Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

【Demonstration of Sustainable Upland Agroforestry Systems in Chinese Taipei】

Project Proposal

Submitted by

Taiwan Forestry Research Institute, Chinese Taipei (TFRI)

Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

Project ID	**APFNet-2010-PP-003**	**Project Type**	
Project Title	**Demonstration of Sustainable Upland Agroforestry Systems in Chinese Taipei**		
Submitting Country	**Taiwan Forestry Research Institute, Chinese Taipei**		
Executing Agency	**Taiwan Forestry Research Institute, Chinese Taipei**		
Total	**USD 400,000**		
Duration *(months)*	**24 months**		

Details of the Project Proposal

SUMMARY

Taiwan is a mountainous island with lush and diverse forests which occupied 58.5% of the island area. Upland area is vulnerable and unstable, especially huge landslides and debris flow disaster happened in upland area frequently in recently decades. However, agricultural practices in upland areas are continuously implemented for livelihood. In Chinese Taipei, one of the present research priorities has been focused on carbon sink effect in afforestation and reforestation. This project will provide more knowledge and technology in this field. Furthermore, agroforestry management systems that encourage the farmers to interplant trees on their farmlands can be a solution to harmonize the land use types in these areas.

The major goal of this project is to develop and demonstrate the sustainable agroforestry systems adaptable in upland areas of Chinese Taipei. Not only at least 2 agroforestry management systems but also the criteria and indicators for evaluating the sustainability will be developed. The ability of soil and water conservation of these agroforestry systems will be verified. Moreover, several farmers' technical teams from upland villages will be fostered to assisting technology dissemination. Taiwan Forestry Research Institute, the executing agency, will cooperate with two agencies, Taiwan Forestry Bureau and Chinese Forestry Association to carry out this project. Farmers who provide their farms as experimental plots, farmers' communities, and industries interested in forest products will also plan an important role in this project.

The field trial and demonstration sites will be in the national forest area, the aboriginal reserves, or on private upland farms in Chinese Taipei. Pilot study sites will be selected in north, east and center Taiwan, respectively. They will vary in elevation and in crop species. Although most population is living in the downstream plain areas, the upland areas are in the upstream and environmentally closely related to the downstream cities. However, the major activity for livelihood in upland villages (including aboriginal areas) is agricultural productions, such as betel nuts, tea, fruits and vegetables. Surface erosion problems might be serious on these cultivated uplands. Therefore, appropriate agroforestry management system(s) in these areas will be able to balance different interests among different parties.

EXECUTING AGENCY	Taiwan Forestry Research Institute, Chinese Taipei
DURATION	24 months
APPROXIMATE STARTING DATE	January 1, 2011

BUDGET AND PROPOSED SOURCES OF FINANCE:	**Source**	**Contribution in US$**
	APFNet	**400,000**
	Counterpart contribution in cash	**131,000**
	Counterpart contribution in kind	**6,000**
	TOTAL	**537,000**

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PROJECT BRIEF

Taiwan is a mountainous island with 58.5% of forest lands. Upland area is very vulnerable and unstable due to its rugged topography. However, the upland villages reply heavily on agricultural practices for livelihood. On the other hand, the Chinese Taipei administration is seeking for sustainable management and increasing carbon sink solutions.

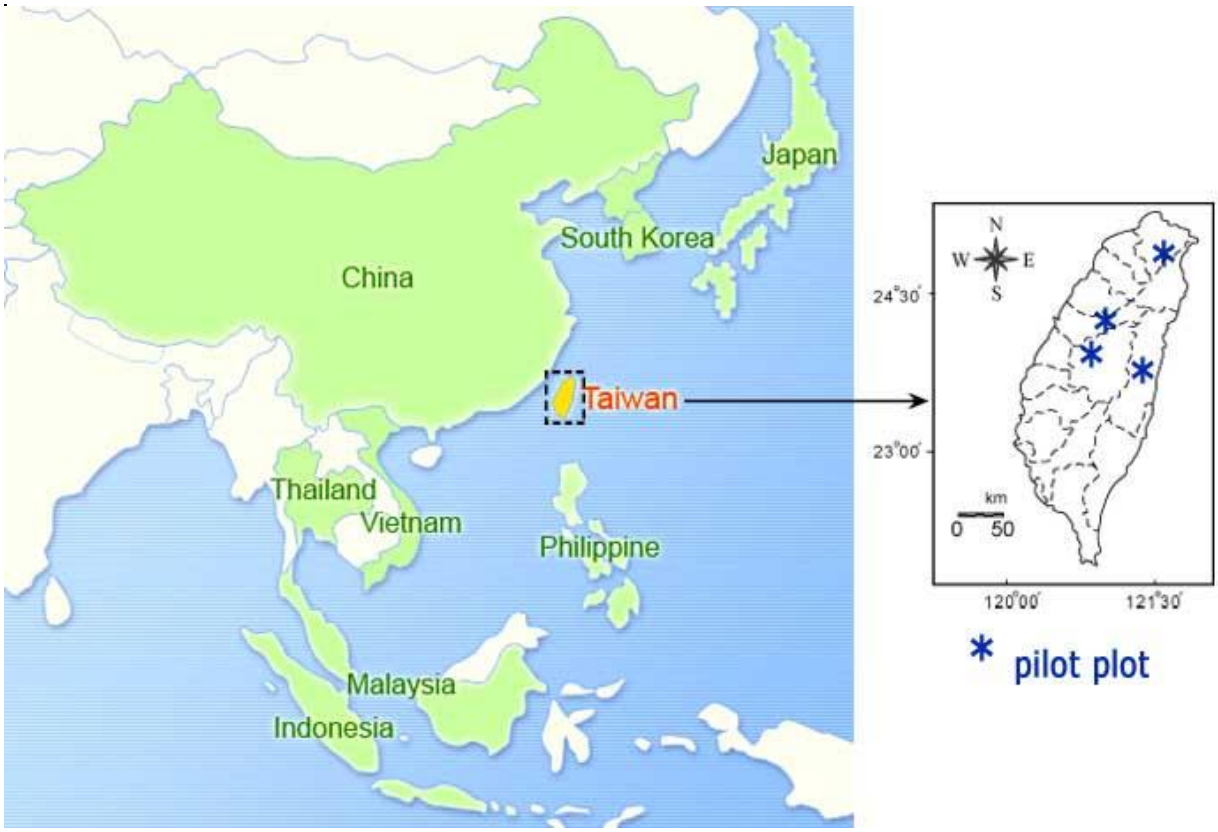
This project will be carried out mainly by the Taiwan Forestry Research Institute (TFRI), cooperated with the Taiwan Forestry Bureau and the Chinese Forestry Association. The overall objective is to develop and demonstrate the sustainable agroforestry systems adaptable in upland areas. The field trial and demonstration sites will be in the national forest area, the aboriginal reserves, or on private upland farms in Chinese Taipei. A set of criteria and indicators for evaluating the sustainability will be ready for application. Several farmers' technical teams will serve as assistants of the researchers on dissemination. Agroforestry management systems which encourage the farmers to interplant trees on their farmlands can be a solution to harmonize the land use types in these upland areas.

The project director, the director-general of TFRI, will organize a research team. Moreover, TFRI has a complete research management system for all research projects, including tracking and assessment system and a committee.

LIST of ABBREVIATIONS and ACRONYMS (If there are many jargons /terms repeatedly used in the context)

1. TFRI: Taiwan Forestry Research Institute
2. TFB: Taiwan Forestry Bureau
3. CFA: Chinese Forestry Association (Chinese Taipei)

MAP of PROJECT AREA



PART I. PROJECT CONTEXT

1.1. Project background

Taiwan is a mountainous island with lush and diverse forests. The total area of Taiwan island is only 3.6 million ha. Forest area is 2.1 million ha which occupied 58.5％ of the island. About 20% (420,000 ha) of the forest area, is plantation, 7% is bamboo forest, and the remaining 73％ is classified as natural forest. With more than 260 mountain peaks over 3,000 meters in elevation, the island of Taiwan supports a diverse flora of over 4,000 vascular plant species and a spectrum of six forest types ranging from tropical rain forest to sub-alpine tundra.

Since the mid 1990s, huge landslides and debris flow disaster occurred frequently due to unusual climate change and occasional earthquake. However, the agricultural practices in upland areas are continuously implemented as a consequence of gaining relatively high revenues comparing to those of plain areas. Many landowners even cut trees on their land and planted high revenue agricultural crops instead. Their behaviors not only violate the forest regulations, but also result in soil erosion and water pollution. As a result, how to balance landowners' profit and land sustainability policy is very important now.

An agroforestry management system that encourage the farmers to interplant trees on their farmlands can be a solution to harmonize the land use types in the upland areas. Upland area is vulnerable and unstable due to its rugged topography. Yet the communities around the mountain villages rely heavily on the production of agriculture such as fruits, tea, and other cash crops for their livelihood. As it usually takes several years or decades in most cases for a planted tree ready for harvest, most farmers/landowners are not willing to change their farms into tree plantations due to lack of income for a long period of time. Moreover, domestic timber market is not sound because over 99% timbers in Chinese Taipei are imported. Therefore, combining partial agricultural crop production for short-term income and partial planted trees for long-term forestation as an agroforestry system should be practical.

Although the Chinese Taipei administration has encouraged private individuals, aboriginal people and/or organizations to plant trees by providing free seedlings, rewards, and long-term low interest loans, there are usually not many landowners being qualified to receive the rewards. For example, no agricultural crops on forestland are allowed if landowners want to apply for reforestation rewards. In other words, agroforestry systems are still not encouraged in the Chinese Taipei forestry policy.

In other cases, agroforestry can make it easier for farmers to transit from one type of crop to another as market demand for their products changes. As many upland landowners are getting older while most their children are working in urban areas, they would like to change their intensive-managed farmland into a low input and labor system, such as forestation. Agroforestry systems will be a good choice during the transition period.

In spite of the advantages of conducting agroforestry systems in upland areas, land management under agroforestry system is still very rare in Taiwan. Related researches in agroforestry in Taiwan are not enough and outdated. More updated technologies in silviculture and plantation management, soil and water conservation, and system evaluation investigations are urgent. Only after we have adequate research results, proper and practical forest policies can be made.

1.2. Relevance

As one of APFNet's objectives is to strengthen sustainable forest management and improve forest quality in the Asia-Pacific region, this project will help achieve this objective, such as developing upland area sustainable agroforestry systems and increasing carbon sequestration.

Many activities of this project will be relevant to the priority of focus for the APFNet. For example, the criteria and indicators for evaluating the sustainability of some agroforestry systems will be established and verified through forest monitoring and assessment. The training of farmer technical team activity will help the development of community-based forest enterprises. Moreover, the cooperation between the research team and farmer villages will enhance the private-public partnerships and corporate social responsibility.

One of the current priority research areas in Chinese Taipei has been focused on carbon sink effect in afforestation and reforestation. This project will provide more knowledge and technology in this research field. In addition, altering farmlands in upland area to agroforestry will be able to reduce disturbances on the vulnerable and unstable areas. In turn, we will achieve the ultimate goal of all forest policies: to preserve our land, protect the environment, and develop an excellent, safe, environmentally-friendly, and biodiverse forestry industry, according to Chinese Taipei's Forestry Law Article 5.

1.3. Target Area

The field trial and demonstration sites will be in the national forest area, the aboriginal reserves, or private upland farms in Chinese Taipei. Near 77% of forest areas is belonging to the national forest area. The majority of aboriginal reserves are located in upland area. When aboriginal people work on their reserve areas, there are special regulations which are usually more flexible to fit the tribe's traditions. Generally, other people's activities on upland areas are more restricted for natural resources protection reason.

Although most population is living in the downstream plain areas, the upland areas are in the upstream and environmentally closely related to the downstream cities. If soil and water conservation job in the upland areas is not well planned and implemented, disasters (such as landslide and flooding) might occur to the downstream big cities. On the other hand, the major activity for livelihood in upland villages (including aboriginal areas) is agricultural productions, such as betel nuts, tea, fruits and vegetables. Surface erosion problems might be serious on these cultivated uplands. Therefore, appropriate agroforestry management system(s) will be a solution to harmonize the land use in these areas.

Farmlands of betel nut and tea are the main target this study. Firstly, betel nut and tea farms occupy majority of upland agricultural areas. In 2009, betel nut and tea farm areas were 49,093 ha and 14,855 ha, respectively. Secondly, the prices of both betel nuts and tea are dropping gradually every year since cheap products are imported from abroad. As a result, some farmers are considering changing their crops of betel nut or tea to other crop(s) or even planting trees.

1.4. Expected outcomes at project completion

Agroforestry management system can be a solution of balancing agriculture for livelihood with sustainability in upland villages in Chinese Taipei.

Under agroforestry system, loss and degradation of agricultural land will be reduced, but resource use efficiency both above and below ground will increase. Moreover, by planting trees we can achieve carbon dioxide reduction. Depending on the tree species interplanted, other advantages of agroforestry systems may include erosion control, soil improvement, windbreak, groundwater management, wildlife habitat, and etc.

The establishment of demonstration sites will encourage other upland village communities to modify their agriculture land into this agroforestry management system. Those trained farmer technical teams will play an important role on helping disseminating the technology.

Furthermore, after providing more updated and relative research results in agroforestry, the Chinese Taipei administration will then be able to make more appropriate and practical forest policy.

Part 2. PROJECT RATIONALE AND OBJECTIVES

2.1. Rationale

The executing agency, TFRI, will cooperate with the other two agencies, TFB and CFA. Farmers who provide their farms as experimental plots, farmers' communities, and industries interested in forest products are the secondary stakeholders. All stakeholders and their role are identified as detailed in Table 1.

Table 1. Stakeholder analysis involvement in project

Stakeholder group	Characteristics	Problems, needs, interests	Involvement in project
Primary stakeholders			
TFRI	Administration department	Developing sustainable agroforestry systems	Executing agency
TBF	Administration department	National forests management	Collaborating agency
CFA	NGO	Community forestry education	Collaborating agency
Farmers	Individual	Improving livelihood	Providing experimental plot
Upland Villages	Community	Supporting farmers	Organizing and helping farmers
Secondary stakeholders			
Industries	Company	Developing forest product industry	Facilitating the cooperation among research teams, farmers, and industries

2.2. Objectives

2.2.1. Development objective and impact indicators

Development objective: To develop and demonstrate the sustainable agroforestry systems adaptable in upland areas.

Impact indicators:

1. At least 2 agroforestry systems for uplands will be provided.
2. At least 2 demonstration sites will be established for inspection.

2.2.2. Specific objective and outcome indicators

Specific Objective:

1. To develop several different agroforestry management systems to cope with different demands of crop planting and afforestation: According to the choice of crop and tree species, the purpose of land owners and the natural condition of the area, various agroforestry systems and management strategies will be developed in this study. A good agroforestry system should not only achieve sustainability in land use, but also fulfill the needs of the local people.
2. To demonstrate the ability of these systems in preventing the destructive landslides and massive surface erosions on cultivated uplands: As huge landslides and massive erosions occurred frequently in upland areas in Taiwan, awareness of the need for soil conservation has arisen. Interplanting trees in farms may control erosion through increasing soil cover, providing hedgerow barriers, stabilizing earth structures and etc.
3. To develop the criteria and indicators for evaluating the sustainability of such agroforestry management systems: One of the most important purposes of developing agroforestry systems in this study is to accomplish a sustainable land-use system. Important criteria and indicators for sustainable may include the evaluation on biological diversity, forestry and crop products, healthy ecosystems, soil and water resources, carbon dioxide sequestration and etc.
4. To encourage the communities of mountain villages to participate in the development of new agroforestry system(s) and take part in the dissemination of new technologies: Not only individual farmers and stewards of natural resources execute the new agroforestry system(s), people from mountain villages need to know the system(s) and encourage related people to participate in some workshops that will be held in the next two years. Linking individual and communities actions to national concerns and achieving sustainable land use becomes important.

Outcome indicators:

1. At least 2 agroforestry systems can be adapted in upland areas.
2. A set of criteria and indicators for evaluating the sustainability will be ready for application.
3. At least 3 upland villages will participate in this research project.

Part 3. DESCRIPTION OF PROJECT INTERVENTIONS

3.1. Outputs and activities

3.1.1. Outputs

Output 1: at least 2 agroforestry management systems, the criteria and indicators for evaluating the sustainability of such agroforestry management systems will be developed by TFRI.

Indicators: The new developed systems and the criteria and indicator will be introduced in published research papers.

Output 2: to set up 3 demonstration areas for verifying the ability of soil and water conservation of these agroforestry systems, will be carried out by TFRI, TFB and CFA.

Indicators: The demonstration sites will also be introduced in published papers and can be inspected by the public as well as foreign researchers.

Output 3: to foster 3 technical teams to be organized by farmers of village communities in uplands for technology dissemination, will be carried out by TFRI and CFA.

Indicators: The farmers' technical teams will serve as assistants of the researchers in this project. At least 3 teams will be fostered by 2011.

3.1.2. Activities

For Output 1:

Activity 1.1: Study sites selection (3) and experimental plots (3) establishment (TFRI)

Activity 1.2: Data collection and analyses, including the growth data of trees and cash crops, soil erosions, and biodiversity indexes.

Activity 1.3: Model simulation for agroforestry systems (TFRI)

Activity 1.4: To establish and verify the criteria and indicators for evaluating the sustainability of these agroforestry systems (TFRI)

Activity 1.5: Aboard training tours to different countries, including the US and China (TFRI)

For Output 2:

Activity 2.1: To select 3 upland villages for cooperative studies including income analyses and land productivity evaluation (TFRI, TFB and CFA).

For Output 3:

Activity 3.1: organize 1-2 seminars for technological discussion and experience exchange (TFRI, TFB, and CFA)

Activity 3.2: To select and train farmers for organizing 2-3 technical teams from upland villages helping technological dissemination (TFRI, TFB and CFA)

Activity 3.3: To set up at least 2 demonstration sites

3.2. Implementation approaches and methods

1. Study sites:

Four pilot study sites will be selected in north, east and center Taiwan, respectively (see page 6, Map of Project area), as weather and soil conditions are varied in the sites. These experimental sites also will differ in elevation (200-300m, 500-700m, 800-1000m) and in crop species. Both elevation and crop type will significantly affect the choice of suitable interplanting tree species and agroforestry management system. Tea and betel nut are two major cash crops in uplands. Fruit orchards usually gain high revenues resulting occupying large area. Coffee farm is a proper place to develop agroforestry, as it is a shade-tolerance species.

Except the position, crop species, and size of plot, the willingness of the landowner/steward is also critical when choosing a study site.

Due to the rugged terrain and small total area of Taiwan, it is hard to find a very large and homogeneous land for study. Nevertheless, in order to have replications of different treatments, the area of a pilot study site has to be large enough (ca. over 0.3 ha.) depending on the experimental design.

2. Experimental design:

There will be a randomized block split-plot design with 2-4 treatments and 3-4 blocks (replications). Treatments to be tested include the relative density of interplanting trees and crop density. Final experimental design at each study site will be adjusted to local conditions.

One experimental design example, the Yuchi study site, is given (Fig. 1). At this study site, it is a pure betel nut farm before planning to interplant *Cinnamomum kanehirae* Hayata, which is the unique culture medium for growing a medicinal fungus. According to TFB reforestation rewards policy, all crop individuals have to be removed before reforestation. However, in a betel nut farm, retaining betel nut trees may play as nurse trees to protect interplanted seedlings and thus improve the success of reforestation. In order to prove this, there will be 3 treatments at Yuchi study site, including retaining all betel nut trees, cut partial betel nut, and cut all betel nut before planning *C. kanehira.*

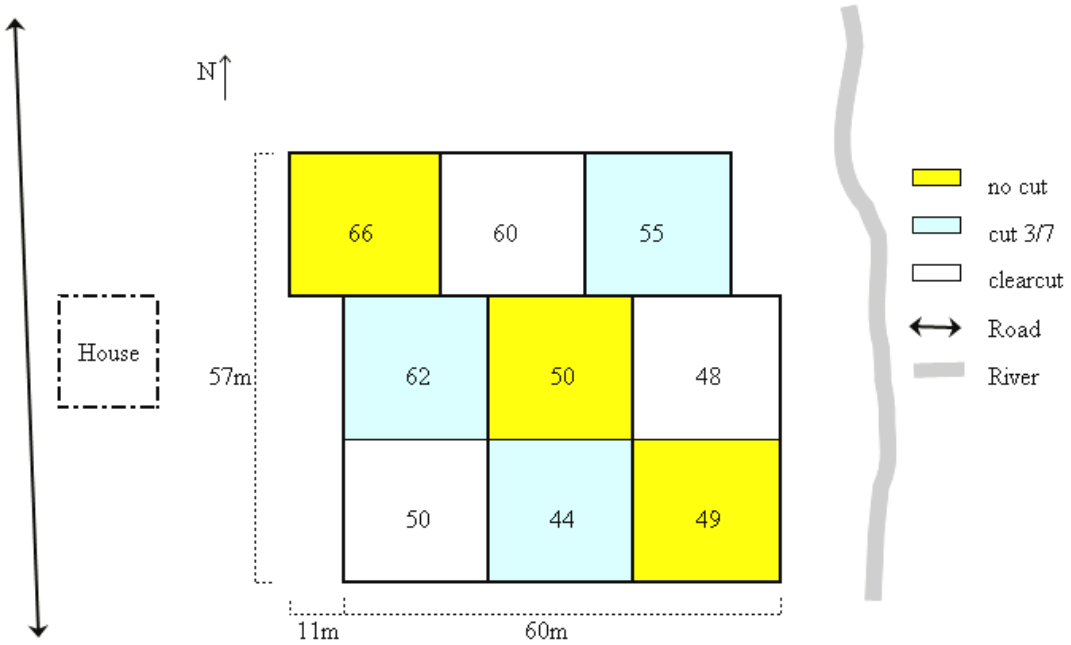


Fig. 1 Plot map of Yuchi betel nut study site, central Taiwan. The number of each plot indicates the amount of betel nut trees prior to treatment.

3. Data collection and analyses:

   Interplanted tree survivorship and growth, vegetation biodiversity, as well as crop yield and production will be surveyed. Environmental factors, such as temperature, precipitation will be recorded for understanding the effects of environment.

   Soil physical characteristics, including soil texture, organic matter, soil bulk, and total porosity, will be sampled at experimental sites. In addition, soil erosion/accumulation will be monitored. The soil loss characteristics after heavy rainfall can help understanding the carbon emission reduction in agroforestry systems.

   The on-site collected data will be used for economic analysis. Interviews with farmers will be important to understand their relevant behavior and need.

4. Evaluation: Criteria and indicators for evaluating the success of the sustainability of these agroforestry systems will be verified in applicability, baseline scenario, eligibility, carbon pool selection, and feasibility. Literature will be reviewed and compared. All parameters used will be adjusted according to local situation.

5. Technical team: After communication with participating upland villages, the research team will help them to organize a technical team. A serial of courses (e.g. workshop and field trip) about agroforestry management systems will be arranged to train the farmers. The content of courses can be adjusted according to potential technical term's need. The research team

will assist the farmers to carry out their discussions for experience exchange.

6. Aboard training tours: In year 1, there will be one training tour to the US and one to Fujian, China. In the second year, there will be one tour to Zhejiang, China. China did excellent job on agroforestry for a long time, such as Tea plantations interplanted with *Aleurites fordii* or other trees.

3.3 Assumptions, risks, sustainability

Assumptions and risks:

1. The risky extreme weather events such as typhoon impacts could ruin the experimental plots and postpone the completion of the project. The recovery expenses will be borne by TFRI.
2. When selecting upland villages and fostering technical teams, TFB and CFA will also participate the process. However, the willingness of cooperation by TFB, CFA and village farmers must be assured prior to the starting of the project.
3. Although there will be an agreement or a contract between the research team (e.g. TFRI) and the cooperative upland village farmers, the farmers might break their promise for various reasons after the project is started. Therefore, good communication between two parties before and during the research project is essential.

Sustainability:

As the agroforestry system is a dynamic system, it may take several years for a land to be stable at the newly developed agroforestry sites. Moreover, the actual performance of agroforestry systems also depends on the effectiveness of management practices by the landowner/farmer. After the expiration of this project, the research team of TFRI will conduct new project(s) to (1) monitor continuously the study sites and (2) offer continuously technical supports to participating farmers.

With the success of several demonstration agroforestry systems, TFB may use the results to modify the current forestry policy which does not allow agroforestry management on national forest areas. Furthermore, TFB may then apply this research results to encourage other upland villages to start their own agroforestry systems.

Our results will also encourage some industries who are interested in developing forest products to participate in agroforestry. In the long-term program, the cooperation between industries and farmers can help the farmers have more stable income and, in turn, they may manage the land in a more sustainable way.

Part 4. Implementation Arrangements

4.1. Organization structure and stakeholder involvement mechanisms

4.1.1 Executing agency and partners

The project will be carried out mainly by the Taiwan Forestry Research Institute (TFRI), cooperated with the Taiwan Forestry Bureau (TFB) and the Chinese Forestry Association (CFA, Chinese Taipei). TFRI is currently focusing researches on the sustainable management and multiple-purpose utilization of forests, therefore, has various expert teams of silviculture, forest management, forest hydrology and forestry economics etc. TFB, responsible for managing national forests and regulating private forests, will help in upland village and technical term selection, and in organizing discussion seminars. CFA, an association connecting academy and industry in forestry, will be in charge of technical teams training.

4.1.2 Project management team

Except the project director, a TFRI research team will be organized. The member of the team will include researchers from the Silviculture Division, Watershed Management Division, Forest Management Division, and Forestry Economics Division. The tasks and responsibilities of the key members of project management team are described as below:

Name	Division	Position	Tasks and responsibilities
Yue-hsing Huang	Taiwan Forestry Research Institute	Director General	Project director, project progress monitoring
Cheng-Kuen Ho	Silviculture	Senior researcher and chief	Tree breeding, site selection
Ching-Te Chien	Silviculture	Senior researcher	Plant propagation and planting design
Fen-Hui Chen	Silviculture	Contract researcher	Agroforest management systems and experimental site establishment
Juang-Pey Lin	Watershed Management	Associate researcher	Soil and water conservation evaluation
Chen-Chen Tsai	Watershed Management	Assistant researcher	Soil erosion and surface runoff analysis
Chih-Ming Chiu	Forest Management	Senior researcher and chief	Model simulation, forest management
Chin-Shien Wu	Forestry Economics	Senior researcher and chief	Upland village cooperation, economics analysis
Jiunn-Cheng Lin	Taimalee Research Center	Associate researcher and chief	Establishing criteria and indicators for evaluating sustainability

Except a few jobs will be subcontracted with companies, local organizations or local farmer himself, all research works will be completed by the project management team. Subcontracted jobs include sites preparation, seedling nursing, interplanting, forest and crop tending (e.g. thinning, weeding, fertilizing, watering) and equipment maintenance. All contracted job will be supervised by the TFRI project team. The contractors need to fulfill the agreement and send finished reports to TFRI regularly. Because most study sites are not closed to TFRI office, the subcontracts will save both travel expenses and project staff labor.

4.1.3 Stakeholder involvement mechanisms

A number of industries are interested in developing some particular forest product industry. They will be able to help finding suitable upland villages to participate, as well as facilitating the cooperation between research teams and farmers.

Farmers from participating upland villages will provide their farms as the experimental plots in this research project. The village communities will organize experimental farmers and help them communicating with the research team if there is any problem.

4.2. Reporting, review, monitoring and evaluation

1. Meeting: To monitoring the progress of project, the project director will hold a meeting with the research team at least bimonthly. Each researcher will have a brief report of their current progress, problems they are facing, and future planning.
2. Project report: In June of each year, a mid-year report will be finished. A final complete written and oral report is required to be completed by TFRI at the end of each year. By the end of second year, when the project is finished, a complete project report will be submitted to AFPNet.
3. Monitoring: TFRI has a complete research management system for all research projects, including tracking and assessment system and a committee.

4.3. Dissemination and mainstreaming of project learning

A list of sustainable upland agroforestry demonstration site and trained farmers' technical team information will be available to the public, including on TFRI website.

Published papers will introduce the new developed system and the criteria and indicators for evaluating the sustainability of such agroforestry management systems. Local and international symposium, seminar and workshops will also provide the information of the project learning.

Through the visiting of demonstration sites and the experience exchanging of technical farmer teams, we expect that more upland farmer villages will be willing to convert their farm into sustainable agroforestry system.

Annex A Logical framework

PROGRAM ELEMENTS	INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Development Objective: To develop and demonstrate the sustainable agroforestry systems adaptable in upland areas	1. At least 2 agroforestry systems for uplands will be provided. 2. At least 2 demonstration sites will be established for inspection.	Research papers/notes and proceedings of seminar or symposium will be available.	
Specific Objective: 1. To develop different agroforestry management systems to cope with different demands of crop planting and afforestation. 2. To demonstrate the ability of these systems in preventing the destructive landslides and massive surface erosions on cultivated uplands. 3. To develop the criteria and indicators for evaluating the sustainability of such agroforestry management systems. 4. To encourage the communities of mountain villages to participate in the development of new agroforestry system and take part in the dissemination of new technologies.	1. At least 2 agroforestry systems can be adapted in upland areas. 2. A set of criteria and indicators for evaluating the sustainability will be ready for application. 3. At least 3 upland villages will participate in this research project.	1. Several agroforestry pilot studies have been carried out in 1980s. However, the trial plots were abandoned for years. This project will try to find out the succession of these pilot plots and gather the existed information. 2. New experimental plots will be set up within 3 study sites. 3. Soil erosion/accumulation of different agroforestry systems will be monitored. 4. The interaction between growth of tree/crops and soil conservation will be evaluated.	The risky extreme weather events such as typhoon impacts could ruin the experimental plots and postpone the completion of the project. The recovery expenses will be borne by TFRI.

PROGRAM ELEMENTS	INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Outputs 1: at least 2 agroforestry management systems, the criteria and indicators for evaluating the sustainability of such agroforestry management systems will be developed by TFRI.	The new developed system and the criteria and indicator will be introduced in published research papers.	First hand on-the-ground data collection/analyses and economic analysis models will supply the necessary information for this project.	
Outputs 2: to set up 3 demonstration areas for verifying the ability of soil and water conservation of these agroforestry systems, will be carried out by TFRI, TFB and CFA.	Three soil and water conservation demonstration areas of these agroforestry systems will be set up	The demonstration sites will also be introduced in published papers and can be inspected by the public as well as foreign researchers.	The willingness of cooperation by TFB, CFA and village farmers must be assured.
Outputs 3: to foster 3 technical teams to be organized by farmers of village communities in uplands for technology dissemination, will be carried out by TFRI and CFA.	The farmers' technical teams will serve as assistants of the researchers in this project. At least 3 teams will be fostered by 2012.	A list of trained farmers' technical teams will be available to the public, including on TFRI website.	Village farmers will follow the agreement and serve after training completing.

Annex B: Work plan

Month	Responsible party	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Overall management / M&E, etc	TFRI																								
Output 1																									
Activity 1.1	TFRI	■	■	■																					
Activity 1.2	TFRI	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Activity 1.3	TFRI													■	■	■	■	■	■	■	■	■	■	■	■
Activity 1.4	TFRI													■	■	■	■	■	■	■	■	■			
Activity 1.5	TFRI					■	■	■	■							■	■	■	■						
Output 2																									
Activity 2.1	TFB, TFRI								■	■	■	■	■												
Output 3																									
Activity 3.1	TFRI, FB, CFA			■	■	■	■	■																	
Activity 3.2	TFRI, FB, CFA													■	■	■	■	■	■	■	■	■	■	■	■
Activity 3.3	TFRI, FB, CFA													■	■	■	■	■	■	■	■	■	■	■	■

Annex D PROFILES OF THE EXECUTING AND COLLABORATING AGENCIES

1. TFRI: Taiwan Forestry Research Institute

The forerunner of the Taiwan Forestry Research Institute (TFRI) was established more than 100 years ago in 1896 during the Japanese colonization period. In accordance with changes over time and needs of society, the TFRI has expanded from just a nursery to an organization of 10 forestry technical divisions, 4 administrative units, and 6 research centers. It has continuously improved its forestry research standards and quality and has obtained abundant achievements. The 10 divisions are forest biology, silviculture, forest economics, forest management, watershed management, forest protection, forest utilization, forestry chemistry, wood cellulose, and forestry extension; the 6 research centers are at Fushan, Lienhuachih, Chungpu, Liouguei, Taimalee, and Hengchun.

By emphasizing the sustainable management and multiple-purpose utilization of forests, the TFRI focuses its work on conserving forest resources, restoring rare animals and plants, selectively breeding endemic tree species, introducing superior tree species, improving silvicultural techniques and biotechnologies, establishing environmental protection forests, managing natural forests, setting up tending systems for plantations, integrating watershed management, improving and elevating forest products manufacturing techniques, providing interpretative services and nature education, enhancing forest recreational quality, and demonstrating management of botanical gardens and experimental forests.

2. TFB: Taiwan Forestry Bureau

The Forestry Bureau can trace its roots back to the Ch'ing Dynasty, the 12th year of the Tong-Chi Emperor, 1873. In that year, the Office of Forestry was established, and placed under the control of the Department of Agriculture in Taiwan. After several times of reorganization, the Bureau became subsumed under the Board of Agriculture, the Executive Yuan, in 1999.

Since the Forestry Bureau is responsible for managing national forests, the business of conservation and national forestry administration, future goals have been set to enhance reforestation, to promote landscape naturalization, to fortify management of watersheds for the safety of downstream inhabitants, agriculture, and industry. Conservation shall be continuously reinforced as wall as the development of forest eco-tourism. The shift of the Forestry Bureau from being supported by timber production to public budget has officially marked the end of exploiting forest resources as means to produce income. Forestry in Taiwan now strives to manage national forests in harmony with

ecological principles and environmental protection, in order to retain the best of welfare Nature has endowed us with.

3. CFA: Chinese Forestry Association (Chinese Taipei)

History of the Chinese Forestry Association may trace to 1917 established Nanjing. It is presently one of the most important forestry organizations in Taiwan. CFA has been facilitating communication and cooperation between domestic and foreign parties in forestry. They also offer suggestions to the administration, supporting to local forest industry, publications (books and periodicals) to the public, as well as hold academic lectures and workshops all over the island.

Moreover, CFA provide scholarship and funding to the public and private organization for research in forestry. Accordingly, they have helped solving many forestry technical questions in Taiwan.

Annex E TASKS AND RESPONSIBILITIES OF KEY

EXPERTS PROVIDED BY THE EXECUTING AGENCY

Name	Division	Position	Research interesting
Yue-hsing Huang	Taiwan Forestry Research Institute	Director General	Forest policy, Forest administration, Forest ecology
Cheng-Kuen Ho	Silviculture Division	Senior researcher and chief	Tree breeding, Forest biotechnology, Utilization of special forest products
Ching-Te Chien	Silviculture Division	Senior researcher	Seed physiology, Seed storage, Plant hormone analysis, Plant propagation and planting
Tsai-Huei Chen	Silviculture Division	Senior researcher	Coastal Windbreak Management, Bamboo stand management, Soil organic matter study
Fen-Hui Chen	Silviculture Division	Contract researcher	Agroforest management, Restoration ecology, Vegetation ecology
Juang-Pey Lin	Watershed Management Division	Associate researcher	Forest hydrology, Sedimentation and erosion
Chen-Chen Tsai	Watershed Management Division	Assistant researcher	Watershed ecosystem analysis and management, Dynamic behaviors of pulsing sediment for watershed
Chih-Ming Chiu	Forest Management Division	Senior researcher and chief	Forest management, Intensive management of plantations, Quantitative and qualitative growth of plantation
Chin-Shien Wu	Forestry Economics Division	Senior researcher and chief	Forestry economics research, improvement of public participation, Aboriginal traditional knowledge
Ming-Yuan Huang	Forestry Economics Division	Post-doc	Bioenergy Policies, Carbon cap and trade, Natural resources economics and policy analysis
Jiunn-Cheng Lin	Taimalee Research Center	Associate researcher and chief	Forest assessment, Forest policy, Forest carbon management
12 Technicians	Silviculture Division	Technicians	Silviculture techniques

Annex F TERMS OF REFERENCE OF PERSONNEL AND CONSULTANTS AND SUB-CONTRACTS FUNDED BY APFNet

Name	School	Department	Research interesting
Chyi-Rong Chiou	National Taiwan University	Department of Forestry and Resources Conservation	Carbon sink management, Resources survey and analysis
Shu-Tzong Lin	National Ilan University	Department of Forestry and Natural Resources	Silviculture, Forest Conservation

Annex G RECOMMENDATIONS of APFNet REVIEWER