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Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

PROJECT DOCUMENT

Reconstruction and sustainable management of degraded forest based on the combination of inter-planting nitrogen fixation rare tree species and thinning

AMONG

Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

AND

Experimental Center of Tropical Forestry, Chinese Academy of

Forestry

AND

Institute of Forest and Wildlife Research and Development,
Forestry Administration of Cambodia

[01–01–2019 to 31–12–2021]

Basic Information

Project title(ID)	Reconstruction and sustainable management of degraded forest based on the combination of inter-planting nitrogen fixation rare tree species and thinning
Supervisory agency	
Executing agency	Experimental Center of Tropical Forestry, Chinese Academy of Forestry
Implementation agency(ies)	Institute of Forest and Wildlife Research and Development, Forestry Administration of Cambodia
Project Director: (Cai Daoxiong, Director of Experimental Center of Tropical Forestry) Tel.: 0771-8526118 Email: rlzxcdx@163.com Fax: 0771-8526320	
Target area(s) (project locations and context) (project sites maps should be attached as Annex if any) Location: Bos Thom village, Khna Por commune, Soth Nikum, Siem Reap province, Cambodia The main forest types are a mix of evergreen and deciduous forest. This community forest was established in 1997 and now has been protected by the farmers but the forest has been left to naturally regenerate. The growth rate of this forest is slow and some important species have been lost. Some parts are degraded with only a few trees left.	
Project implementation duration: [01/2019 to 12/2021, 36 months]	
Total budget(USD)	503, 000
APFNet grant(USD)	378, 000
Counterpart contribution (USD)	125, 000 (in-kind)

Project description (Please brief problems/issues to be addressed, goal(s) and objectives, expected outputs/outcomes and key activities, beneficiaries and main stakeholders, methodology and approaches)

Due to years of conversing forest to reclaim land and excessive deforestation, Cambodia is now facing low quality of forest resources and recessing forest. Using degraded forests in Siem Reap as pilots, this project was to increase the level of forest resource restoration and the ability of forest sustainable management in Cambodia through the establishment of demonstration forests and technical training.

The objectives include: 1) To transform degraded forests, improving the growth and quality of the forest stand and enhancing ecological services including carbon sequestration, catchment and soil protection, biodiversity conservation by enhancing forest restoration and sustainable forest management; 2) To develop environment-friendly alternative livelihood and community, improving the livelihood of the forest dependent poor people; 3) To share information and knowledge of best practices on forest restoration and rehabilitation.

In the demonstration sites, it is expected to establish 60 hectares of demonstration forests, increase economic and ecological benefits of forests, compile technical manuals, train Cambodian technical personnel and local people, and hold International seminars. Key activities such as forest status inventory, demonstration forests establishment, small scale infrastructures construction, and information and knowledge sharing will be conducted. With the target group of forest dependent communities, the potential beneficiaries and main stakeholders include the forestry managers/technical personnel, forest companies and farmers, Chinese Academy of Forestry, and Cambodian Forestry Administration. Through inter-planting selected target local tree species with nitrogen-fixing tree species, thinning the non-target tree species, and enhancing the livelihoods of the rural people, the goals of the project will be achieved. As active participating in project activities, the farmers are equipped with skills. Since the project activities are in line with national and local policies, it is easy to solicit support from different-level governments. The project will also be sustained through long-term cooperation with domestic and foreign teaching and research institutions.

Please add

Abbreviations and acronyms

Center — Experimental Center of Tropical Forestry, Chinese Academy of Forestry;

CFA — Forestry Administration of Cambodia

IRD — Institute of Forest and Wildlife Research and Development

DBH—Diameter at breast height

CF— Community forest

Project details

1. Background and Rationale

- Project Contexts and situations; specify if the project is under any existing initiative or program.
- Problems to be addressed, how the project could address problems and what environmental, social, economic benefits to target area and in broader scale could be brought;
- Stakeholders and target beneficiaries;
- Relevance to APFNet priorities, to forestry strategy, policy, laws and regulations in target economy (ies), and linkage with other projects and programs.
- Conceptions, ideas, methodology and approaches innovative or complementary to any existing efforts to be adopted.

1.1 Background

With abundant forest resources, Cambodian forest coverage continues to decline, due to an increase in population, destruction of forest by agriculture and industrial primary estates, over-exploitation, years of civil war and the crisis of timber supply in recent years. In the late 1960s, the forest coverage rate was as high as 73%, but decreased to 49% in 2014. Since 1994, the Cambodian government has issued several forest resources protection laws. However, lagging economic development, limited capacity of effective supervision and various restrictive mechanisms have caused weak implementation of these laws. At present, the Cambodian forests are under continuous and unrestrained degradation, and the management of

these forests is being reformed. Thus, reasonable management in the future can maintain and increase the forest cover in Cambodia. This will help to ensure the prosperity of the economy and the maintenance of biological genetic resources and environment. In 2010, the Cambodian government endorsed Cambodia National Forestry Program, the key strategic forestry document of the government for sustainable forest management from 2010 to 2029, which contains six thematic programs. Among the themes, Program 2 was developed aiming to promote forest restoration and conservation, promote forest ecosystem rehabilitation, and meet the needs of national economic development.

Forest distribution varies across Cambodia: evergreen forest dominates in the west and northwest, whereas deciduous forest is prominent in the northeast. Degraded forest lands, in serious need of restoration, are prominent in Siem Reap province in northern Cambodia. Due to deforestation there is a shortage of wood for domestic cooking fires, construction materials and other non–timber forest products. Owing to the poor economic condition and lack of forest management technology and forest protection awareness of local people, the community forest in Bos Thom village where this project will be conducted has been over exploited, forming large canopy gaps, reducing biodiversity and causing soil erosion. The forest stand is seriously degraded and there is a need to restore and rehabilitate the forest ecosystems.

This project will be carried out in Bos Thom village, Khna Por commune, Sorth Nikum district of Siem Reap province. 30 km away from Siem Reap, the village has a relatively backward economic society. With a population of about 300, the residents are living by planting rice. The main source of

income is beans, cucumber and other crops. In addition to food, the rest is sold to the market to meet their daily living expenses. Since the total plantation area of crops per household is less than 1 hectare, the average cash income for one household is lower than $300/year, indicating a very poor economic condition. It is necessary to improve the living standard of the local people through project activities.

1.2 Rationale

According to the status of Cambodian forestry, the forest is seriously degraded and it is imminent to restore and reconstruct the forest ecosystem. Through adopting scientific and reasonable reforestation measures, the future forest estate will not only provide biodiversity and ecosystem service values for Cambodia, but it will directly benefit the future livelihood of disadvantaged rural populations. Therefore, this project follows the principles of "feed long-term on short-term, combine long-term with short-term, and integrate economic and ecological benefits", targeting degraded woodlands, supplemented by scientific measures to optimize the right combinations of cover (light), water availability, soil type, nutrient supply, and other natural resources, to make full use of degraded land for future functional forest ecosystems. Obviously, this project can promote and improve sustainable forest management and rehabilitation in Cambodia.

The Project has three main approaches. The first is a focus on inter-planting selected target local tree species with nitrogen-fixing tree species in order to increase the survival and number of target tree species, improve tree structure, and promote a positive succession of the forest ecosystem. The overall purpose is to gradually promote a resilient uneven-aged mixed forest, and at the same time to enhance productivity, stand quality, stand stability and ecological function of the forest. The

second approach is to influence the direction of forest succession and to shorten the cycle of forest resource cultivation through thinning the non–target tree species. The third approach is to enhance the livelihoods of the rural people through increasing economic source, providing living facilities and their involvement in reforestation programs. During the whole project, we will conduct various kinds of activities, and improve the local people's awareness through capacity–building, information–sharing, and demonstration activities.

Recently, an APFNet funded project entitled "Multi–Function Forest Restoration and Management of Degraded Forest Areas in Cambodia" has been completed. This project was designed to develop the capability of the Forestry Administration of Cambodia and local communities on the management and restoration of the economy's biodiversity. It was conducted mainly in a community forest in Kampont Thom Province. With a different location and forest conditions, our project can be a good complement, and the two together will promote the restoration of degraded forests in Cambodia. However, as the soils in Siem Reap province are sandy, low in soil organic carbon, nutrient poor and have poor water holding capacity, different approaches to those adopted in the first APFNet funded project are required in order to achieve successful restoration of degraded forest. The use of nitrogen fixing trees is one of the most promising and low cost measures for restoring these kinds of forests. So far, no research has been conducted in this field regarding restoration methods in Cambodia. Meanwhile, a 2 ha forest tending demonstration site has been established

in the target community forest and a research station called Khum Ream with a nursery has been established about 50 km away from Bos Thom community forest which could facilitate this project. These experiences along with those gained through the implementation of our project will contribute to increased knowledge in forest restoration in Cambodia and other parts of the world. In addition, the project will foster alternative livelihoods for local people, thus ensuring the viability of the forest restoration. Furthermore, the project will evaluate the effect of silvicultural practices on productivity and socio-economic benefits to local communities. Thus, this project can contribute greatly to achieving the goals of the government as defined in the Cambodian National Forest Program 2010-2029.

2. Goal(s) and Objectives

- Goal(s) should detail the desired long term impact(s) of the project, such as the desired future status of a target. A good goal meets the criteria of being: linked to targets, impact oriented, measurable, time limited, and specific.
- Objectives should detail the desired specific achievements of the project year. A good objective meets the criteria of being: outcome oriented, measurable, time limited, specific, and practical.

Goal(s):

To increase the level of forest resource restoration and promote forest sustainable management in Cambodia through the establishment of demonstration forests and technical personnel training. To improve the livelihoods of local people through non-forestry livelihood activities.

Objectives:

(1) To demonstrate effective approaches on degraded forest transformation to improve the growth and quality of the forest stand and enhance ecological services by enhancing forest restoration and sustainable forest management. 50 hectares of demonstration forest will be restored by thinning and replanting with nitrogen-fixing tree species.

(2) To improve the livelihood of the local forest dependent poor people; by establishing 10 hectares of home garden with short-term economic benefits of fruit trees or crops with high economic value and setting up 16 small solar equipment to provide adequate electricity.

(3) To share information and knowledge of best practices on forest restoration and rehabilitation; by organizing a technical training course for the local people and holding an international seminar on restoration and reconstruction of tropical forest, to improve the awareness of forest restoration and sustainable forest management; a technical manual will be compiled and distributed to share the best practice and experience of the project.

3. Outputs and Activities

- Describe outputs and activities to be taken to achieve each output, presenting why and how activities will be carried out and what stakeholders will be involved. Activities selected should be the most cost efficient, meeting the criteria of being: linked, focused, feasible, and appropriate.
- Each activity should be broken down into several work packages, which detail methods, places, participants and responsible person, work plan.
- Methodologies and approaches to be used.
    - Output 1
        - Activity 1.1 (who, when, where, how)
        - Activity 1.2

Output 1: To explore and demonstrate effective approaches on degraded community forest, optimize the forest structure, and improve forest ecosystem services.

Description

The theory used in this activity is mainly close-to-nature forest management. Close to nature forest management is an approach treating forest as an ecological system performing multiple functions. Close to nature silviculture tries to achieve the management objectives with minimum necessary human intervention aimed at accelerating the processes that nature would do by itself more slowly.

The heart of close-to-nature forest management is "individual cultivation of target tree – selective cutting of individual plants", that is,

throughout the forest cultivation process, all forest management measures are carried out around the target tree to foster mixed multi-functional uneven aged stratified forest that focuses on the production of large diameter timber, so as to provide continuous coverage of large diameter timber and woodland, and mitigate the negative effects caused by forest cutting on the severe fluctuations of the ecological environment, and enhance the ecological function of forests.

Through thinning of the low quality trees, inter-planting with rare tree species of biological nitrogen fixation ability in the gaps, the degraded forest will be restored and an uneven-aged mixed forests with multi-structure will be formed, which will help improve the productivity, stand quality, and stand stability.

- **Activity 1.1 Forest status inventory and species screening**
- **Activity 1.1.1 Forest status inventory**

- **Place**

  Bos Thom village, Khna Por commune, Soth Nikum, Siem Reap province, Cambodia

- **Basic information**

  The target area of this project is a community forest with a total size of 445 hectares. (194 ha fully stock, 207 ha saplings/poles, 44 ha grassland/open). The main forest types are a mix of evergreen and deciduous forest. This community forest was established in 1997, due to intensified harvesting in the past, reclaiming land for rice production by destroying forests, continuously cutting of big trees in normal times, and interrupted grazing, the community forest is degraded. Some parts

of this area are highly degraded with only a few trees left and in other parts there are some young newly regenerated trees with high densities that need thinning, pruning and silviculture works.

- **Methods**

  Forest investigation will be carried out with the methods of sample plot investigation. Based on plant community appearances and internal species compositions, the CF is classified into 3 grades (i.e. Severely Degraded forest, Moderately Degraded forest, and Slightly Degraded Forest.). Three 20 × 30m (or 30 × 30m, depending on the site situation) sample plots will be selected randomly for investigation in each forest type.

- **Investigation content**

  Investigation of the sample plots covers: (1) species name, DBH and height of each tree in the tree layer; (2) species name, height, number and coverage in the shrub and herb layer; (3) soil samples taken from each horizon of the 1m deep soil profile in each plot. The bulk density, water holding capacity, texture, N, P, K, Ca, Mg content of the soil sample will be tested in the laboratory.

- **Activity organization**

  An investigation and planning team will be organized with the participation of qualified experts from the Center, IRD professionals, local FA staffs, and villagers. The Chinese expert will be the team leader

to guide the whole process and responsible for bringing in knowledge and techniques for forest inventory.

- **Output**

  A summary report of forest inventory will be presented, including the characteristics of forest structure, productivity and soil fertility for each forest type. This report will provide a technical reference for the selection of artificial supplementary tree species and forest management in local communities. The sample plots of different disturbance intensity will be monitored during the project, as a basis for ecological and economic effect assessment of the project.

- **Responsible person:** Guo Wenfu (Center)
- **Timeframe:** The activity will be conducted in the first season of the first year, and will be finished before April, 2019.

Activity 1.1.2 Screening out suitable species

- **Place:** Siem Reap province, Cambodia
- **Methods**

  A small workshop will be held to discuss and select suitable species. On the basis of the Species List as well as the field investigation, approximately 10–15 experts and project members from the Center, IRD and local FA will be invited to the workshop. In principle, the local tree species with strong adaptability and high value are preferred. After the workshop, 1–2 nitrogen fixation species should be selected as prior tree species for artificial enrichment planting, another 1–2 species should be

selected as alternate tree species. If the prior tree species has a poor survival rate or bad performance, we may use the alternate tree species for another artificial planting in the next year.

- **Responsible person:** Jia Hongyan (Center)
- **Time:** The activity will be conducted in the first season of the first year, and will be finished before June, 2019.

- **Activity 1.2 Demonstration forests establishment by thinning, inter-plantation and tending**

- **Place:** Bos Thom village, Khna Por commune, Soth Nikum, Siem Reap province, Cambodia
- **Description**

  In the community forests, three types of degraded forestlands, i.e., Severely Degraded Forest, Moderately Degraded Forest, and Slightly Degraded Forest, and also open forest land/sparse forest will be chosen and blocked to build restoration models. The demonstration forest will be established by thinning, inter-plantation and tending. Relevant techniques will used in corresponding to current conditions of each type of degraded forestlands.

- **Methods**

  50 hectares of degraded forest will be selected as the targeted operation area, including Severely Degraded forest, Moderately Degraded forest and open forest land. The area of each type is 15-20 hectors, and the total area for restoration is 50 hectors. The accessibility and convenience should be also considered while selecting the targeted area. Different measures will be taken according to the degraded degree. In Severely Degraded forest, Moderately Degraded

forest, a thinning will be conducted to clear the liana and the low quality trees, and then the rare species and/or N–fixing plants will be planted in the gaps formed by thinning. In open forest land, afforestation will be conducted uniform planting mode with a spacing of 2m × 2m.

- **Detailed Implementation Approach**

Thinning and clearing. In the degraded secondary forest area which has high coverage but without targeted and valuable tree species, a thinning will be conducted to form a canopy gap of 6–8m in diameter. Dominant trees with straight trunks and valuable tree species in the tree layer will be remained, while the low quality trees, shrubs, liana and weeds under remnant trees are cleared out. Make use of the existing gaps if there is any.

Planting. (1)Cluster planting: In the gaps formed by thinning, plant the N–fixing rare species in clusters with a density of 90–120 clusters per hectare, and 4 seedlings per cluster (i.e. at 360–480 seedlings/ha). (2)Uniform planting: In the open forest land, plant the N–fixing rare species in the spacing of 2m × 2m (i.e. at 2500 seedlings/ha). The size of pit for planting is 50×50×30 cm. Field planting will be carried using 1–year–old seedlings.

Maintenance. After planting, the plantations will be maintained by conducting periodic weeding to free the planted seedlings from competing weeds and vines that will suppress the newly planted seedlings. Tending and weeding for continuously three years after planting. In the first year, tend the young forest for three times; in the second and the third year, tend the young forest twice. For cluster planting, scarify the soil and do the weeding focusing on the planting

blocks of 4m×4m. For uniform planting, tending and weeding will be carried around the seedling.

- **Responsible Party:** The restoration design will be handled by Center project staffs with the assistance from IRD. Thinning, planting, and maintenance will be organized by IRD and the community, with the technical guidance from project staffs, and other preparations will be handled by the CF management team with the assistances from village chief and other villagers.
- **Responsible person:** Cai Daoxiong (Center), IRD
- **Timeframe:** The thinning and planting will be carried out at the first year of the project after the completion of the activity 1.1. The maintenance will be started right after the planting, and will last for at least 3 years.

- **Activity 1.3 Ecological and economic benefits evaluation in forests**

- **Description**

  By monitoring the 9 sample plots established in activity 1.1 representing for different degraded content (i.e. Severely Degraded forest, Moderately Degraded forest, and Slightly Degraded Forest.) in the first and second year after planting, the ecological benefits of the demonstration forest will be comprehensively evaluated by calculating the carbon sequestration, nitrogen fixation and soil aeration and water retention, the economic benefits will be evaluated by calculating the net increase earning of the villagers and the increment of the forest products.

- **Methods**
- Besides the background survey of activity 1.1 at the beginning of the project, the project staff will conduct another two surveys after planting the nitrogen fixed tree species (i.e. one year and two years after planting, respectively).
- *Seedling/sapling growth investigation*: The growth investigation will be conducted one year and two years after planting, respectively. The survival rate of the seedlings will be checked one year after planting; the height and diameter of the seedlings/saplings will be measured. 3 representative seedlings/saplings will be randomly selected in each sample plot, and the aboveground and underground biomass, nitrogen content root nodule biomass of the representative seedlings/saplings will be measured.
- *Soil sample investigation:* The soil samples of 0–10cm and 10–20cm will be selected from 5 points of *S* shape in each plot two years after planting. Mix the soil samples from the same depth in the same plot for laboratory determination. The soil physical properties (i.e. bulk density, porosity, water holding capacity, moisture) and chemical properties (i.e. pH, organic matter, total nitrogen, total phosphorus, total potassium, available nitrogen, available phosphorus, available potassium, organic carbon and nitrogen content, soil microbial biomass carbon and nitrogen content) will be tested in the laboratory.
- *Ecological benefit evaluation*: (1) The effect of carbon sequestration of will be evaluated by comparing the height, ground diameter, aboveground and underground biomass of the seedling/sapling, soil organic carbon and soluble carbon content, soil microbial biomass carbon content before and after planting. (2) The effect of nitrogen

fixation in the demonstration forest will be evaluated by comparing the contents of total nitrogen, inorganic nitrogen, available nitrogen and microbial biomass nitrogen in soil before and after planting. (3) The soil aeration and water retention of the demonstration forest will be evaluated by comparing the soil bulk density, porosity and water holding capacity before and after planting.

- *Economic benefit evaluation*: (1) Investigate and calculate the incomes get from the short-term economic crops established in the home garden of activity 2.1, as the economic benefit output of non-wood products; (2) According to the market price, calculate the value of increment of the forest volume for the rare tree species and planted nitrogen fixed species, and subtract the cost of establishing and maintenance the forest, which will be the economic returns for woody product.
- **Place:** Bos Thom village, Khna Por commune, Soth Nikum, Siem Reap province, Cambodia
- **Timeframe:** The investigation will be conducted in May or June 2020 and 2021, respectively. A report on evaluation of forest economic and ecological benefits will be presented before the end of the project (the last season of 2021).
- **Responsible Party**: The investigation will be designed by Center project staffs. The field investigation will be conducted by project staff from the Center and IRD, with the assistance from the community. The laboratory determination will be conducted in Cambodia. The report on evaluation of forest economic and ecological benefits will be drafted by the Center and reviewed by IRD.
- **Responsible person**: Lu Lihua (Center), IRD

Output 2: Non-forestry livelihood activities are developed to improve the local's livelihood.

The local residents are the forest dependent poor people and the main source of their income is planting and sale crops. The grim reality of the economic situation causes the need for developing alternative income regeneration, which will contribute to a better restoration of degraded forest. At the same time, to reduce the consumption of firewood, it is necessary to develop alternative energy sources. Home gardens surround folk houses will be established by planting fast-growing fruit trees to increase the local's income. These interventions will help reducing dependency of farmers and pressure on forests.

- **Activity 2.1 Construction of home garden and planting fast-growing fruits and/or crops of high economic value**

- **Description**
- The Bos Thom village has a population of about 522 in 99 families, the residents are living by planting rice. The main source of income is beans, cucumber and other crops. In addition to food, the rest is sold to the market to meet their daily living expenses. The total plantation area of crops per household is less than 1 hectare. A total area of 10 hectares of home garden will be established in this activity. The home garden will make use of the space surround folk houses. We will organize an expert team to help them with planting with fast-growing fruit trees/crops, i.e. banana, papaya, coconut, cashew nuts etc.
- **Place:** Bos Thom village, Khna Por commune, Soth Nikum, Siem Reap province, Cambodia

- **Timeframe:** The activity will be conducted in the middle of 2019 and 2020, respectively.
- **Responsible party**: The activity is responsible by IRD, and experts from the Center will provide technical guidance in establishing home garden.

- **Activity 2.2 Developing community alternative energy sources and conserving forest resources**

- **Description**

  At the time of our survey of the village, there was no electricity in the village. Although the government was connected with electricity in the village recently, some families are still too poor to afford it. This activity is to install small–scale solar equipment in representative households to provide them with adequate electricity. A total number of 16 small–scale solar systems will be installed in the village. It is expected to install 10 solar systems into the very poor families and 6 in the public area of the village, such as school, village path, village office, etc. Priority will be given to those very poor families who don't have access to electricity. Ideally to those who are to be selected for implement the home gardens.

- **Place:** Bos Thom village, Khna Por commune, Soth Nikum, Siem Reap province, Cambodia
- **Timeframe:** The activity will be conducted in the middle of 2019 and 2020; 8 solar systems will be installed in 2019 and 2020, respectively.
- **Responsible party**: The activity is responsible by IRD, and experts from the Center will provide technical guidance in installing solar systems.
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- **Activity 2.3 Revolving funds and marketing of village products**

- **Description**

  Contact enterprises to bring in the idea about revolving funds and marketing of village products. Setting up a revolving fund of $5,000 for the local farmers. A small committee will be established to oversee the fund. Regulations on how to lend the money to their members will be made. Those who are interested and are eligible based on the criteria that will be developed and agreed among themselves. The farmers will learn about how to operate the fund, and market the village products from activity 2.1, and then to improve the income of the villagers.
- **Place:** Bos Thom village, Khna Por commune, Soth Nikum, Siem Reap province, Cambodia
- **Timeframe:** The activity will be conducted in 2019 and 2020.
- **Responsible party**: The activity is responsible by IRD

- **Activity 2.4 Assessing the livelihood improvement**
- **Description**

  A local consultant group will be hired (1)to make assessment of livelihoods through household survey to get the socio–economic data especially data related to income and expenditure of farmers; and (2) make assessment to compare and see how local livelihoods has been changed at the end of the project. An assessment reports will be submitted at the end of the project.
- **Place:** Bos Thom village, Khna Por commune, Soth Nikum, Siem Reap province, Cambodia
- **Timeframe:** The activity will be conducted at the end of 2019, 2020 and 2021.
- **Responsible party**: The activity is responsible by IRD

- **Activity 2.5 Field monitoring**

- **Description**

  Staff from IRD will travel from Phnom Penh to Bos Thom village regularly to monitor the field activities such as establishing the demonstrative forest, tending the new forest, establishing home gardens, etc. to ensure the effects of the activities.

- **Place:** Bos Thom village, Khna Por commune, Soth Nikum, Siem Reap province, Cambodia
- **Timeframe:** The activity is expected to be conducted once a month in 2019–2021.
- **Responsible party**: The activity is responsible by IRD

- **Output 3: To share information and knowledge of best practices on degraded forest restoration and rehabilitation in Cambodia.**

- **Activity 3.1 Awareness raising and training courses/study tours for local and nearby staff and farmers**

- **Description**: A training course will be organized to train local people surrounding the project sites. At least 50 local people will be trained including forestry managers/technical personnel as well as community farmers. The training will cover the basic silviculture knowledge i.e. site preparation, planting techniques (cluster planting and uniform planting), maintenance and tending, pruning, thinning etc. The training course will last for 3 days, one day for lectures in the meeting room, and two days for the practical training outdoors.
- **Places:** The indoor training session will be held in the school near the village. The outdoor activity will be held in the demonstration sties.

- **Timeframe:** The training will be held in the first year and second year of the project.
- **Responsible Party**: The training will be organized by the Center. The lecturer and trainer will be the project staff of the Center. The IRD and the village director will help with recruitment of the trainee.
- **Responsible person**: Cai Daoxiong (Center)

- **Activity 3.2 Holding seminars and technological discussion and experience exchange between China and Cambodia**
- **Activity 3.2.1 Holding international seminars on Restoration and Reconstruction of Tropical Forest**

- **Description**: A four-day international seminar on Restoration and Reconstruction of Tropical Forest will be held in China to share the experience and outputs of the project. 8 participants from Cambodia (including experts, technical personnel, and forest managers) will fly to China to participate in the seminars. Well-known experts from other Chinese institutes will be invited to give speeches in the seminar. A field trip to visit the demonstration forest of the Center will be organized during the seminar.
- **Places:** The seminar will be held in Guangxi province, China. The field trip to the Center will be in Pingxiang, Guangxi, China.
- **Timeframe:** The seminar will be held during the last year of the project.
- **Responsible Party**: The international seminar will be hosted by the Center.
- **Responsible person**: Cai Daoxiong (Center)

Activity 3.2.2 To provide technical guidance and implement project activities

- **Description**: During the project, the team member of the Center will fly to Cambodia to provide technical guidance and implement project activities. It is expected that 6 person will fly to Cambodia at the first year of the project for forest inventory, species selection, conducting the training for local people, establishing demonstration forest etc.; 4 person will fly to Cambodia in the second year of the project for establishing home gardens and solar systems, a second survey on the plots to check the survival rate, establishing demonstration forest; 4 person will fly to Cambodia in the third year of the project to conduct a third survey on the plots and an investigation on the livelihoods of local people for ecological and economic evaluation.
- **Place:** Bos Thom village, Khna Por commune, Soth Nikum, Siem Reap province, Cambodia
- **Responsible person**: Cai Daoxiong (Center)

- **Activity 3.3 Technical manual compiling**

- **Description:**

  Integrating the achievements of project activities to compile a technical manuals for degraded forest transformation and cultivation in tropical regions, using Chinese, English and Cambodian. 300 copies of the technical manuals are going to be printed out and disseminated. It is expected to distribute 100 copies for local people in Bos Thom village (one copy for a family), another 100 copies will be distributed to the forestry research institutes, forestry departments or any forest communities in Cambodia by IRD; another 100 copies will be distributed

to Chinese forestry research institutes, forestry departments by the Center. It could also be distributed on the seminar hosted by the Center.

- **Place:** Guangxi province, China; Siem Reap province, Cambodia
- **Timeframe:** The manual will be complied in the last year of the project.
- **Responsible Party**: The Center will be responsible for the Chinese version of the manual and draft the English version. Both Chinese version and English version will be reviewed by qualified experts. The IRD will be responsible for the Cambodian version.
- **Responsible person**: Guo Wenfu (Center), IRD

4. Risks and Assumptions

– Identify potential assumptions, including risks and uncertainties as well as positive factors that might impact the achievement of project objectives, and how they will be managed or mitigated.

(1) This project adopts community-based participatory approach. It is possible that some individual farmers are lack of enthusiasm or unwilling to participate. The project Work Team will strengthen communication with those who are lack of enthusiasm or unwilling to participate, to let them understand the benefits of implementing this project. Meanwhile, these issues will further be effectively solved through indoor publicity, showing related promotional materials (such as papers and videos) or off-site study tours, etc.

(2) Problem from language and customs may affect the implementation of the project. Community staffs who can speak local

language will be helpful during the project organization and implementation.

(3) Seeds and/or seedlings especially those high value timber species may be stolen due to poverty. The project implementation area may be damaged by animals. To strengthen the communication with local residents, to let them understand the benefits of implementing this project. The demonstration sites will be surrounded by protecting fence. The project will also work closely with local forestry officers in charge of the project area especially the field of law enforcement and coordination with local authorities.

5. Institutional Management and Communication

- Describe how and with whom the project steering committee will be established to supervise the project and keep smooth and timely communication; what meeting and consultation mechanisms will be identified to guarantee its effective functioning and communication with project team.
- Describe human resources needed to establish the project team, specifying duties and responsibilities for the key roles. Describe what will be done to strengthen project team's capacity of project implementation.

- TOR(s) should be used to describe requirements of consultants to be recruited for project implementation as Annex.
- Good communication with project stakeholders and other implementing partners should be kept over project implementation.
- The project management structure and communication mechanism should be illustrated by chart(s) as Annex;

5.1 Project Consultant

A Project Steering Committee (hereafter referred as to the Committee) shall be established to supervise project implementation and make decisions on crucial issues. The Committee shall be composed of representatives from the Executing Agency and Implementing Agency, and local Forestry Administration. At the inception workshop, the Executing Agency and the Implementing Agency recommended the chairman and members of the Committee, which will be established after approval by both parties. In principle, the Committee shall meet at least once a year to review annual project progress report and work plan for next project year, and provide guidance to addressing technical and financial issues as well as the policy hurdles. APFNet may join the Committee meetings as the observer.

Other persons such as experts from other countries or institutions will be invited to evaluate and participate in the project.

5.2 Project participant

Basically there are six project proponents in this project, with the following responsibilities and capacity required for key project roles:

1) Experimental Center of Tropical Forestry: To establish a Project Management Team headed by Project Director, design and record the project, most importantly to provide experiences on sustainable management and restoration of degraded forests;

2) Institute of Forest and Wildlife Research and Development: To set up a Project Offices led by Project Manager, provide in-kind donations for the project, supervise the launching of local project activities and make sure of smooth project operation. The Project Manager is appointed by the Executing Agency in consultation with APFNet;

3) Local Forestry Administration: Provide policy, in-kind and personnel support for project implementation;

4) Local community: Major participants and beneficiaries of the project. In this project, community participation will be divided into two levels: one is the full participation of the community, and the other is the participation of community village representatives. The project will adopt a bottom-up approach. Under the guidance of the project staff, all villagers are called upon to participate in the project activities, and the consensus opinions reached by the villagers for extensive discussion, negotiation and voting are directly incorporated into the project planning and design, implementation, monitoring and evaluation. At the same time, the elected village

representatives will be invited to participate in the project working group, and fully participate in the entire project implementation process and its specific work. The project team will welcome villagers who volunteer to participate in the project;

5) Project full-time staff: The project will hire a special coordinator to be responsible for the routine management and communication of the project, and encourage and mobilize personnel to actively participate in the project activities through discussion, communication and publicity;

6) Temporary hiring staff: The project will also employ some labor force to participate in part of the project activities, such as thinning, planting, and tending.

5.3 Project Management Structure and Communication Mechanism (Annex C)

6. Project resources and financial management

- Complete the budget (both by activity and by category)for the project in Annex D and G, presenting funding resources secured both from APFNet and other channels;
- Describe in what way the project will maximized the cost-efficient use of resources; if any procedures and regulations will be obeyed with in terms of personnel employment, procurement of goods and services, as well as financial management.

- Provide(if already determined) information of an external accounting firm which will be in charge of auditing during project implementation and provide periodical and final audit reports .

6.1 Project resources

There is a school near the project area, which can provide places for the communication of local farmers and project participants. Center has great office conditions, with various office equipment, including printers, fax machines and projectors, as well as laboratories. However, cameras for field are needed. There are some project activities involved the assessment of forest ecological and economic functions. These activities require a large number of field and indoor observation equipment, which is relatively in short at present. For example, data recorder, VERTEX and some silvicultural equipment are needed for filed survey as well as afforestation. The properties of soil and vegetation should be repeatedly and automatically determined, through the soil temperature and humidity recorder, data collector and so on.

6.2 Financial management

This project is designed and conducted on the basis of the existing project experience. As one project executing agency, Center has rich experience in international cooperation, especially on rare species silviculture, restoration and protection of degraded forest. They are experienced in financial management on relative fields. IRD has a better understanding of the local people's livelihood, social and economic conditions. Being fully negotiated, the project will require a total budget of USD 503,000. Out of this, USD 378,000 will be requested from APFNet for funding and the remaining USD 125,000 will be counterpart of IRD in term

of kind contribution. The budget (both by activity and by category) for the project are shown in Annex D and G. The budget could be allocated to Center and IRD according to their roles and activities in the project by the Center. Existing facilities can be made full use of to maximize the cost-efficient use of resources.

There will be special financial personnel to ensure the reasonable use of project funding. The project accounts shall be audited during and after the project implementation if required, by an independent audit firm appointed by the Executing Agency and Implementing Agency in consultation with APFNet, by examining the documents or by on-the-spot checks, on the basis of supporting documents for the accounts, accounting documents and any other documents relevant to the financing of the project.

7. Monitoring and evaluation

- Describe the indicators and plans for monitoring and evaluation to keep project implementation on track and measure the success and lessons learned.

To make a project work plan and monitoring schedule in the early stage of the project, which includes the project name, brief description of objectives of project, the activities necessary to fulfill the objectives, responsible person, indicators, duration of each activity, and the persons responsible for monitoring and progress reports. Monitoring or reporting

will be carried out every year through record-keeping and writing progress reports.

The following aspects could be included in the progress reports: 1) completed activities; 2) problems or difficulties encountered during the project implementation; 3) how to solve the above problems/difficulties; 4) evaluation on the project current achievements according to the project work plan; 5) activities need to be completed; and 6) possible change of project duration and/or activities.

With regard to the final report, the aspects could be: 1) to what extent the objectives of the project were accomplished (the indicator values the project has achieved against the ones set in the project proposal and state the methods used to calculate or derive indicator values; describe the quality of completing the indicator values); 2) the immediate and long term benefits received by the participants and/or the recipient communities; 3) new Developments and unexpected difficulties/problems during the implementation of the project, and the solutions; and 4) lessons learned (innovations and best practice during project implementation; what works, what doesn't work and why; how to avoid the same problem in the future).

The Project Steering Committee will be established to monitor and evaluate the project implementation progress and fund usage as well.

8. Dissemination, duplicability and sustainability

- Describe the plan to disseminate results and outputs of the project, including form and contents, and the target audience, and how to extend project's impacts.

- Describe expectations for the project beyond the funding period, factors that ensure the achievement and efforts to be sustained over time.

Photos, audio, video and other forms of communications will be made full use of to record all the activities during the project, as well as the beneficiary's benefit. Disseminate project results through newspapers, news, journals, conferences, training, etc., and print the equipment purchased with APFNet LOGO.

The project has a good sustainability. This project is aiming at ecological restoration and integrated sustainable management of the degraded forest in Cambodia based on comprehensive consideration of local people, natural resources and land-use. It will also use adaptive management according to the results of regular monitoring and evaluation. The relationship between ecological integrity of the degraded forest and the improvement of local people's livelihood is considered comprehensively and systematically. The integrated and sustainable management on forest degradation is carried out through community-based participatory approaches. Local farmers take the initiative through their active participation, which lays a fundamental foundation for the sustainability of this project. At the same time, these activities of the project are in line with policies of national and local government, which advocates ecological protection, local economy development, improvement of the overall quality of community residents, strengthening community capacity building, and so forth, thus, easy to solicit support from different-level governments. This project is typically representative, exemplary and replicable. The experience and achievements from this project can be directly used for the restoration of degraded forest in the surrounding area of the project.

After the project completion, some planned activities will allow this project to be sustained through long-term cooperation with domestic and foreign teaching and research institutions, and the project area can be continuously developed as a research and practice base. The results of this project could also be promoted through implementing other new projects.

Annex A: Project sites map and relevant information

This part presents the map and the current status of the project sites, including its size, forest type, natural, socio–economic conditions as well as the land use status, potential demonstrative effect to other regions or economies.

A list of maps in Annex A:

Details:

The project site is a community forestry (CF) located in Siem Reap province in northern part of Cambodia. The government of Cambodia has made efforts to promote the development of community forestry since early 1990s. The CF Guideline of the government allows the allocation of forests to local communities to manage and use for their own benefits. Up to now there are around 400 community forestry groups established throughout the economy. In most cases, the forest areas handed to local communities under this forest management scheme are degraded and located in areas of poor and less fertile lands. Local communities find themselves helpless in trying to restore and rehabilitate their forests as the government could provide only limited support. Most of farmers in this area have an approximate 1 hectares of land and are dependent their live mostly on agriculture and collection of forest products.

The target area of this project is a community forest with a total size of 445 ha (194.17 ha fully stock, 207.19 ha saplings/poles, 43.8 ha grassland/open). The annual precipitation is 1200–1400 mm and the altitude is 60–72 m above sea level. Soil texture is sandy soil and red–yellow podosols, with soil depth of 25cm and

ground water level of 8m. Forest cover rate is approximately 50%, ranging from 13–53% canopy cover. The pole zone consisted of *Diospyros pilosanthera* (Troyeung), *Sindora cochinchinensis* H. Baill (Kor koh); *Dialium cochinchinensis* Pierre (Kro lanh), *Peltophorum dasyrrhachis* (Tro Sek), *Syzygium jambos* (Pring) and *Cratoxylum formosum* (Langeang). The timber zone included *Artocarpus rigidus* Blume (Knor prey), *Syzygium jambos* (Pring), *Anisoptera costata* Kort (Pdeak), *Hydnocarpus annamensis* (Krobao) and *Irvingia malayana* (Cham bok). The stand density and stock of pole and timber zones were 52 trees/ha and 5 m^3/ha, 708 trees/ha and 67.71 m^3/ha, respectively. In addition, the average DBH and height for timber zone were 25–30 cm and 3–10 m or 8–15 m, separately.

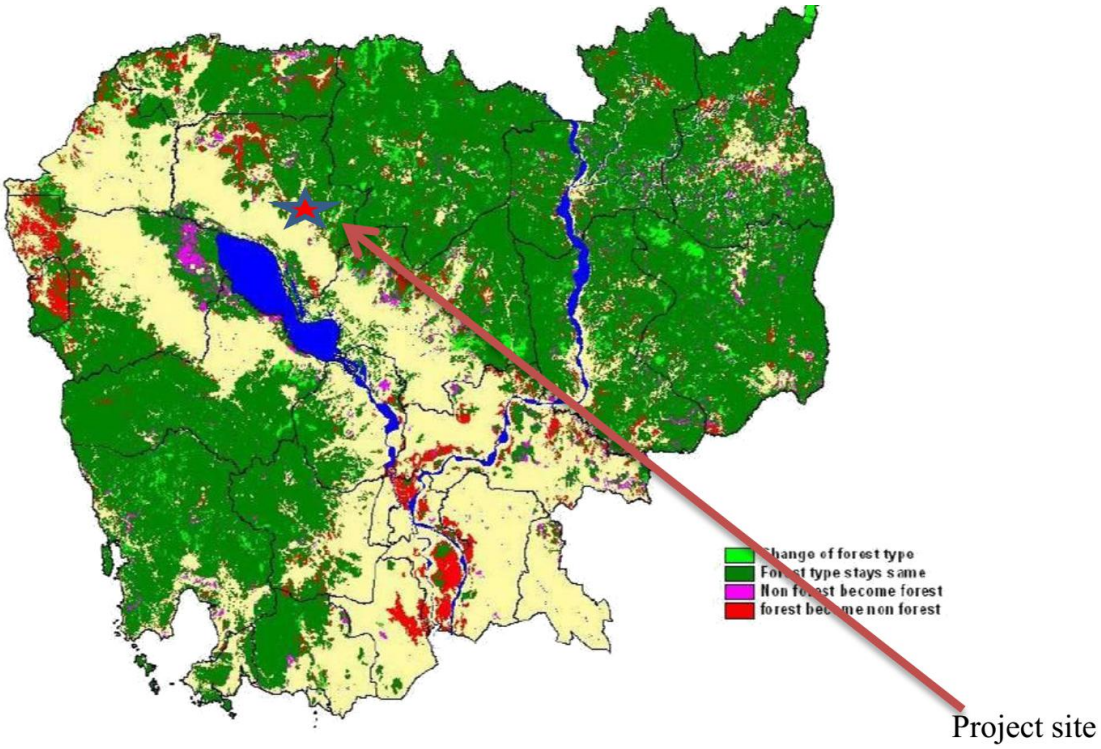
The main forest types are a mix of evergreen and deciduous forest. This community forest was established in 1997 for the farmers living in Bos Thom village, Khna Por commune, Sorth Nikum district of Siem Reap province. This community forest is managed by the community management committee which is consist of 10 members elected by the villagers. A recent visit to the area has revealed that this community forests is a former logged over area and rice fields. Up to now, the area has been protected by the farmers but the forest has been left to naturally regenerate. The growth rate of this forest seems too slow and some important species have been lost. Some parts this area are very degraded with only a few trees left and some other parts there are many young newly regenerated trees with high densities that need thinning, pruning and silviculture works. Owing to the lack of forest management technology, the community forest has been over exploited, forming large canopy gaps, reducing biodiversity and causing soil erosion. The forest is seriously degraded and it is imminent to restore and reconstruct the forest ecosystem as soon as possible.

32.72 km away from Siem Reap, the Bos Thom village has a relatively backward economic society. With a population of about 522 in 99 families, the residents are living by planting rice. The main source of income is beans, cucumber and other crops. In addition to food, the rest is sold to the market to meet their daily living expenses. Since the total plantation area of crops per household is less than 1 hectare, the average cash income for one household is

lower than $300/year, indicating a very poor economic condition.

Therefore, a successful demonstration of forest restoration and livelihood intervention in this project site can become a forest restoration model that other community forestry groups in Cambodia and in the regions can learn and adapt for better management of their forests. In addition, the project site can serve as a learning school for students and researchers to improve their knowledge and experiences.

The following shows the maps of the project site.



Annex A: Project sites map and relevant information

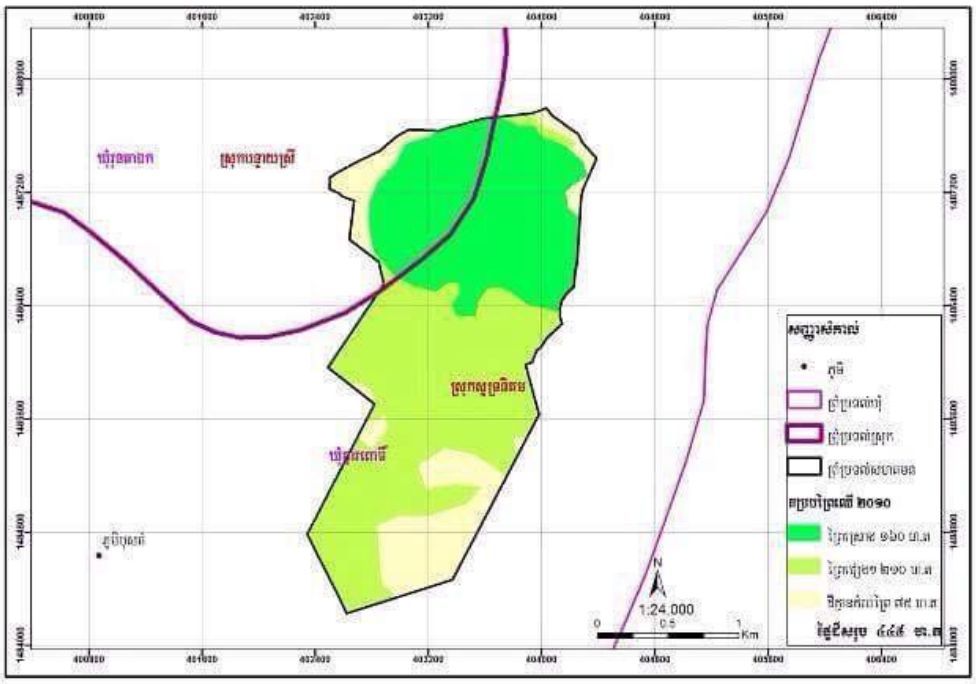


Figure 1. Location map and vegetation

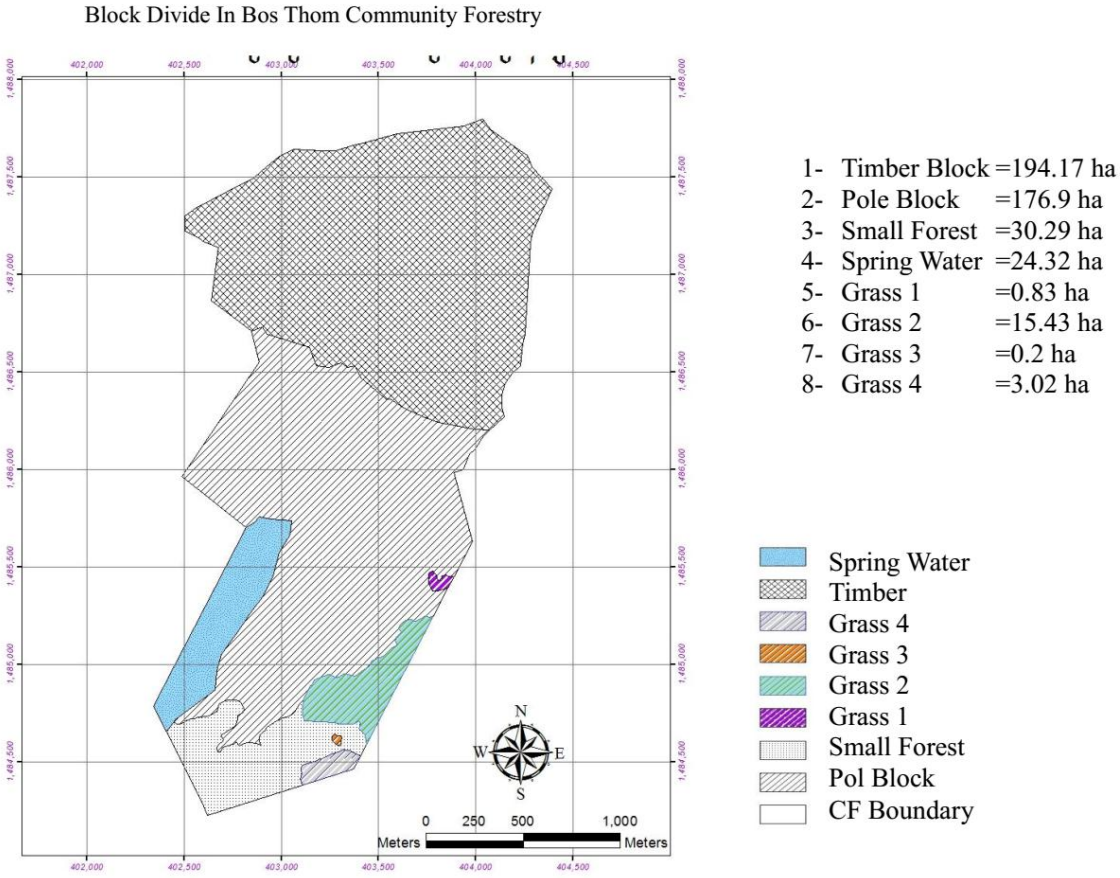


Figure 2. Forest/vegetation distribution map of Bos Thom CF

Annex A: Project sites map and relevant information

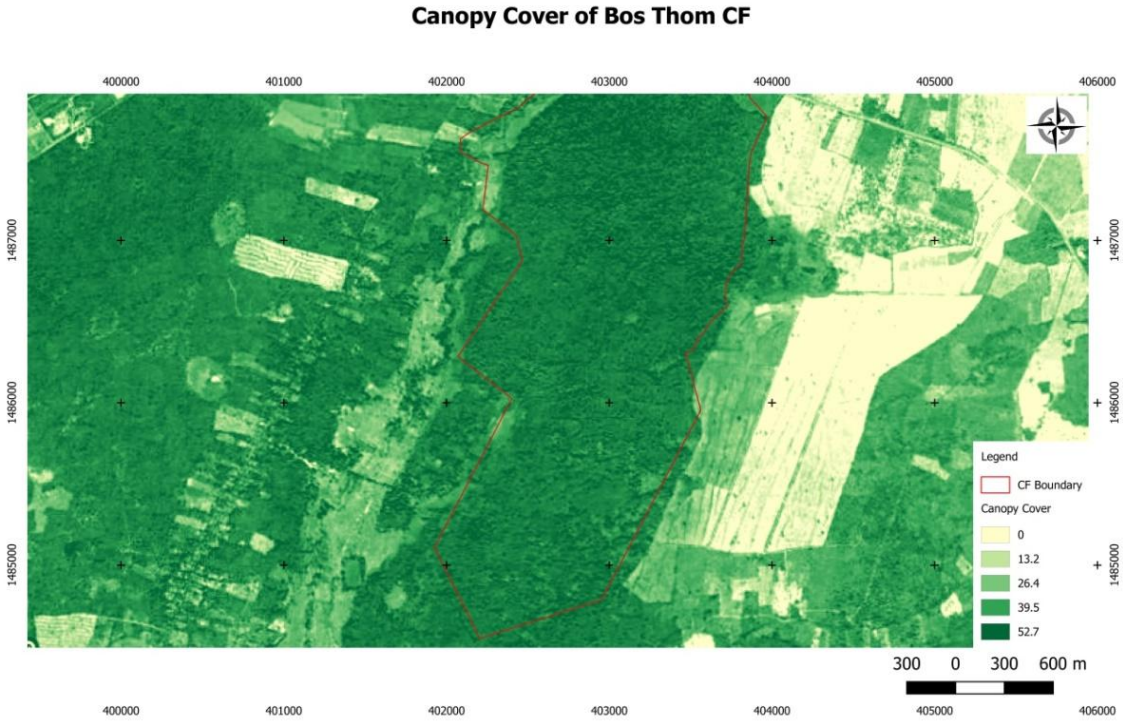


Figure 3. Canopy Cover of Bos Thom CF

Figure 4. Location of the demonstration site for home gardens

Annex A: Project sites map and relevant information

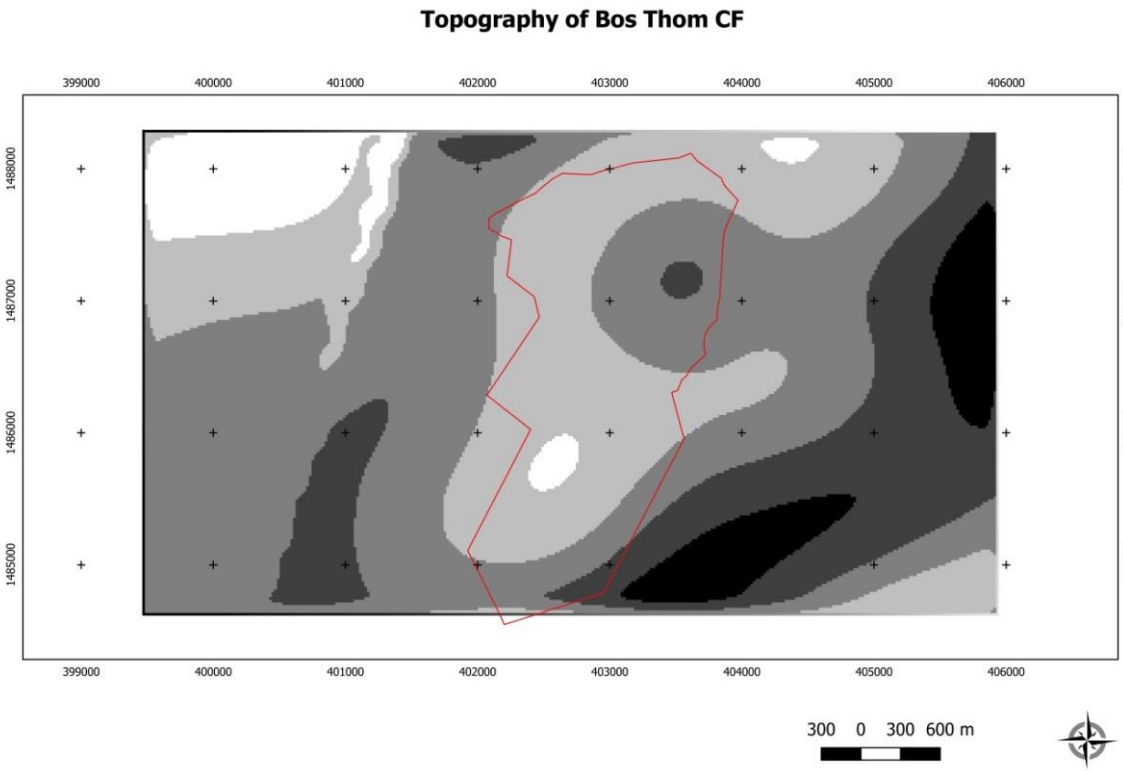


Figure 5. Topography of Bos Thom CF

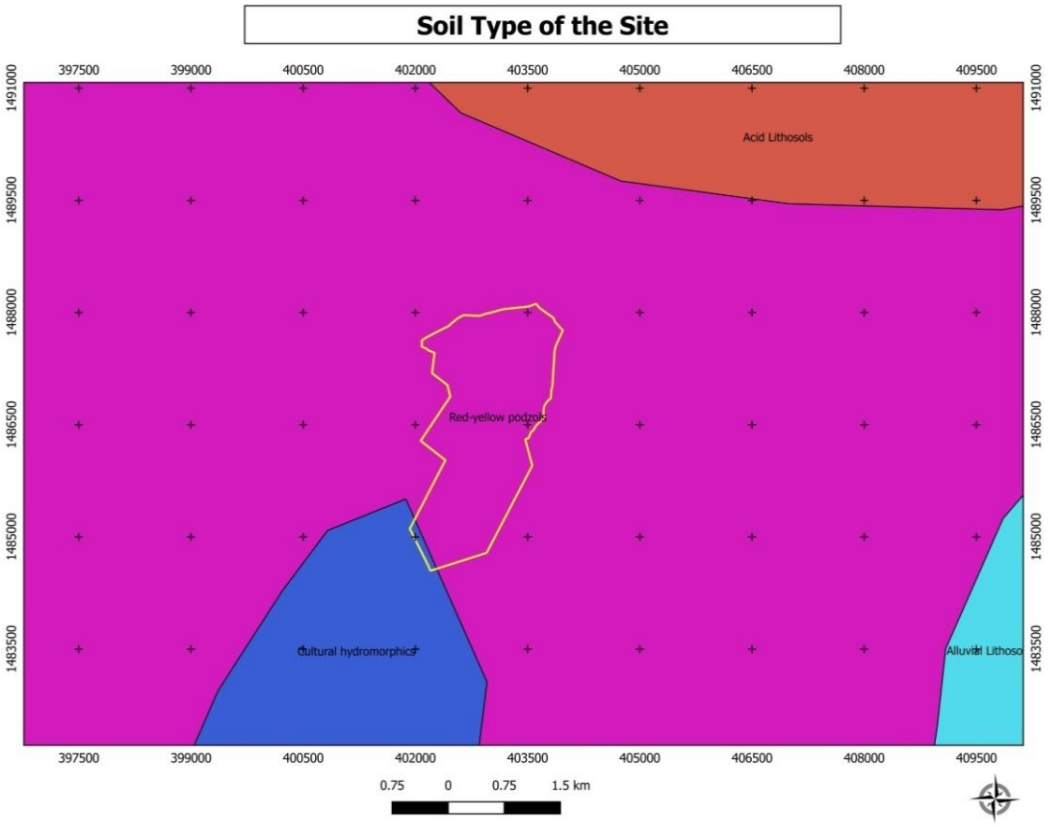


Figure 6. Soil Type of the Forest Site

Annex A: Project sites map and relevant information

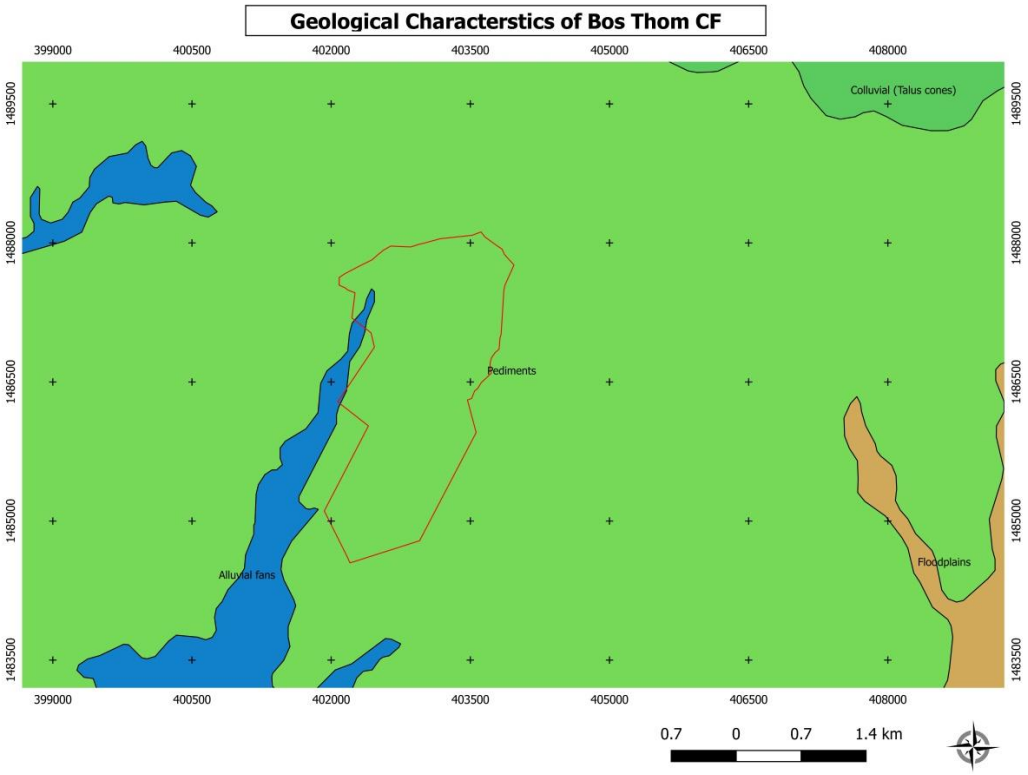


Figure 7. Geology of the site

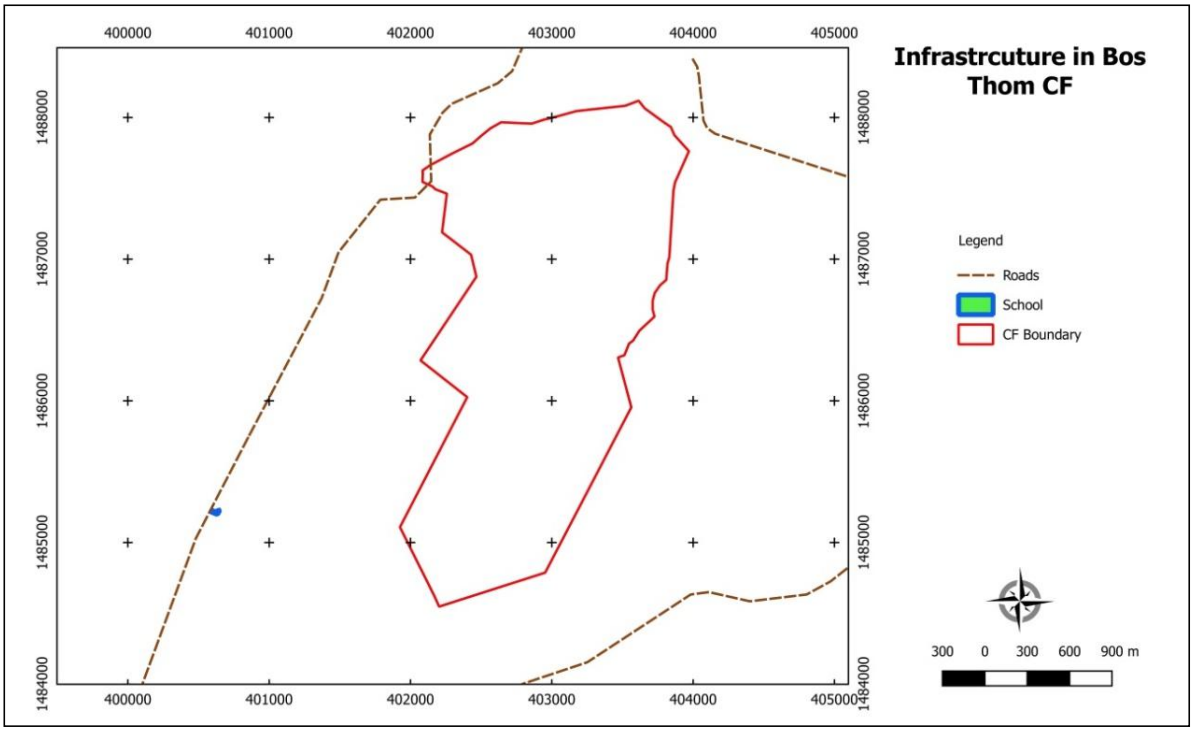


Figure 8. Infrastructures in Bos Thom CF

Annex B: Project logical framework

Items	Intervention logic	Objectively verifiable indicators of achievement[5]	Sources of information and means of verification[6]	Assumptions[7]
Goal(s)[1]	To increase the level of forest resource restoration and the ability of forest sustainable management in Cambodia through the establishment of demonstration forests and technical personnel training.	1) 60 hectares of demonstration forest are established; 2) the productivity and ecosystem stability and function of the forest is improved; 3) the livelihood of the local forest dependent poor people is improved.	1) Project report 2) Technical report 3) Evaluation report 4) Investigation 5) Interview 6) Meeting material 7) Photo	1) Fund on time; 2) Coordination between different departments; 3) International/national experts in position on time; 4) Avoid the risk occurring in the process of project implementation; 5) Active participation of the project partners, local governments
Objectives[2]	1) Provide effective ways to improve forest growth and quality and strengthen ecological services; 2) Improve the lives of the poor who depend on the forest for their livelihood; 3) Share information and knowledge about best practices for restoring forests.	1) 50 hectares of demonstration forest are established; 2) the productivity and ecosystem stability and function of the forest is improved; 3) the livelihood of the local forest dependent poor people is improved.	1) Project report 2) Technical report 3) Evaluation report 4) Investigation 5) Interview 6) Meeting material 7) Photo	1) Fund on time; 2) Coordination between different departments; 3) International/national experts in position on time; 4) Avoid the risk occurring in the process of project implementation; 5) Active participation of the project partners, local governments
Output 1[3]	To explore and demonstrate effective approaches on degraded community forest, optimize the	1) Totally 50 hectares of demonstration forest are established; 2) the growth of the reserved tree is improved,	1) Forest status inventory; 2) comparison	Adequate personnel to conduct the field survey and research

Annex B: Project logical framework

	forest structure, and improve forest ecosystem services. Responsible person: Center	and the annual increment of the target tree's DBH is increased as compared to the control forest; 3) the forest ecosystem stability and function is improved, and the site productivity is enhanced	researches; 3) project documents and reports; 4) internal records; 5) photos	
Activity 1.1[4]	Forest status inventory and species screening Responsible person: Center	At less 2 suitable species (including N-fixing tree species) for the transformation and sustainable management of the degraded forests are screened out.	Project documents and reports; surveys; internal records (such as memos and e-mail)	Adequate preliminary study and investigation on the target species
Activity 1.2[4]	Demonstration forests establishment by thinning, inter-plantation and tending Responsible person: Center and IRD	A representative area of 50 hectares of the degraded forest transformation forest with rare species and demonstration forest through thinning in the northern Cambodia are established.	Project documents and reports; surveys; photos; internal records (such as memos and e-mail)	Well-established knowledge on close-to-nature forest management theory
Activity 1.3[4]	Non-forestry livelihood activities are developed to improve the local's livelihood Responsible person: IRD	(1) The growth of the reserved tree is improved, and the annual increment of the target tree's DBH is increased as compared to the control forest; (2) The forest ecosystem stability and function is significantly improved, and the site productivity is enhanced; and (3) The close-to-nature sustainable management pattern is preliminarily formed.	Surveys; project documents and reports; photos	NA
Output 2[3]	Non-forestry livelihood activities are developed to improve the local's	Alternative livelihood is equipped to the locals, improving their livelihood.	1) Photos; 2) internal records	The locals are willing to develop the alternative livelihoods

Annex B: Project logical framework

	livelihood Responsible person: IRD			
Activity 2.1[4]	Construction of home garden and planting fast-growing fruits and/or crops of high economic value Responsible person: IRD	10 hectares of home garden of fast growing fruits or crops is established. At least one non-forestry livelihood is developed in the demonstration site.	Photos; internal records (such as memos and e-mail)	The locals are willing to develop the alternative livelihoods
Activity 2.2[4]	Developing community alternative energy sources and conserving forest resources Responsible person: IRD	Small-scale solar equipment is installed.	Photos; internal records (such as memos and e-mail)	The locals are willing to develop the alternative livelihoods
Activity 2.3[4]	Revolving funds and marketing of village products Responsible person: IRD	Enterprises are involved in the marketing of the village products, and the incomes of the villagers are improved.	Photos; internal records (such as memos and e-mail)	The locals are willing to develop the alternative livelihoods; there are relative enterprises in the economy
Activity 2.4[4]	Assessing the livelihood improvement Responsible person: IRD	At least one assessment is held to get the socio-economic data before and after activity 2.1-2.4 through household survey. An assessment report will be submitted.	Photos; internal records (such as memos and e-mail), report.	The locals are cooperative into the project assessment.
Output 3[3]	To share information and knowledge of best practices on degraded forest restoration and rehabilitation in Cambodia. Responsible person: Center	(1) Technical manuals are compiled; and (2) providing sivilculture guidance to local technicians; 3) training, study tours and seminars are held.	Photos; internal records; meeting minutes; attendance roster; interviews	Rational evaluation and summary on the project
Activity 3.1[4]	Awareness raising and training courses/study tours for local and	Local people's awareness is raised in degraded forest protection and restoration, and over 50%	Photos; meeting minutes; attendance	Rational evaluation and summary on the project

Annex B: Project logical framework

	nearby staff and farmers Responsible person: Center	residents take active participation in the restoration of degraded woodland.	roster; interviews	
Activity 3.2[4]	Holding seminars for technological discussion and experience exchange between China and Cambodia Responsible person: Center	10–15 key managers and technical personnel from Cambodia are trained, while 100 Cambodian technical personnel at the basic level are trained by Chinese experts.	Photos; meeting minutes; attendance roster; internal records	Rational evaluation and summary on the project
Activity 3.3[4]	Technical manual compiling Responsible person: Center and IRD	Technical manuals for degraded forest transformation and silviculture are compiled.	Technical manual	Rational evaluation and summary on the project

Annex C: Project management structure and communication mechanism chart(s)

This part mainly illustrates the project management structure and communication mechanism.

The following organization chart indicates how the project will be managed and supervised, highlighting the key roles and their responsibilities: