knowledge on medicinal properties of rainforest plants is very high in the project zone. With the disappearance of the forest, access to these plants gets more and more difficult. Introducing appreciated medicinal plants into the homegardens may be of much value to the rural household, contribute to maintaining biodiversity and the rural knowledge base.

LANDSCAPE APPROACH—ECOREGIONAL APPROACH—LAND TENURE

The approach of working with agroecological niches and across agroecological niches at the farm level presents a good unit from which allows to scale up to the landscape and ecoregional level. This is where coherent approaches with Module 1 and 2 are to be sought. In addition, the supervisors of Module 2 and Module 1 should be well aware of the agroecological and agricultural intensification opportunities that can be developed with a landscape approach over a medium to longer term time period (5-10 to 20 years) integrating it in their planning work. This concern for instance land use and land management options in the zones of GCF and GELOSE, that should be in harmony with Module 3 approach.

ERIs approach to work on both fronts securing land tenure of forest resources (Module 2) and agricultural intensification (Module 3) is unique within the Madagascar development programs, and it is agreed that the combination of these two instruments may be among the most efficient ways to combat tavy.

ERIs is interested in the land tenure question and how it influences land use and pressure on the rainforest. ERI follows the national debate surrounding the creation of new *Guichet Fonciers* and the accompanying land registration practices. Complexity of land tenure situation is very high in the project zone. It is different for each of the niches and looks quite different from a traditional or official point of view. ERIs efforts to remain aware of land tenure issues and contribute to the debate are applauded. One aspect where ERI could get more involved in, is the search for opportunities within the traditional land tenure to craft sustainable land management arrangements especially for the uplands. Traditional upland tenure rights are often individualistic but there is a high solidarity aspect to sharing land. It can be highly likely that new sustainable upland management models could be developed through discussions and agreements at the community level (that nevertheless respect the individual access rights).

TECHNICAL QUALITY

This analysis agrees with Pierre Thevenot's conclusions about technical quality in his report (page 67), where he recommends a) to have an improved workplan for technical testing on demonstration plots, b)

to integrate economic parameters into production equations, c) to reinforce the capacity of the PVs, and to d) increase the follow-up on technical quality delivered by out-sourced contractors.[12]

The technical quality of the promoted innovations is in general good. This is proven by the number of techniques that are already adopted and well integrated within the farming system. The challenge remains with the follow-up on technical development that happens on farm. Currently there is not sufficient technical ERIs staff to assure that technical quality in the field remains high. Too much responsibility is given to PVs for technical oversight. This has consequences on the overall impact of the project, as not the full potential of the proposed innovations is translated, for instance into productivity increase. Another worry that is associated with the limited staff number relates to the more complicated techniques that ERI should embark on, such as longer-term soil fertility restoration. This calls for system-level thinking and a good analysis of the farming system to elaborate sound and practical solutions at the farm level. It is doubtful that with only the Module responsible having a higher technical education (one person per region!), these tasks will be handled appropriately. One solution may be to reengage in collaborating with researchers and universities. The drawback is often that master thesis research demands much time and input from the project, and the research period is often too short to make a considerable contribution.

Another aspect that justifies the demand for high quality technical knowledge and well-developed approaches for longer-term and more complex techniques is the danger of failure. If for instance the concept of improved fallows is not well enough designed, and farmers are willing to test this new concept, it can become counter productive to have started working on it. Farmers may have invested time and labor into the innovation which does not deliver the promised or expected results. If no quality technical follow-up can be provided, this can turn into frustration and a negative overall attitude towards the technique. Thus, although the technique could have played an important role in the farming system, the attitude towards it becomes negative. These are important points to watch out for from the very outset of an activity.

ERI's decision making process which techniques to choose for dissemination is not always clear, and seems sometimes 'opportunistic'. This can have different outcomes. On the one hand, ERI takes full advantage of the technical capacity that exists in the region and input into the program can be of high quality and thus reinforcing the program.

On the other hand, ERI is dependent on third parties to implement activities and is not always able to control the outcome of the situation. For instance, a contract with the company BRL (for the testing of cover crops) in Ambatondrazaka was implemented late, resulting in poor plant establishment. Consequently the technique did not perform properly. The installation could have been judged a failure. Despite, farmers were demanding later on for seeds to continue with the testing. This outcome was fortunate, but could also have created the opposite result.

In addition, when outsourcing technical tasks, ERI needs to keep the oversight to make sure that technical advice is following agroecological principles that the program subscribes to. Another example from the BRL contract: BRL technicians applied their technological package including herbicide use. This should have been discussed before, as ERI is debating to subscribe to organic agricultural principles.

[12] Pierre Thévenot, « Situation du Mouvement Kolo Harena de la vulgarisation faite par ses membres paysans et du Programme ERI », Programme ERI/USAID Madagascar, juin 2006.

FARMER-TO-FARMER EXTENSION APPROACH

The agroecological approach with farmer-to-farmer extension is very innovative and is successful in its implementation given the fact that KH members are increasing and that landscapes are visibly changing under the adaptations of innovations. It is also a promising approach given the worries of sustainability and scaling up that are of importance if thinking beyond the project lifetime. ERI was able to build on the work of LDI that had started out with a more conventional extension approach. In the beginning, technical staff was interacting directly with villagers to transfer new knowledge and technologies. Step by step the approach has evolved towards a farmer-to-farmer approach and ERI is working very hard to improve the approach further. Some findings and recommendations that issue from the field visits on the three different extension channels, KH house, demonstration sites and farmer field schools, is provided hereafter.

KOLO HARENA HOUSE (MAISON KOLOHARENA)

The concept of the Kolo Harena House has a very good potential to become a 'local center' where farmers gather and exchange information or germplasm. The center should be open to any interested farmer. ERI may think about providing some training to KH house 'managers', how to run a 'center' openly and help them design some activities to attract outside farmers (e.g. open house training within a set time interval). In addition, seed multiplication should become a priority for the KH houses.

DEMONSTRATION SITES

It would be highly desirable if ERI could initiate more interactions with research institutions including universities to test new techniques. The demonstration sites can be very useful in doing a first screening of technical options. At present, some of the demonstration plots were too large in size, putting much burden on the KH farmers to look after the fields.

FARMER FIELD SCHOOLS

The concept of FFS is already well assimilated by farmers who have done it for one season.

- Farmers seem to be convinced about the usefulness of FFS, are enthusiastic and proud of their progress and findings.
- FFS generates a great wealth of knowledge. Not only one or two, but a number of innovations emerge within only one season, which farmers propose for further testing.
- Technicians of ERI or specialized PV were often absent, thus a large potential for learning is undermined

- Some FFS have studied only their traditional practices without being aware of improved technical opportunities, which again is hindering the potential of progress and a waste of resources given the fact that farmers invest a lot of time in FFS.
- ERI field technicians do not seem to have a well elaborated concept on the follow-up of innovations and how to capture and disseminate this new knowledge (e.g. Fiche technique, exchange visits).
- FFS has attracted many non-KH farmers to participate which is very much welcomed
- There has been little exchange between FFS in a same region

Recommendations

- Farmers who participate in FFS need to benefit from some outside advice or information exchange; otherwise they may not have any incentive to share their new findings with others. This can either be technical advice, exchange with other FFS, encouragement to take a leadership role in information exchange (e.g. take them to the radio etc.).
- Technical support needs to be reinforced and adjusted according to the complexity and newness of the studied techniques. (E.g. SRA does not need as much input anymore compared to onions where farmers had no idea on improved techniques, seeds etc).
- Research results from Fofifa, Fifamanor or other institutions should be discussed in the beginning of the season in order to broaden the range of options for farmers to choose from.
- There should be a meeting before the season to set up the FFS and their themes as well as at the end of the season to bring the results together and discuss how to continue.
- Exchange visits between FFS during the cropping seasons, FFS and demonstration sites or research sites if relevant to their investigations, invitation of non-KH farmers to visit FFS, demonstration sites, KH Houses.
- At the end of a season systematic exploitation of the created knowledge needs to be done, and dissemination strategy executed (Technical leaflets, radio emissions, etc). Farmers should get trained in putting together a technical sheet, and ERI staff should take the time to do a good synthesizing of information that needs to be widely shared before the next season.

If ERI has decided to commit to FFS, then it should be carried out correctly. The experience of the first season shows that FFS has been very well accepted within the farming communities, but the technical follow up has been weak. There is an imminent danger to miss out on the real potential FFS can deliver in technology adoption, advancement in agricultural intensification and in scaling up. With lack of technical follow up, farmer groups will definitively benefit for themselves, but there is no collective learning on technology adaptation to the local conditions. Another FFS may repeat the exact same experiment the next year without having been able to benefit from the findings from previous FFS. The use of the video media would be a very powerful tool and could help in sharing knowledge more quickly across the intervention zone.

The development of an improved communication strategy is of critical importance at this stage of the program. Well designed communication tools used in relation with the FFS, demonstration plots and KH houses, can play a significant role in the scaling up of the program activities.

LADIA FORMER CDIA (CENTRE DE DIFFUSION ET D'INTENSIFICATION AGRICOLE)

LADIA's role is to provide trainings, to present technical innovations on Center's fields, to welcome researchers for their field research, and to produce high quality animal and plant germplasm for the surrounding population.

During the visit of the center, not many of the above roles and activities could be identified. Training is currently the main activity of the Center and many PVs and PAs have been trained here. As for the other objectives, it seems that the Center has lost its direction and activities since the ending of LDI, and not much clear guidance exists today, of where the Center likes to go. The Center does not display many new technologies on its site. Students or researchers are absent. The nursery seems to be empty, although much demand for high quality fruit trees as well as for reforestation species exists in the area. Techniques that are well mastered, such as raising of layers (chicken) or swine, are only kept at the demonstration level. These are a few observations. The Center has a very big potential of playing the role it was designed for, but as already said, the guidance seems to be missing.

Recommendations

- Reintroduce technical innovations on the farm, label them in the field and accompany them with leaflets that provide a short explanation.
- Reengage in applied research: research can be done by farmers through FFS, by students from national or international universities, by the private sector, NGOs or other interested partners.
- Become a center for multiplication of seeds for crops, soil improving plants (cover crops, improved fallows etc) as well as for animals (fish, porc, chicken, rabbits). Produce high quality grafted fruit trees, agroforestry and forestry species for sale.
- Generate income through on station production and transformation.
- Introduce a variety of transformation techniques, with small machinery that can be rented out to farmers and where farmers can be trained and eventually build up their own transformation units.

4.4. CONCLUDING REMARKS AND RECOMMENDATIONS

The ERI program strives for the reduction in slash-and-burn agriculture and deforestation through the promotion of an agroecological approach to agriculture and rural development in its intervention zones. This consists primarily of encouraging adoption of new agricultural innovations and practices in different agroecological niches ranging from the lowland rice fields to upland forest fragments. The intervention zones where ERI work face many constraints regarding economic development and sustainable management of the natural resource base. The challenge for ERI and the other actors lies in the identification of opportunities and of the comparative advantages the region has, and from which successful and sustainable development can be initiated. These comparative advantages lie in the natural and agricultural biodiversity, the multitude of cropping systems, the option to pursue organic farming, and the range of high value and specialty cash crops that thrive in this area.

ERI is on the right track with the adoption of a range of approaches that allows the program to respond to the specificities and challenges of the intervention zone. These include the agroecological approach, the niche approach, farmer-to-farmer extension, Appreciative Inquiry and Development Pathways. In addition, the multidisciplinary approach from policy work, to community based natural resource

management, to agricultural intensification, and to rural community organization provides the program great strength. The program is not only on the right track it is also extremely innovative. Much of Madagascar's development and conservation communities, as well as international audiences should be able to learn from the program.

The ERI program has a big advantage as a follow-on project to LDI and PTE. This enables the program to build on and carry out a medium-term approach to development. Much of the hard groundwork of LDI is starting to pay off. In addition ERI has an exceptional staff that is committed to the program's mission. Unfortunately, staff numbers are too small for the ambitious program, and thus the entire staff is overworked, which should not be an acceptable situation in the long run. Many danger points have been identified in this report that relate to staff shortages. Main impact can be loss of the overall quality of the program implementation and the missing out on scaling up opportunities.

It order to further improve program performance it is recommended that ERI refocuses its intervention zones towards the actual deforestation zone (or zone 1 as defined in this report). More technical staff as well as more *Paysans Vulgarisateurs* should reach this zone. It would be advantageous for the program, if ERI could invest more attention in developing direct alternatives to tavy. The commercialization strategy in the deforestation zone would also need to be adapted. It should take into account the transportation problems, the subsistence characteristics of the system, as well as the farming system dynamic that is influenced by a certain itinerant behavior.

In view of scaling up, ERI could promote the dissemination at the large scale (mass media) of the techniques that found ample adoption with the KH farmers. As for the techniques that are not yet fully developed, and given the time constraints of the program, it is recommended that ERI:

- Takes a more systematic and conceptual approach
- Takes advantage of existing scientific findings from the region, e.g. information on soil fertility management could be gathered, analyzed and practical recommendations elaborated
- Deepens the collaboration with research institutions
- Provides adequate training for its staff at all levels,
- Provides farmers with quality technical oversight.

The farmer-to-farmer approach is a very powerful tool and it can play a major role for scaling up but opportunities need to be seized.

As the national policies and decision-making in other sectors other than agriculture and resource conservation do indeed influence rural development, ERI should continue to engage in national policy debates. The USAID Madagascar mission should continue to provide supplementary support especially in regards to infrastructure (road and railroad maintenance, small-scale irrigation infrastructure), land tenure, seed and germplasm services, and rural security.

The complexity of the tavy phenomenon, the urgency to find sustainable solutions, and ERIs very unique position to work successfully with the tavy farming communities, obliges ERI to carry out a wide variety of actions. This includes improved monitoring tavy expansion or reduction and further analysis of the underlying influences and driving forces (political, economic, climatic, availability and

implementation of technical alternatives) of slah-and-burn agriculture. ERI would be in an excellent position to fuel pragmatically and openly the national debate with its valuable on-the-ground insights.

To increase the efficiency of implementing alternatives to tavy, it would be valuable if ERI would adopt a more clear ‘carrot and stick’ approach and thus reinforce the coordination of:

- Agricultural intensification (carefully adapted to local farming system specificities)
- Land tenure security of forestland through the instruments of GCF and GELOSE and
- Reinforcement of forest control integrated into the Durban Vision and the creation of new protected areas.

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THEMATIC ONLINE AND OTHER RESOURCES

A collection of downloaded documents can be found in an attached CD.

Agroecology

http://www.agroecology.org/

Agroecology in action: M.A.Altieri's webpage

http://www.cnr.berkeley.edu/~agroeco3/index.html

Two articles by Altieri:

Agroecology: principles and strategies, by M. A. Altieri

http://www.agroforestry.net/overstory/overstory95.html

Agroecology: The science of natural resource management for poor farmers in marginal environments

http://www.agroeco.org/brasil/material/nrm.htm

Case study collection according to principles of agroecology:

http://www.agroecology.org/cases/caselinks.htm

Book:

Uphoff, N. (Ed). 2002. Agroecologial Innovations. Increasing Food Production with Participatory Development, Earthscan Publications Ltd, London, Sterling, VA.

Ecoagriculture

http://www.ecoagriculturepartners.org/

Book:

McNeely, J., Scherr, S. 2002. Ecoagriculture: Strategies to Feed the World and Save Wild Biodiversity, Island Press, Washington DC.

Most important reports published:

Common ground, common future: to download in pdf from: http://www.futureharvest.org/earth/common_ground_bio.shtml

Scientific Assessment of Ecoagriculture has been undertaken by a number of researchers of Cornell University:

Buck, L.E., Gavin, T.A., Lee, D.R., Uphoff, N.T. (2004). ECOAGRICULTURE:

A Review and Assessment of its Scientific Foundations. Cornell University, Ithaca, N.Y., p. 142 http://www.oired.vt.edu/sanremcrsp/documents/publications/EcoAgricultureReport.pdf

Summaries of case studies can be found:

http://www.ecoagriculturepartners.org/cases/cases.htm

Case studies according to themes

- Creating Biodiversity Reserves that Benefit Local Farming Communities
- Developing Habitat Networks in Non-farmed Areas
- Reducing Conversion of Wild Habitat to Agriculture by Increasing Farm Productivity
- Minimizing Agricultural Pollution
- Modifying Management of Soil, Water and Vegetation Resources
- Modifying Farming Systems to Mimic Natural Ecosystems

Sustainable land management

A new publication of the World Bank provides an excellent overview of the SLM approach, its challenges, opportunities and trade-offs.

(World Bank, 2006, Sustainable Land Management)

Agrobiodiversity

The PLEC Network (People, Land Management and Environmental Change) was a GEF project (1998-2002) at the United Nations University. PLEC list serve is still active: subscribe at: http://c3.unu.edu/plec/subscribe.html

PLEC's list of publication can be found at: http://www.unu.edu/env/plec/documents.html

Books:

- Brookfield, H. (2001) Exploring Agrodiversity. Columbia University Press. NY.
- Brookfield, H., Parson, H., and Brookfield, M. (2003). Agrodiversity: Learning from Farmers across the World. United Nations University Press, Tokio, New York. (Summary of PLEC project experience)
- Collins, W.W., and Qualset, C.O. (1999). Biodiversity in Agroecosystems. CRC Press, Boca Raton, FL.

Agroforestry

http://www.agroforestry.net/

Overstory: free agroforestry ejournal: possible to subscribe for email delivery at:

http://www.agroforestry.net/overstory/index.html

Species references online databases:

http://www.agroforestry.net/aflibr.html#Anchor-SPECIES-49575

ICRAF—World Agroforestry Centre: http://www.worldagroforestry.org/

ICRAF AGROFORESTREE database: http://www.worldagroforestry.org/Sites/TreeDBS/aft.asp

African Highland initiatives with two sites: Antsirabe and Fianarantsoa:

http://www.africanhighlands.org/madagascar.html

Seeds and propagation

On-line plant propagation manual:

http://hcs.osu.edu/mg/manual/prop.htm

Alternatives to slash-and-burn agriculture

http://www.asb.cgiar.org/

Organic agriculture

Organic agriculture at FAO

http://www.fao.org/organicag/

http://www.fao.org/organicag/default-f.htm In French

IFOAM's webpage

http://www.organic-agriculture.net/

Conservation Agriculture

Conservation Agriculture—a practical online learning module

With database, articles, 'how to get started', links to discussion groups

http://mulch.mannlib.cornell.edu/CAwebsite/index.htm

Soil Management

5 Principles for soil fertility

http://www.agroforestry.net/overstory/overstory20.html

Management of Organic Inputs in Soils of the Tropics (MOIST) is a rich source of information on green manure/cover crops and hosts an active email discussion group on green manures/cover crops http://ppathw3.cals.cornell.edu/mba_project/moist/home2.html

Cover crops and green manure

Groupement semi direct de Madagascar

http://www.cirad.mg/fr/gsdm.php

Management of Organic Inputs in Soils of the Tropics (MOIST): a wealth of resources and links: http://ppathw3.cals.cornell.edu/mba_project/moist/home2.html

Mulch-L Electronic Discussion Group -Traffic (2001-2005): Summarized discussions: http://mulch.mannlib.cornell.edu/mulchL02.html

CIEPA: Centre d'Information et d'Echanges sur les Plantes de Couverture en Afrique

http://ppathw3.cals.cornell.edu/mba_project/CIEPCA/home.html

CIDICCO: Cover Crop International Clearing House

has green manure/cover crop information for small farmers (Latin America)

http://cidicco.hn/newcidiccoenglish/index.htm

UC SAREP Cover Crop Resource Page has data on thousands of species used for organic matter production and erosion control <http://www.sarep.ucdavis.edu/ccrop/>

Food and Feed from Mucuna: Current Uses and the Way Forward Proceedings of an International Workshop: http://cidicco.hn/newcidiccoenglish/food_and_feed_from_mucuna.htm

Forage improvement: Table of adapted forage species per ecological region in Madagascar:

http://www.fao.org/ag/AGP/AGPC/doc/Counprof/Madagascar/madagascareng.htm#6.OPPORTUNITIES

Tree Oil Crops

Jatropha

http://www.jatropha.de/ ; http://www.jatrophaworld.org/

When Oil grows on Trees: ICRAF article
http://www.worldagroforestry.org/news/default.asp?NewsID=75F25096-4E40-4437-B445-37AD534D033F

SRI: System of Rice Intensification

http://ciifad.cornell.edu/sri/

Green manure in lowland rice systems

http://www.agroecology.org/cases/greenmanure.htm

Radio show script for green manure in rice systems at FARM RADIO NETWORK

http://www.farmradio.org/english/radio-scripts/58-2script_en.asp

Nutrition garden

Project where a student grew his own food on a garden plot.

http://www.cityfarmer.org/albie.html

Communication

Radio scripts are available at FARM RADIO NETWORK

http://www.farmradio.org/english/radio-scripts/

LEISA Magazine on low external input and sustainable agriculture at:

http://www.ileia.org/, would be a valuable magazine to subscribe to.

List serves

Relevant and informative list serves: for email subscription

ERI regional offices could set up a common email account (e.g. for all ERI senior staff), where everybody has access to and subscribe to these lists, so that the messages don't clog up all the individual email boxes.

ASB (Alternatives to slash and burn):

SRI : To subscribe to SRI-RICE-L, send the following message to: listproc@cornell.edu:

SUBSCRIBE SRI-RICE-L Firstname Lastname

POLEX (Forest policy): http://www.cifor.cgiar.org/Publications/Polex/

PLEC Agrobiodiversity: http://c3.unu.edu/plec/subscribe.html

Flows (News on Payments for Watershed Services): http://www.flowsonline.net/

MULCH-L: to subscribe to MULCH-L, send the following message to: **listproc@cornell.edu**: SUBSCRIBE MULCH-L Firstname Lastname

Search engines

Worldwide Portal to Information on Soil Health: a browsing library for internet resources

http://mulch.mannlib.cornell.edu/browse.html

New: Visit the CGVlibrary at: http://vlibrary.cgiar.org

Get instant access to research on agriculture, hunger, poverty, and the environment using a valuable new resource—the CGIAR Virtual Library. From just one search engine, tap into leading agricultural information databases, including the online libraries of all the Consultative Group on International Agricultural Research (CGIAR) centers. Use the CGVlibrary to discover resources, go directly to the full text of thousands of publications, and stay current on CGIAR research. Custom select databases you want to search or use the topic-based QuickSets preselected by CGIAR information specialists.

ANNEX 1: CONSULTANCY TERMES OF REFERENCE

Ecoregional Initiatives Program

Terms of Reference

"Tropical Farming Systems Specialist"

February 4, 2006

A. BACKGROUND

The Ecoregional Initiatives program (ERI) of USAID Madagascar promotes ecoregional conservation and development along forest corridors in the provinces of Toamasina and Fianarantsoa. The ERI program promotes a wide variety of interventions designed to reduce the conversion of primary forests through the promotion of alternatives to slash-and-burn agriculture (*tavy*). These consist primarily of a package of agroecological practices introduced through the Koloharena farmer movement set up initially through USAID programs. ERI program interventions are focused in two parts of the country—the Ankeniheny-Zahamena forest corridor that straddles the eastern range of mountains in the Toamasina province and the Ranomafana—Andringitra forest corridor in the province of Fianarantsoa that similarly covers the north-south mountain range.

The ERI programs consists of five integrated results modules: (1) Ecoregional Planning, (2) Community-Based Natural Resources Management, (3) Alternatives to Slash-and-Burn Agriculture, (4) Socio-Organizational Support to Rural Associations and (5) Strategic Communication. The program is carried out by small regional office staff in Toamasina and Fianarantsoa with coordination facilitated by the national office in Antananarivo. Sub-contracts are extended to partner organizations to carry out a wide range of activities associated with these module activities.

The following section is a brief description of current ERI agricultural intensification and institutional support initiatives launched in the Fianarantsoa and Toamasina provinces but focused along the fringes of the respective forest corridors. This description provides the technical and institutional context for this consultancy.

Agricultural production practices

The ERI program strives to promote an agroecological/eco-agriculture approach to agriculture and rural development in its areas of intervention. This consists primarily of encouraging adoption of new agricultural innovations and practices within highly variable farming systems in different agroecological niches ranging from the lowland rice fields to upland forest fragments. These areas are situated at the fringes of forest corridors where transport and market linkages are extremely weak. Roots causes of biodiversity loss in these areas are often due to the lack of basic rural infrastructures like roads, markets, schools, and health care facilities. The ERI program encourages low external input agriculture (ie: judicious use of inorganic fertilizer, integrated pest management, small scale agricultural machinery like hand-held weeders…), selective integration of households into local as

well as international markets, and strengthening of rural farmers institutions. The range of practices currently being introduced by ERI field agents and partners in different agroecological zones are:

Low-land Rice Fields: Introduced techniques focus on the increase in yields of rice in lowland valleys through the use of SRA and SRI practices centering primarily on controlling water flow, augmenting weeding, increasing soil fertility through composting, rice-fish culture, deeper plowing, and improved seeds. Productivity increases are limited by a wide range of socio-economic factors. For instance, in some cases rice fields are being converted to Royal Carp and Tilapia fish ponds because income and fertility gains are highly apparent. Farmers use the nutrient rich mud to fertilize adjacent fields while selling easily fish in the adjacent markets. ERI works through Koloharena associations to expand the production of vegetables, beans, potatoes and other crops like peanuts into rice fields as a dry- or off-season crop in order to stimulate not only higher production through the use of compost and fertilizer, but to obtain a residual fertility effect for rice. Similarly, it works with partner USAID funded organizations like BAMEX et CRS/Title II to identify new market opportunities for surplus crop production.

Borders to Rice Field: This fringe of gently sloping lands surrounding rice fields (5-25 meters) is intensively cultivated for dry-season agricultural production as well as perennial tree crops and other agroforestry practices. Fish ponds for Royal Carp and Tilapia production are often built by farmers in this zone. ERI is introducing new varieties of bananas into these areas but also improved varieties of fruit trees. Recently, ERI has introduced tuber crops into this zone such as vitamin rich orange sweet potatoes and potatoes.

Degraded Up-lands and hills (Fallows): The majority of rural landscapes are comprised of highly degraded shrub fallow or grasslands. Soil fertility is poor. Program interventions aim to increase biomass production in these areas while at the same time increasing soil fertility. Program interventions have consisted of introducing vetiver bunds planted on contours, biomass banks of tephrosia, flemengia, and crotorlaria. Seeds are often lacking or are very expensive. More recently, ERI introduced the cultivation of *Jatropha curcas* in various agroforestry permutations. Tree tenure may constrain advancement in landscape restoration. Adoption of agroecological restoration techniques appears often to be very slow due to poor market incentives as well as land and tree tenure constraints.

House-Hold Gardens: This micro-ecological zone most often consists of an intensively cultivated area under various types of agroforestry systems based primarily on the cultivation of fruit trees with understories of annual field crops. Soil fertility is higher in these areas due to the addition of manure and household wastes. ERI tries to introduce into these areas various tree crops like *Moringa olifera*, coffee, bananas, litchi, papayas, and higher yielding varieties of fruit trees. Expansion is contingent upon the availability and high cost of seeds and grafting materials. Bee keeping is actively encouraged and farmers usually build hives in the immediate vicinity of the household. Small scale animal raising is actively supported through vaccination programs and some selected breeding.

Reforestation Plots: Over the years the ERI program has worked closely with rural associations to set up village and association tree nurseries of indigenous and exotic species. “Parc à bois” plots of trees and other plants like vetiver have been set up in several sectors. Survival rates vary considerably depending on the capacity of households and associations to protect trees. Land tenure arrangements are often a disincentive to community woodlots.

Secondary forest-fallow: Secondary forest zones, *poupaka*, are some of the most threatened fallow areas due to progressively declining fallow periods linked to restrictions in expansion of slash-and-burn agriculture into primary forests. These secondary bush fallow areas are under high pressure because they represent the last soil fertility reserves in many areas.

Primary forests: ERI interventions focus primarily in working with a variety of partners to establish new protected and sustainable-use areas under the new *Systèmes d'Aires Protégées de Madagascar* and to support the establishment of community resource management agreements (GCF and GELOSE) in and along forest corridors. Resource management plans are associated with these agreements and ERI tries to provide technical and financial support to the implementation of these community initiatives.

Koloharena Farmer's Movement

The Koloharena farmer's movement was initiated by the LDI/USAID program seven years ago. Presently, the movement consists of about 20,000 members comprised of a national confederation, federations of associations uniting member cooperatives and associations. The foundation of the movement is built upon the hundreds of Koloharena rural associations comprising of no more than 15 members often organized around family or clan relations. This encourages internal household and family solidarity while avoiding some of the classical problems of capture of the movement by traditional village elites. Koloharena cooperatives and associations are legally registered and recognized bodies subject to the rights and responsibilities granted by the national legal framework. The Koloharena association charter calls for members to renounce slash-and-burn agriculture and to commit themselves to increasing agricultural production and revenues. While some differences in structure exist between Fianarantsoa and Toamasina, the Koloharena movement has built up over the years a complex set of internal committees and management structures aimed at promoting agroecological production, increases in revenue, and diversification of the household economy through conservation-based enterprises. Annual internal planning mechanisms generate work plans and strategies at the various levels of the movement.

Farmer Extension System

The agricultural extension system promoted by ERI is based on a farmer-to-farmer extension model which itself is intimately linked to the Koloharena movement. The system is based primarily on the work of farmers selected by the local community (*Paysans Vulgarisateurs* and *Paysans Animateurs)* to acquire and then transmit improved agricultural extension practices and organizational techniques. These PA and PV receive a certificate from the Ministry of Agriculture and the Ministry of Environment certifying acquisition of particular skills. In principle, these farmers are paid a small monthly salary or an annual payout by the cooperative. However, financial sustainability are always issues. Recently, the ERI program has extended sub-contracts to the Koloharena federations and cooperatives allowing them to hire themselves agronomists and socio-organizers to carry out annual work plans developed in conjunction with the communes (lowest elected governance unit). The ERI program promotes through this system the FAO inspired "Farmer Field School" approach that encourages farmer led agricultural research and observation. The farmer extension system is linked to a network of cooperative-managed Agricultural Supply Centers. These stores sell agricultural inputs, extend small sums of credit, and facilitate the expansion of grain banks. The Agricultural Supply

Centers sometimes operate rice mills and other food transformation activities though these are limited in size and scale.

While the ERI program feels that the Koloharena movement is acquiring considerable maturity, problems still exist. The ERI team questions whether the movement is truly durable and if it can survive without sustained support from donor funded organizations. Is the movement an instrument of USAID projects and thus inherently tied to project implementation cycles or is it indeed capable of expanding and surviving in an autonomous fashion? In light of experiences with farmer's movements in other parts of Africa, Asia, and Latin America are there lessons to be learned? What measures should ERI implement at this point to work with the associations to become more dynamic and independent of external support. These questions lead us to ask whether ERI is on the right track through our approaches to encouraging the growth of the farmer-to-farmer extension system. These and other questions guide this consultancy.

B. OBJECTIVES

The ERI program requests the assistance of a highly qualified tropical farming systems specialist in order to foster reflexion, dialogue, and debate on ways to improve the performance of the ERI agricultural intensification and diversification program (Results Module III). The presence of an external viewpoint is anticipated to stimulate internal program reflections on ways to improve agricultural intensification and diversification as alternatives to slash-and-burn agriculture but within the context of limited personnel and financial resources.

Objective 1: To review ERI Fianarantsoa and Toamasina Module III (Alternatives to Slash-and-Burn) agricultural intensification strategies and activities in order to provide recommendations on ways to improve program performance.

Objective 2: To exchange technical information and ideas between tropical farming systems specialist and ERI technical staff (senior agronomists, ERI Regional Coordinators, ERI field agents, and Koloharena association technicians and *paysans vulgarisateurs*).

Objective 3: To provide USAID Madagascar and members of the Ecoregional Alliance with technical recommendations on ways to advance agro-ecological development interventions.

C. TASKS

Task 1: Review ERI Module III technical documentation to obtain a general overview of program orientations and meet with senior project agronomists to clarify and elucidate program interventions. Review key national agricultural policy documents (ie: Master Plan for Agriculture Development, PADR, Plans Régionaux de Développement, USAID BAMEX project orientations) to determine the optimal interface between ERI programs and national and regional agricultural policy.

***Task 2*:** Prepare a compendium of tropical agroecological and farming systems documentation in French and/or English for use by technical agents of ERI and partner organizations. Articles should focus on case studies and experiences in other countries of introducing agroecological and farming system approaches and innovative techniques of potential use in Madagascar. Compendium may consist of documentation scanned and placed on CD ROM or hard copy.

Task 3: Visit ERI Fianarantsoa and Toamasina field sites to review range of agroecological practices and current ERI Module III strategies employed on the eastern and western sides of the forest corridors.

Task 4: Visit CDIA Beforona (agricultural intensification diffusion center) near Moramanga to review program and range of technical practices. Assess the potential for replicating improved agricultural intensification techniques and demonstrations in the two ERI ecoregions.

Task 5: Based on field visits in the Fianarantsoa and Toamasina regions and the review of ERI Module III program activities and staffing constraints, assess the potential for focusing agricultural intensification activities on a discrete number of *filières* or value chains. Similarly, evaluate the extent to which current Module III activities are appropriate for the ERI client population, i.e., poor farming families often located in remote areas often disconnected from regional and international markets.

Task 6: Assess the technical capacities and aptitudes of local, Malagasy technical partners for agricultural intensification activities and the extent to which ERI Module III work could potentially be undertaken by them.

Task 7: Provide technical training inputs to an ERI refresher agricultural intensification training course offered to field agents and partner organizations.

Task 8: Prepare case study/summary document of ERI agroecological or faming systems approach describing approaches, impacts, and challenges based on review of project documentation and field visits.

Task 8: Provide ERI and USAID Madagascar with technical recommendations on ways to strengthen approaches and practices in agroecological intensification and improved farming systems, especially in relation to scaling up program interventions.

D. LEVEL OF EFFORT

Person	Level of Effort	Dates
Tropical Farming Systems Agronomist	40 days	Late March, early April 2006

E. DELIVERABLES

Deliverable 1: Mission Report of analysis and recommendations.

Deliverable 2: Background Documentation presented as a compilation of photocopies or scanned papers delivered on a CD ROM.

Deliverable 3: Case Study/Summary Description of ERI Agricultural Intensification approach and practices.

F. CALENDAR

Mission should be coordinated with the mission of rural extension specialist scheduled to participate with the agronomist at the same time in order to foster maximum exchanges of ideas and information.

G. MONITORING AND EVALUATION

Mission report and other deliverables will be reviewed by ERI Fianarantsoa and Toamasina regional coordinators in association with Module III supervisors.

H. ERI REGIONAL OFFICE RESULTS MODULE SUPERVISOR

Overall supervision is provided by Regional Coordinators Mark Freudenberger and Tom Erdmann, but each Results Module III staff member will be responsible for day-by-day management of the mission.

I. BUDGET (ESTIMATION)

ANNEX 2: MISSION SCHEDULE

MISSION CONJOINTE MME. ERIKA STYGER ET M. PIERRE THEVENOT

Mardi 09 mai :

- Arrivée de FAR et DAR à Fianarantsoa
- Nuitée FIA : Hôtel SORATEL—par BC pour FAR et DAR

Phase I : Préparations avant la Mission[13]

- Bibliographie d'informations sur ERI
- Préparation des documents intéressants pour l'équipe ERI
- Synthèse débat sur l'intensification agricole et conservation de la biodiversité
- Informations sur les mouvements paysans et la formation agricole—FFS et autres

Phase II : Introductions à Antananarivo (1/2 jour)

Mercredi 10 mai :

- Arrivée de Pierre de Erika et Pierre à Antananarivo. Nuitée TNR : Hôtel Tana Plazza (65 Euros par chambre).
- Introduction de Pierre aux ministères (MINENVEF, MAEP) pendant la journée.
- Arrivée de FAR et DAR à Fianarantsoa. Nuitée FIA : Hôtel SORATEL

Jeudi 11 mai: Rencontres initiales

- 8h30 : Rencontre Erika et Pierre avec ERI.
- 9h30 : Rencontre Erika et Pierre avec BAMEX et USAID.
- 12h40 : Départ Erika et Pierre pour Fianarantsoa (Ivato avant 11h40)

Phase III : Mission à Fianarantsoa[14] (8 jours)

- Jeudi 11 mai: Rencontres initiales
- 13h50 : Arrivée Erika et Pierre à Beravina/Fianarantsoa

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[13] N.B. : Cette mission consiste de 40 jours de travail qui pourraient se diviser entre les préparations, la mission au Madagascar, et le rapport finale. Il est estimé que 21 jours seront au Madagascar, et environs 9 jours pour la préparation et 10 jours pour le rapport final (à incorporer les jours de voyage)

[14] N.B.: L'équipe de la mission consistera des 2 consultants, 1 agronome de ERI Fianarantsoa, 1 socio-organisateur de ERI Fianarantsoa, 1 agronome de ERI Toamasina, 1 socio-organisateur de ERI Toamasina

- 14h30 : Rencontre initiale avec équipe ERI Fianarantsoa
- Nuitée FIA : Hotel SORATEL à 28.000Ar la nuit pour Erika et Pierre—BC pour FAR et DAR

Vendredi 12 mai

- Visites, discussions et observations à l'Assemblée Générale de la Confédération Nationale de Koloharena à EASTA/Iboaka
- Nuitée FIA : Hôtel SORATEL à 28.000Ar la nuit pour Erika et Pierre—BC pour FAR et DAR

Samedi 13 mai

- Visite de terrain à la Maison Koloharena de Morafeno ou Alatsinainy Ialamarina pour connaître approche agronomique et institutionnelle des Koloharena sur le versant Ouest corridor forestier
- Dîner de la mission chez Famille Freudenberger
- Nuitée FIA : Hôtel SORATEL à 28.000Ar la nuit pour Erika et Pierre—BC pour FAR et DAR

Dimanche 14 mai

- 7 :00 Départ du train FCE pour Manampatrana
- 02 de nos voitures attendront à Manampatrana
- Visites avec Koloharena l'après-midi de dimanche (eg. Systèmes d'agroforesterie locale, visite à la vallée de réhabilitation…)
- Passer la nuit chez M. Claude
- Nuitée Manampatrana : Merci de prévoir 7.000 Ar par nuit pour lodging à Manampatrana pour tout le monde

Lundi 15 mai

- Visite sur le terrain, versant Est du corridor forestier (aux alentours d'Ikongo)
- Passer la nuit chez M. Claude
- Nuitée Manampatrana : Merci de prévoir 7.000 Ar par nuit pour lodging à Manampatrana pour tout le monde

Mardi 16 mai

- Visite sur le terrain, versant Est du corridor forestier (aux alentours de Ranomafana et Kelilalina)
- Nuitée Ranomafana : IHARY HOTEL Ranomafana à 33.000Ar la nuit pour Erika et Pierre et BC pour le reste.

Mercredi 17 mai

- Matin : Retour à Fianarantsoa en passant par Ambatovaky (visite au Centre d'Appro, décortiqueuse…)

- Après-midi : Table Ronde avec DRDR (Ministère de l'Agriculture), DDR (Régions), ONG partenaires (AIDE, CEP, AGED, etc)
- Nuitée FIA : Hôtel SORATEL à 28.000Ar la nuit pour Erika et Pierre—BC pour FAR et DAR

Jeudi 18 mai

- Matin : Libres discussions avec équipe ERI Fianarantsoa
- 14 :10 Départ par vol Air Madagascar MD 5701 pour Antananarivo
- Vos billets d'avion à part celui de Erika et Pierre que j'ai déjà envoyé à Holy, sont prêts
- 15 :20 Arrivée à Ivato
- 18 :15 Départ Air Madagascar MD 508 pour Toamasina (Billet avec Holy)
- 19 :15 Arrivée Toamasina
- Nuitée Toamasina : Hôtel Génération dont 45.900Ar la nuit pour Erika et BC pour HGR et JAR

Phase IV : Visite à Toamasina (9 jours)

Vendredi 19 mai

- Orientation Globale programme ERI Toamasina (présentations par TKE, FAR, DAR)
- Discussions individuelles avec autres membres du staff ERI Toamasina (GRK, MAR, TKE)
- Rencontres, entretiens avec DRDR, DDR (Atsinanana), CARE, CRS
- Nuitée Toamasina : Hôtel Génération dont 45.900Ar la nuit pour Erika et BC pour HGR et JAR

Samedi 20 mai

- Départ pour Andranobolaha
- Introduction aux activités M3 et M4 à Andranobolaha (Ranary Be, [avec l'appui de DAR, FAR])
- Réunion avec le CA du CKH d'Andranobolaha ; réunion avec quelques PA/PV (équipe M4)
- Visites des réalisations : sites FFS, démonstrations agricoles (équipe M3)
- Nuité Andranobolaha

Dimanche, 21 mai

- Visite des réalisations et entretiens avec PA/PV dans une FKT d'Andranobolaha (autre que le chef-lieu de la commune) : tout le monde ensemble
- Départ pour Beforona
- Nuitée CDIA Beforona: Merci de prévoir 8.000Ar par nuit pour tout le monde

Lundi 22 mai

- Présentation et visite du CDIA

- Discussion avec le Directeur et Agronome du CDIA et le Président du CKH Tongalaza
- Départ pour Moramanga
- Nuitée Moramanga: Emeraude Hotel dont 19.000Ar la nuit pour Erika et Pierre—BC pour les restes

Mardi 23 mai

- Départ pour Ambatondrazaka de bon matin
- Introduction aux activités M3 et M4 dans la zone d'Ambatondrazaka (Hery Be, Gabriel, Germain, Lala [avec l'appui de DAR, FAR])
- Nuitée Ambatondrazaka: Max Hotel à 28.000Ar la nuit pour Erika et Pierre—Nab Hotel par BC pour JAR et HGR

Mercredi 24 mai

- Visite des zones de la rive Est du lac :
  - Réalisations (FFS, DRS, Jatropha, etc.) dans la zone d'Antanandava (équipe M3)
  - DRS/semis direct démonstrations de BRL (équipe M3)
  - Rencontres avec Maires, CA des CKH, PA/PV, AKH—zones d'Ambatosoratra et d'Amparihintsokatra (équipe M4)
- Nuitée Ambatondrazaka: Max Hotel à 28.000Ar la nuit pour Erika et Pierre—Nab Hotel par BC pour JAR et HGR

Jeudi 25 mai

- Visite de la rive Ouest du lac (tout le monde ensemble) :
  - Réalisations (FFS, DRS, Jatropha, etc.) dans les zones d'Amparafaravola et Tanambe
  - Rencontres avec Maires, CA des CKH, PA/PV, AKH—zones d'Amparafaravola et Tanambe
- Nuitée Ambatondrazaka: Max Hotel à 28.000Ar la nuit pour Erika et Pierre—Nab Hotel par BC pour JAR et HGR

Vendredi 26 mai

- Réunions avec partenaires clés à Ambatondrazaka (p. ex., Région Alaotra-Mangoro, Durrell, OTIV, EAM, FFEM)
- Dernier entretien/debriefing avec l'équipe d'Ambatondrazaka
- Départ pour Moramanga
- Nuitée Moramanga: Hotel dont 19.000Ar la nuit pour Erika et Pierre—BC pour les restes

Samedi 27 mai

- Retour sur Antananarivo de Erika—Pierre—JAR - HGR

- Transbo à Moramanga à 9h30
- Retour FAR et DAR sur Toamasina
- Nuitée Tana: Tana Plazza pour Erika et Pierre, et Aina Hotel pour JAR et HGR

Phase V : Restitution à Antananarivo (3 jours)

Dimanche 28 mai

- Repos
- Nuitée Tana: Tana Plazza pour Erika et Pierre, et Aina Hotel pour JAR et HGR

Lundi 29 mai

- Arrivée de FAR et DAR à Antananarivo par vol Air Mad
- Préparation de restitution
- Nuitée Tana: Tana Plazza pour Erika et Pierre et Aina Hotel pour JAR et HGR et FAR et DAR

Mardi 30 mai

- Restitution de la Mission : Table Ronde avec USAID, MCA, ERI, BAMEX, Ministère de l'Agriculture, Ministère des Eaux et Forêts et Environnement…
- Nuitée Tana: Tana Plazza pour Erika et Pierre, et Aina Hotel pour JAR, HGR, FAR et DAR

Phase VI : Préparation du Rapport Final

Mercredi 31 mai

- Retour de FAR et DAR sur Toamasina
- Départ de Erika pour WDC (Ivato avant 22h50)