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Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

COMPLETION REPORT

Landscape Approach to Sustainable Management of Forests in Prek Thnot Watersheds (2015P1-KAM)

June 2015-May 2019

Ministry of Agriculture, Forestry and Fisheries (MAFF)

Supervisory Agency

Institute of Forest and Wildlife Research and Development (IRD)

Executing Agency

May 2019

Date of submission

BASIC INFORMATION

Project Title(ID)	**Landscape Approach to Sustainable Management of Forests in Prek Thnot Watershed**		
Supervisory Agency	Ministry of Agriculture, Forestry and Fisheries (MAFF)		
Executing Agency	Institute of Forest and Wildlife Research and Development (IRD)		
Implementing Agency			
Date of Project Agreement: [dd/mm/yy]: March 17th 2015			
Duration of implementation: [01/06/15], 36 months (extended by 10 months)			
Total project budget(in USD)	573,015.00	APFNet assured Grant (in USD)	499,215.00
Actual expenditure project	488,215.00	APFNet disbursed Grant(in USD)	438,295.00
Disbursement Status		Date of disbursement	Amount (in USD)
Initial disbursement		Aug 2015	226,786.00
Second disbursement		Aug 2017	164,831.00
Third disbursement		Nov 2018	46,678.00
Total APFNet Grant Disbursed to IRD		As of Nov2018	438,295.00
Balance to be retained by APFNet for M&E		Y1-3	11,000
Balance to be disbursed			49,920.00
Reporting Status		Schedule [1]implementation	Project progress status[2]
First reporting (period covered: mm/yy-mm/yy)		06/15-07/16	Moderately Satisfactory
Second reporting (period covered: mm/yy-mm/yy)		06/17-05/18	Satisfactory
Third/Final reporting (period covered: mm/yy-mm/yy)		06/18-05/19	Satisfactory

Prepared and Submitted by

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Director, Institute of Forest and Wildlife Research and Development
Project Director signature on behalf of EA
Date: 26 Nov 2019

Reviewed and Endorsed by

H.E. Dr. Keo Omaliss
Delegate of the Royal Government of Cambodia
Director General of Forestry Administration
Project Steering Committee Chair Signature
Date: 25 Dec 2019

[1] Schedule [1]implementation status could be on track/behind/ahead of schedule
[2] Project progress status could be ranked as satisfactory, dissatisfactory, moderately satisfactory, moderately dissatisfactory

EXECUTIVE SUMMARY

Prek Thnot watershed covers the provinces of Kampong Speu and Kandal and Phnom Penh, the Capital City of Cambodia. It covers a total land area 666,764 hectares, 77.8% of which are in Kampong Speu province. Most of the forest cover of Prek Thnot watershed is found in the northwestern part although few patches of forests could still found on the downstream part. The watershed provided ecosystem goods and services and support the livelihoods and production systems of the downstream communities. The surface runoffs of the watershed drain towards Phnom Penh via the streams and rivers.

Prek Thnot is one of the watersheds that have high risk of impairment of its watershed function. The loss of forest cover can greatly diminish the protective role of the watershed and increase the vulnerability of the downstream communities. The ongoing deforestation in the uplands increasingly subjects the downstream communities including Phnom Penh to flooding. The unsustainable use of the watershed and some developments will breach the carrying capacity threshold of the watershed resulting to negative environmental impacts. Prek Thnot is facing threats from: (1) Unabated logging of the forest areas, particularly those adjacent or within the Cardamom Mountains; (2) Fuelwood and charcoal industry; (3) Expansion of farms and agro-industries; (4) Settlers migrating from the nearby districts within Kampong Speu province and from other provinces; and (5) From 2002-2010, the forest losses were 20,722 hectares. Most of the areas are now being developed for agro-industries such as rice, sugar cane, corn, cassava and fruits.

Meeting the conflicting demands is indeed complicated and it is further aggravated by the need for the land use plan to meet the biophysical and social constraints (carrying capacity). The project aims to contribute to the management of Prek Thnot watershed to sustain its supply of fresh water and protection to Phnom Penh and adjoining areas from natural disasters. The project aims to: (1) To build capacity and raise awareness on the concept of integrated watershed/landscape planning for central and local stakeholders through scientific assessments, analysis and participatory watershed/landscape planning processes; (2) To develop a watershed management plan of Prek Thnot watershed with participation of stake holders; and (3) To share the experiences and lesson learned from the project to stakeholders.

Expected Outputs: (1) Improved knowledge and awareness of the target stakeholders on the concept of integrated watershed planning and the development issues in Prek Thnot Watershed that affect the forest-dependent communities; (2) enhanced capacity of the FA staff on participatory watershed management planning; (3) characterization of Prek Thnot Watershed; (4) socio-economic and biophysical information for Prek Thnot Watershed; (5) integrated watershed landscape development plan that are validated with the local authorities and key stakeholders; (6) agroforestry demonstration Sites; (7) forest-based livelihood supported; and (8) a

draft policy brief for the sustainable development of the Prek Thnot watershed landscape.

Expected Impacts: The project is expected to result to the following impacts: increased capacity of the selected FA staff for developing watershed plans and contribution to better governance of Prek Thnot watershed through the development of policy briefs and will provide a framework for developing the CLUPs.

This report covers the entire implementation of the project "**Landscape Approach to Sustainable Management of Forests in Prek Thnot Watershed".** The report covers a period of 36 months plus 10 months no-cost extension to May 2019. The project was implemented by the Institute of Forest and Wildlife Research and Development (IRD) of the Ministry of Agriculture, Forestry and Fisheries. All the activities were completed.

This report compiled all the progress reports from the first year up to the third year of implementation. All the targets activities were completed and accomplished. In the initial implementation, the implementations of some activities were delayed and were rescheduled to year 2. All the carryover activities in the first year were finally completed. One activity, the holding of the third PSC meeting was cancelled since the schedule is already close to the end of the workshop activities. A request was submitted to the APFNet for the cancellation of this activity and was duel approved.

The Lessons Learned were presented in this report which extracted from the separate publication of lessons learned.

The impacts of the project are based on the result of Ex-Ante impact assessment of the IWMP, meaning, the potential impacts of the project in the future. A hydrological model (Soil and Water Assessment Tool/SWAT) was used to assess the impact in the future. The impacts of the technology were based on the monitoring made with the farmers' production.

This report includes the project completion workshop that was conducted in May and the Audit of the project which was conducted after the project completion workshop.

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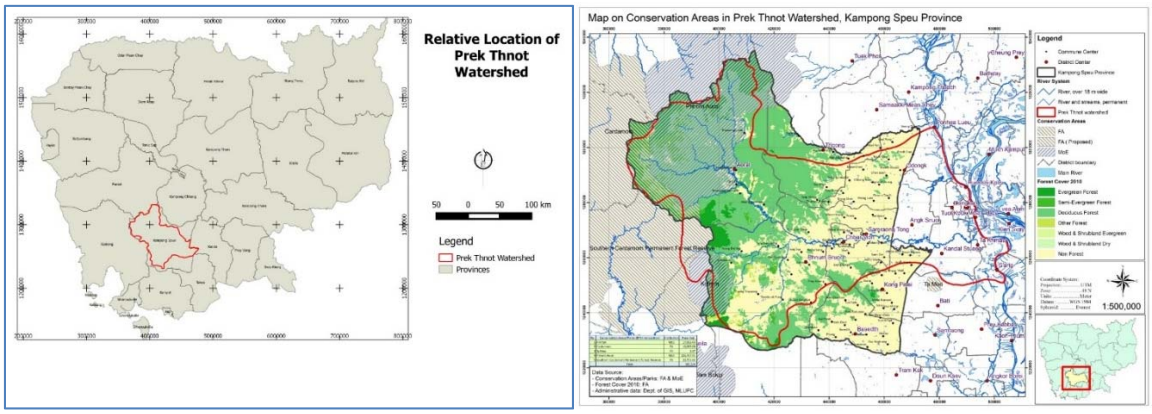
1. BACKGROUND AND INTRODUCTION

1.1 Project Context

Prek Thnot watershed is considered to be one of the high risks of impairment. Maintaining good forest cover is crucial for the effective functioning of the watershed. Prek Thnot watershed covers a total land area of 666,764 hectares, located in the provinces of Kampong Speu, and Kandal, 77.8% of which are in Kampong Speu province. The watershed provides ecosystem goods and services and support livelihoods and production systems of downstream communities. Prek Thnot is facing threats from: (1) unabated cutting of the forest areas; (2) fuelwood and charcoal production; (3) expansion of farms and agro-industries; (4) settlers migrating from the nearby districts; and (5) agro-industry development such as rice, sugar cane, corn, cassava and fruits. The ongoing deforestation in the uplands increasingly subjected the downstream areas to flooding. Meeting the conflicting demands is complicated and the unsustainable development in the watershed may have breached its carrying capacity resulting to negative environmental impacts.



Map 1. Map of Prek Thnot watershed in Kampong Speu

Landscape level planning is needed to effectively address the conflicting uses and deforestation. Spatial planning integrates different, and often competing uses of land towards a balanced territorial development and physical organization of space[3]. While allocation of lands for specific uses has been expressed in Cambodian laws, there are some limitations and shortcomings in its implementation. These include lack of overall framework for proactive land allocation of the watershed. Proper land allocation in the landscape can help in addressing these shortcomings especially that some of the laws have ambiguous provision to guide developments. An integrated watershed management plan (IWMP) in Prek Thnot will provide a guide to the policy makers on the appropriate land uses and management that minimize the impairment of the watershed. The IWMP will also coordinate the development of Commune Land Use Plan (CLUP) in Cambodia.

[3] MLMUPC, 2016

The Royal Government of Cambodia issued a Law on Land Use Planning Urbanization and Construction requiring for the establishment a land use master plan. The smallest political unit who are required to develop the land use plan are the communes. The plans developed by the communes are called Commune Land Use Plans (CLUP). The IWMP therefore is envisioned to provide a macro level planning that could provide a general guide to the communes in developing their CLUPs.

The current spatial planning system of Cambodia mentioned the hierarchy of the level of planning as shown in Figure 1. The hierarchy of area plans include[4]:

National/Regional Level planning	Developed by the National Committee on Land Management and Urban Planning, established by Royal Decree under the leadership of MLMUPC, and be adopted by Royal Decree. The plan shall have its vision for at least 20 years and shall be revised after 10 years through the request of Royal Government except there is a necessity then the revision could be made before this period.
Capital/Provincial Level planning	Developed by the Capital/Provincial Committee on Land Management and Urban Planning, which is set up by sub-decree, with coordination from Capital/Provincial Council with approval from National Committee on Spatial and Urban Planning and adopted by sub-decree. The plan shall have their visions and last for at least 20 years and could be revised in every 5 years.
Municipality/District/ Khan Level planning	Developed by the Municipal/ District/Khan Committee on Land Management and Urban Planning, which is set up by sub-decree, with approval from Capital/Provincial Council and adopted by the Chairman of the National Committee on Spatial/City Planning. The plan shall have their visions and last for at least 15 years and could be revised in every 5 years.
Commune/Sangkat Level planning	Developed by Commune/Sangkat Council with coordination and technical support from Municipality/District /Khan Council on Land Management and Urban Planning. It shall be approved by Capital/Provincial Council through Capital/Provincial Committee on Spatial and Urban Planning. The plan shall have its vision and last for 10 -15 years, and can be modified in every 5 years, based on the need, situation of local development and especially commune/Sangkat investment program.

[4] MLMUPC, 2016

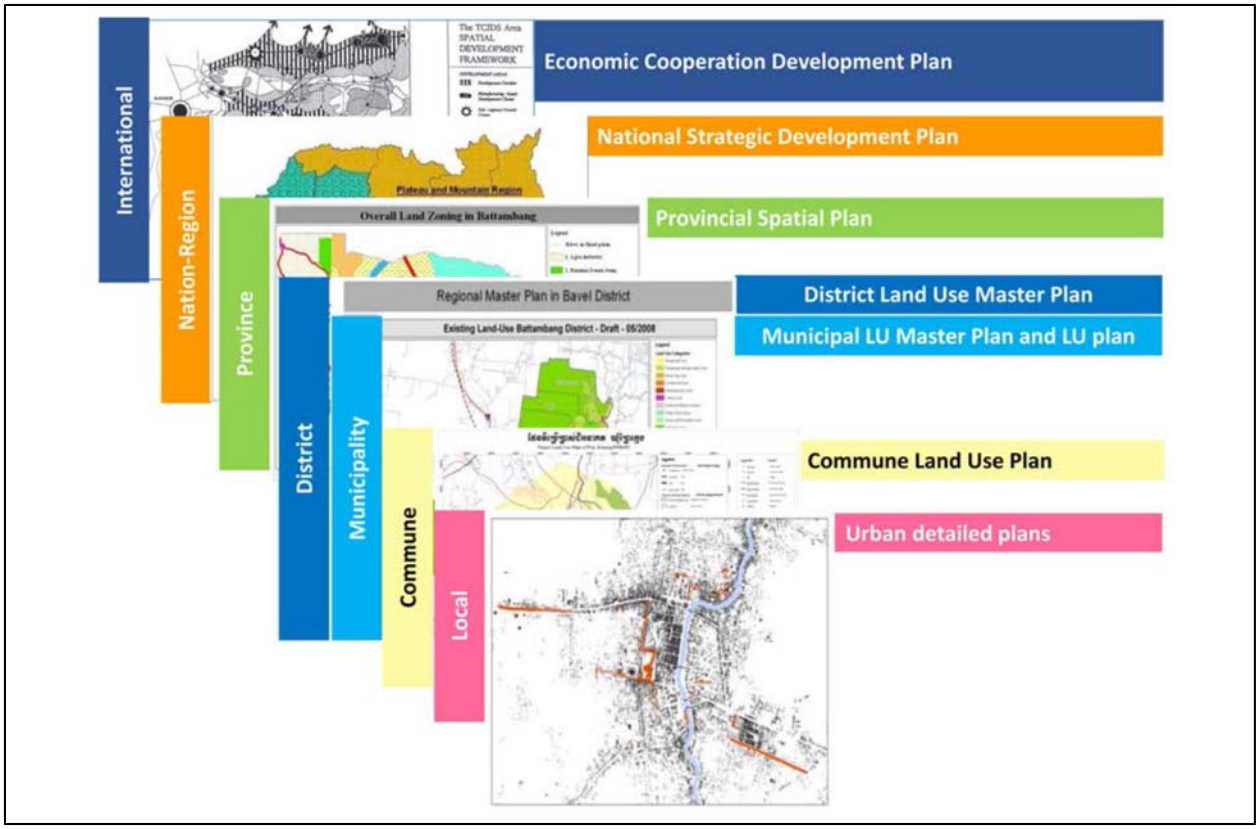


Figure 1. Hierarchy of Spatial Planning in Cambodia
Source: MLMUPC, 2016

While the planning system seems highly developed, there are only few communes that have developed their CLUPs. It was noted that while there are tangible experiences and guidance for commune level land use planning (CLUP), there is very little sub-national level planning made and higher level spatial land use plans that integrate CLUPs. There are so far only two provinces that have embarked on provincial planning, four municipalities and two districts who started developing their land use master plan[5]. Only the City of Battambang's Land Use Plan has been approved early in December 2015 after more than 10 years of foreign technical aid, primarily from the GIZ.[6]

The provinces of Kampong Speu have existing provincial development plan. But most of the province's plan are textual, without delineating specific areas to be developed. There was an enumeration of some priority projects in the province but specific targets are not provided. This made developing the watershed plan quite challenging. In its absence, the watershed management plan will play an important tool for the local authority in developing their CLUPs and ultimately their respective areas.

[5] MLMUPC, 2016
[6] http://www.mlit.go.jp/kokudokeikaku/international/spw/general/cambodia/index_e.html

This project is in line with the APFNet's 2014 priorities. There are three priority areas of the APFNet that this project aims to address: (1) Demonstration of sustainable forest management model: *this was achieved by the project through integration of optimized land allocation models and participatory watershed planning; (2)* Forest rehabilitation and sustainable management for climate change adaptation: *this was addressed through the establishment of pilot Agroforestry model using soil and water conservation structures; (3)* Community based forest resource management and rural development: *this was addressed by integrating CBFM[7] in watershed landscape development.*

The project is also aligned with the National Forest Programme of Cambodia. The NFP 2010-2029 aims to develop 2 million hectares of forests that will be managed under community forestry. One way to achieve this target is by seeking wider involvement, particularly the communes, in the development and management of the forest resources. The development of the Prek Thnot watershed landscape is also in line with the government's objective of addressing issues on climate change by increasing the land cover and increasing the carbon sequestration through increased biomass production. The project is also aligned with the Law on Water Resources Management of the Kingdom of Cambodia through the adoption of an integrated water resources management (IWRM) (Article 4) including the management of the watershed runoff (Article 10). The beneficiaries of the project are the communities living within Prek Thnot Watershed (upstream and downstream communities of Prek Thnot watershed. The project supported the judicious use of Prek Thnot watershed by improving its productive and protective function. This was achieved thru a systematic approach of planning the watershed. The integrative landscape planning approach will be conducted thru consultations.

There are already existing laws and policies that could provide guidance in the land use planning and developments. The Land Law highlights the importance of land uses in allocation of lands for ELCs. *Based on the Sub-Decree on Economic Land Concessions (ELC)[8],* an economic land concession may only be granted when all the following criteria are met:

(i) The land has been registered and classified as state private land, in accordance with the Sub-Decree on State Land Management and Sub-Decree on Procedures for Establishing Cadastral Maps and Land Register, or Sub-Decree on Sporadic Registration;

[7] Cambodia awarded to the communities the right to manage the community forest or natural resources over a period of 15 years and can be renewed depending on the evaluation. The granting of the rights over the community is aimed at alleviating poverty in the rural areas. There are three forms of CBFMs given to the communities: Community Forestry (CF) which is awarded to the communities in areas under the Forestry Administration (FA), Community Protected Areas (CPA) awarded to communities for areas under the jurisdiction of the MoE, and Community Fishery which are awarded to the fishery communities by the Fishery Administration, which cover the mangrove and flooded forests.

[8] The Royal Government of Cambodia awarded Economic Land Concessions (ELCs), a lease agreement, to private companies who develop the marginal lands and open areas for industrial crops, like cassava, sugar cane, potato, and industrial tree plantations.

(ii) A land use plan for the land has been adopted by the provincial or municipal state land management committee, and the land use is consistent with the plan.

The Green Growth Strategy of Cambodia also specifies land use planning as a basis for achieving sustainable development of the economy.

The National Strategic Plan for Green Growth has pointed provisions for sustainable management of the watershed resources and land use plans:[9]

> ***4.2 Sustainable Water Resources Management.*** *The sustainable water resource management to achieve green growth goals shall engage the following strategies: Promoting water resources and watershed protection at national and sub-national levels*
>
> ***4.4 Management and Sustainable Land Usage****. In order to reinforce the successful strategy practices, competent ministries shall have plans of sustainable land use, agroindustry cropping, forestry management, management of the protected area establishment of forestry communities and protected areas communities, development planning, investment and the private sector development. Zoning identification is promoted for a basis of land use planning and identification environment management zone in the protected areas as well as studying natural potentials to create provincial protected areas, this strategy supports, promote and participates in implementation of the state land title registration rights in the protected areas, the coastal areas, the forest protected areas, the industry areas, tourism attraction areas and various land uses for the public needs, which requires cooperation with relevant industries/institutions and local authorities at all levels.*
>
> > ***4.4.1 Conservation, Management and Sustainable Use of Nature Resources.*** *In natural resource management competent ministries/institutions shall prepare strategy and distribution planning and identify management zones for natural resource protection, such as mines, forests, water and fisheries by balancing between conservation and development to enhance national resource and rural economy.*
> >
> > ***6.3.2 Managing green economy to balance with environment. Activities to be implemented for the short, medium and ling terms are as follows****: Coordinating zoning identification to classify areas for productivity of environment protection services*
> >
> > ***6.3.4 Green environment and natural resources management.*** *Activities to be implemented for the short, medium and long terms are as follows: Establishing sustainable land use for tourism, agriculture industry and residential land.*

[9] National Strategic Plan on Green Growth

The Forestry Law also mentioned some provisions related to land uses:

Article 7. The Forestry Administration shall perform the following duties:

3. *Assess boundaries, classify and demarcate forests in order to establish a land use map of the Permanent Forest Estates in coordination with the Ministry of Land Management Urban Planning and Construction, local authorities and communities.*

Article 11. *Ministry of Agriculture, Forestry and Fisheries shall classify, register and set boundaries for all forests within the Permanent Forest Estates. In carrying out these activities, Ministry of Agriculture, Forestry and Fisheries shall coordinate with concerned local communities, concerned authorities and the Ministry of Land Management Urban Planning and Construction in order to assist in registration of land property of indigenous community and preparation of the national land use map.*[10]

Under the existing laws, the land use plan for Prek Thnot watershed is developed to support the sustainable development of Kampong Speu trough the formulation of the Integrated Watershed Management Plan (IWMP). The experience of developing the Integrated Watershed Management Plan can be replicated to the other watersheds.

1.2 Project Goal(s) and Objectives

The goal of this project is to improve the ecosystem services (balanced watershed ecosystem services and socio-economic development) of Prek Thnot Watershed Landscape through judicious land use planning and wider participation of different stakeholders on integrated watershed management.

The project aims to contribute to the management of Prek Thnot watershed to sustain its supply of fresh water and protection to Phnom Penh and adjoining areas from natural disasters. Specifically, the project aims to:

1. To build capacity and raise awareness on the concept of integrated watershed/landscape planning for central and local stakeholders through scientific assessments, analysis and participatory watershed/landscape planning processes;
2. To develop a watershed management plan of Prek Thnot watershed with participation of stake holders; and
3. To share the experiences and lesson learned from the project to stakeholders.

[10] *Forestry Law*

1.3 Project Expected Outputs and Outcomes

The expected outputs of the project are: (1) improved knowledge and awareness of the target stakeholders on the concept of integrated watershed planning and the development issues in Prek Thnot Watershed that affect the forest-dependent communities; (2) enhanced capacity of the FA staff on participatory watershed management planning; (3) characterization of Prek Thnot Watershed; (4) socio-economic and biophysical information for Prek Thnot Watershed; (5) integrated watershed landscape development plan that are validated with the local authorities and keys stakeholders; (6) agroforestry demonstration Sites; (7) forest-based livelihood supported; and (8) a draft policy brief for the sustainable development of the Prek Thnot watershed landscape.

The project is expected to result to the following impacts: increased capacity of selected FA staff of developing watershed plans and contribute to better governance of Prek Thnot watershed. In order to achieve the desired outcomes, the following activities were conducted: (1) conducted awareness raising to the target stakeholders on the concept of integrated Watershed Planning and development issues in Prek Thnot Watershed, particularly its impact to the forest-dependent communities; (2) conducted training to the FA subnational to increase their capacity in watershed planning and soil and water conservation technologies; (3) conducted characterization of Prek Thnot watershed; (4) developed the integrated watershed management plan thru participatory approach; (5) pilot the agroforestry development in selected farms; (6) piloted livelihood project to the selected community members; and (7) developed a policy brief that support the sustainable development of Prek Thnot watershed landscape.

2. PROJECT IMPLEMENTATION

2.1 Project schedule and implementation arrangements

The implementation of the project was extended to May 2019, instead of formally completing in June 2018 after a delayed implementation of the second year of operation. The no cost extension was duly approved by the APFNet. The project management team made some adjustments to the project activities in accordance to the situation in the field.

There was also a movement of some of the staff of the project in the province who were reassigned to new position. The project has replaced the staff so as not to disrupt the operation of the project. There was also a delay in the deployment of the consultant to monitor the hydrological condition of the watershed. During the delay, the Project Team conducted the collection of the hydrological data.

Annually, the project prepared an Annual Work Plan and Budget which were submitted to APFNet for approval. Some of the activities were adjusted according to the actual needs of the project.

Some activities were added following the recommendations of the independent evaluators. Among the new activities that has been implemented by the project that are not within the plan includes Preparation additional sites for agroforestry (Activity 2.2.1) and conducting hydrological impact assessment of the Land Use Plan (Activity 2.2.3.3). Additional 2 sites were established following the recommendations of the PSC members. The project realigned some of its budget in the first year to cover the new activities.

The project has anticipated some of the risks and corrective measures were made. Among the major risks identified by the project and activities taken (risk management) are shown in Table 1 below.

Table 1. Risks and management of risks

Intervention logic	Objectively Verifiable Indicators of Achievements	Timeframe	Risks	Probability and Potential Impacts of the Risks on the Project	Management of Risks
To promote the sustainable development (balanced watershed ecosystem function and economic development) of Prek Thnot Watershed Landscape thru judicious land use planning and wider participation of the forest-dependent communities on CBFM	*Improvement of the facilitation skills of the FA Subnational on Watershed Management Planning, participatory action research*	Within 3rd Quarter of Year 1	There will be movement with the other assignment/project	This might cause a delay of project implementation	One of the Project Staff in the province was promoted and reassigned to other province. The project replaced him with the other personnel based in the province.
	Developed an integrated Watershed Land Use Development Plan of Prek Thnot Watershed in a participatory manner	Within 3rd Quarter of Year 1	Some of the investments plans in Prek Thnot watershed are not known; Stiff opposition from the stakeholders when the allocation plan ran counter to their	Make a wider stakeholder consultation as possible	Some of the missing information were supplemented by local knowledge.

Intervention logic	Objectively Verifiable Indicators of Achievements	Timeframe	Risks	Probability and Potential Impacts of the Risks on the Project	Management of Risks
			planned development		
Objective 2. To increase the capacity of the 10 FA Subnational on participatory watershed planning and research	*Hydrological and socioeconomic data are collected and compiled*	Qtr 3 of Yr. 1	The FA Subnational might forget what they learned	There will be inefficient data collection	The Consultant provided backstopping
Objective 3: To develop a Watershed Land Use Plan for Prek Thnot Watershed and identify priority development for CBFM taking into account the watershed's carrying capacity	*Optimal land allocation of Prek Thnot Watershed developed*	Year 2	Some of the information are not reflective of the real condition in the field	Sub optimal land allocation of the watershed	An exhaustive review of the assumptions and coefficients was done
	Formulation of Action Plan to develop the watershed landscape and increase access of the forest dependent communities and identify appropriate measures for land uses such as the ELCs and Mining that	Year 2	The participants of the planning may have no sufficient background and idea on the priority of the sectors they represent	These will undermine the reliability of the plan	Efficient facilitation during the consultation workshop

Intervention logic	Objectively Verifiable Indicators of Achievements	Timeframe	Risks	Probability and Potential Impacts of the Risks on the Project	Management of Risks
	minimize impact to the watershed				
Objective 4: Strengthen the sustainable forest and land management of Prek Thnot watershed landscape					
Output 4.1 Agroforestry Demonstration Sites contributing to soil and water conservation and livelihoods	*5 Agroforestry Sites established and monitored for hydrology and farm productivity*	Year 3	Limited participation of the farmer cooperators due to limited benefits/incentives	Difficulty in getting information	Incentives were provided such as planting materials
Output 4.2 Forest-based enterprise supported	*Enterprise Plan Developed*		There might be limited resources that the community can commercialize. The handling of funds will also not be properly disbursed that will have provided optimum results.	The proposed livelihoods may not be appropriate for the community	The selected livelihood was based on the interest of the community
	Policy notes developed	Year 3			

2.2 Project resources and costs

The project needed a total budget of USD **573,015 to** cover the three-year operation. The budget was broken as follows:

APFNet	USD **499,215**
Counterpart	USD **73,800**

As of November 2018, the total amount disbursed to the project was 438,295 or 88 percent of the total grant. Out of the total disbursement, the project has spent $ 488,215 or 98% of the total amount disbursed leaving $-60,920 as balance of the disbursed amount.

The extension of the project was requested without costs to the APFNet. While waiting for the second year budget, the payments of the Project Staff were suspended pending the approval and release of the year 2 budget.

The disbursement of the project follows the government rules and procedures. The field staff were provided a daily subsistence allowance based on the New Sub-decree on DSA for government staff issued by the Prime Minister on 22nd July 2014 as follows:

- Senior staff including Director of Department level will get 49 USD per day
- Middle class staff will get 40 USD per day
- Lower class including commune council members will get around 34 USD per day.

All the items procured were also provided with supporting receipts as required by the Cambodian law. The receipts were presented to the Auditor.

The counterpart fund was provided by the Royal Government of Cambodia (RGC) in the form of in-kind contribution. Among the important budget line items funded by the project include the Personal Services, the budget for the international consultants, the purchase of vehicles, and seed fund for the livelihood project of the communities. Among the important cost component of the project were the following:

1. **Project Staff**. The project was implemented by the staff of the FA and some recruited personnel worked as full-time staff of the project. Some of the salary of the project staff serves as in-kind contribution of the FA. The Project tapped the Sub-National Staff and representative from the Local Authority.

2. **Admin/Finance Officer**. The project hired an Admin/Finance Officer who was responsible on personnel management and who looked after the financial disbursements.

3. **International Consultant (Technical Adviser)**. An International Consultant was hired to provide the technical support in the implementation of the project. Among the services that the consultant provided include developing mathematical models on land allocations, spatial analysis, land use planning, preparing the reports and guiding the Project Staff on participatory watershed planning. The consultant worked part time and contracted for 3 years.

4. **Contract Costs for Local Experts**. The project commissioned local consultants/experts on hydrology, livelihoods, agroforestry and participatory land use planning. They served as resource persons during meetings and workshops. The duration of their engagements varied depending on the schedule of the activities.

5. **Seed Grant for Community Enterprise**. A budget was set aside to the community for the development of their enterprise. The grant serve as a seed fund to develop a forest-based enterprise to the selected CF. The progress of development of the community enterprise was closely monitored by the FA and project staff.

6. **Supplies and Materials**. The supplies and materials include both the field and office supplies and materials.

7. **DSA**. The field staff were provided a daily subsistence allowance when they go to the field or hold meetings and workshops. The DSA covered meals and cost of accommodation. Based on the New Sub-decree on DSA for government staff issued by the Prime Minister on 22nd July 2014, the following DSA were provided:
   - Senior staff including Director of Department level will get 49 USD per day
   - Middle class staff will get 40 USD per day
   - Lower class including commune council members will get around 34 USD per day.

8. **Office Operation Cost**. The office operation cost includes internet and telephones/communications, maintenance of project equipment, electricity and water etc. Some of these are counterpart contribution of FA to the project.

9. **Purchase of Vehicle**. A vehicle and 2 units of motor bikes were purchased by the project to increase the mobility of the project staff during the course of project implementation. The motorcycles were distributed to the field staff in Kampong Speu. This is also part of building the capacity of the office in sustaining the project after its completion. Most of the areas in Prek Thnot are in remote villages and project vehicle are indispensable in project implementation and monitoring.

To increase the efficiency of the use of the resource, an independent monitoring and audit was conducted aside from the internal monitoring and performance audit that was conducted by the project management. The financial control and disbursement was handled by the Administration and Finance Officer of the project.

2.3 Procurement and Consultant Recruitment

The project was able to recruit the international consultant and 5 national consultants/experts. The consultants were recruited to perform the following jobs:

- **International Consultant.** He provides overall technical support to the Project Coordinator in the implementation of the project. He is also responsible in preparing Term of References (ToRs) for the local consultants/Experts. The main role of International consultant is well defined in the TOR and in section 7.2 of the Project Document. The International Consultant was responsible in developing the land allocation plan, writing the IWMP, preparing the consultation concepts, maintaining the work plan and budget, preparing the progress report, guiding the local consultants, and technical backstopping of the project staff.

- **Trainer, GIS/Participatory Mapping.** The Project engaged the GIS expert to provide training to the FA staff. The GIS training has been conducted to the FA staff. The GIS technology was introduced to the FA staff to provide them basic skills in the interpretation and manipulation of the software. The GIS training provided by the GIS Trainer aims to build the capacity of the FA staff basics of GIS technology. The skills will enable the project staff to read and share spatial information.

- **Trainer, Agroforestry.** The Agroforestry Trainer was hired to conduct basic training to the FA staff. After conducting the training to the FA staff, the AF expert also provided support to the Project staff in training the farmers on Agroforestry techniques. For the training of the farmers, the AF Expert and the International Consultant provide backstopping to the Project Staff who conducted the training of the farmers.

- **Consultant, Agroforestry Monitoring/ Coaching/ Mentoring.** The Agroforestry consultant/specialist was responsible in providing training to the FA Staff and the farmers on various agroforestry technologies that would prevent soil erosion as well as designing the agroforestry farmers.

- **Trainer, Part. Action Research**. An expert was contracted to provide training on Participatory Action Research to the FA staff. The Trainer also guided the FA staff in implementing the Participatory Action research with the farmers in the field. Participatory Action Research was introduced to the Project Staff since the project is involving the farmers in data collection from their farms.

- **Trainer, Watershed Hydrology**. An expert was contracted to provide capacity building to the project staff on the basics of watershed hydrology. The consultant provided training on the basics of hydrology to enhance the understanding of the FA staff on the hydrologic processes in the watershed particularly the relationship of precipitation, land cover and hydrological response of the watershed.

- **Consultant, Hydrology Monitoring**. A separate contract was entered by the project to an expert to provide analyses of the collected rainfall and soil erosion.

- **Consultant: PRA/Enterprise Development Planning/Writeshop Planning and Development of Enterprise Development Plan.** A consultant was hired to facilitate the identification of community enterprises. The consultant conducted PRA with the community on appropriate livelihood and facilitated the writing of the enterprise development plan.

- **Consultant: Implementation and Monitoring of Enterprise**. To ensure success of the community enterprises, the project, contracted an expert on livelihood/enterprise to provide support and mentoring to the community.

- **Consultant - Watershed Characterization: Bio-physical, socioeconomic survey and risk assessments to the critical priority areas. Team of Experts for the Watershed Characterization**. A team of experts was contracted to conduct a watershed characterization study of Prek Thnot watershed. The Team of experts will conduct the socioeconomic survey and biophysical analysis of Prek Thnot. It is expected that the Team of Consultants will use the base maps that was prepared by the Project Staff with the guidance of the GIS expert.

- **SWAT Modeling Expert and Environmental Professional to Translate the IWMP**. Two consultants were hired to perform the new activities. A SWAT modeler was hired following the recommendation of the MT Evaluators to conduct impact assessment (ex-ante) of the watershed based on the proposed land use plan. It was also realized that the translation of the IWMP will require considerable cost. The cost of hiring the SWAT modeler and translator were given priority of the budget and the budget for the CLUP/Land Use planning and watershed/landscape expert to review the IWMP was reallocated to this two new budget lines.

The procurement of equipment was conducted in a transparent manner following the government rules and regulations. At least three bidders were invited to submit their quotation of the equipment that were purchased by the project (please see Annex C).

The list of consultants that were hired by the project and their specific responsibilities are shown in Appendix D.

2.4 Monitoring, Evaluation and Reporting

Monitoring was conducted based on the progress of the work plan. The different outputs being monitored include the following indicators:

Table 2. Indicators for Monitoring

Goals and Objectives	Indicators of Achievements
Objective 1. To build capacity and raise awareness on the concept of integrated watershed/landscape planning for central and local stakeholders through scientific assessments, analysis and participatory watershed/landscape planning processes.	▪ KPI 1.1 Critical priority areas of Prek Thnot watersheds providing important ecosystem services especially irrigation and drinking water for local communities and downstream agricultural land and cities identified; ▪ KPI 1.2 Land use plan of Prek Thnot Watershed/Landscape developed through scientific assessment, analysis participatory planning process
Objective 2. To improve the integrated management of Prek Thnot Watershed with participation of stakeholders.	▪ KPI 2.1A. Landscape restoration plans, considering the needs to both people and nature, are developed for 1-2 priority areas with 19 CFs and CPAs; ▪ KPI 2.1B. Numbers of river basins proposed for protection and restoration towards better water security and ecosystem services; ▪ KPI 2.1C. Areas in the pilot sub-basins proposed for restoration, protection and sustainable management for the benefits of both nature and people; ▪ KPI 2.2 Two (2) Farmer Cooperators in the pilot areas/river basins piloting community-based forest management livelihood and agroforestry technology ▪ KPI 2.3 1 Forest-based enterprise supported. ▪ KPI 2.4 Impacts analyzed and communicated to key stakeholders and authorities;
Objective 3. To share the experiences and lesson learned from the project to stakeholders.	▪ KPI 3.1 Best practices analyzed and summarized, leading to a suite of knowledge and communication products; ▪ KPI 3.2A. Project success and experiences disseminated through the Partnership for Integrated

Goals and Objectives	Indicators of Achievements
	Watershed management/Landscape planning; ▪ KPI 3.2B. Greater brand recognition and stakeholder appreciation obtained from both local and national audience

Monitoring were based primarily on the submitted progress report in relation to the approved work plan. Spot checking were done in the field to verify the reported accomplishments. An internal Annual Review will be conducted by the Team through a small group meeting to assess the progress of the project.

2.4.1 Project Monitoring (Activity 7.1)

The monitoring of the project was conducted by the project staff for internal monitoring (Activity 7.1.1) and independent review consultant (Activity 7.1.2). While the project monitoring was conducted regularly by the project staff, the consultants, Mr. Van Piseth, Dr. Koy Ra and Mr. Kim Sobon were involved in the site monitoring of the enterprises, hydrology and soil erosion, and progress of agroforestry development, respectively.

2.4.1.1 Internal Monitoring (Activity 7.1.1)

The project management staff conducted regular monitoring in the demonstration Agroforestry site (Photo1). The monitoring is conducted by the project staff together with the national consultant. There are 2 pilot sites located in Chrok Teak village Tropeang Chor Commune Oral District and 2 sites in Dork Por Village Krang Deivay Commune Phnom Srouch District that are monitored by the Project staff and the national consultant. During the monitoring, the national consultant provided advice to the Project Staff as well as to the farmer collaborators on the maintenance of the farms. To date, there were four monitoring conducted by the consultant on hydrology. Another consultant has conducted an interview with the farmer collaborators to determine the economic impact of agroforestry.

Photo 1*. Monitoring the agroforestry farms in Phnom Srouch and Aoral District*

2.4.1.2 Monitoring and Evaluation Conducted (Activity 7.1.2)

Monitoring and evaluation include the monitoring and evaluation conducted by the External Evaluator and the internal monitoring conducted by the project staff. A midterm evaluation was conducted. On 23 to 26 April 2018, a representative from APFNet and external evaluator visited the site to evaluate and validate the reported progress of the project (Photo 2). The evaluation team visited the sites and interviewed several community members and farmers. A debriefing was conducted afterward providing some recommendations. The external evaluator noted the importance of disseminating information to the stakeholders and the need to conduct impact assessment using hydrological models such as MODFLOW.[11]

[11] **MODFLOW** is the U.S. Geological Survey modular finite-difference flow model, which is a computer code that solves the groundwater flow equation. The program is used by hydrogeologists to simulate the flow of groundwater through aquifers. The source code is free public domain software, written primarily in Fortran, and can compile and run on Microsoft Windows or Unix-like operating systems.

Other recommendations of the evaluators include the holding of more dialogues and awareness raising to the communities; improving the soil collection structure; evaluation of the economic benefits of the agroforestry plots; reporting the streamflow patterns of the main river systems; and increase the dissemination of the sustainable utilization of the forest.

Photo 2. *Visit of the MTE Team*

2.4.2 PSC Meetings (Activity 7.2)

The project organized PSC meeting on 12 July 2016. During the PC meeting, the PSC members were appraised of the progress of the project and the works plans were presented for endorsement to APFNet. The PSC members also provided some suggestions to improve the

(https://en.wikipedia.org/wiki/MODFLOW)

implementation of the project.

All the project issues were shared with the stakeholders during the consultation forum. The operational issues were discussed with the PSC Committee and sought their guidance in implementing the project activities. A third PSC meeting was about to be conducted shortly before the completion of the project. But due to the workloads, a request was made to forego the second PSC meeting explaining the need to focus on the remaining activities. The request was duly approved by the APFNet.

2.4.3 Coordination Meetings (Activity 7.4)

The Project Director and the Project Coordinator called meetings with the Central and Field Staff to discuss issues related to the operation and field implementation, and to update the status of the project. The meetings were called to discuss some urgent issues that need to be addressed. The coordination meeting and the PSC meetings provide control mechanisms of the project. In the same manner, the coordination meeting conducted by the project provide an opportunity to discuss some of the issues affecting the implementation of the project. The discussions in the PSC meeting and the coordination meetings provide a guidance on prioritizing critical activities needing immediate attention.

2.5 Dissemination and Knowledge Sharing

Various information dissemination activities were conducted during the course of implementation. The biophysical status of Prek Thnot were disseminated to different stakeholders during the kick starting activity of the project. During the course of consultation, the project also presented the initial lessons learned and results of the land allocation. The results were presented before the NGOs, FA, Communes, Districts and Provincial Governors, and representative from MLMUPC for the purpose of enjoining them to support of the integrated watershed management. Since the land allocation modeling is technical in nature, a faculty representative from the College of Forestry of the Royal University of Agriculture (RUA) were also invited.

The people who attended the events are shown in the Table below:

Table 3. Organizations who participated in the project consultation

Activity	Organizations who participated and number of People who Attended
First Consultation	NGOs: 10 CFMC: 12 Local FA: 40 District: 22

Second Consultation	NGOs: 9 CFMC: 7 Local FA: 33 District: 10
First Consultation provincial forum	NGOs: 4 CFMC: 16 Local FA: 21 District: 19
Second Consultation provincial forum	NGOs: 2 CFMC: 6 Local FA: 21 District: 31
Completion Workshop	NGOs: 7 CFMC: 11 Local FA 31 District: 33

Most of the dissemination and knowledge sharing activities were conducted under Activity 3.1.2 (Organize and launch national campaigns to raise awareness among the public). Among the different specific activities under Activity 3.1.2 are discussed below.

2.5.1 Awareness Raising about the soil and water conservation for farmers in the target areas (Activity 3.1.2.1)

Awareness raising to the farmers was embedded in various activities of the project and also included as part of the output of the Service Providers. During the establishment of the agroforestry plots, a meeting with the farmers was called to discuss the purpose of setting the soil and water conservation plots (see Activity 1.1.1.2.1). Dr. Koy Ra was commissioned to conduct training on agroforestry and soil conservation integrated the awareness raising on environmental issues and impact of soil degradation, and the need to address these problems. The awareness raising was also integrated during the training to the farmers on the use of the soil testing kits. The Project Staff demonstrated the use of soil testing kits to the farmers in Dokpor Village, Krang Deivay Commune, Phnom Srouch District and Chrok Teak Village, Tropeang Chor Commune, Oral District on 15 to 16 January 2019 (Photo 3). There were 30 local farmers (4 women) from Dokpor Village, 30 local farmers (5 women) from Chrok Teak Village who attended the demonstration on the use of the soil testing kits. Aside from the farmers, the demonstration was also attended by 2 provincial FA staff, 6 Local FA staffs, 4 people from Mlub Baitung (NGO) and 4 people from COWES project. The awareness raising activity also includes the importance of the forage crops to support the backyard cattle raising activities of the CF members (see Activity 2.3.4).

Photo 3. Farmers' field visit at Tropeang Chor Commune, Oral District on 15 to 16 January 2019.

Photo 4. Demonstrating to the farmers the measurement of the soil physical properties using the soil testing kit and thermometer (in Krang Deivay) (January 15-16, 2019)

2.5.2 Awareness Raising about the soil and water conservation for students on agroforestry development (Activity 3.1.2.2)

The project intends to disseminate the experience and benefits of agroforestry technology to different sectors. Academia is a strategic partner for dissemination of technologies. During the second PSC meeting, it was agreed that the project will provide modest support for field visits of Forestry students who will observe the project. Encouraging the academe to observe the pilot agroforestry site will be a long term investment of knowledge since most of the students will later on be involved in restoration and conservation activities.

On January 29-30, 2018, 21 second and third year students from the Royal University of Agriculture visited the agroforestry site in Damrey Chaktholork (Photo 5). The Project Staff explained to the students the purpose of the agroforestry and soil erosion control measures introduced by the project. The student visitors learned how to collect soil samples and precipitation. The visitors were also interested on the function of contour canals and the hedge rows along the contour line in controlling erosion. A second visit was organized on 16 January 2019. The visitors composed of third year Forestry students from the Royal University of Agriculture who visited the AF research plot in Trapeang Chor Commune, Aoral District (first site). The IRD demonstrated to the students the benefits of agroforestry particularly on the improved physical properties of soils in agroforestry. The students were also taught on the construction and use of A Frame in establishing the contour canals.

All in all, there were 51 students who visited the site. In the first visit, there were a total of 21 students who visited and another batch of 30 students for the second visit.

Photo 5*. Students who visited in the agroforestry site (first visit)*

Photo 6. The students listening to the demonstration of the construction and use of A Frame (second visit)

2.5.3 End of the Project National Workshop (Activity 3.1.2.3)

The project conducted End of the Project Workshop in Kampong Speu on 14 June 2019, the last activity of the project (Photo 7). During the final workshop, various stakeholders were invited. The accomplishment of the project were presented to the stakeholders including the features of the IWMP. The various publications were also distributed to the stakeholders.

The objectives of the completion workshop were:

1. To raise awareness on the situation of Prek Thnot Watershed
2. To raise awareness on the importance of watershed lands use planning;
3. To disseminate information about the accomplishment of the project;
4. To disseminate the information about the features of the IWMP.

The completion workshop was attended by 74 people coming from different agencies and organizations. The completion workshop was held at the function hall of the Kampong Speu provincial office. Representatives from the Local Authority and the line agencies also attended the completion workshop. During the workshop, several information materials were distributed, such as the leaflets, policy brief, lessons learned and the integrated watershed management plan of Prek Thnot. Posters were displayed to enhance awareness about Prek Thnot watershed.

Table 4. Participants of the completion workshop

Office/Organization	No. of Participants
Office of the Governor	2

Office/Organization	No. of Participants
Representative from the District	
Aoral	1
Odongk	1
Phnum Sruoch	1
Samraong Tong	1
Thpong	1
Commune Council Chief (Communes With CLUP)	
Aoral	1
Odongk	1
Phnum Sruoch	1
Samraong Tong	1
Thpong	1
Commune Council Chief (Communes Without CLUP)	
Aoral	2
Odongk	2
Phnum Sruoch	2
Samraong Tong	2
Thpong	2
MLMUPC	1
Department of Agriculture	1
ELC Secretariat	1
MoE	1
MOWRAM	1
RUA	1
CFO	1
FAC Kandal and Kampong Speu	2
FAD	4
FAT	4
IRD	5
Cambodia Chambers of Commerce	1
ELC Representative: Grandis Timber and Others	3
Representative from the UNDP	1
MRC	1
RECOFTC	1
Mlup Baitung	1
CEDAC	1
NGO Forum	1
CFMC Chief	5

Office/Organization	No. of Participants
CFiMC Chief	5
CPAMC Chief	5
Village Farmers Association	5
Total	**74**

Among the policy recommendations that were presented during the workshop include the following:

Watershed Governance: Creation of a governing body for Prek Thnot watershed. The management of the watershed should be under a single governing body. It is proposed that the office of the Provincial Governor will undertake the coordinating role of various agencies in developing Prek Thnot watershed. The governing body will also coordinate the different stakeholders, agencies and ministries who are major stakeholders of the watershed like the Forestry Administration, the Ministry of Environment, the Department of Agriculture, the Fishery Administration, MLMUPC and MoWRAM and the development NGOs and CBOs who are working in the area.

Capacity Building: Build the watershed management capability of the actors in Prek Thnot watershed. There is a need to enhance the skills of the different line agencies managing the watershed due to limited availability of professional hydrologists who can conduct the monitoring of the hydrological functions of the watershed.

Investment: Promote the investments in Prek Thnot watershed. Encourage economic investments and restoration of Prek Thnot watershed. Currently there is very limited budget for restoration of Prek Thnot watershed. The communes should support the reforestation, conservation and agroforestry in Prek Thnot through their CIP/CDP.

Sustainable Land Management: Promote the adoption of soil and water conservation among the developers in Prek Thnot watershed. A soil and water conservation policy needs to be promoted to land developers, particularly the Economic Land Concessionaires so that they adhere to the sustainable land management in their land developments. The ELCs must comply the provisions in their EIAs and the proposed code of conduct in the watershed.

Land Use and Development: Adopt the IWM as the framework in Commune Land Use Planning. The IWM Plan will serve as a framework in formulating the CLUPs. The IWMP can coordinate the land use planning among the different communes.

Policy Integration and Support of the IWM Plan: Increase buy-ins of the IWMP among the policy makers to integrate the plan in various development programs. The provisions of the IWMP should be integrated to government programs and targets. The provincial government of Kampong Speu should lobby to the policy makers to support the implementation of the IWMP. Also, the plan should be integrated and harmonized to the five-year development plan of Kampong Speu. Workshops should be conducted to disseminate the IWMP to different stakeholders in Prek Thnot watershed.

Monitoring: Institutionalize the monitoring of the tracking indicators of the IWMP. Monitoring should be conducted in Prek Thnot watershed on the hydrological changes and the tracking indicators set in the IWMP. Satellite images or drone photos should be part of the monitoring modality. The office of the provincial governor should take the lead in consolidating and disseminating information to the public on status of Prek Thnot watershed.

Institutionalization of the Code of Conduct in Prek Thnot Watershed. A code of conduct should be developed for Prek Thnot watershed that will serve as a guide among the developments (including NGOs). The Code of Conduct will be implemented in tandem with the IWMP and may be part of the EIA compliance.

4.0 Expected Outcome

At the end of the workshop, it is expected that the participants will increase their awareness of the issues of Prek Thnot watershed and the IWMP that helps in addressing further degradation of the watershed.

Photo 7. Scenes of the project completion workshop held on 14 June 2019 in Kampong Speu province

3. PROJECT PARTNERS' PERFORMANCE

3.1 Performance of Supervisory Agency

The Supervisory Agency (MAFF) has provided guidance to the Executing Agency especially during the consultation workshop and during the PSC meeting. The representative from the Supervisory Agency was invited during the PSC meeting and provided some inputs and guidance especially on the issues affecting the operation of the project.

3.2 Performance of Executing Agency

The Executing Agency (Institute of Forest and Wildlife Research and Development/IRD) has endeavored to ensure that the targets set in the work plans and project document are accomplished. The EA is also responsible in ensuring that the expenditures are according to

budget and adhere to the government policies. The EA also conducted internal monitoring to validate the progress of implementation in the field.

3.3 Performance of Implementing Agency, consultants (technical assistants), contractors, and suppliers

This project has no Implementing Agency. The performance of the different consultants is shown in the Table below.

Table 5. Performance of the consultants

Name of Consultant and Roles	Actual Output	Performance
Name: Edward V. Maningo, Ph.D. **Position: International Consultant (part time)** **Duties:** Led the following activities: ▪ Orientation of the project staff ▪ Development of the Land Use plan; ▪ Formulate the integrated watershed management plan; ▪ Developing mathematical models on land allocations, spatial analysis, and land use planning; ▪ Draft policy brief on sustainable development of the Prek Thnot Watershed ▪ Assisted the Project Staff in conducting provincial stakeholders' forums to present the results of the consultations and draw action plan for the development of Prek Thnot Watershed Landscape; ▪ Assisted in the compilation of proceedings and lessons learned/Writeshop on Experience and Lessons Learned of the Project ▪ Assisted the project staff in launching the national campaigns to raise awareness among the public	▪ Annual Work Plan and Budget prepared ▪ Biannual Progress report ▪ Publications and documentation report ▪ Land Use and Watershed management plan Integrated Watershed Management Plan Lessons learned of the project	The performance is Very Satisfactory. All the deliverables have been delivered.

Name of Consultant and Roles	Actual Output	Performance
▪ Assisted in the hiring of national consultant and provide technical guidance to the Project Staff and national consultants in carrying out specific/specialized tasks as required by the project: ▪ Map out critical areas in Prek Thnot watershed ▪ Collection of base maps and pertinent data of the watersheds ▪ Assisted the Project staff in the preparation and holding of consultative meeting activities ▪ Provide technical inputs in the development of agroforestry sites ▪ Assist the project staff in the collection of data (hydro meteorological and soil data) from runoff plots ▪ Provide guidance to the local consultant on the conduct PRA of Potential Enterprises ▪ Provide technical guidance in the Implementation and monitoring of the forest-based enterprise in a community forest ▪ Developed the project annual report and annual work plan and target and documentation reports.		
Name: Mr. Kim Sobon **Position: Trainor, GIS/Part. Mapping Trainer** **Duties:** • Prepared training design for the selected IRD staff on GIS • Prepared base maps including satellite images	• Training plan • Training conducted • Brief GIS training report, summarizing what has been accomplished, Action plan for the Trainees and Lessons learned. The final report will also include recommendations on	The performance is Very Satisfactory. All the deliverables have been delivered.

Name of Consultant and Roles	Actual Output	Performance
• Coach/mentor the IRD staff during the course of implementing the project • Help in installing GIS software to the computers of IRD.	improving the capacity of the staff and mentoring approach with proposed budget. • Production of maps	
Name: Kim Sobon **Position: Specialist, GIS Mapping/ Spatial Analysis** **Duties:** ▪ Develop criteria for the development of the land suitability maps. The criteria were drawn from the consultative workshops. The criteria were presented and approved by the Management Team. ▪ Develop a model in coming up with a land suitability map. The model need to be presented and approved by the Project Management Team. ▪ Develop land suitability maps based on the land suitability criteria and land suitability model. ▪ Brief report describing the methodology.	Maps of suitable areas	The performance is Very Satisfactory. All the deliverables have been delivered.
Name: Dr. Koy Ra **Position: Trainor, Agroforestry** **Duties:** • Prepare training design for the selected IRD staff on Agroforestry and skills training • Provide training to the selected IRD staff on Agroforestry and transferring of skills to the farmers • Provide guidance in the actual development of Agroforestry sites • Provide guidance on monitoring	▪ Training materials on agroforestry system prepared and submitted ▪ Conducted ToT to the FA Staff ▪ Training report submitted ▪ Field trainings conducted ▪ Trees and plant species for the AF plots identified ▪ AF plots established in the field	▪ The performance is Very Satisfactory. All the deliverables have been delivered. ▪ The guideline for the moitring of Agroforestry ploits is shown iun Annex F

Name of Consultant and Roles	Actual Output	Performance
• Prepared training Report	▪ Conducted Field Assistance in the setting up of Agroforestry Sites ▪ Guideline for monitoring of the AF plots. ▪ Site development report submitted ▪ Rain gauges established ▪ Conducted Field Assessment and Provided Technical Recommendations	
Name: Dr. Koy Ra **Position: Consultant, Agroforestry Monitoring/ Coaching/ Mentoring** **Duties:** ▪ Prepare a monitoring tool that will be used by the Project Staff. ▪ Guide the project staff in monitoring of the outcome of implementation of the Forestry Project and in preparing the monitoring report ▪ Conduct field visit and observe the progress of the AF site development. Based on his observation in the field, provide mentoring and coaching to the farmers and the Field Staff how to improve the AF practices. ▪ Propose a work schedule and budget for field supplies and materials for the monitoring, subject to review of the Project Management Team. The disbursement of the supplies and materials will be controlled by the Project Management Team.	▪ Work Plan and Budget for the monitoring activities ▪ Design the monitoring tool with recommendations on the parameters to be monitored ▪ Monitoring report for every field work on the progress of Agroforestry Implementation ▪ Photo documentation of the monitoring ▪ Recommendations on how to improve the implementation of the Agroforestry/SWC technologies	The performance is Very Satisfactory. All the deliverables have been delivered.
Name: Dr. Il Oer	▪ Training Modules	The performance is Very

Name of Consultant and Roles	Actual Output	Performance
Position: Trainor, Part. Action Research **Duties:** ▪ Prepare the Training Module on PAR as specified in the Term of Reference as attached to this contact. The Training Module shall be submitted to the Project Management Team for review before conducting the training. ▪ Prepare and administer pre and post-test. ▪ Prepare a training report that contains analysis on the pre and post-test, lessons learned of the training, assessment of the participants, and recommendations on how the skills can be applied in the data collection.	▪ Pre and Post Assessment Tools ▪ Training Report that should include among others, lessons learned, assessment of learnings using pre and post-test, and recommendations how the learnings will be streamlined in the implementation of the project. ▪ Photo documentation	Satisfactory. All the deliverables have been delivered.
Name: Dr. Koy Ra **Position: Trainor, Hydrology** **Duties:** ▪ Prepare the Training Module on watershed hydrology as specified in the Term of Reference as attached to this contact. The Training Module shall be submitted to the Project Management Team for review before conducting the training. ▪ Prepare a training report that contains analysis on the pre and post-test, lessons learned of the training, assessment of the participants, and recommendations on how the	▪ Training design and training materials (PPt Presentation and/or lecture notes). The Training design should include, but not limited to, the data collection and analysis of rainfall data, erosion, and the analysis of the factors affecting soil erosion. ▪ Delivery of the training, both theory and field data collection ▪ Pre and Post Assessment Tools ▪ Training Report that should include among others, lessons	The performance is Very Satisfactory. All the deliverables have been delivered.

Name of Consultant and Roles	Actual Output	Performance
skills can be applied in the data collection. ▪ Supervise the practical field data collection	learned, assessment of learnings using pre and post-test, and recommendations how the learnings will be streamlined in the implementation of the project. ▪ Photo documentation of the training	
Name: Dr. Koy Ra **Position: Consultant, Hydrology Monitoring** **Duties**: ▪ Review the monitoring tool designed for the project ▪ Guide the project team in data gathering from the established rain collectors and soil collection ▪ Collect water discharge from river gaging stations, precipitation and climatological data from major rainfall stations ▪ Provide an analysis of the collected data from the pilot agroforestry sites and the collected data from the hydrometeorological data and river gaging stations ▪ Prepare the hydrological data of the province and the project site, and trend of soil erosion; ▪ Conduct percolation rate testing in the agroforestry site. ▪ Provide analysis on the change of the soil physico-chemical properties of pilot agroforestry sites	▪ Monitoring report on the hydrological trend (discharge of major rivers, rainfall of the province) and relationship between rainfall and soil erosion in the two Agroforestry sites including the water percolation rate ▪ Photo documentation of the hydrological monitoring activities	The performance is Very Satisfactory. All the deliverables have been delivered.
Name: IDE/Mr. Vann Piseth	▪ Proposed Methodology	The performance is Very

Name of Consultant and Roles	Actual Output	Performance
Position: Consulting Firm: PRA/Enterprise Development Planning/Writeshop Planning **Duties:** • Develop the enterprises on cattle-based silvopasture • Estimate the economic benefits of the farmers' enterprise • Facilitate a writeshop with the community to develop the community-based forest enterprise. The formulation of the forest-based enterprises should be done on a participatory manner. The community enterprise plan must include the steps of the priority activities to be undertaken. • Propose a Monitoring plan, detailing the targets and success indicators and who will monitor. The indicators should be set in a participatory manner	and outline of reports. The outline should briefly describe the contents of the section. ▪ PRA report ▪ Enterprise Development Plan ▪ Monitoring Plan	Satisfactory. All the deliverables have been delivered.
Name: IDE/Mr. Vann Piseth **Position: Consulting Firm: Implementation and Monitoring of Enterprise** **Duties:** • PRA report • Enterprise Development Plan • Monitoring Plan	▪ Proposed methodology and work plan for monitoring and follow up cattle raising business is produced with an outline of reports describing the business development and growth for each implementation stage ▪ Training course on cattle raising and other business development concept ▪ Enterprise implementation plan	The performance is Very Satisfactory. All the deliverables have been delivered.

Name of Consultant and Roles	Actual Output	Performance
Name: Dr. Koy Ra **Position: Consultant - Watershed Characterization: Bio-physical, socioeconomic survey and risk assessments to the critical priority areas** **Duties:** • Design/propose a research methodology • Prepare an Inception Report. • Make presentation of the outcome of the survey	▪ Prepare a report describing the bio-physical (topography, slope, etc.), socioeconomic condition (income, crops, livelihoods) and areas prone to erosion/disaster ▪ Report indicating the major land uses of the selected communes?	The performance is Very Satisfactory. All the deliverables have been delivered.
Name: Mr. So Than **Position: Local Consultant on CLUP/Land Use Planning** **Duties:** ▪ Facilitate the consultation workshop on land use plan in Prek Thnot watershed ▪ Provide technical inputs during the watershed development formulation ▪ Come up with a brief report describing the proceedings of the consultation	▪ Consultation report	The performance is Very Satisfactory. All the deliverables have been delivered.
Name: Dr. Loeung Kesaro **Position: Consultant, translation of the IWMP** **Duties:** ▪ Translate the contents of the IWMP to Khmer	▪ Draft and final version of the Khmer version of the IWMP	The performance is moderately satisfactory. The translation need to be reviewed and revised by the Project Coordinator.
Name: Ms. Lim Sopheap **Position: Hydrology Modeler** **Duties:**	▪ Developed a SWAT model associated with Spatial assessment for surface runoff, soil erosion and	The performance is Very Satisfactory. All the deliverables have been delivered.

Name of Consultant and Roles	Actual Output	Performance
▪ Prepare the input data for the models, that include existing and proposed land use/land cover, long term monthly climatic forecast that has been calibrated with the nearest gaging stations, climatic data for the past 30 years, etc.; ▪ Make a current and long term hydrological forecast (climate, surface runoff, erosion, underground water recharge, etc.) of Prek Thnot watershed using SWAT model and a GIS approach for spatial assessment; ▪ Provide coaching and mentoring to the selected staff on the use of SWAT model and GIS approach for spatial assessment; ▪ Prepare a report of the outcome of the model together with assessment; and ▪ Present the result to the Project Management Staff for some clarification.	groundwater recharge; ▪ Provide training and coaching sessions with the FA staff on the use of SWAT software; ▪ Submit a draft report of the result of the SWAT model and Spatial assessment modeling containing the following: ▪ Make presentation of the model with the Project Management Team; ▪ Submit the final report incorporating the suggestions from the Management Team.	

3.4 Performance of APFNet

The APFNet Secretariat has provided commendable assistance and support to the Project. The technical staff of APFNet provided constant advice to the Project particularly on financial issues and preparation of reports and work plans. There are some issues however on the disbursement of the grants, especially on the second year of implementation resulting to the delay of some activities. The APFNet also provided support especially in the mid-term evaluation of the project. The inputs of the External Evaluators were very useful in improving the implementation of project activities..

4. PROJECT PERFORMANCE

4.1 Project achievements

The project has achieved all the target activities. The accomplishment against the target is summarized in Annex A..

Activity 0.0 Start-up Activities

All the targets under this activity were achieved. This activity involves the recruitment of national consultants as well as preparation of annual work plan. The recruitment of the consultants was done progressively (from Year 1 to Year 2) according to the need of the project. Preparatory activities also included formal launching of the project by holding an inception workshop and organizing the Project Management Team. Under these two outputs, the following activities were conducted:

- Activity 0.1 Establish project steering committee and project management team;
- Activity 0.2 Recruit international and national consultants;
- Activity 0.3 Orientation of New Staff
- Activity 0.4 Project Inception Workshop
- Activity 0.5 Preparation of Annual Work Plan

Activity 0.1 Establish project steering committee and project management team

The project has completed organizing the PSC in the first year. The PSC was organized to provide input and guidance to the project management in the implementation of the project and ensure that the project will be implemented according to schedule. Several changes were made on the composition of the PSC. Originally, the PSC was Chaired by the Ms. Vong Sopanha and then replaced by the Director General of the FA, H.E. Dr. Chheng Kimsun after Ms. Sopanha was assigned to a different office. After the changes in the leadership of the FA, H.E. Ung Sam Ath, became the head of the PSC replacing H.E. Chheng Kimsun who was promoted as Undersecretary of MAFF. Recently, H.E. Keo Omaliss has been assigned as the D.G. of FA replacing H.E. Ung Sam Ath as PSC Chair. The current composition of the PSC is shown in Table 2.

Activity 0.2 Recruit international and national consultants

The hiring of consultants was done on a yearly basis or according to the timing of the activies.

The project hired an International Consultant to provide Technical Backstopping to the Project Management Staff. The National Consultants/Specialists were hired to perform specific task. All in all, the project hired 13 Consultants/Specialists. There were 2 Consultancy Positions that were replaced due to the actual needs of the project:

1. Local Consultant on CLUP/Land Use Planning – This was replaced with 2 Specialists who worked on Translating the Proceedings of the Land Use Plans and the Integrated Watershed Management Plan.
2. Consultant on Watershed/ Landscape Restoration Plan Development – this budget was utilized in hiring a SWAT Modeling Expert

Activity 0.3 Orientation of New Staff

An orientation of the new staff was conducted. The staff were briefed about the objectives of the project, the location and the functions. The project staff were also briefed on the organizational structure the roles, and the issues of Prek Thnot Watershed.

Activity 0.4 Project Inception Workshop

An initial dissemination of the project among the stakeholders was conducted during the launching of the project on March 17, 2015 (Photo 8) in Phnom Penh. The inception workshop was conducted together with the closing of the First APFNet Project "*Multi-function forest restoration and management of degraded forest areas in Cambodia*". During the workshop, the Project Management Team presented the objectives and target of the project. The Workshop was graced by H.E. Chheng Kimsun, the Director General of the Forestry Administration.

The inception workshop was attended by representatives from Forestry Administration; APFNet; CDRI; Lecturers/Resource Person; Students; CF Members; and Project Management Team. The list of participants who attended the workshop includes in the following:

Office	Number of Participants
Delegate from FA	1
Delegate from APFNet	3
PSC member	4
FA	26
Local FA	14
RUA	6
Prek leap nation university	6
RUPP	6
Presenter	5

Office	Number of Participants
CF at kompong tom province	6
CF at Seim Reap Province	6
CF at kompong Spue province	9
Project Team	9

The workshop was conducted as part of the completion workshop of the APFNet project "Multi-function Forest Restoration and Management of Degraded Forest Areas in Cambodia". Dr. Thea, the Coordinator of the Project, presented the objectives and the expected output of the project. Some of the CF members who live in Prek Thnot asked clarification questions of the interventions of the project, especially the approach. The Project Management Team explained to the participants about the method and the intention of the project. After the program, a signing ceremony was done for the new project.

Photo 8. ***Inception Workshop of the project***

Activity 0.5 Preparation of Annual Work Plan

Three Annual Work Plans were prepared by the project and submitted to the APFNet for approval. The AWPs were presented to the PSC for comments and endorsement before these were submitted to the APFNet.

Objective 1. To build capacity and raise awareness on the concept of integrated

watershed/landscape planning for central and local stakeholders through scientific assessments, analysis and participatory watershed/landscape planning processes.

There are two Outputs under this objective:

- Output 1.1 Improved knowledge and awareness of the target stakeholders on the concept of integrated Watershed Planning and the development issues in Prek Thnot Watershed that affect the forest-dependent communities; and
- Output 1.2 Watershed Characterization Report of Prek Thnot Watershed

The indicators of the two outputs were achieved 100%.

Output 1.1 Improved knowledge and awareness of the target stakeholders on the concept of integrated Watershed Planning and the development issues in Prek Thnot Watershed affecting the forest-dependent communities

All the indicators under this output were achieved 100%. There were 6 Main Activities under this indicator:

- Activity 1.1.1 Assess the training needs and provide training to FA Staff and Farmers
- Activity 1.1.2 Map out critical areas in Prek Thnot watershed that provide substantial irrigation water to agricultural land and identify priority areas for forest-dependent communities and habitat for wildlife.
- Activity 1.1.3 Preparation for consultative meeting activities
- Activity 1.1.4 Conduct consultative meetings on integrated watershed planning with participations of stakeholders to map out the critical priority areas
- Activity 1.1.5 Develop a land use plan for the Prek Thnot watershed and critical priority areas to engage the stakeholders in the mapping and assessment processes and wrap-up results to inform concerted support and leverage greater actions from the stakeholders.
- Activity 1.1.6 Conduct provincial stakeholder's forum to present the results of the land allocation and draw action plan for the development of Prek Thnot Watershed Landscape;

Activity 1.1.1 Assess the training needs and provide training to FA Staff and Farmers

There were two sets of trainings that were provided: (1) Training to FA staff (Activity 1.1.1.1) and (2) Training to Farmers (Activity 1.1.1.2). All the trainings were completed according as planned. For the Forestry Administration (FA), the training was conducted on the topic: (1) participatory Action Research; and (2) Watershed Hydrology. The farmers were trained on basic hydrological

monitoring and collection of soil erosion data. The project endeavored to build the capacity of the IRD staff and the key sub-national FA staff on participatory watershed planning. The community forestry (CF) members were also trained on soil and water conservation and livelihoods.

The trainings were conducted to capacitate the Field Staff to carry out planned activities of the project. The trainings were conducted as an exercise of due diligence on the part of the Project to minimize the risks of its implementation. Since the community will be involved in data collection, there is risk that the cooperating farmer will not fully understand what they are doing. Thus, they will most likely do not be conscious in the collection of data.

Capacity building was made in pursuit of developing the watershed management plan. Appropriate tools were developed and administered by the trainer.

Among the trainings that were identified include the following:

Table 6. List of Training Topics and Target Participants

Training Topics	Name of the trainee	Affiliation
GIS/Participatory Mapping (for FA staff): 26-30 October 2015		
	Mr Ma Vuthy	IRD staff
	Mr Uy Srey	IRD staff
	Mr Li Kimsann	Kampong Speu FA Cantonment
	Mr Chea Sarorn	Kampong Speu FA Cantonment
	Ms Kheav Channara	IRD staff
	Ms Norn Navin	IRD staff
	Mr Sem Rida	IRD staff
	Mr Phoung Pich Ponnareay	IRD staff
	Ms Khim Sophal	RUA student
	Ms Kong Borey	RUA student
	Mr Chheng Vuchna	RUA student
	Mr Sam Ratana	RUA student
	Mr Chantha Yuthea	RUA student
	Mr Ah Proh Den	RUA student
Agroforestry and Watershed (for FA staff): 4-5 February 2016		
	Mr Chea Sarorn	Kampong Speu FA Cantonment
	Mr Ngeth Phou	Deputy Director, Kandal FA Cantonment
	Mr Sem Rida	IRD staff
	Mr Suy Sotheara	IRD staff
	Mr Norn Navin	IRD staff
	Mr Kheav Channara	IRD staff
	Mr Li Kimsann	Kampong Speu FA Cantonment

Training Topics	Name of the trainee	Affiliation
	Mr Ma Vuthy	IRD staff
Participatory Action Research (for FA staff): 2-5 October 2017		
	Ms Chhit Sophal	IRD staff
	Mr Seung Kosal	IRD staff
	Mr Roeun Chhaya	IRD staff
	Ms Chhorn Savoeun	IRD staff
	Mr Sem Rida	IRD staff
	Mr Chea Sarorn	Kampong Speu FA Cantonment
	Mr Ly Kimsann	Kampong Speu FA Cantonment
	Mr Muong Chet	IRD staff
	Mr Meng Loth	IRD staff
	Ms Kheav Channara	IRD staff
	Mr Ma Vuthy	IRD staff
Watershed Hydrology (for FA staff): 14-15 March 2017		
	Mr Mao Boramin	Deputy Director, Kampong Speu FA Cantonment
	Mr Chea Sarorn	Deputy Chief of Oral FA Division
	Mr Ly Kimsann	Staff of Kampong Speu FA Cantonment
	Ms Kheav Channara	IRD staff
	Mr Meng Loth	IRD staff
	Ms Nat Srey Neang	IRD staff
	Mr Ma Vuthy	Technical staff
Agroforestry technology (and soil and water conservation) (for farmers): 25 June 2016		
	Mr Kim Chap	Farmer, Trapang Chor Commune
	Mr Kim Mao	Same as above
	Mr Phom Kim	Same as above
	Mr Hor Theun	Same as above
	Mr Li Khim	Same as above
	Ms Keb Navi	Same as above
	Mr Sorn Son	Same as above
	Mr Oeun Khorn	Same as above
	Mr Suy Buntheun	Same as above
	Mr Kim Meth	Same as above
	Ms Kim Ny	Same as above
	Mr Keo Korn	Same as above
	Ms Phea Lin	Same as above
	Mr Khim Phat	Same as above
Soil and water conservation (for farmers): 6 – 8 October 2017		
	Mr Theam Keang	CF member, Damrey Chak Thlork
	Mr Verb Chim	Same as above

Training Topics	Name of the trainee	Affiliation
	Mr Thoun Thy	Same as above
	Mr Seav Lim	Same as above
	Mr Thaung Bunthim	Same as above
	Mr Men Veun	Same as above
	Mr Chim Phal	Same as above
	Ms Sim Tauch	Same as above
	Mr Lim Liv	Same as above
	Mr Neang Nem	Same as above
	Mr Yi Mon	Same as above
	Mr Sokh Vann	Same as above

Activity 1.1.1.1 Provide training to FA Staff

Capacity building and training of trainers (TOTs) were provided to the FA central and sub-national staff (FA Cantonment and Divisions). All the planned trainings were completed. After the training, the trained FA staff conducted participatory data collection in the field.

Activity 1.1.1.1.1 Provide training to FA Staff on GIS/Participatory Mapping

The training aims to provide the Project Staff basic skills on GIS for them to be able to analyze the condition of the site using GIS technology. The training is part of the capacity building effort of the project. The training was conducted by a GIS expert and was attended by 14 participants. Some of the participants came from the Ministry of Agriculture, Forestry and Fisheries (MAFF), Forestry Administration (FA) and academe who actively participated in previous APFNet projects. The training was conducted on October 26-30, 2015.

Activity 1.1.1.1.2 Provide training to FA Staff on Hydrology

A training on basic Hydrology was conducted to the FA staff on 14th and 15th March 2017 (Photo 9). The training was aimed at building the basic knowledge of the FA staff on hydrology so that they can effectively explain to the farmers on the importance of conserving the watershed. The project commissioned an expert on Watershed to train the FA staff. The main objective of the training was to provide technical capacity to FA staff on the following:

- Basic principles of hydrology of the watershed
- Understand the factors that affect the erosion and surface runoff in the watershed, the components of the watershed and the basic hydrologic cycle.
- Develop the capacity of the Staff on the collection and analysis of the hydrological data such as rainfall, percolation and soil erosion.

Photo 9*. The FA staff attending the training on hydrology*

Before the start of the training, the participants were asked for their expectation of the training. The pre and post evaluation were based on the following criteria:

- The objectives of the training were clearly defined
- Participation and interaction were encouraged
- The topic cover was relevant
- The content was organized and easy to follow
- The materials distributed were helpful
- This training experience will be useful to my work
- The trainer was knowledgeable about the training topics
- The trainer was well prepared
- The training objectives were met
- The time allocated for the training was sufficient.
- The meeting room and facility were adequate and comfortable

The result of the evaluation indicates that most of the expectations of the training were met.

Activity 1.1.1.1.3 Provide training to FA Staff on Agroforestry and Watershed

Another set of training was provided to the Project staff on Agroforestry and watershed management. The training was conducted on February 4-5, 2016 participated by 8 national and sub-national FA Staff. The lecture was conducted at the IRD meeting room in Phnom Penh and

after the lecture, a practicum was conducted where the trainees worked in the field with the farmer beneficiaries. The trainees demonstrated to the famers how to set up the contour using the A-Frame. The Agroforestry Consultant assisted the staff during the field activities.

Activity 1.1.1.1.4 Provide training to FA Staff on Participatory Action Research

Participatory Action Research (PAR) has been proven to be an effective approach in community-based research, and has been used in this project. The concept of Participatory Action Research (PAR) has been successful as a modality of engaging the farmers in collaborative research. This concept was thus introduced to minimize failure in data collection. The PAR Training was conducted on October 2017. While the Project Staff have sufficient skills and training on technical aspects of forestry including the scientific research, there is still a need to strengthen their skills on social research. The objectives of the PAR Training are:

- To gain insights on the process and methods for designing, data collection, analyzing and planning with community members.
- To draw lessons that may be useful for their work based on the field experience of participants.
- To design a follow-up plan for subsequent, follow up and reflection.

There were 9 staff of IRD and 2 from Cantonment who participated in the training. The training was conducted for 2 days in the IRD meeting room and 2 days for field practice. The participant's capacities were analysed according to the pre-and post-test questions that were handed to participants individually before the start of the session and the last day of the training. In addition, the trainers also added some inputs based on their observations.

The participants gained knowledge of PAR and understood about the community's living condition based on the reflection and analyses on the results from the 2-day visit in Krang Deivay commune. They only practiced the first step of PAR cycle to understand the community, but not yet able to bring the people to analyse the root-causes of the problem and its effects through raising critical questions due to limited time.

The reflection session on the result of pre-test and post-test showed the improvement of the awareness and capacities of the participants (Figure 2). The top two aspects stood out very clearly: the ability to analyse community strengths and weaknesses, and ability to identify the existing social groups. However, through reflection in the villages, they have not yet been able to identify the various social groups that exist in the village and how they relate to each other for village development or responding to common challenges.

The rating of the other result areas is moderate. The lowest rate is about their confidence to write

reports. It was observed that they still have difficulty analysing the issues and put them into the report and this is reflected in their preparation in small group work for presentation. It is interesting to see that while all participants seem to value high on the importance of staying in the community as one of the aspects in PAR, there was a need for better preparation of them to be able to adapt to staying in the field so that they have greater understanding of the community life and their daily interactions. This type of activity would allow the participants to appreciate the amount of information that they might gain before they can engage with community for a more informal dialogues and analysis.

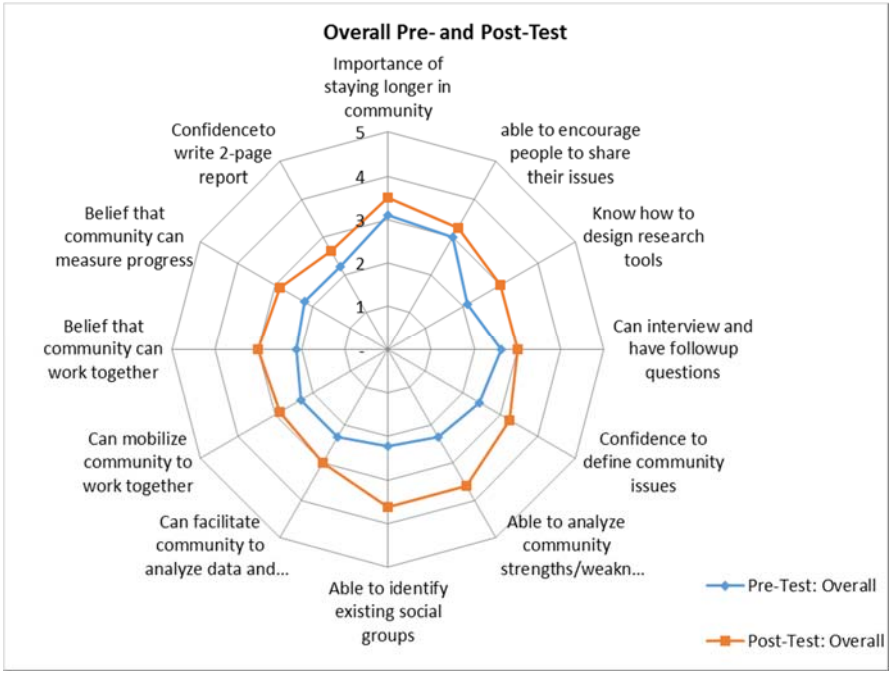


Figure 2. Result of the Pre and Post Test

Activity 1.1.1.2 Training of 10 farmers on agroforestry technologies, hydrologic monitoring and participatory action research

There were 2 trainings that were conducted: (1) Training on agroforestry; and (2) Training on basic hydrological monitoring. The two trainings were conducted by the Project Staff as application of what they learned from the training. The trained FA staff applied in the field what they learned by engaging the farmers in implementing the field research. The trainer provided backstopping support.

Activity 1.1.1.2.1 Training of 10 farmers on agroforestry technologies

The Project Staff re-echoed their knowledge on agroforestry and soil and water conservation technique to the farmers (Photo 10). The training was conducted by the field staff who just completed their training from the Trainer (Consultant hired to provide training to the FA staff). There were 10 people from Trapang Chor commune who attended the training. The farmers were briefed about the project, the reasons why there is a need to establish soil and water conservation measures, and the technology of conserving the soils of their farm. The farmers were trained on the use of A Frame and determining the contour of the farm. The farmers' training was done in a simple and practical ways. It was done through hands on and experimental learning to produce tangible results.

According to Mr. Kim Chap, the owner of the farm where the field practicum was conducted:

> *I'm very pleased that IRD introduced this technology. So far we don't know how to prevent our soil from erosions. We now understand the usefulness of simple tools like the A-Frame in constructing the contours and the function of contour canals in reducing soil erosion during rainy season. The soil and water conservation technique is very important to me and farmers in this area who rely on agriculture. Before, my crop grows very well and the soil is very productive. Lately, agricultural production has decreased and the soil become sandy and rocky. We are very happy if the project will contribute additional seedlings both fruit trees and wild tree seedlings about 200 seedlings for planting near raining season.*

The training is just an introduction to the farmers the concept of soil and water conservation. Most poor farmers are generally averse to technology. It may take time that the understanding of the benefits of technology can be realized.

Photo 10. *Farmers learning the use of A-Frame*

Activity 1.1.1.2.2 Training of 10 farmers on hydrologic monitoring and participatory action research

After the FA staff were trained on PAR, they were deployed to the field for practicum. This time, the FA staff who were trained on Agroforestry and Hydrology, imparted to the farmer's hands-on collection of data collection. The trained FA staff explained the different factors that contributed to the erosion and how these can be mitigated. The training was conducted by the field staff who just completed their training (a Consultant hired to provide training to the FA staff).

The group conducted water infiltration testing using improvised gadget as part of the actual hands-on. The participants chose 4 forest sites and 4 non-forested sites (agriculture land, farm land). The result of the sampling showed that the water infiltration of forest sites was 0.31 cm/min while the sites without forest showed that the water infiltration was 0.06 cm/min. The testing demonstrated that the forest sites have faster water infiltration than the sites without forest. This demonstrated the importance of the forest in increasing the infiltration of the water to the ground, minimized surface runoff and prevent erosion.

The FA staff conducting reecho training to the farmers on measuring water infiltration

Activity 1.1.2 Map out critical areas in Prek Thnot watershed that provide substantial irrigation water to agricultural land and identify priority areas for forest-dependent communities and habitat for wildlife / Collection of base maps and pertinent data of the watersheds

The project staff compiled spatial data about the watershed. These were stored in the GIS database. Some of the files were generated by the GIS consultant and during the training. These

maps were prepared as reference for the watershed characterization activities.

Activity 1.1.3 Preparation for consultative meeting activities

Prior to the holding of the consultation workshop, the Project staff conducted coordination meetings with the different agencies to look for potential speakers. There were series of meetings and site visits before holding of a consultative workshop. Preparatory meetings were conducted with the Community Forestry Management Committee (CFMC) Chief of Damrey Chakthlork, with the Field FA Staff, and the staff of the Provincial Governor. The venue for the holding of the workshop was finalized and invitations were sent to the target participants of the consultative workshop.

Activity 1.1.4 Conduct consultative meetings on integrated watershed planning with participations of stakeholders to map out the critical priority areas

The consultation workshop on “Integrated Watershed Planning for Prek Thnot Watersheds” was conducted on 30 April 2016 in Kampong Speu Province. The objectives of the workshop were (1) to raise awareness on the importance of Prek Thnot Watershed and participatory watershed planning, (2) consul with stakeholder on criteria for land use for Prek Thnot watershed planning, and (3) Solicit recommendations on how to address the negative impacts from inappropriate land uses.

The consultative workshop was one of the important part of legitimization process of the Integrated Watershed Management Plan. The consultation, was participated by a diverse group of stakeholders (Table 7). The consultation workshop was focused on setting the criteria for the land suitability mapping. The stakeholders identified the criteria for land allocation in the watershed.

Table 7. Sectors who participated in the consultation workshop

Office/Sector	No. of Participants
Forestry Administration	12
Presenter	10
NGO and industry at Kampong Speu	24
Community Forestry	26
Project Team	13
Royal University of Agriculture	2
Organization	3

During the workshop the importance of watershed, concept of participatory watershed

management, as well as the current condition of Prek Thnot watershed were presented. The participants actively participated and shared information during the workshop. The workshop also became the start of disseminating information about the “Landscape Approach to Sustainable Management of Forests in Prek Thnot Watershed” project. The workshop provided a useful information for the project team to move forward. Most of the answers from group discussion serve as input to the GIS expert/project team in coming up with a land allocation.

Activity 1.1.5 Develop a land use plan for the Prek Thnot watershed and critical priority areas to engage the stakeholders in the mapping and assessment processes and wrap-up results to inform concerted support and leverage greater actions from the stakeholders/Spatial Land Allocation Mapping

This activity (land allocation mapping) made a tentative allocation based on the optimization model (Goal-Linear Programming). In the development of the land allocation model, criteria were set. The criteria serve as input to the consultant who developed the land suitability map. As soon as the GIS consultant developed the land suitability maps, these were used in developing the land allocation model and ultimately the allocation map. The tentative land allocation map was presented to the stakeholders for any comments (Photo 11).

Photo 11. Participants holding small group discussion during the consultative workshop

The land allocation model gave consideration on the biophysical constraints and carrying capacity of the watershed. In formulating the land allocation plan, decision support tools such as Linear and Goal Programming and GIS were used. After developing the land allocation model, the allocation area was located in the site using GIS. The land allocation model gets input from the consultant who develop the land suitability map. The different land options for Prek Thnot include:

1. Rice Production
2. Industrial Crops
3. Industrial Tree Plantations
4. Fruit Orchard
5. High Value Crops
6. Conservation/Protection
7. SFM
8. Forage Production

The land allocation aims to satisfy the following societal goals (Benefit maximization and Carrying Capacity limitations):

1. Maximize Income from Land Use (Honey, Mushroom, Sugar, Rattan, Resin, Rice, Fruits, Ecotourism, etc.) (Products and Employment Income)
2. Maximize Rice Production (Limited by Site Carrying Capacity)
3. Maximize Meat Production - Bushmeat (as proxy production value) and Livestock (Limited by Site Carrying Capacity)
4. Maximize Supply of Construction/High Value Timbers
5. Maximize Supply of Fuelwood
6. Maximize Total Biomass Produced
7. Maximize Forage Production

8. Maximize Water Infiltration for 3-Hr. Rain
9. Minimize Soil Erosion
10. Minimize Total Pesticide Loads
11. Minimize Social Cost for Protection Management

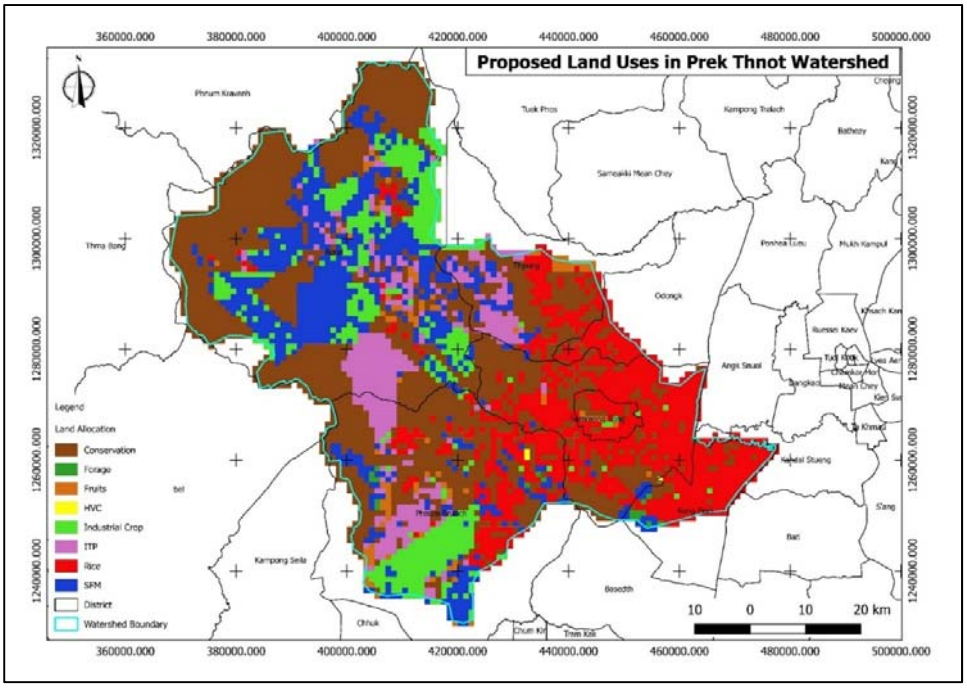
The societal goals were based on the national goals (food security and poverty allocation), Cambodia Rectangular Strategy, Cambodia Sustainable Development Goals, National Forest Programme and Cambodia Greengrowth Strategy. The land

allocation mentioned above are the most significant goals that have spatial requirements and can be addressed by the land use plans. The land allocation follows the criteria set during the first consultation workshop.

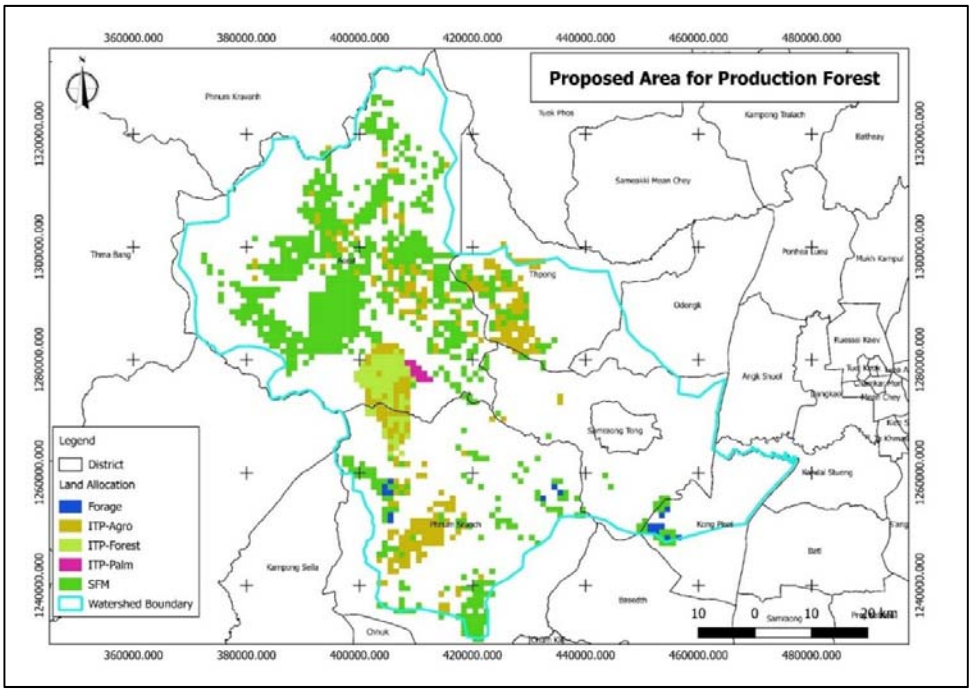
Table 8. *Result of the land allocation*

Land Use	Aoral	Basedth	Chbar Mon	Kong Pisei	Odongk	Phnum Sruoch	Sam-raong Tong	Thpong	Total	%
Rice Production	-	-	7,200	9,700	9,000	8,400	56,200	13,800	104,300	20.6
Industrial Crops	67,000	200	-	-	-	11,300	1,300	12,700	92,500	18.3
Industrial Tree Plantations	3,200	100	-	400	-	4,300	3,500	2,300	13,800	2.7
Fruit Orchard	39,400	100	600	13,200	-	69,400	3,600	8,900	135,200	26.7
High Value Crops	2,000	-	-	-	-	3,500	1,400	500	7,400	1.5
Conservation/Protection	95,100	-	-	-	-	5,700	100	100	101,000	19.9
SFM	19,000	600	100	1,500	-	20,100	5,800	5,200	52,300	10.3
Forage Production	-	-	-	-	-	-	-	-	0	
Total	**225,700**	**1,000**	**7,900**	**24,800**	**9,000**	**122,700**	**71,900**	**43,500**	**506,500**	

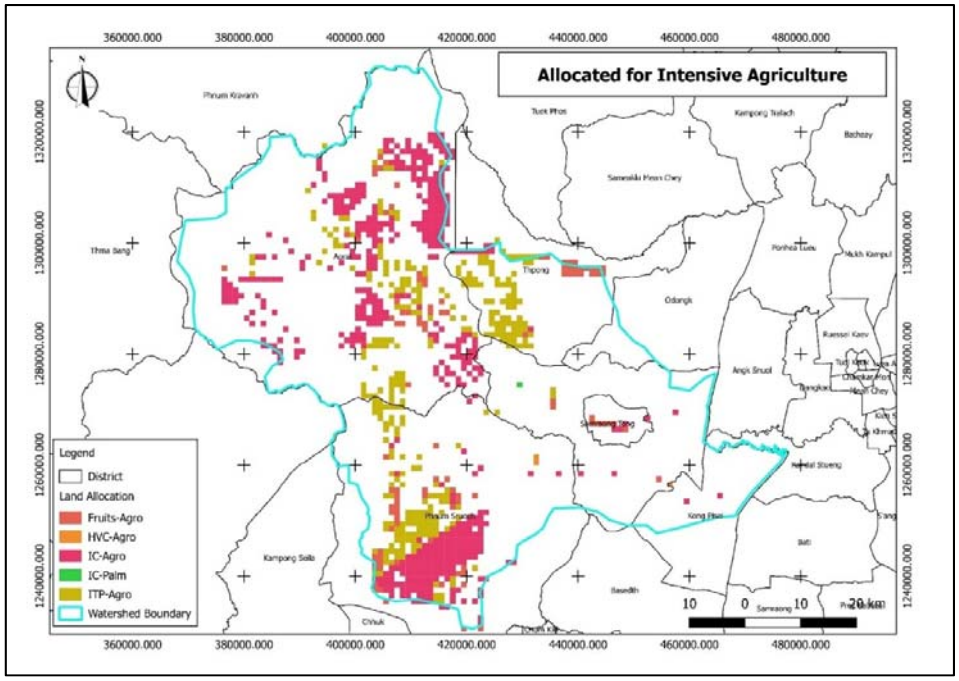
The final output (i.e. allocation maps) are shown in the maps below:



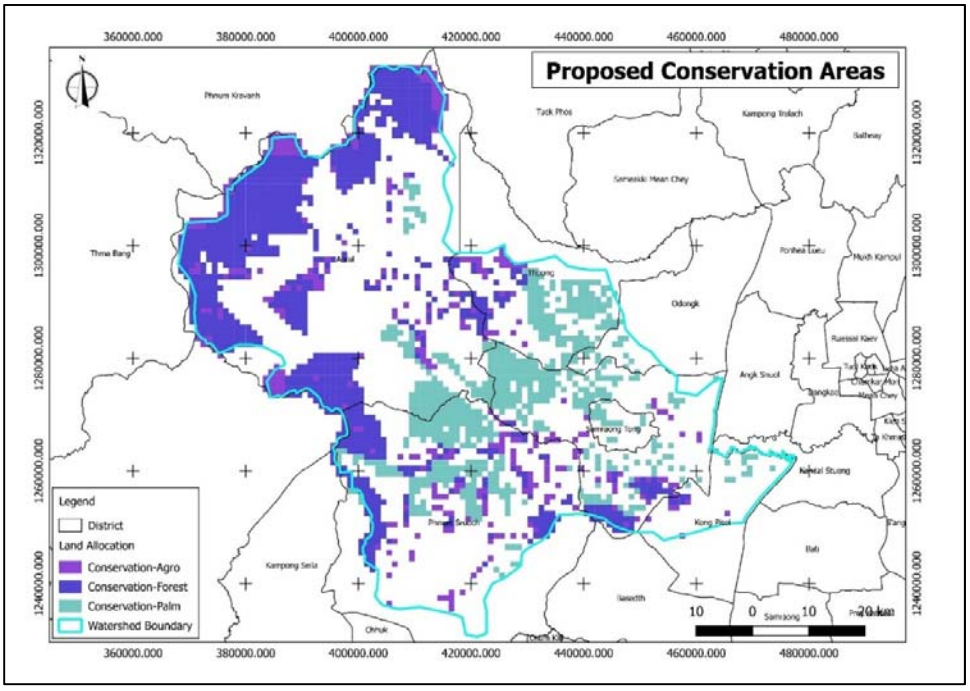
Map 2*. Overall land allocation of Prek Thnot watershed*



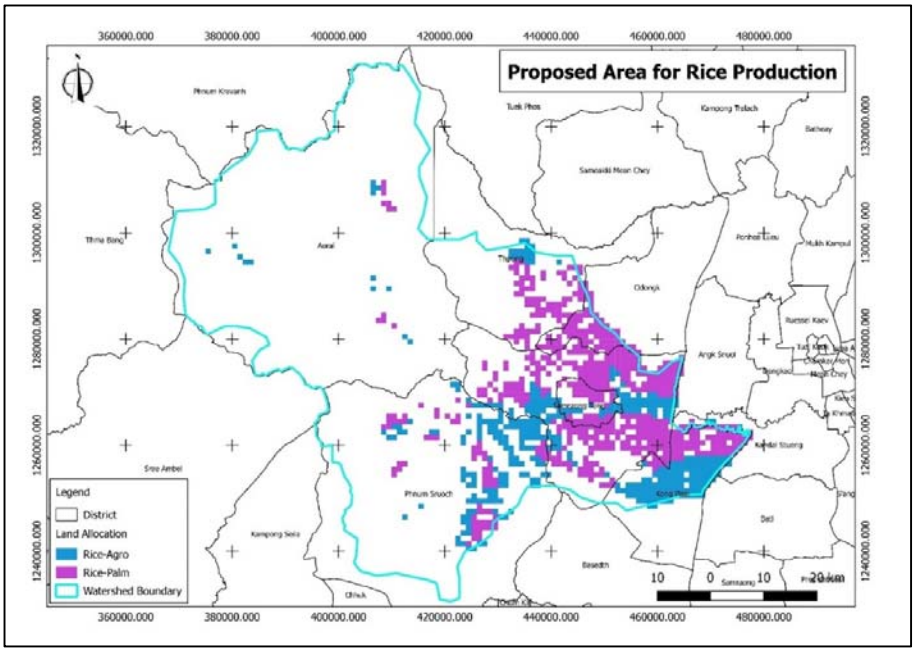
Map 3*. Proposed area for production forest*



Map 4*. Proposed area for Intensive Agriculture*



Map 5*. Proposed Conservation Areas*



Map 6*. Proposed area for rice production*

Activity 1.1.6 Conduct provincial stakeholder's forum to present the results of the land allocation and draw action plan for the development of Prek Thnot Watershed Landscape

Landscape planning always observe consultation with the stakeholders. A forum was conducted in November 7, 2017 with a total number of 58 participants to present the outcome of the land allocation. During the forum, the participants provided input on the possible interventions in areas where there are incompatible uses of the land (i.e. farming in steep slopes, etc.). As in previous forums, the Project Team distributed posters and pamphlets to increase awareness of the participants about the issues in Prek Thnot watershed. The provincial stakeholder's forum also drew potential mitigating measures that can be applied in areas that have conflicting land uses in Prek Thnot Watershed Landscape. The forum was participated by the Local Authority (province, district, commune and village), Community-based Organizations, relevant NGOs, FA and relevant Authorities. During the consultative workshop, the stakeholders reviewed the proposed land allocation.

During the presentation of the land allocation, there was a general acceptance of the land allocation. It was only in Phnum Sruoch that the participants specifically pinpointed an area to be allocated for ecotourism. This did not alter so much on the land allocation since the result of the land allocation identified the site for conservation purposes which is compatible to ecotourism use.

The workshop was also asked to provide inputs for the development of the integrated watershed management plan. The participants were divided into 13 groups of 3

persons each. Each group has the opportunity to discuss all questions. The results of discussion on each questions are summarized in Table 9 below.

Table 9. Result of group discussion

No.	Questions	Results
1	What do you think are the most important services of Prek Thnot watershed?	For watering, reducing flood, fishing, ecotourism, ground water, hydropower damp, increasing agricultural productivity, bird habitat, food production, income generation, clean water, soil erosion prevention, ecosystem services.
2	What do you think are the most important problems/issues that must be addressed by all stakeholders?	Soil erosion, land degradation, land conflict, flood, drought.
3	Vision Setting: Please describe what is your wish of how Prek Thnot watershed will look like 25 years from now?	No soil erosion, no chemical and pesticide, no flood, vegetation cover along stream, no disaster, fertile soil, enough water, become ecotourism site, enough fish for local people, a beautiful and productive area, good environment, rich of bird, poverty reduction, increasing people livelihood.
4	What are your suggestions to reduce the erosion, surface runoff and flooding in downstream areas?	Planting trees, awareness raising on the important of Prek Thnot watershed, increasing productivity of agroforestry, check damp, land use planning, sustainable agriculture, forest protection, ground water management,
5	What are your suggestions to control/reduce deforestation/ degradation/forest conversion in Prek Thnot watershed?	awareness raising, forest rehabilitation, generate job, implement REDD+, law enforcement, reduction of charcoal/fire wood, develop land use plan, increasing agricultural productivity,
6	What are your suggestions to increase the wildlife population of Prek Thnot watershed?	Awareness raising on the important of wildlife, law enforcement, forest protection, patrolling, awareness raising on forest fire, encourage people who want to raise wildlife, provide job opportunity to wildlife hunter through skill training, identify wildlife corridor, reforestation, etc.
7	What are your suggestions to increase the total	Protect natural resources, promote and increase agricultural value chain,

	income/economic benefits in Prek Thnot watershed?	implement sustainable agriculture, develop ecotourism, water conservation, awareness raising on suitable land use, promote integrated farming, connect to market.
8	What are your suggestions to increase food security in Prek Thnot watershed?	Increase forest cover (fruit tree and timber tree), irrigation system, suitable species with site condition, promote organic crop, promote and scaling new technology, enhance agroforestry, agricultural processing, forest protection and promote NTFP.
9	What are your suggestions to increase the availability of fuelwood and sawtimber supply in Prek Thnot watershed?	Increase tree plantation (both long and short term), forest rehabilitation, livelihood improvement through agroforestry, establishment of CF, promote biogas utilization, increase ecosystem services, promote serving stove, changing from wood utilization to metal for construction.
10	What are your suggestions to increase the biomass production or carbon sequestration in Prek Thnot watershed?	Conduct afforestation, forest protection, fruit tree plantation, agroforestry, increase forest cover, encourage tree plantation, planting bamboo along the stream, forest silviculture, identify tree for planting, awareness raising and law enforcement, participation from all stakeholder.
11	What are your suggestions to minimize/prevent chemical pollution of the rivers and lakes of Prek Thnot watershed?	Promote awareness on the importance of water utilization, awareness raising on the pesticide/chemical fertilizer utilization, soil erosion control, reduction of chemical fertilizer, water analysis, terracing, law enforcement.
12	What are your suggestions to minimize the conflicts in Prek Thnot watershed?	Control migration to the watershed, control land titling, conduct awareness raising on the use of existing resources, conduct law enforcement, promote land use planning, community establishment for land, water, forest utilization, forest land encroachment control.
13	What are your suggestions to ensure that the proposed watershed plan will be supported by the different sectors?	Conduct documentation, drafting master plan, meeting with technical stakeholder on the draft plan, involvement from private sector, land use zoning,

Output 1.2 Watershed Characterization Report of Prek Thnot Watershed

Activity 1.2.1 Preparation for Watershed Characterization Activity

The Project Management Team hired an expert on socioeconomic study and watershed to conduct watershed characterization and socioeconomic condition of the community, land use, and farming practices. The project provided support to the expert and coordinated in the field study.

Activity 1.2.2 Conduct bio-physical, socioeconomic survey and risk assessments to the critical priority areas

The area surveyed covered 10 villages in the target Communes in the districts of (1) Thpong; (2) Samraong Tong; (3) Phnum Sruoch; (4) Aoral). The survey used standard socioeconomic questionnaire. The expert who was contracted by the project established contacts to the project site (the location and basic information of the site), and organized meetings. Base maps (such as land allocation, land suitability maps) were printed out and used during the participatory mapping. The expert submitted to the Project Management the final report. The report described Prek Thnot watershed, particularly its biophysical and socioeconomic condition.

Objective 2. To improve the integrated management of Prek Thnot Watershed with participation of stake holders

All the outputs under this objective were completed. There are 3 Outputs under this Objective:

- Output 2.1 Integrated watershed landscape development plan for Prek Thnot Watershed developed
- Output 2.2 Demonstration sites on agroforestry system, contributing to soil and water conservation and livelihoods established
- Output 2.3 Forest-based community enterprise supported

Output 2.1 Integrated watershed landscape development plan for Prek Thnot Watershed developed

This activity involves the actual drafting and formulation of the IWMP. The IWMP includes identifying strategies and action plan and priority areas for development.

Activity 2.1.1 Develop participatory landscape restoration and sustainable management strategies and action plans for the identified critical priority areas/Develop landscape restoration and sustainable management strategies

and action plans thru participatory method

After completing the watershed characterization and land allocation, an integrated watershed management plan was developed. The draft integrated watershed management plan was presented to the 4 Districts (Photo 12). There were 2 District consultations conducted (2 Districts per consultation). During the District Consultation, the Land Allocation and the Watershed Management Plan were presented to the stakeholders. On 22nd March 2018, the project team organized district consultation workshop in Aoral (Aoral and Thpong District). There were 77 participants (5 were female) coming from the FA, District Administration, Commune Council, District line Offices, Community Forestry, Private Sector, and NGOs. The second consultation workshop was organized in Phnom Srouch District Hall (Phnom Srouch and Samrong Tong District) on March 30, 2018. There were 81 participants (5 female) who attended coming from National, Provincial, and District/Commune level. The agencies who participated come from the FA, District Administration, Commune Council, District line Offices, Community Forestry, Private Sector, and NGOs.

The main objective of the workshops was to: (1) share the draft Prek Thnot land use plan to stakeholder; and (2) gather comments and suggestion from all stakeholders of the improvement of the land use plan. The expected outputs from the workshop were: (1) Participants aware the progress of the progress of Prek Thnot Watershed land use plan, and a better understanding of the land use planning in the watershed; and (2) collect feedback from all participants for the improvement of Prek Thnot land use plan.

During the consultation, the participants were required to address several sets of questions. The result of the workshop is shown below:

Table 10. Outcome of the consultation workshop

No	Questions	Results
1	Based on the proposed allocation (please refer to the map of the 2 districts), are there any conflicts in your respective areas that were not captured? If so, what are these and what are your recommended land uses?	▪ West of Chambak commune (for conservation and agro-industrial) ▪ North-West Tumpor Meas commune (for agro-industrial; mountainous areas for reforestation) ▪ Tree plantation for protection against erosion and land slide in Kahèng, Tang Kroch, Tumpor Meas commune ▪ Treng Trayeung (for agro- industrial) ▪ Krang Deivay commune (for forest conservation and agro-industrial) ▪ Kiri Voan commune (for agriculture at the foot-slope) ▪ Tang Sya commune (for agriculture; Northern part forest protection)

No	Questions	Results
		▪ Moha Sang commune (for agriculture and forest protection ▪ Roleang Chak, Roleang Kreul, and Trapeang Kong (for agriculture) ▪ Sankat Chbar Mon and Ktum Krang (North-Western part is for industrial zone)
2	Based on the planned land use, are there any land use that you would like to add? What other strategies are needed to increase the financial and economic benefits from Prek Thnot watershed?	▪ Plant crops according to land suitability (vegetable, mango, banana, rice etc.) ▪ Apply right technique for establishment of industrial crops to prevent erosion ▪ Plant bamboo (for bamboo shoots and bamboo for consumption) along water ways, creeks, rivers, sloping areas ▪ Maintain the existing forest in the riparian areas (for fisheries) ▪ Plant grass and other trees species in sloping areas ▪ Plant trees on degraded sloping areas (land that cannot grow industrial crops any more) ▪ Raise animals and develop for eco-tourism ▪ Develop Eco-Agro-Forestry (establish a station for medicinal plants plantation - eco-aquaculture) ▪ Introduce planting technique and technique for animal raising ▪ The developments should cater to the market demand (quantity, quality) ▪ Establish as community or group ▪ Make extension of the products ▪ Provide fund and material ▪ Exchange experience (study tour) ▪ Put up irrigation system ▪ Introduce processing and packaging ▪ Put up a product storage (ware house)
3	Based on the recommended land use, what can you suggest in order that these land use can be successfully implemented in the ground?	▪ For rice production: dig canal/irrigation; provide seeds and fertilizers; stabilize the market prices ▪ Provide market for industrial crops ▪ For Industrial timber: provide guidelines; financial support; contract in marketing ▪ For fruit orchard: support the contract to ensure the market and price) ▪ For high value crops: provide irrigation;

No	Questions	Results
		construct reservoirs, dams, and canals; provide technology and market support ▪ For Conservation and protection forest: implement extension and education; establish more CFs; intensify the conservation and reforestation; protection of Stung Prek Thnot watershed ▪ Sustainable forest management: support the CFs for patrolling; protect from forest fires; seek for funding and support from FA; demarcate the boundary ▪ Fodder production: introduce fast growing and fodder species (legume); plant fodder trees around home garden; protect range against forest fire; plant king grass (use less water and fast clump multiple) ▪ Government should find market and stabilize the market price ▪ Provide equipment for testing (microbe, quality) to match the ISO ▪ Implement education extension, awareness raising ▪ Make land use planning on rice production and agro-industrial crop ▪ Use seeds varieties according to zone and season ▪ Support capacity building (human resource) ▪ Protect the riparian forest (some area could use for growing vegetable) ▪ Establish a working group to facilitate with local authority for coordinate and M&E ▪ Prepare a watershed-class map within the watershed ▪ Study on soil fertility to identify the agriculture production zones ▪ Get support from policy makers ▪ Get international support for the projects ▪ Get support from the local people ▪ Intensify the awareness raising on the benefit of land use plan ▪ Seek involvement from related authorities ▪ Should study on the impact (EIA) and local demand

No	Questions	Results
		▪ Prevent of illegal activities and forest fire (wild fire)
4	Who do you think should be the target for awareness raising? What are your suggestions to make the stakeholders (policy makers, famers, private companies, businessmen, communities, etc.)?	▪ People in village, commune, district, District Office of Agriculture, Department of Environment; Department of Water Resource; Department of Cadastral; NGOs; Private Companies; Department of Education; Local Authorities; Armed Forces; Courts; Department of Women Affairs; Department of Rural Development; Department of Commerce; Department of Finance ▪ Press ▪ Monks ▪ Students ▪ Policy makers ▪ Prepare geographic map; promote the proper land use ▪ Disseminate the laws ▪ Prepare training courses ▪ Provide funding for the implementation of the plan ▪ Involve technical institution ▪ Rehabilitate the degraded forests ▪ Conserve the areas along the river banks ▪ Promote agroforestry ▪ Private companies should be enjoined to maintain buffer zones for creeks, rivers as stated in the law (for private company) ▪ Plant trees on the slope of the river bank ▪ Organize study tour
	What are your suggestion to make the stakeholders (policy makers, farmers, private companies, businessmen, communities, etc.) support the Integrated Watershed Management Plan?	▪ Seek active participation from all stakeholders ▪ Seek active participation from people live within the watershed particularly the local authority, technical officials ▪ Promote stakeholders understanding on impact of erosion ▪ Have a clear plan (geographical location, quantity, quality) ▪ Promote broader extension on impacts of the activities to the watershed

No	Questions	Results
		▪ Promote proper land allocation ▪ Promote the benefits of land use plan ▪ Develop the human resources (material, fund) ▪ Seek strong commitment and responsibility from different stakeholders ▪ Identify areas that can be converted to eco-tourism ▪ Promote transparency in implementation ▪ Hold a watershed protection day

Photo 12. Small group discussion in Phnum Sruoch and Aoral District

The IWMP was finalized by integrating some of the comments of the participants. The Integrated Watershed Management Plan (IWMP) prescribed a land allocation of the watershed that can meet the objectives of increasing the economic without impairing the environment. An optimization model, linear programming and goal programming, that was used in land allocation, considered satisfying the societal goals (i.e. maximization of benefits and minimization of the externalities or negative impacts). The goals were used as basis of the watershed management plan. The plan gave consideration on the carrying capacity of the watershed. There are eight major land allocation options considered in the IWMP:

1. Rice Production
2. Production of Industrial Crops (cassava, sugar cane, potato, etc.)
3. Industrial Tree Plantations (Eucalyptus, Mangium and other Fast Growing Species)
4. Fruit Orchards
5. High Value Crops (Cabbage, Tomato, Spices, etc.)
6. Conservation/Protection Forest
7. Sustainable Forest Management (CF, Partnership Forestry, Low Impact Logging)
8. Forage Production

At the same time, the IWMP satisfied the 11 goals:

1. Maximizing income from land use (honey, mushroom, sugar, rattan, resin, rice, fruits, ecotourism, et.)
2. Maximizing rice production (limited by site carrying capacity)
3. Maximizing meat production - bush meat and livestock (limited by site carrying capacity)
4. Maximizing supply of construction/high value timbers
5. Maximizing supply of fuelwood
6. Maximizing total biomass produced
7. Maximizing forage production
8. Maximizing water infiltration (for 3-hr. rain)
9. Minimizing soil erosion
10. Minimizing total chemical (pesticide and fertilizer) loads
11. Minimizing social cost for protection and management

The result of land allocation noted some conflict between recommended land use and actual situations in the ground. Mitigating measures were drawn to mitigate these conflicts that include: (1) Promote sustainable land management and eco-farming in the ELCs and farmers; (2) Developments of some areas for ITP; (3) Introduce agroforestry to ELCs and individual farmers; (4) Promote organic rice farming to areas recommended for rice farming but located in critical areas. These areas have to be delineated solely for production of organic rice; (5) Promote precision agriculture technology and judicious use of chemical fertilizers and pesticides. (6) Set aside buffer zones along rivers and streams for protection forest.

The IWMP also made a projection of the total cost required to implement the land developments based on the land allocation and the expected benefits. The document was translated to Khmer to be useful to the local authority.

Output 2.2 Demonstration sites on agroforestry system, contributing to soil and water conservation and livelihoods established

There were three main activities implemented by the project to achieve this output:

- Activity 2.2.1 Preparation activities for AF Site development
- Activity 2.2.2 Identification of two agroforestry sites and farmer cooperators
- Activity 2.2.3 Establish regular soil and hydrological monitoring systems and measures and based on regular monitoring and periodic assessment, analyze and communicate the results to stakeholders.

All the milestones for the three activities were achieved 100%.

Activity 2.2.1 Preparation activities for AF Site development

The project staff has coordinated with the FA subnational staff in identifying area as pilot for testing of the agroforestry and soil and water conservation technique. The group visited the site for the potential establishment of the Agroforestry and has made preliminary arrangement with the farmers to use the farms for testing the agroforestry models.

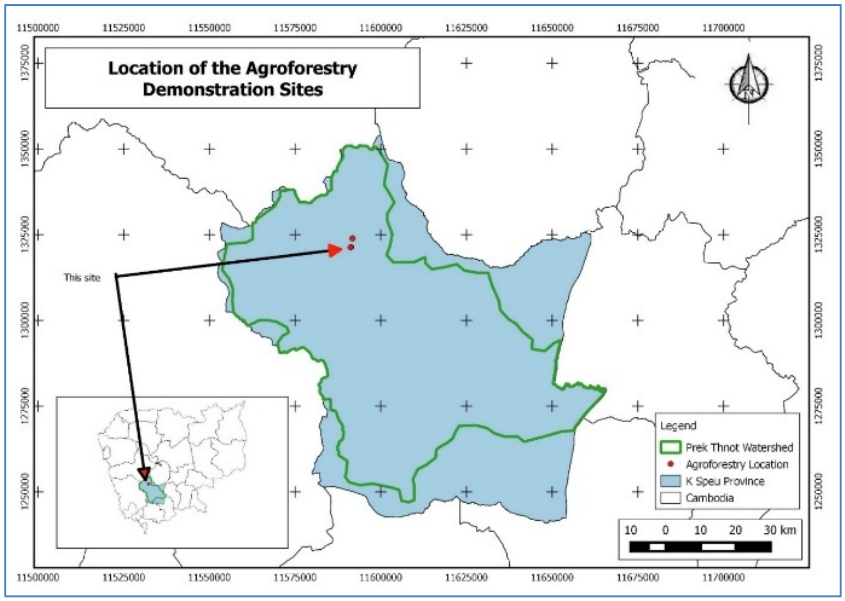
Activity 2.2.2 Identification of two agroforestry sites and farmer cooperators

Two sites had been identified and the farmers gave consent to use the land and also participated in the Agroforestry trial. The sites were located about 50 meters along the road and one of the tributaries of Prek Thnot River. Its accessibility made it an ideal site for agroforestry technology demonstration. It was learned that some farmers collected non-timber forest products (bamboo) and wildlife for subsistence. The yield of the farms however is modest considering that the soil is very poor and shallow. The poor soil condition could be attributed to the erosion that taking place.

The original target under this activity was already completed in the first year of operation. However, an additional area was developed following the recommendation by the PSC. The project team established additional agroforestry (AF) sites in Damrey Chakthlork. A design of soil and water conservation plots and preparation of materials needed for the collection of rainfall and soil erosion were prepared and installed in the agroforestry sites. The farmers in the second site are members of the CF who also depend on the forest for a living.

Initially, the Project Management Team tried to locate sites that are at least 1 hectare each. This requirement was difficult to meet considering that most farmers who are actual tillers own small areas of farmland. The Project Team just settled for smaller-sized farms near Damrey Chakthlork CF. Two farmer cooperators expressed interest

to participate in the pilot agroforestry testing. An agreement was entered between IRD and the farmer cooperators to develop their farms in exchange of technical assistance and some planting materials.



Map 7*. **Relative location of the Agroforestry Demonstration Sites***

The plots were located on farmers' lands in the form of home garden and fruit orchard. The private land was purposely selected because the project wants to engage the farmers in on-farm research. It was anticipated that this would be more effective when the practice is adopted by the farmers. The selection of these sites were made in consultation and participation of APFNet experts/consultants during the project formulation.

Activity 2.2.3 Establish regular soil and hydrological monitoring systems and measures and based on regular monitoring and periodic assessment, analyze and communicate the results to stakeholders

There are two sub-activities under this activity:

- Activity 2.2.3.1 On-site development of agroforestry system including installation of rain gauge and erosion monitoring plots
- Activity 2.2.3.2 Collection of data (hydro meteorological and soil data) from runoff plots
- Activity 2.2.3.3 Conduct Hydrological Impact Assessment of the Land Use Plan

Activity 2.2.3.1 On-site development of agroforestry system including installation of rain gauge and erosion monitoring plots

The activity includes: (1) on-site development of soil and water conservation (SWC) system including installation of rain gauges and erosion monitoring plots; and (2) collection of data (hydro meteorological and soil erosion data) from runoff plots. The project assisted the three farmer cooperators in maintaining the demonstration farms and were taught on some methods of maintaining the contour canals.

The project has established soil collecting trough and rain collectors in two AF sites to monitor the rainfall in the area. The soil collecting troughs were installed along the contour canals that collected soils eroded from the AF site.

Photo 13. Installing the soil and water control structures

The soil and water conservation structures were established as part of the agroforestry technology. The objectives of the AF plots were to: (1) improve the productivity of the farm land. A number of agricultural crops, pineapple, lemon grass, custard apple, lemon tree) and trees (such as *Dalbergia cochinchinensis, Hopea odorata* and *Dipterocarpus alatus*) were planted in the farmers' lands; and (2) generate empirical data on soil erosion from agricultural land. The second objective is to generate empirical data on soil erosion from farm land in the upper part of the watershed. The empirical data were presented in the consultation meeting with relevant stakeholders and also in the land use modeling.

The project distributed more than 80 fruit trees such as sour-sop, jackfruit, mango, Moringa and tree seeding such as *Dalbergia cochinchinensis* to the farmer cooperators and local people in Krang Deivay commune.

During the mid-term evaluation, the external evaluator suggested to improve the existing soil and water control structures. It was recommended that the experience in Taipei on soil erosion control structures has to be adopted including the installation in the control plot. Following the recommendation, the project introduced additional development in the agroforestry sites. The contour canals were improved and additional planting of fruit trees and cash crops were conducted. Concrete barrier was established to exclude runoffs from adjoining areas. Two soil erosion control plots measuring 9 m x 24 m was established. The farmers planted *Albizia lebbeck*, Santol (*Sandoricum koetjape*) tree, lemon grass, pineapple, mango banana, cassava, papaya in their farms. Under the new design, there was a more effective and accurate collection of soil data compared from the previous set-up.

Photo 14. Concrete canal for soil data collection

Photo 15. Development of the new site for Agroforestry

Activity 2.2.3.2 Collection of data (hydro meteorological and soil data) from runoff plots

The four farmer cooperators started collecting rainwater and eroded soils from AF plots (two involved with soil collection and two involved with rainfall collection). A form was prepared for the recording of the rainwater and the soils eroded. The recording was made by the two cooperating farmers. The collection of rainwater and soil erosion is mainly part of the demonstration to the famers on the relationship of rainfall and rainfall. The collection of the rainfall was conducted during the last two years of the project which is in time of the establishment of the Agroforestry plots due to the delay in the hiring of the Consultant.

Photo 16. Installation of the rainwater collector

The original concept of establishing the soil collection plots and monitoring the collected soils is to raise the awareness to the farmers the amount of soils that will be lost and deposited to the waterways without the appropriate soil and water control structures (Photo 17). The staff and the local expert involved the farmers in the collection of soil data. The staff also explained to the farmers on the reason of the trend of the erosion following the Participatory Action Research (PAR) approach. The Project Staff was assisted by a Consultant on Hydrological Monitoring in the collection and analysis of the hydrological and soil erosion data, and by an agroforestry expert on the coaching and mentoring of farmers. The soil data was collected every month by local farmers who practice in the project. After analyzing the collected soils, the following information were noted:

- There are 14.82 ton/ha of soil erosion in Phnom Srouch District and 32.97 ton/ha of soil erosion in Oral District.
- There are 1,485.4mm of rainfall in Phnom Srouch District and 1,177.04mm of rainfall in Oral District.

Photo 17. ***Soil data collection***

The agroforestry sites were visited together with the monitoring consultant to check the collected rainfall, soil erosion and the soil and water control structures (Photo 18). In Krang Deivay commune, the hydrology monitoring consultant observed good soil management practices although some of the practices need some improvement. The monitoring consultant discussed with the farmers in setting up soil collection troughs. The collected data showed a direct relationship of soil erosion and rainfall. However, at one point, he noted high erosion even with low rainfall. This was due to the harvesting activities of the farmers at that time.

The consultant noted the benefit of participatory action research in providing understanding to the farmers. He emphasized the value of constant discussion with the farmers to enhance their understanding on the impacts of farming to the watershed and the benefits of soil water control measures. The farmer's involvement in field research provided benefits in increasing the understanding of the hydrological processes and the impacts of human activities to the watershed.

The consultant noted the challenges of involving the farmers in the research due to their limited knowledge in data collection and need to be guided closely. He noted the need to repeatedly explain to the farmers the value of research.

Photo 18. Collection of soil erosion from the farms

Activity 2.2.3.3 Conduct Hydrological Impact Assessment of the Land Use Plan

This is a newly added activity. Following the recommendation of the Mid Term Evaluation Team, the Project conducted an *ex ante* impact evaluation of the proposed land use/land allocation of Prek Thnot watershed. A Hydrological Modeler was commissioned to conduct an impact analysis of the proposed land use on the erosion and surface runoff, and groundwater discharge of Prek Thnot watershed using SWAT model. The model also analyzes the hydrology of the watershed due to climate change.

SWAT model was used in quantifying the impacts of the land allocation (erosion and surface runoff). A hydrological modeler was commissioned to conduct the study. The study conducted an assessment of the current (baseline) and the future scenarios (using the land allocation scenario and status quo but under a changing climate). The result of the model for the baseline scenario showed that the current surface runoff is estimated at 94.14 mm. If the watershed will be developed using the proposed land allocation, the surface runoff will reduce to 83.79 mm. It means that more rainwater will infiltrate to the ground. Under a climate change scenario, there is an expected increase of surface runoff (i.e. from 94.14 to 101.95). In terms of erosion, the current erosion is estimated to be 41.19 tons/ha and will increase to 45.08 tons/ha under the climate change scenario. Under the proposed land allocation, the soil erosion will reduce to 15.23 tons/ha. The current groundwater discharge of Prek Thnot watershed is estimated at 333.14 mm. This will increase to only 349.30 mm under a climate change scenario. But using the proposed land allocation, the ground water discharge is expected to increase to 362 mm. Based on the ex-ante assessment, this should compel the manages of Prek Thnot Watershed to adopt the proposed land allocation plan.

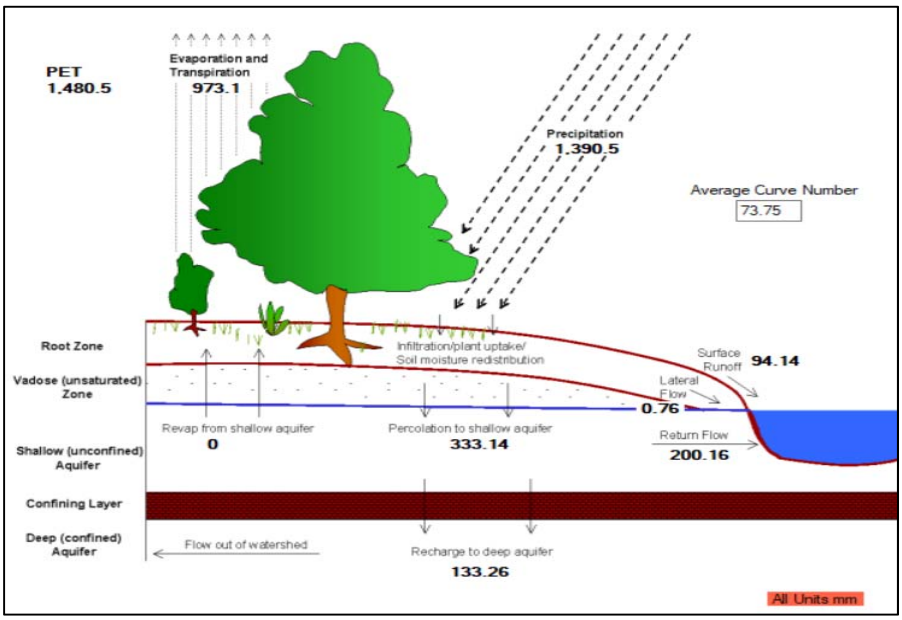


Figure 3. Baseline water balance model for Prek Thnot Watershed

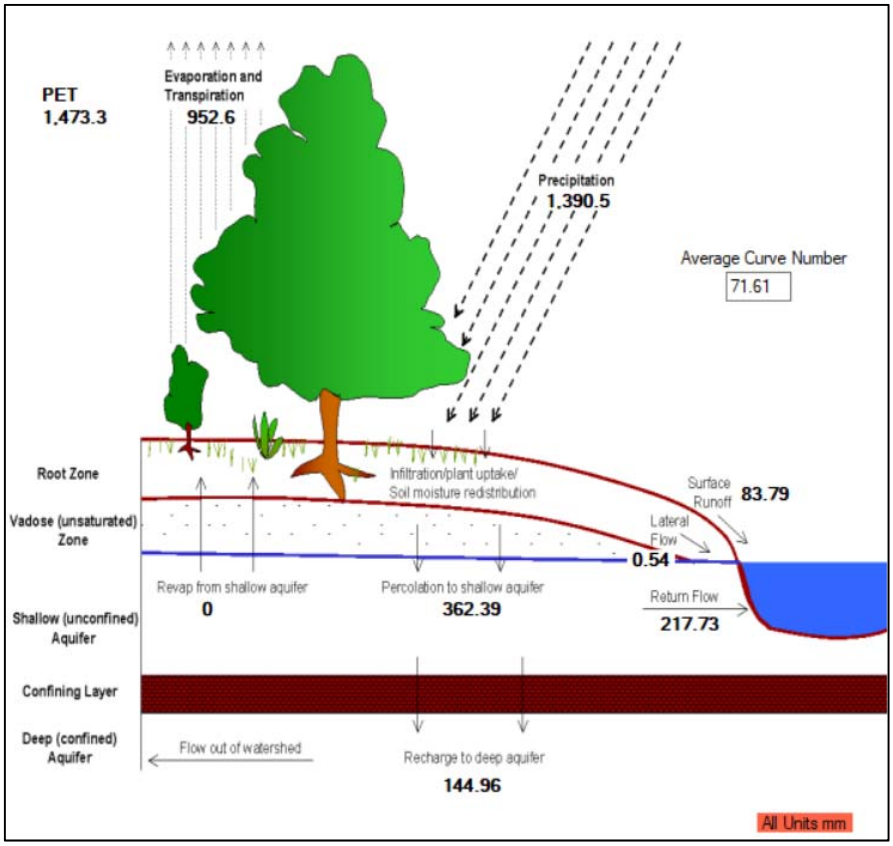


Figure 4. Hydrology of Prek Thnot watershed as a resulted from Land Use Change (Land Allocation)

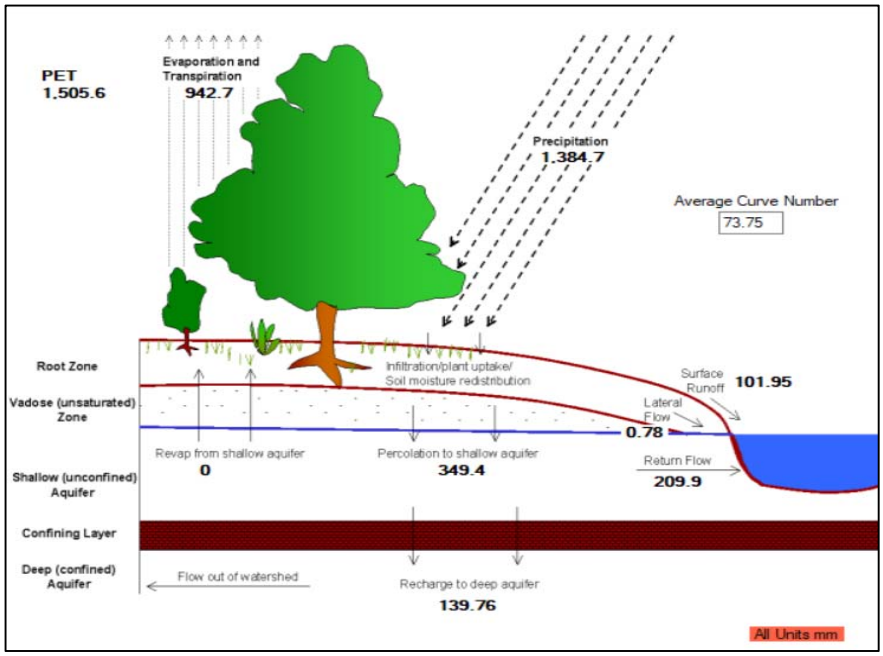


Figure 5. Hydrological characteristics of Prek Thnot catchment as affected by climate change

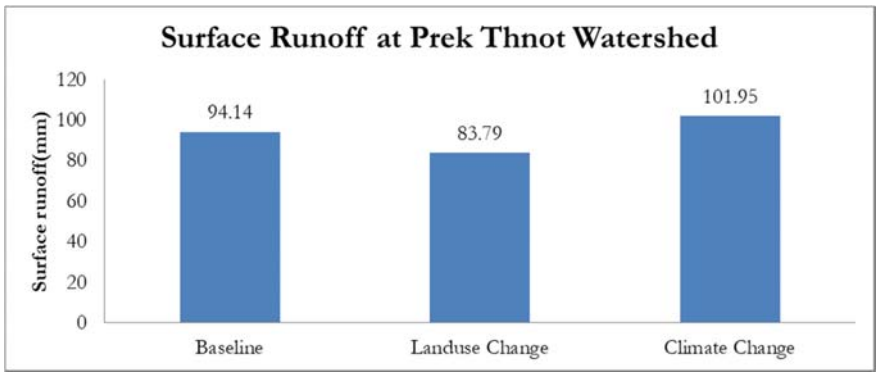


Figure 6. Surface Runoff (mm/year) under three scenarios development (a) Baseline, (b) Land use change and (c) Climate Change

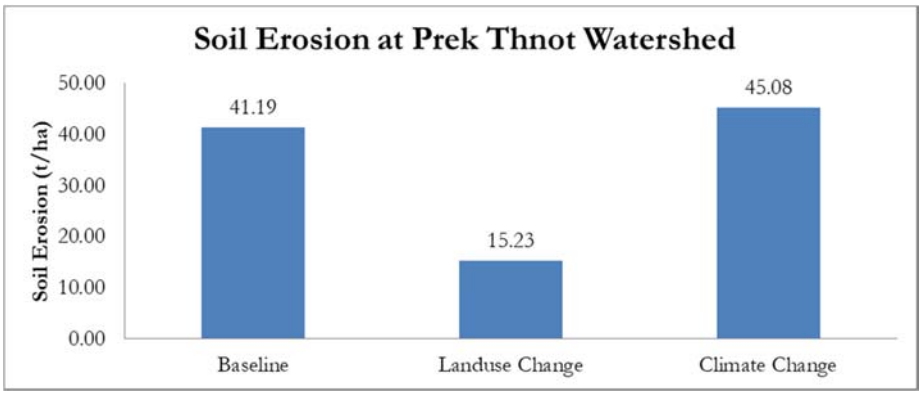


Figure 7. Soil Erosion (tons/Ha./Year) under three scenarios development (a) Baseline, (b) Land use change and (c) Climate Change

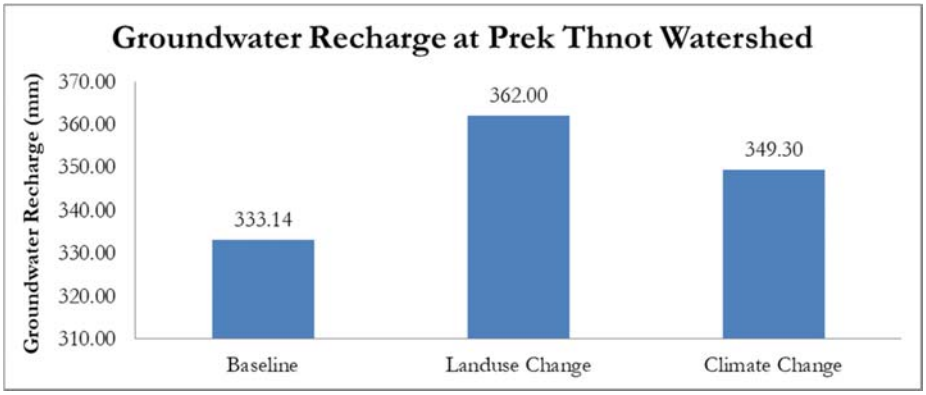


Figure 8. Groundwater Recharge (mm/year) under three scenarios development (a) Baseline, (b) Land use change and (c) Climate Change

The Consultant also provided a brief training on the capability of SWAT to the Project staff to have a better appreciation and capability of the model. The introductory training was conducted on September 27-28, 2018 at the IRD in Phnom Penh (Photo 8). The pre-training assessment noted that the Project Staff have no working knowledge on SWAT. The participants mentioned in the evaluation that the training was useful to their work on water resource management and planning. The Project Staff also expressed satisfaction with the training and the instruction materials.

Activity 2.2.4 Assessment of the Socioeconomic Benefits of Agroforestry.

The assessment of economic benefits of agroforestry is a new activity following the comments and suggestions of the MT Evaluator. A local consultant was commissioned to assess the benefits of agroforestry on the income of the farmer beneficiaries. The consultant conducted interview with the farmer collaborators of the project, collecting the changes of their production and income (Photo 19). The result of the study highlights the economic benefits of agroforestry to the farmer beneficiaries. The soil

and water conservation measures also noted the significant nutrient-rich soils that were tapped in the SWC structures that were constructed in the farmers' farm.

Photo 19. Interview with local farmer about the benefit before and after project conducted

The consultant reported that the interviewed families gained financial benefits from the sale of their products. The families got benefits from their participation of the project through training and practicing mixed crop planting in their farmlot. The Agroforestry intervention has increased the availability of fruits, vegetables and other firewood for domestic use. The agroforestry intervention also reduced household expenses for food. One farmer whose farm is located on a sloping ground near the river reported that they planted cover crop or tree species to protect erosion from the slope and no longer use pesticides based on what he learned from the project on its impacts to the aquatic biota. The farmer also kept the grasses along riverbanks that serve as buffer. The consultant concluded that the AF model is appropriate for small-scale farmers and provide both food security and nutrition to the family members. The famer beneficiaries generated surplus of agri-products that were sold to middlemen or collectors in the village. The 10-year benefit cost analysis made by the consultant indicated a positive net present value (NPV) indicating sustainability beyond the project lifetime.

Output 2.3 Forest-based community enterprise supported

There were 4 activities to achieve this Output:

- Activity 2.3.1 Preparatory activities for PRA and forest-based enterprise development
- Activity 2.3.2 Conduct PRA of Potential Enterprises
- Activity 2.3.3 Writeshop planning for the forest-based enterprise in a community forest
- Activity 2.3.4 Implementation and monitoring of the forest-based enterprise in a community forest

All the target activities were completed 100%.

Activity 2.3.1 Preparatory activities for PRA and forest-based enterprise development

A consulting firm was hired to conduct the Participatory Resource Appraisal (PRA) and design a community-based enterprise. The PRA and consultation with the community has led to the selection of Silvopasture as a pilot enterprise that will be implemented in the field. The cattle intend to benefit the CF members. However, due to the small budget, the cattle started with only few families. The number of beneficiaries are expected to increase after the cattle will give birth and the calves will be distributed to other members of the CF. A forage area (1-2 hectares) were developed to support the cattle. The forage production was used as input in the land use allocation model. The preparatory activities include scoping and consultation of potential enterprises identified by the community.

Activity 2.3.2 Conduct Participatory Resource Appraisal (PRA) of Potential Enterprises

An assisting firm with experience on enterprise development was commissioned to conduct an enterprise study and provide technical assistance in developing the enterprise plan. The Participatory Resource Appraisal (PRA) was focused on validating with the community of their interest on the community enterprise that was identified by the CFMC members. The validation was a formal way of ensuring commitment from the community members, and in explaining to them the purpose of the grant, the benefit sharing, auditing procedure and the committees to create. The session was aimed at determining alternative community enterprise options.

The PRA described the resources present and the market condition of the planned enterprises in the CF. During the initial consultation for livelihoods, the community initially identified raising of edible ants as livelihoods. However, during the consultation and PRA, the community has changed their preference, after considering the seasonality of the product. Several enterprises were considered during the consultation:

1. Date palm plantation
2. Backyard cattle raising and planting of King Grass (*Pennisetum purpureum*)
3. Seedless Lemons plantation
4. Sweet Bamboo plantation
5. Mango orchard
6. Cassava plantait9on
7. Lemon grass plantation
8. Leucaena plantation
9. Cashew Nut plantation

Based on the assessment of the resources and the preference of the community members, they finally selected backyard cattle raising.

Activity 2.3.3 Writeshop planning for the forest-based enterprise in a community forest

After consulting with the community, the community decided to raise cattle and a Community-based Enterprise Development Plan was developed for the identified enterprise (i.e. silvopasture). The project purchased five heads of cattle and they were dispersed to one Farmer who is a member of the community forestry as initial beneficiary. While the intention of the cattle is for selling, the community intends to keep it as a starter breeder. Cattles are commonly serve as “banks” to the villagers (i.e. they invest on cattle and will sell some in times of hardships).

To ensure that the enterprise will succeed, the Project commissioned a Firm to assist the community in managing their enterprise. The Consulting Firm provided a training on “Cattle raising for Family Economy” with the community members. There were 25 peoples who participated in the training (3 females). The training was conducted for three days at Damrey Chaktlork CF. The participants also learned about how to prepare forage for the cow. The participants also underwent field practicum.

The cattle was selected by the community during the consultation. A simple plan was developed with the community to serve as guide to the community in running their community enterprise. The formulation of the enterprise development plan was done through community participation to ensure sense of ownership among the community. The plan involves the raising of forage in the backyard and at the same time lending 5 heads of cattle to the 1st beneficiary. The arrangement is that after the cattle give birth, the cattle will be passed to other farmers until more farmers will have the opportunity to raise cattle. The cattle has produced few calves due to the problem of foraging It is expected that the number of heads of cattle will increase next year.

Activity 2.3.4 Implementation and monitoring of the forest-based enterprise in a community forest

A firm was hired to provide entrepreneurship training and coaching to the cattle dispersal beneficiaries. The firm developed training lessons and handouts for 5-day training curriculum. There were 3 key results from the implementation of the capacity building to CF committee and members: (1) Entrepreneurship training, (2) Cattle Raising training and (3) Start-up grants to selected successful entrepreneurs in Damrey Chakthlork CF area. For business plan development, 21 individual participants (out of 22) have completed basic training for 5 days' session. In the training, specific skills on the business plan preparation with simple calculation of profit and loss were introduced and applied to their own business. The Cattle Raising for Family Economy course was organized on August 2-4, 2017 with one-day field trip to visit cattle farm in Kampong Speu province. The course aimed at helping the farmers/entrepreneurs enhance their business and current livelihoods. The assistance of the firm resulted to the significant improvement of skill and practices of the beneficiaries. Other CF committee and members in Damrey Chakthlork CF also received training on cattle raising from the firm to upgrade cattle raising skills and practices (Photo 20 and Photo 21).

A seed grant of $5,000 was used in the purchase of initial stock of cattle which was dispersed to one CF. The enterprise development plan was developed to minimize the risk of failing.

The consulting firm assisted the recipients on the internal rules in the transfer of cattle to the next beneficiary. The implementation and monitoring of the enterprises was implemented in Year 2. This activity was delayed until the completion of the Enterprise Development Plan. The monitoring of the community enterprises was focused on the progress of the cattle dispersed by the project including the status of forage production. There are now more than 6 heads of cattle that were dispersed to the farmer beneficiary. So far, the herds are still in the hand of one farmer and these are set to be rotated to the next farmer.

Photo 20. Training of the farmers on forage preparation

Photo 21. ***Development of the forage production area***

Objective 3. To share the experiences and lesson learned from the project to stakeholders.

This objective, there is only one output to complete: Project success and experiences disseminated and policy briefs for the sustainable development of the Prek Thnot Watershed drafted (Output 3.1).

Output 3.1 Project success and experiences disseminated and policy briefs for the sustainable development of the Prek Thnot Watershed drafted

There were 2 activities that were conducted in order to achieve this output:

- Activity 3.1.1 Develop knowledge and communications products including best practices, case studies and policy recommendations based on the experiences from the pilots, and circulate the products at various levels, through the delivery of a Communications and Advocacy Strategy.
- Activity 3.1.2 Organize and launch national campaigns to raise awareness among the public

Activity 3.1.1 Develop knowledge and communications products including best practices, case studies and policy recommendations based on the experiences from the pilots, and circulate the products at various levels, through the delivery of a Communications and Advocacy Strategy

This activity has 2 sub-activities:

- Activity 3.1.1.1 Compilation of the proceedings and lessons learned/Writeshop on Experience and Lessons Learned of the Project. This involve documentation and compilation of Proceedings/Lessons Learned about the project

- Activity 3.1.1.2 Drafting of a policy brief and Feature Stories on sustainable development of the Prek Thnot Watershed. This involves the production of Policy Brief and 2 Feature Stories Developed.

Activity 3.1.1.1 Compilation of the proceedings and lessons learned/Writeshop on Experience and Lessons Learned of the Project

The project documented the highlights of the project operation including the lessons learned and progress of project activities. The project distributed preliminary information to the Stakeholders of Prek Thnot during the consultative workshop (Activity 1.1.6). A Fact Sheet was also developed and posted in the IRD website (Photo 22). The posters and Information and Education Campaign (IEC) materials were developed,used and distributed during the consultative and completion workshops.

Photo 22. The Fact Sheet and information of the project posted at the IRD website

A document on the lessons learned from the project was produced and distributed to the participants of the completion workshop (please see section 5.2 for the list of Lesson Learned).

Activity 3.1.1.2 Drafting of a policy brief and Feature Stories on sustainable development of the Prek Thnot Watershed

This activity is an added activity following the recommendation during the first PSC meeting. The project has completed drafting the English version of the 2 feature stories. A native English speaker was hired to edit the feature stories and the feature stories were translated to Khmer. There were two feature stories that were drafted: (1) Innovative farming techniques minimize soil erosion in Prek Thnot watershed; and (2) Collaborative landscape planning is possible in Prek Thnot watershed. The first feature story highlights the outcome of the agroforestry/soil and water conservation to the farmer (http://www.irdfa.org/innovative-farming-techniques-minimize-soil-erosion-in-prek-thnot-watersed.html), while the second feature story highlights the experience of the project in conducting participatory planning in the landscape/watershed (http://www.irdfa.org/collaborative-landscape-planning-is-possible-in-prek-thnot-watersed.html). The second feature story was also posted in the APFNet website: http://www.apfnet.cn/en/show-list-1349.html. The feature stories were printed in hard copies and disseminated during the forum and PSC meeting.

4.2 Project Impacts

Few impacts can be cited brought about by the project which include improvement on the capacity of the FA related to the management of the watershed and in implementing agroforestry and soil and water conservation measures.

4.2.1 Impacts of the Project on the Capacity of the Local FA on Integrated Watershed Management and Planning

The concept of land use planning at the landscape level is gradually being internalized. The project has pioneered in the watershed-level planning in Cambodia and has been recognized by Development Partners. Recently, two projects were implemented in Prek Thnot watershed by UNDP and APFNet (under the GMS Project). These two projects are timely and an opportunity for the plan to be utilized. The UNDP-funded project "**Collaborative Management for Watershed and Ecosystem Service Protection and Rehabilitation in the Cardamom Mountains, Upper Prek Thnot River Basin (CoWES)"** was implemented by MAFF.

During the project inception workshop of COWES, the Proejct Coordinator was invited to present the Prek Thnot watershed project (Photo 23). The COWES project sought collaboration with the APFNet's project. The land allocation plan could provide a guide to the COWES project of UNDP in locating development activities in Prek Thnot watershed.

Photo 23. The project coordinator presenting the Prek Thnot watershed project during the inception workshop of COWES Project

4.2.2 Impacts of the Project on Public Awareness of the Issues of Prek Thnot Watershed

Among the watersheds in Cambodia, Prek Thnot was considered to have the highest risk of being impaired. The project has contributed in raising the awareness of the watershed in Cambodia, particularly Prek Thnot watershed, through series of consultative workshops. Posters, factsheets and information materials were distributed to various stakeholders.

4.2.3 Impacts on the Skills of the Farmers on Agroforestry and Soil and Water Conservation

The project has contributed to the improvement of the skills of farmers on agroforestry and soil and water conservation. Adjacent to the demonstration plot in Oral District, a farmer, tried to adopt the soil and water conservation technology. He started constructing a small terrace of his rolling farm and planted some lettuce. The SWC he practiced still need some improving since he just observed and listened to the farmers. He was not assisted by the Project Staff on the proper method of establishing the SWC structure. The soil and water conservation approach draw interest from the community. The Chief of Community Protected Area (CPA) in Chambok expressed his interest in land/soil management for sustainable agriculture which he learned from the workshop. He felt that the knowledge he learned will be applicable in his site.

4.2.4 Economic Impacts of the Project to the Communities

The agroforestry interventions have brought some socioeconomic changes that include reduction of the erosion and runoffs, the improvement of the land productivity, and the income of the households.

Box 1. Economic impacts of Agroforestry

All the farmer-cooperators reported that the agroforestry techniques and soil and water conservation measures provide benefits to them. After only a few rainfall occurrences, farmers observed how contour canals and fascines trapped considerable amount of nutrient-rich topsoil, which otherwise would have been lost. Throughout project implementation, the farmers worked with the project team to analyze soil erosion from their fields. The results indicate that soil erosion ranges from 0.278 to 0.763 metric tons per hectare per month. The results also indicate a significant increase in economic benefits compared to baseline.

Owing to the small size of their landholdings, most of the plants the farmer-cooperators harvested, such as water melon, morning glory, jackfruit, mango, banana, soursop and longan, were used for household consumption rather than selling. They sold only a small percentage of their surplus, mainly to intermediaries or collectors in the village. They also shared some of their produce with neighbors and relatives. Growing fruits and vegetables on their farm has significantly reduced their food expenses. The initial benefits of the project are expected to catch the interest of other farmers.

Agroforestry has also contributed to the economic welfare of the project beneficiaries. Mr. Kim Chap, for instance, said that his income has improved since adopting the new techniques and he has been able to save enough money to build a new house. Mr. Kim Mao, another farmer cooperator, was able to buy a new motorcycle, which he uses for local transport. Mr. Siv Lim was able to buy a new phone and can now easily contact his daughter who is in primary school in Krang Deivay. And Mr. Men Vorn said that because of his increased income, he can support the education of his daughter who is at primary school.

4.2.5 Impacts of the Project in Participatory Landscape Planning and Governance

The Integrated Watershed Management Plan (IWMP) will be very useful to the provincial government of Kampong Speu and the decision makers in deciding development activities in the watershed. For instance, the decision makers can prioritize which areas will be given priority for rice, for industrial timber, conservation, etc.

4.2.6 Anticipated Economic and Environmental Impacts of the Watershed Management Plan

An ex-ante impact assessment on the future hydrological condition of the Prek Thnot watershed shows a significant reduction of erosion and runoff. Using a business as usual scenario (which is equal to the baseline scenario), the estimated soil erosion is 41.19 ton/ha/year whereas under the proposed land allocation, the erosion is lower (15.23 ton/ha/year). The climate change will aggravate the erosion of soils in the watershed. Aside from SWAT, the allocation and proposed management of Prek Thnot is expected to provide not only the direct benefits to local communities but also a range of environmental benefits like storing more carbon and controlling soil erosion. The expected tangible benefits of the proposed land use include optimizing rice production, increased availability of sawtimber, fuelwood, increased production of forage and biomass. It is also anticipated that the watershed will increase its capability to recharge the aquifers by increasing infiltration, reduction of soil erosion, minimized chemical loads to the watershed.

4.3 Sustainability

The IWMP will help in guiding local authorities in managing their areas within the watershed. The land allocation may serve as a framework to the Communes in developing their Commune Land Use Plans. The lessons learned and the experience of the exercise can be incorporated in updating the CLUPs of the communes in Prek Thnot watershed.

The project developed a policy brief that provided policy directions to support the implementation of the IWMP and improve the management of Prek Thnot watershed. It is important therefore that after the completion of the project, a second phase will follow that focus on the site developments. The implementation of the plan will include:

1. Updating the CLUPs of the communes;
2. Implementing the sustainable forest and land management in Prek Thnot watershed; and
3. Piloting the implementation of the sustainable land management (e.g. agroforestry, contour plowing/farming, restoration) in the ELCs, Community Forestry, Community Protected Areas and in riparian areas.

COWES, funded by UNDP has already started implementing agroforestry and restoration of the headwaters in Prek Thnot waterehd, while the APFNet-funded GMS project also started a pilot restoration and agroforestry projects in Damrey Chakthlork CF. Incidentally, these are what has been embodied in the IWMP. What is lacking is integrating the IWMP to the activities of NGOs and local authorities in their development activities. After the IWMP was distributed to the stakeholders, it is anticipated that the organizations will integrate the interventions in their programs.

5. CONCLUSION, LESSONS LEARNED AND RECOMMENDATIONS

5.1 Conclusion

Watershed planning is high time considering that the growing need of managing the watershed. The local authorities also have not yet developed a subnational plan. The watershed plan can be an opportunity to organize the land management of local authorities. The project has completed all its target after the APFNet granted the project extension.

5.2 Lessons learned and recommendations

Lessons Learned from the Planning Process. Landscape land use planning is relatively new in Cambodia, piloted by some Development Partners, like GIZ. The approach used by the project is still novel despite its popularity in other developing economies (e.g. Philippines, Africa, Western and European economies, and Indonesia). Landscape level land use planning is very timely considering that there is no landscape plan that serves as a framework and guide the communes in developing their respective Commune Land Use Plans (CLUPs). The experience demonstrated GIS technology as an indispensable tool in land use planning.

Watershed planning needs good information of its land use and land cover. But base maps are mostly wanting in Prek Thnot watershed. There are few updated maps on cultivations, industrial developments, crops and local development plans. The local knowledge had been very useful in supplementing the limited information through participatory mapping.

Lessons Learned from Consultation. The consultation workshops were able to draw ideas from participants on the criteria of suitable land uses, getting additional spatial information from the actors, strategies of implementing the IWMP and drawing support to the proposed developments.

The experience revealed that most local governments have no development plans. The absence of a development plans in their respective areas resulted to sporadic developments. The experience of the consultation workshop demonstrated the feasibility of bringing together different stakeholders who have diverse or conflicting interests in the watershed. For example, the conservation NGOs would like to set aside more lands for protection forests which usually in conflict with the ELCs who wish to develop more lands for industrial tree plantations and industrial crops, and with the government who promote the sustainable harvesting of timber as a way of increasing government revenues. The agriculture sector for instance would like to increase more rice producing areas, but this may be in conflict with the sustainability of fishery resources, since the increased level of pesticides and fertilizers from the rice farming

may affect the productivity of the aquatic biota. The conflict was minimized by agreeing the land suitability criteria instead of directly delineating over the map the land allocations.

The implementation of landscape level planning was complicated by the fact that there are several key actors who often have conflicting interests in the watershed. Despite the conflicting interests, the project was able to come up with a consensus of land use criteria. Through proper facilitation, ideas were systematically collected from different actors and avoided confrontation. The provincial governor played a very important role in bringing together the stakeholders in a forum. It is important that a respected officer orchestrate the discussion and sharing of ideas. The experience showed the importance of the skills of the Project Staff in facilitating the discussion. The experience of the project noted a positive and cordial exchange of views among the participants of the workshop and came up with a consensus in developing the watershed.

It was observed that some organizations sent different representatives from previous consultations. As a result, some participants in the consultation who have not attended the previous consultation raised some questions that were already resolved. It is therefore important that the proceedings of each consultation should be shared to respective organizations to appraise their respective offices of the proceedings.

Lessons Learned from Carrying Capacity Consideration in Watershed Planning. The experience of the project demonstrated the usefulness of optimization models in meeting the different management objectives of the watershed. One of the important determinants of allocation models are the coefficients used. Considering that the landscape changes every year, there is a need to periodically review and update the land allocation. The optimal land allocation may also change as the coefficients used in the model changes. The constant development in the watershed and economic changes may render the current land allocation assumptions archaic a few years hence (for example, the income form SFM may increase due to improved income caused by improved value chain of forest products, or the income from rice per hectare has increased due to improved export market, etc.).

Lessons Learned from Participatory Action Research: Farmer Involvement and Farm Trial. The use of Participatory Action Research (PAR) showed potential in implementing community-based research and technology testing particularly in imparting technology to the farmers. In technology adoption, there is a need for a constant interaction with the farmers to enhance their understanding on the impacts of farming to the watershed and the benefits of soil water control measures. The farmers' involvement provided benefits in increasing the understanding of the hydrological processes and the impacts of human activities to the watershed.

While the project has succeeded in establishing the plots in the farmer's farm trials, the uptake and dissemination of the technology to neighbouring farmers remain limited.

It is important that a Community Organizer will be deployed in areas that are target for technology dissemination. The value of living with the community as part of PAR practices is still not fully internalized by the field staff. The need to fully immerse and stay in the village to gain full understanding and trust with the community should be considered if similar projects will be implemented in the future.

Lessons Learned from Forest-based Community Enterprises. The experience of the project showed that the community could hardly identify forest-based livelihood due to the degraded condition of the community forest. Despite managing a large tract of land, the income from sustainable forest management remains limited. This is aggravated by the limited entrepreneurial capability of the community.

The farmers do not have the culture of raising grasses as forage for their livestock since they practice releasing their cattle or buffalo into the forest for months or fed with rice straw that they stocked after rice harvest. This has resulted in the difficulty of persuading small-scale farmers to plant grass as forage.

The presence of naturally-growing forests have some influence on the attitude of some farmers towards planting trees. A Deputy Chief of a commune from Samroang Torng district said that the people rely on the remaining forests along the river for fuel wood and small construction material. Thus, because wood products can be sourced readily from the natural forests, the community do not see the need to invest on tree planting.

Lessons Learned Soil and Water Conservation Measures. The experience showed the benefits of soil and water conservation measures in arresting soil erosion. Topsoil were collected in the contour canals and prevented from being washed downstream. The economic benefits of soil conservation are not yet felt by the farmers since it will take time for the farm to improve its fertility. The farmers remain less enthusiastic in adopting the soil and water conservation technology due to poverty, and farming only serve as their alternate income, as some farmers depend from seasonal employment.

Soil and water conservation measures provide off-site benefits (i.e. by preventing siltation of rivers). The farmers may be encouraged to adopt soil and water conservation measures if they will be given incentives in adopting soil and water conservation measures. The sustainable land management practices of the farmers are expected to l benefit lowland communities particularly the fishery resources.

It was difficult to introduce technology to the poor farmers. They tend to spend more time on activities that could provide them immediate income. Introducing soil and water conservation technology is difficult since most farm owners who are actually till their farms have limited means of investing on soil and water conservation measures whereas land owners who have the capability to invest on soil and water conservation measures are not actual land tillers.

Lessons Learned from Hydrology Monitoring and Impact Assessment.

The result of the study shows the benefits of properly allocating lands in the landscape. There are various decision support tools that can be used in land allocation as well as in impact assessment. The value of organizing multidisciplinary team is important in developing a watershed management plan as it will involve different disciplines.

Some of the decision support tools (SWAT and GP/LP) are widely used in other countries, but are relatively new in Cambodia. There are only very few professionals who are aware of the tools. Capacity building is therefore very important component of the watershed development. There is a need to simplify the technical concepts of watershed management planning.

Lessons Learned from Capacity Building. Capacity building is indispensable in the development of the watershed. The agroforestry and soil and water conservation technologies need to be disseminated to the farmers. Poverty constrained the farmers from adopting the introduced technologies. Technology adoption may take time depending on how impoverished the farmer is. There is a need to constantly educate the farmers on the negative impacts of farming on soil productivity, and to constantly motivate the farmers to adopt the soil and water conservation measures. The community organizers and farmer instructors (for famer-to-farmer learning) will play a very important role in effective dissemination and adoption of technologies.

Since the project is now in the final phase, the recommendations are intended for scaling up and for any related projects:

Increasing the Capacity of Resource Managers:

- Formulate a capacity development roadmap for watershed development
- Increase the capacity of resource managers on the use of the modeling tools, soil and water conservation technologies, sustainable forest management and forest-based community enterprises; and
- Strategize the dissemination of technologies (e.g. soil and water conservation; eco-farming; multistory planting; etc.) through participatory action research

Improving the Management of Prek Thnot Watershed

- Decision support tools (Linear and Goal Programming) and should be used in the management of Prek Thnot watershed;

- Continuously update the models (LP/GP and SWAT) to validate the relevance of the model and the assumptions *vis-a-vis* the changing situation in the watersheds.
- The changing pattern of the landscape should be monitored based on state of the art technologies (e.g. land satellite images or aerial drone photos);
- Continuously monitor the hydrology of the watershed using the SWAT model to validate the impacts of the land use or land use changes) on the hydrology of the watersheds;
- Explore other decision support tools (e.g. Ex-ACT of FAO for carbon sequestration) and other useful hydrological models in assessing the watershed;
- Monitor the tracking indicators set in the IWMP;
- Promote sustainable land management (agroforestry and soil and water conservation measures) to the farmers, especially those who are cultivating along the riparian areas and sloping areas;
- Promote sustainable Forest Management to Community Forestry sites;
- Assist the CFMCs in developing their Forest-based Community enterprises based on the approved CFMP.

Increasing Technology Adoption

- Invest on Community Organizers (COs) and Farmer-to-Farmer Learning. Projects should deploy community organizers who will promote the adoption of soil and water conservation measures. The COs will facilitate farmer-to-famer learning on sustainable agriculture.
- Adopt the Participatory Action Research (PAR) in technology promotion.

Policy and Program Development

- Strengthen the development planning framework. The IWMP should be integrated in the development of the landscape and the CLUP at the commune including the District and provincial development plans. The IWMP will also be integrated in other landscape plans, like the management plan of the protected areas.
- Develop a Code of Conduct in Prek Thnot Watershed. The desired level and impacts of the IWMP are hardly achieved without the support and commitments of the key actors and stakeholders of the watershed, especially the Provincial Governor's office and the land developers. The Watershed Code of Conduct will secure commitment of support from the different actors. While the IWMP is a not legally binding, key actors can be invited to a roundtable discussion and secure their commitments and support. These will then be reflected in the Code of Conduct.
- Integrate the IWMP to the Provincial Development Plan and the Green Growth Strategies. The IWMP should be integrated to the provincial development plan. Workshops will be conducted to integrate the IWMP to the Provincial Development Plans. The spatial development plans will be cascaded down to

the District and to the Communes. In addition, the IWMP must also be integrated to the Green Growth strategies to support the sustainable development of the province.

Annexes

A. Project Implementation status
B. Financial statement (including balance sheet, source and use of Funds statement, and expenditure details) by both category and activity
C. Project audit report
D. Project outputs, such as technical reports, key project documents (workshops, field visits, technical visits, trainings etc.), publications, brochures, webpages, etc.
E. 2-3 Feature stories from the project for promotion
F. Photos, media clips and other materials used/available for project outreach

Annex A Implementation status (scheduled versus actual)

Project Objective/Outputs/ Activities (in line with PD/AWPs)	Indicators (in line with PD/AWPs)	Baseline of activities	Progress made (%completion of activities and degree of output/objective achievement)		Appraisal time	Actual time
			%	Remarks		
0.0 Start-up Activities						
Activity 0.1 Establish project steering committee and project management team;	PSC and Project Mgt. Team Organized		100%	Completed		Oct 2015
Activity 0.2 Recruit international and national consultants;	13 Consultants/ Specialists Hired		100%	13 Consultants hired	1st year – 2nd year	1st year – 2nd year
Activity 0.3 Orientation of New Staff	1 Orientation Conducted		100%	Conducted 1 orientation	Jul 2015	Dec 2015
Activity 0.4 Project Inception Workshop	1 Inception Workshop Conducted		100%	Conducted 1 Inception Workshop Conducted	Sep 2015	Sep 2015
Activity 0.5 Preparation of Annual Work Plan	3 Annual Work Plan Developed		100%	Prepared and submitted 3 AWPs	Jul 2015; June 2016; Apr 2018	Jul 2015; Oct 2017; Jun 2018
Objective 1. To build capacity and raise awareness on the concept of integrated watershed/landscape planning for central and local stakeholders through scientific assessments, analysis and participatory watershed/landscape planning processes.						
Output 1.1 Improved knowledge and awareness of the target stakeholders on the concept of integrated Watershed Planning and the development issues in Prek Thnot	Awareness rising were conducted to the stakeholders of the watersheds		100%	5 awareness raising workshops has been conducted	From first year to third year of implementat	From first year to third year of implementatio n

Project Objective/Outputs/ Activities (in line with PD/AWPs)	Indicators (in line with PD/AWPs)	Baseline of activities	Progress made (%completion of activities and degree of output/objective achievement)		Appraisal time	Actual time
			%	Remarks		
Watershed that affect the forest-dependent communities	were				ion	
Activity 1.1.1 Assess the training needs and provide training to FA Staff and Farmers						
Activity 1.1.1 Assess the training needs and provide training to FA Staff and Farmers	Training Design Prepared and Training conducted		100%	Training design prepared and training conducted	Ápr 2016; May 2016; May 2016	Ápr 2016; July 2017; May 2016
Activity 1.1.1.1.1 Provide training to FA Staff on GIS/Participatory Mapping	1 GIS Training Conducted		100%	1 GIS Training Conducted	Ápr 2016	Ápr 2016
Activity 1.1.1.1.2 Provide training to FA Staff on Hydrology	1 Hydrology Training Conducted		100%	2 Hydrology training conducted. The second hydrology training was on the use of SWAT modeling tool	May 2016	July 2017
Activity 1.1.1.1.3 Provide training to FA Staff on Agroforestry and Watershed	1 AF Training Conducted		100%	1 AF Training Conducted	May 2016	May 2016
Activity 1.1.1.1.4 Provide training to FA Staff on Participatory Action Research	1 PAR Training Conducted to FA Staff		100%	1 PAR Training Conducted to FA Staff	July 2017	Oct 2017
Activity 1.1.1.2 Training of 10 farmers on agroforestry technologies, hydrologic monitoring and participatory action research	Training Design Prepared (1) Agroforestry; (2) Hydrology Monitoring		100%	2 Training design prepared	Jul 2017	Oct 2017

Project Objective/Outputs/ Activities (in line with PD/AWPs)	Indicators (in line with PD/AWPs)	Baseline of activities	Progress made (%completion of activities and degree of output/objective achievement)		Appraisal time	Actual time
			%	Remarks		
	and Participatory Action Research					
Activity 1.1.1.2.1 Training of 10 farmers on agroforestry technologies	1 AF Training Conducted to Farmers		200%	2 AF Training Conducted to Farmers	May 2016	May 2016
Activity 1.1.1.2.2 Training of 10 farmers on hydrologic monitoring and participatory action research	1 Hydrology Monitoring and PAR Training Conducted to Farmers		200%	2 Hydrology Monitoring and PAR Training Conducted to Farmers	July 2017	Oct 2017
Activity 1.1.2 Map out critical areas in Prek Thnot watershed that provide substantial irrigation water to agricultural land and identify priority areas for forest-dependent communities and habitat for wildlife.						
Activity 1.1.2.1 Collection of base maps and pertinent data of the watersheds	10 Maps Compiled and Organized		150%	15 Maps Compiled and Organized	Nov 2015	Oct 2015
Activity 1.1.3 Preparation for consultative meeting activities	1 Communities Coordinated and Ready for the Meeting		200%	2 Communities Coordinated and Ready for the Meeting	Jan 2016	Jan 2016
Activity 1.1.4 Conduct consultative meetings on integrated watershed planning with participations of stakeholders to map out the critical priority areas	1 Consultation Meeting Conducted		100%	1 Consultation Meeting Conducted	Jan 2016	Apr 2016
Activity 1.1.5 Develop a land use plan for the						

Project Objective/Outputs/ Activities (in line with PD/AWPs)	Indicators (in line with PD/AWPs)	Baseline of activities	Progress made (%completion of activities and degree of output/objective achievement)		Appraisal time	Actual time
			%	Remarks		
Prek Thnot watershed and critical priority areas to engage the stakeholders in the mapping and assessment processes and wrap-up results to inform concerted support and leverage greater actions from the stakeholders.						
Activity 1.1.5.1 Spatial Land Allocation Mapping	1 Land Allocation Model Developed		100%	1 Land Allocation Model Developed	Jun 2017	Sep 2017
	Maps Prepared/ Finalized		100%	Maps Prepared/ Finalized	Feb 2018	Sep 2017
Activity 1.1.6 Conduct provincial stakeholders forum to present the results of the land allocation and draw action plan for the development of Prek Thnot Watershed Landscape;	1 Forum Conducted		100%	1 Forum Conducted	Aug 2017	Nov 2017
	2 Poster Designs Produced		100%	2 Poster Designs Produced		
	15 Posters Printed		100%	15 Posters Printed		
	1 Pamphlets Designed		100%	1 Pamphlets Designed		
Output 1.2 Watershed Characterization Report of Prek Thnot Watershed						
Activity 1.2.1 Preparation for Watershed Characterization Activity	Field Coordination and Arrangements Made		100%	Field Coordination and Arrangements Made	Jan 2016	Jun 2017
Activity 1.2.2 Conduct bio-physical, socioeconomic survey and risk assessments to the critical priority areas	1 Biophysical Characterization Survey Conducted		100%	1 Biophysical Characterization Survey Conducted	Mar 2016	Jun 2017

Project Objective/Outputs/ Activities (in line with PD/AWPs)	Indicators (in line with PD/AWPs)	Baseline of activities	Progress made (%completion of activities and degree of output/objective achievement)		Appraisal time	Actual time
			%	Remarks		
Objective 2. To improve the integrated management of Prek Thnot Watershed with participation of stake holders.						
Output 2.1 Integrated watershed landscape development plan for Prek Thnot Watershed developed						
Activity 2.1.1 Develop participatory landscape restoration and sustainable management strategies and action plans for the identified critical priority areas						
Activity 2.1.1.1 Develop landscape restoration and sustainable management strategies and action plans thru participatory method	4 District Consultation Planning Conducted		100%	4 District Consultation Planning Conducted	Dec 2017	22 March 2018 30 March 2018
	1 Landscape Restoration Plan Prepared		100%	1 Landscape Restoration Plan Prepared	Dec 2017	March 2018
	1 Landscape Restoration Plan Developed		100%	1 Landscape Restoration Plan Developed	Dec 2017	March 2018
Output 2.2 Demonstration sites on agroforestry system, contributing to soil and water conservation and livelihoods established						

Project Objective/Outputs/ Activities (in line with PD/AWPs)	**Indicators** (in line with PD/AWPs)	**Baseline of activities**	**Progress made (%completion of activities and degree of output/objective achievement)**		**Appraisal time**	**Actual time**
			%	Remarks		
Activity 2.2.1 Preparation activities for AF Site development - TOTAL	4 Sites Coordinated		100%	4 Sites Coordinated	Jun 2017	Jun 2017
Activity 2.2.2 Identification of two agroforestry sites and farmer cooperators - TOTAL	1 Site identified (with MOU)		200%	2 Site identified (with MOU)	Jun 2017	
Activity 2.2.3 Establish regular soil and hydrological monitoring systems and measures and based on regular monitoring and periodic assessment, analyze and communicate the results to stakeholders.						
Activity 2.2.3.1 On-site development of agroforestry system including installation of rain gauge and erosion monitoring plots - TOTAL	2 Sites Developed		200%	4 Sites Developed	Jun 2017	Aug 2017
	2 Farmers Participated in the Development		200%	4 Farmers Participated in the Development		
Activity 2.2.3.2 Collection of data (hydro meteorological and soil data) from runoff plots	2 AF Sites Maintained		200%	4 AF Sites Maintained	Jul 2015	May 2019
	2 AF Site Monitoring and Monitoring Report Submitted by Consultant		200%	4 AF Site Monitoring and Monitoring Report Submitted by Consultant	Jul 2015	Mar 2019
	2 Hydrological Data collected		100%	2 Hydrological Data collected	Jul 2015	Mar 2019

Project Objective/Outputs/ Activities (in line with PD/AWPs)	Indicators (in line with PD/AWPs)	Baseline of activities	Progress made (%completion of activities and degree of output/objective achievement)		Appraisal time	Actual time
			%	Remarks		
Activity 2.2.3.3 Conduct Hydrological Impact Assessment of the Land Use Plan	1 Hydrological Model Developed		100%	1 Hydrological Model Developed		Nov 2018
Output 2.3 Forest-based community enterprise supported						
Activity 2.3.1 Preparatory activities for PRA and forest-based enterprise development	Coordination Activities Conducted		100%	Coordination Activities Conducted	Feb 2016	Jun 2016
Activity 2.3.2 Conduct PRA of Potential Enterprises	1 PRA conducted and report submitted		100%	1 PRA conducted and report submitted	Feb 2016	Jun 2016
Activity 2.3.3 Writeshop planning for the forest-based enterprise in a community forest	1 Writeshop Planning Organized		100%	1 Writeshop Planning Organized	Mar 2016	Jun 2016
	1 Forest-based enterprise developed		100%	1 Forest-based enterprise developed	Mar 2016	Jun 2016
Activity 2.3.4 Implementation and monitoring of the forest-based enterprise in a community forest	1 Community Enterprise Implemented		100%	1 Community Enterprise Implemented	Mar 2016	Jul 2017
	Monitoring Conducted on Community Enterprise and Monitoring Report Including Recommendation Submitted		100%	Monitoring Conducted on Community Enterprise and Monitoring Report Including Recommendation Submitted	Mar 2019	Mar 2019

Project Objective/Outputs/ Activities (in line with PD/AWPs)	Indicators (in line with PD/AWPs)	Baseline of activities	Progress made (%completion of activities and degree of output/objective achievement)		Appraisal time	Actual time
			%	Remarks		
	Seed Fund Granted to Community		100%	Seed Fund Granted to Community	Mar 2016	Jul 2017
Objective 3. To share the experiences and lesson learned from the project to stakeholders.						
Output 3.1 Project success and experiences disseminated and policy briefs for the sustainable development of the Prek Thnot Watershed drafted						
Activity 3.1.1 Develop knowledge and communications products including best practices, case studies and policy recommendations based on the experiences from the pilots, and circulate the products at various levels, through the delivery of a Communications and Advocacy Strategy.						
Activity 3.1.1.1 Compilation of the proceedings and lessons learned/Writeshop on Experience and Lessons Learned of the Project	Documentation Compiled; Proceedings/Lessons Learned Report Submitted		100%	1 Documentation Compiled; Proceedings/Lessons Learned Report Submitted	June 2015	May 2019

Project Objective/Outputs/ Activities (in line with PD/AWPs)	Indicators (in line with PD/AWPs)	Baseline of activities	Progress made (%completion of activities and degree of output/objective achievement)		Appraisal time	Actual time
			%	Remarks		
Activity 3.1.1.2 Drafting of a policy brief and Feature Stories on sustainable development of the Prek Thnot Watershed	1 Draft Policy Brief Completed		100%	1 Draft Policy Brief Completed	May 2019	May 2019
	2 Feature Stories Developed/submitted		100%	2 Feature Stories Developed/submitted	Dec2018	May 2019
Activity 3.1.2 Organize and launch national campaigns to raise awareness among the public						
Activity 3.1.2.1 Awareness Raising about the soil and water conservation for farmers in the target areas	Awareness Raising Conducted		100%	Awareness Raising Conducted	Dec2018	Jan 2019
Activity 3.1.2.2 Awareness Raising about the soil and water conservation for students on agroforestry development	Awareness Raising Conducted		100%	Awareness Raising Conducted	Dec2018	Jan 2019
Activity 3.1.2.3 End of the Project National Workshop	1 National workshop/campaign conducted (anticipated)		100%	1 National workshop/campaign conducted (anticipated)	Jan 2019	June2019
	1 Video Clip Production Produced		100%	1 Video Clip Production Produced	Jan 2019	May 2019
	Posters Designed		100%	Posters Designed		May 2019
	Reproduction/Printing - Poster		100%	Reproduction/Printing - Poster	Jan 2019	May 2019

Project Objective/Outputs/ Activities (in line with PD/AWPs)	Indicators (in line with PD/AWPs)	Baseline of activities	Progress made (%completion of activities and degree of output/objective achievement)		Appraisal time	Actual time
			%	Remarks		
	Pamphlets/Handouts Printed/Produced		100%	Pamphlets/Handouts Printed/Produced	Jan 2019	May 2019
	1 Book Published on the Lessons Learned of the Project		100%	1 Book Published on the Lessons Learned of the Project	Jan 2019	May 2019
7.0 Monitoring and Evaluation						
7.1 Project Monitoring						
7.1.1 Internal Monitoring	As needed		N/A	60 monitoring	The beginning up to now	The beginning up to now
7.1.2 External monitoring Conducted:	2 monitoring		50%	1 monitoring. The final monitoring will be done on November	First Second	-April2018 -Still conduct in November 2019
7.2 PSC Meetings	3 meetings		67%	2 meetings The Project requested to forego the 3rd PSC meeting since it is already very close to the Completion Workshop. The requ3est was approved by APFNet.		-July2015 -Aug2018
7.3 Audit	3 audits		100%	3 Audits		Feb2017 Sep2018 July2019

Project Objective/Outputs/ Activities (in line with PD/AWPs)	**Indicators** (in line with PD/AWPs)	**Baseline of activities**	**Progress made (%completion of activities and degree of output/objective achievement)**		**Appraisal time**	**Actual time**
			%	Remarks		
7.4 Coordination Meetings	As needed		N/A	40 meetings	The beginning up to now	The beginning up to now

Annex E. Policy Brief for Prek Thnot Watershed

Carrying Capacity Consideration in Integrated Watershed Management Approach to Landscape Planning: The Prek Thnot Watershed Project Experience
Policy Brief

Key Messages

- ❑ Prek Thnot is one of the important watersheds providing ecological and environmental services that are in dire need of attention.
- ❑ The consultative process and optimization approach used by the APFNet–funded "Landscape Approach to Sustainable Management of Forests in Prek Thnot Watershed" demonstrate the possibility of developing a watershed management plan that consider the carrying capacity of the watershed and optimized benefits
- ❑ Policies are needed to improve the management of Prek Thnot watershed:
  - Creation of a governing body for Prek Thnot watershed under the office of the Provincial Governor.
  - Build the watershed management capability of the actors in Prek Thnot watershed.
  - Promote the investments in Prek Thnot watershed.
  - Promote the adoption of soil and water conservation among the land developers in Prek Thnot watershed.
  - Increase buy-ins of the IWMP among the policy makers to integrate the plan in various development programs.
  - Institutionalize the monitoring of the tracking indicators of the IWMP
  - Promote a Code of Conduct in Prek Thnot Watershed

1.0 The Watershed Approach to Sustainable Landscape Management

Prek Thnot watershed provide important ecological and economic services. Prek Thnot watershed covers the provinces of Kampong Speu and Kandal and Phnom Penh, the Capital City of Cambodia covering a total land area 666,764 hectares, 77.8% of which are in Kampong Speu province. The surface runoffs of the watershed drain towards Phnom Penh (Figure 1).

The watershed provides a practical way of defining a landscape since it is easier to visualize the impacts of land management such as surface runoff, soil erosion, pesticide deposition, groundwater condition etc. The watershed approach involves consideration of landscape scale (The Nature Conservancy, 2014).

A watershed is an area of land (a catchment) that catches precipitation and drains towards a common outlet[12] (such as rivers, streams, lakes or sea). It is sometimes interchangeably used with river basin. Milwaukee Riverkeeper made a distinction between the two: while both drains towards a common outlet, the river basin are described to areas where the water drains to a larger river. The term watershed is used to describe an area, smaller than the basin that drains to a smaller stream, lake or wetland. Many smaller watersheds may therefore found within a river basin.

Prek Thnot watershed is a mosaic of various ecosystems and pockets of forest that mostly become geographically isolated with sporadic agricultural developments. The loss of the forest cover of Prek Thnot are caused by unabated cutting of the forest areas, fuelwood and charcoal production, expansion of farms and agro-industries, settlements and diminished its protective role.

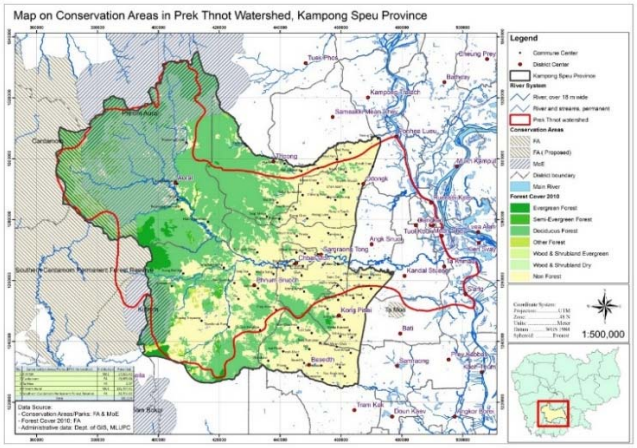


Figure 9. Map of Prek Thnot watershed

2.0 The APFNet-Funded "Landscape Approach to Sustainable Management of Forests in Prek Thnot Watershed"

The project supported the implementation of an integrated watershed management plan (IWMP) that strike a balance between the economic development and biophysical limits (carrying capacity) of Prek Thnot watershed. The project showcased a participatory process of bringing together different stakeholders to come up with a common vision amidst the diversity and conflicting interests. The plan aims to meet the economic development needs of the province without impairing the hydrological function of the watershed. The planning has the following features:

1. Considered the carrying capacity of the watershed
2. Use optimization and trade-off in land use planning
3. Adopted a consultation process

The development of the watershed planning followed the following phases: development of the optimum land allocation model, developing the land allocation map, and developing the watershed management plan based on land allocation (Figure 1). An optimal land allocation of the area amidst the competing goals was determined using mathematical models (Linear and Goal Programming). Consultations were conducted with the stakeholders as part of the legitimization

[12] Milwaukee Riverkeeper. https://www.milwaukeeriverkeeper.org/whats-a-river-basin-whats-a-watershed/

process of the Integrated Watershed Management Plan (IWMP). The consultation is the cornerstone of legitimization of the IWMP.

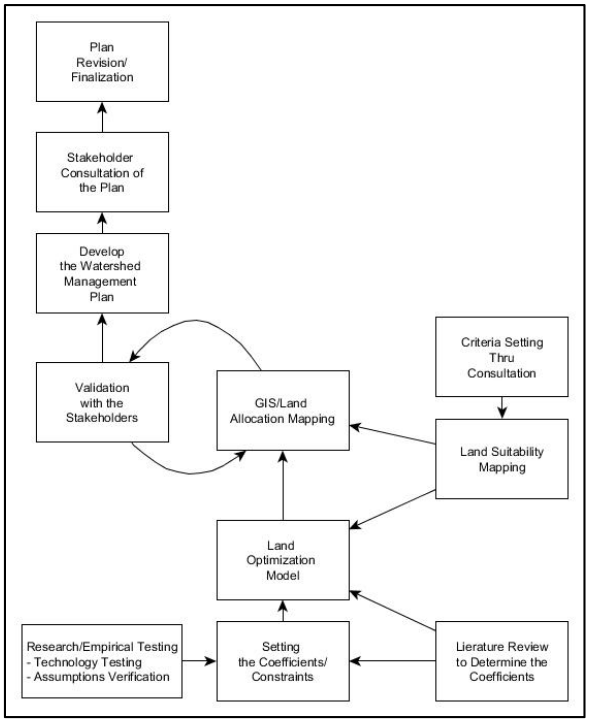


Figure 10. The process of developing and legitimization of the IWMP

Landscape Approach to Land Use Planning. Landscape approach to planning are becoming more relevant as an effective means for addressing natural resource degradation and enhancing ecosystem services and biodiversity benefits. The catchment is more practical in defining the boundaries of a landscape since the interactions among the different land uses can easily be identified and measured (e.g. erosion and hydrologic function as indicator of forest health upstream). An essential element of a landscape approach is the involvement of all relevant stakeholders in decision making through a transparent and accountable multi-stakeholder process (CARE Nederland and Wetlands International. 2017). Collaborative landscape planning and management can be challenging as it requires support from different stakeholders. Landscape plans must therefore meet the basic criteria of being technically, socially and political acceptable. Technical acceptability includes satisfying carrying capacity, economic viability and land suitability criteria.

Some of the main characteristics of the landscape approach[13]:

- It places communities at the center, especially the poor and vulnerable, whose lives and livelihoods are increasingly under threat from disasters, the impacts of degraded ecosystems and climate change.
- It takes into account all actors - either contributing to or impacted by disaster risk - and factors that influence this risk, such as the status of ecosystems, land and water use, infrastructure, and climate change.
- It examines the entire landscape in which risks originate and manifest themselves and the many interactions and interdependencies between ecosystems and human socioeconomic systems. This approach focuses on the catchment upstream of the target community as the defining geographic area of interest, but also recognizes the area downstream to avoid unintended consequences of planned interventions.
- It includes an analysis of the hydrology (groundwater and surface water) and how this affects the community.
- It considers the ecosystem provisioning services (which directly support livelihoods) and on sustaining their regulating and supporting services.
- • It manages trade-offs: There are often trade-offs between building resilient ecosystems, implementing broader development interventions and enhancing livelihoods. The landscape approach actively seeks synergies between different types of interventions and preventing unintended negative (downstream) impacts.
- It demands for a long-term perspective to ensure lasting impact. In most cases, a programmatic approach involving more than one project is needed to make a difference in a landscape

[13] *Source: CARE Nederland and Wetlands International. 2017. A Landscape Approach in 7 steps for Disaster Risk Reduction. July 2017. https://reliefweb.int/sites/reliefweb.int/files/resources/CARE_WI-A-Landscape-Approach-for-DRR-in-7-Steps-1.pdf*

2.1 **Carrying Capacity in Land Use Planning, Optimization and Trade-offs.** In this project, the heart of the land use allocation is a mathematical model (Linear and Goal Programming models). Although this approach has been widely used in many resource management problems, this is relatively new in Cambodia. The models seek to minimize the deviations between the desired goals and the actual results (Ostadhashemi et al., 2014) while Linear Programming (LP) technique is relevant in optimization of resource allocation and achieving efficiency. The plan give consideration on the carrying capacity of the watershed. The absorptive capacity of the ecosystem (or its resistance to change and resilience) in response to anthropogenic impacts (UNEP, undated) is the main consideration to achieving sustainable water resource management. The different societal goal considers maximization of benefits and minimization of the externalities or negative impacts. The goals of the land allocation of the plan include:

- Maximize Income from Land Use (Honey, Mushroom, Sugar, Rattan, Resin, Rice, Fruits, Ecotourism, etc.) (Products and Employment Income)
- Maximize Rice Production
- Maximize Food Production
- Maximize Supply of Construction/High Value Timbers
- Maximize Supply of Fuelwood
- Maximize Total Biomass Produced
- Maximize Forage Production
- Maximize Water Infiltration
- Minimize Soil Erosion
- Minimize Total Pesticide Loads
- Minimize Social Cost for Protection Management

In ecology, carrying capacity means the maximum number of individuals that can be supported in an environment without experiencing decreases in the ability to support future generations within the area (Kormondy 1996). The concept is used to point out that there is a limit to the growth of biological populations, and an analogy can be made for human societies (Schroll et al., 2012). The Watershed Management Plan provide a land use allocation that maximize the societal benefits without breaching the carrying capacity of the watershed.

The allocation was reflected spatially in the watershed using GIS. The siting was guided by the land suitability maps based on the criteria set by the stakeholders in the consultation workshop. There are eight land use options considered in the model:

9. Rice Production
10. Production of Industrial Crops (cassava, sugar cane, potato, etc.)
11. Industrial Tree Plantations (Eucalyptus, *Acacia mangium* and other Fast Growing Species)
12. Fruit Orchards
13. High Value Crops (Cabbage, Tomato, Spices, etc.)
14. Conservation/Protection Forest
15. Sustainable Forest Management (CF, Partnership Forestry, Low Impact Logging)
16. Forage Production

3.4 **Consultation Process (Social and Political Acceptability).** The project conducted series of information dissemination workshops with different stakeholders to explain landscape planning concepts and land use siting criteria (Figure 3). The consultations also set the watershed vision and expected watershed services, which are key elements in shaping the watershed management plan. and the proposed measures to mitigate incompatible land uses.


Figure 11. Consultative workshop conducted

3.5 **Testing the Soil and Water Conservation technology.** Farming has been identified as a major causes of erosion in Prek Thnot watershed. The pilot agroforestry demonstrated the effectiveness of a soil and water control techniques in controlling soil erosion.

3.0 The Integrated Watershed Management Planning/Landscape Planning

An integrated approach to natural resource management at the watershed level ideally address the complex system dynamics in watersheds, and achieve global environmental benefits (Mena *et al.*, 2017). The coordinated efforts of different stakeholders, production of food and energy, mitigation of droughts, proper land use, reducing sedimentation, and improving the environment of the watersheds can be achieved. Integrated Watershed Management (IWM) implies the judicious use of natural resources such as land, water, biodiversity and overall ecosystem to obtain optimum production with minimum disturbance to the environment (Mena et al., 2017). The aim of IWM is to achieve sustainable development of the communities living in the watershed and improve productivity of available natural resources. This requires balancing their economic needs and expectations with environmental concerns. IWM approach, which takes into account the social, political, economic, and institutional factors, is generally recognized as the most practical and efficient way to improve water quality and other environmental components (Mena *et al.*, 2017) and the integrated watershed management plan of Prek Thnot watershed revolves around these principles.

4.0 Outcomes of the Project

4.1 **Land Allocation.** The consultation and land allocation model based on the criteria set by the participants resulted to optimum land allocation of Prek Thnot watershed [Table 1].

Table 11. Result of the land allocation in Prek Thnot watershed

Land Use	Total ('000 Ha)
Rice Production	103.900
Industrial Crops	92.500
Industrial Tree Plantations	12.900
Fruit Orchard	135.000
High Value Crops	7.400
Conservation/ Protection	104.500
Sustainable Forest Management (SFM)	50.300
Forage Production	-
Total	506.500

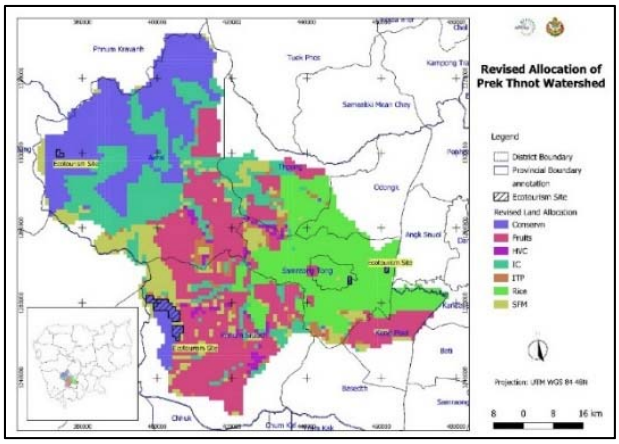


Figure 12. Optimum land allocation **of Prek Thnot watershed**
Conservn = Conservation Area; Fruits = Fruit Orchard; HVC = High Value Crops; IC = Industrial Crops; ITP = Industrial Tree Plantations; Rice = Rice Production; SFM = Sustainable Forest Management

4.2 **Soil and water Conservation**. The demonstration plot shows the effectiveness of controlling soil erosion. After its establishment and after only a few rain occurrences, considerable amount of nutrient-rich topsoil was trapped in the soil and water control structures. The estimated soil erosion is 14.82 ton/ha/year in Krang Dei Vay Commune and 32.97 ton/ha/year in Tropeang Chor Commune.

Table 12. Result of soil analysis

Soil Properties	**Location**		Difference	Remarks
	Outside contour canal	**In the contour canal**		
Soil acidity (pH)	7.65	6.57	-1.08	lower
Organic matter %	2.92	313.00	310.08	significantly higher
Carbon %	1.70	1.82	0.12	increased
Nitrogen %	0.16	0.17	0.01	increased
Phosphorus %	0.044	0.045	0.001	improved
Potassium %	0.96	1.44	0.48	improved

Figure 13. Farmer collecting topsoil deposited in the contour canal

4.3 **Expected Impacts.** The total potential income of the watershed is estimated to reach to US$585 million if the area will be totally developed. The rate of return (IRR) is estimated at 10.2% with NPV of US$ 74 million.

It is anticipated that the watershed will increase its capability to recharge the aquifers through increased infiltration, reduction of soil erosion and minimized chemical loads to the watershed (Table 3). The hydrological model (SWAT) indicates that the proposed land allocation will improve the hydrology of Prek Thnot watershed in terms of reducing surface runoff and soil erosion due to improved land use (Figure 6).

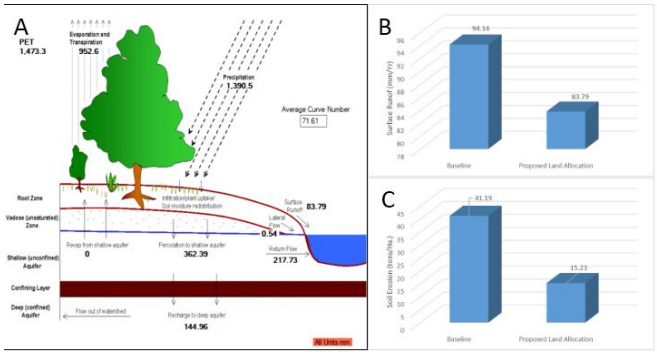


Figure 14. Hydrology of Prek Thnot watershed. (A) Estimated baseline water balance; (B) Comparative current and project surface runoff; and (C) Comparative current and projected soil erosion.

Table 13. Expected outcome (**Societal Goals) after the land allocation**

Maximize Income from Land Use (Honey, Mushroom, Sugar, Rattan, Resin, Rice, Fruits, Ecotourism, etc.) (Products and Employment Income)	585,419	US$ '000 /year
Maximize Rice Production (Limited by Site Carrying Capacity)	417,200	t/year
Maximize Meat Production - Bushmeat and Livestock (Limited by Site Carrying Capacity)	794,106	kg /year
Maximize Supply of Construction/High Value Timbers	157,281	m^3/year
Maximize Supply of Fuelwood	129,061	m^3/year
Maximize Biomass Production	7.7	Million ton
Maximize Forage Production	273,935	t/year
Maximize Water Infiltration for 3-Hr. Rain (m^3/ha.)	4,906	Million m^3
Minimize Soil Erosion	16,810	t/year
Minimize Total Chemical Loads	26,106	t/year
Minimize Social Cost for Protection and Management	1,776	US$ '000 /year

5.0 Challenges of Integrated Watershed Management

The implementation of the IWM is expected to face the following challenges : (1) limited awareness of the stakeholders and the communities; (2) resistance of target farmers to technological changes that will be introduced due to poverty and education; (3) uncertainty of sustainable funding to support the development programs; (4) limited skills of the farmers and key actors especially in controlling soil erosion, organic farming and agroforestry; (5) and speculation that put constant pressure to the forest and causing land conversion; and (6) weak institutional support.

6.0 Policy Recommendations

6.1 **Watershed Governance: Creation of a governing body for Prek Thnot watershed.** The management of the watershed should be under a single governing body. It is proposed that the office of the Provincial Governor will undertake the coordinating role of various agencies in developing Prek Thnot watershed. The governing body will also coordinate the different stakeholders, agencies and ministries who are major stakeholders of the watershed like the Forestry Administration, the Ministry of Environment, the Department of Agriculture, the Fishery Administration, MLMUPC and MoWRAM and the development NGOs and CBOs who are working in the area.

6.2 **Capacity Building: Build the watershed management capability of the actors in Prek Thnot watershed.** There is a need to enhance the skills of the different line agencies managing the watershed due to limited availability of professional hydrologists who can conduct the monitoring of the hydrological functions of the watershed.

6.3 **Investment: Promote the investments in Prek Thnot watershed.** Encourage economic investments and restoration of Prek Thnot watershed. Currently there is very limited budget for restoration of Prek Thnot watershed. The communes should support the reforestation, conservation and agroforestry in Prek Thnot through their CIP/CDP.

6.4 **Sustainable Land Management: Promote the adoption of soil and water conservation among the developers in Prek Thnot watershed.** A soil and water conservation policy needs to be promoted to land developers, particularly the Economic Land Concessionaires so that they adhere to the sustainable land management in their land developments. The ELCs must comply the provisions in their EIAs and the proposed code of conduct in the watershed.

6.5 **Land Use and Development: Adopt the IWM as the framework in Commune Land Use Planning**. The IWM Plan will serve as a framework in formulating the CLUPs. The IWMP can coordinate the land use planning among the different communes.

6.6 **Policy Integration and Support of the IWM Plan: Increase buy-ins of the IWMP among the policy makers to integrate the plan in various development programs.** The provisions of the IWMP should be integrated to government programs and targets. The provincial government of Kampong Speu should lobby to the policy makers to support the implementation of the IWMP. Also, the plan should be integrated and harmonized to the five-year development plan of Kampong Speu. Workshops should be conducted to disseminate the IWMP to different stakeholders in Prek Thnot watershed.

6.7 **Monitoring: Institutionalize the monitoring of the tracking indicators of the IWMP.** Monitoring should be conducted in Prek Thnot watershed on the hydrological changes and the tracking indicators set in the IWMP. Satellite images or drone photos should be part of the monitoring modality. The office of the provincial governor should take the lead in consolidating and disseminating information to the public on status of Prek Thnot watershed.

6.8 **Institutionalization of the Code of Conduct in Prek Thnot Watershed.** A code of conduct should be developed for Prek Thnot watershed that will serve as a guide among the developments (including NGOs). The Code of Conduct will be implemented in tandem with the IWMP and may be part of the EIA compliance.

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Annex F. Guidelines for Monitoring Agroforestry Sites (Excertps from the Consultant's Report)

Monitoring of Agroforeostry Lots for Controlling Soil Erosion

The scoring system is developed to score each pilot plot whereof criteria are set out in a rank from 0 to 6, from least developed to fully developed in terms of land cover, density, integrated agroforestry techniques applied, effectiveness for preventing soil erosion, and so on. Total scores would be withdrawn with challenging/risk factors in which minus scores with the same rank from 0 to 6 are set against each factor such as prepared/designed plots, management, slope level, soil type, and rainfall. The final scores of each plot reflects that either technical or managerial improvement is further required.

Table 14. Scoring system for monitoring the integrated agroforestry practices.

No.	Influential factors/Criteria	Scoring rank (0-6: not done to fully developed)		
		Not done/Least developed (0-2)	**Rather developed (3-4)**	**Completed/Fully developed (5-6)**
1	A Frame technique	Not/little area applied	Applied at some sloping areas	Applied at all areas accurately
2	Agroforestry techniques: - Windbreak - Contour buffered strip - Silvopasture - Alley cropping	Not suitable for reducing soil erosion/degradation (soil erosion is not prevented)	Less suitable for reducing soil erosion/degradation (soil erosion is less prevented)	More suitable for reducing soil erosion/degradation (soil erosion is almost prevented)
3	Intercrops: (1) Homegarden (mixed vegetables); (2) Fruit trees mixed with vegetables; (3) Fruit crops mixed with trees; (4) Fruit trees mixed with grass for animals feeding; (5) grass grown on the dikes across rice field	Not suitable for reducing soil erosion/degradation (soil erosion is not prevented)	Less suitable for reducing soil erosion/degradation (soil erosion is less prevented)	More suitable for reducing soil erosion/degradation (soil erosion is almost prevented)
4	Crop density/land cover	10-20% shadow	30-50% shadow	50-100% shadow
5	Cycle of cultivation	A few months	A half year	Yearlong
6	Applied deep-rooted crops: ex. Bamboo species	Not at all	Some	A lot
7	Soil nutrient test at Pre-cultivation (at soil lab)	Not at all	Collect some soil samples	Collect soil samples with technical accuracy

No.	Influential factors/Criteria	Scoring rank (0-6: not done to fully developed)		
		Not done/Least developed (0-2)	**Rather developed (3-4)**	**Completed/Fully developed (5-6)**
8	Is soil sample collected & analysed yearly/every two years?	Not at all	Just some years	Yearly conducted
9	Is organic matters applied on sandy soil/degraded soil?	Not at all	Applied on some areas	Applied on the whole land
10	How is soil erosion measured/reduced yearly?	Not reduced at all/soil is still heavily eroded	Soil erosion is decreased gradually	Soil erosion is reduced extremely
11	Is plot well designed/prepared?	Not designed at all	Just planned & planted crops	technically designed with analyses
12	Is plot well equipped with facilities? Ex. Irrigation, labour force	Rain-fed crops	Have a pond/lake for temporary uses	Irrigation system available all time, well-prepared drainages
13	Is plot well managed?	Poor management	Good management	Better management
14	Did the plot return economic benefit? Or did such techniques generate profit?	Not at all	Just Some	More profitable
15	Are these techniques socially and economically acceptable?	No.	Yes, somewhat acceptable	Yes, absolutely practical
	Total scores	**0-30**	**45-60**	**70-90**

Not done/Least developed: the plot is less practical; many tremendous obstacles may undermine the ongoing development of the project. Many key interventions are further required.
Rather developed: the plot is just practical; some obstacles may limit the ongoing development of the project, something is required to improve.
Completed/Fully developed: the plot is more practical; a few obstacles may just need to be justified maintaining the ongoing development of the project.

Table 15. Challenging/risk factors restricting the development of integrated

agroforestry techniques.

No.	Risk factors/Criteria	Scoring rank (from -1 to -6)		
		Less limited (-1 to -2)	**Moderately limited (-3 to -4)**	**Strongly limited (-5 to -6)**
1	Slope	< 7%	7-20%	>20 %
2	Soil Type	Alluvial Lithosols Alumisols Brown Alluvial Soils Brown hydromorphics Cultural hydromorphics Grey hydromorphics Lacustrine Alluvial Soils Planosols Regurs	Basic Lithosols Coastal Complex Latosols Plinthite podzols Plinthitic hydromorphics	Acid Lithosols Red-yellow podzols
3	Rainfall	< 1700mm	1700 to 2100mm	>3100mm
4	Soil erosion vulnerability	None to slightly	Moderately vulnerable	Highly Vulnerable

Table 16. Scoring of demonstration plots.

No.	Influential factors/Criteria	Scoring rank (0-6)		
		Demo plot 1	**Demo plot 2**	**Demo plot 3**
1	A Frame technique	4	0	5
2	Agroforestry techniques: - Windbreak - Contour buffered strip - Silvopasture - Alley cropping	3	4	5
3	Intercrops: (1) Homegarden (mixed vegetables); (2) Fruit trees mixed with vegetables; (3) Fruit crops mixed with trees; (4) Fruit trees mixed with grass for animals feeding; (5) grass grown on the dikes across rice field	3	4	5
4	Crop density/land cover	2	3	4
5	Cycle of cultivation	2	3	4
6	Applied deep-rooted crops: ex. Bamboo species	2	3	4
7	Soil nutrient test at Pre-cultivation (at soil	0	0	0

No.	Influential factors/Criteria	Scoring rank (0-6)		
		Demo plot 1	**Demo plot 2**	**Demo plot 3**
	lab)			
8	Is soil sample collected & analysed yearly/every two years?	0	0	0
9	Is organic matters applied on sandy soil/degraded soil?	0	1	3
10	How is soil erosion measured/reduced yearly?	2	4	5
11	Is plot well designed/prepared?	4	4	5
12	Is plot well equipped with facilities? Ex. Irrigation, labour force	1	3	4
13	Is plot well managed?	2	4	6
14	Did the plot return economic benefit? Or did such techniques generate more profit?	0	3	4
15	Are these techniques socially and economically acceptable?	1	3	5
	Total scores	**26**	**39**	**59**
	Risk factors/Criteria	**Less limited (-1 to -2)**	**Moderately limited (-3 to -4)**	**Strongly limited (-5 to -6)**
1	Slope	-2	-2	-6
2	Soil Type	-1	-1	-6
3	Rainfall	-1	-1	-4
4	Soil erosion vulnerability	-3	-3	-5
	Total minus scores	**-7**	**-7**	**-21**
	Remaining score	**19**	**32**	**38**

Interpretation:

- If the remaining scores is less than 25, it means the plot is not practical; the ongoing development on the pilot plot is necessarily re-examined and redesigned. Both technical and managerial aspects are required for new development on the regular basis.
- If the remaining scores is between 25 and 35, it means the plot is some obvious practical; either technical or managerial aspect is necessarily re-examined, making sure that the ongoing development on the pilot plot is on the right track.
- If the remaining scores is more than 35, it means the plot is more practical, and the demo can be scale up because of its fruitful success; however, best practices resulted from either technical or managerial aspect should be maintained.