



*Asia-Pacific Network for Sustainable Forest Management  
and Rehabilitation*

# PROJECT DOCUMENT

Enrichment of Pine Plantations of Sri Lanka with native species

Forest Department

October 2017 – September 2020

### Basic Information

<b>Project title(ID)</b>	Enrichment of Pine Plantations of Sri Lanka with native species	
<b>Supervisory agency</b>	Ministry of Mahaweli Development and Environment	
<b>Executing agency</b>	Forest Department	
<b>Implementation agency</b>	Forest Department	
Project Director: W.A.C. Weragoda Conservator of Forests (Silviculture and Forest Management)		
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<b>Target area(s)</b> (project locations and context)		
Badulla, Nuwara Eliya and Matale districts of Sri Lanka		
<b>Project implementation duration:</b> [10/2017 to 09/2020    36 months]		
<b>Total budget(USD)</b>	596,800.00	
<b>APFNet grant(USD)</b>	477,300.00	
<b>Counterpart contribution (USD)</b> (list other funding souces and amounts, specify cash and in-kind constribution)	119,500.00 Government of Sri Lanka will contribute in kind during the first three years and provide funds for maintainanace after three projecct years.	

## **Project description**

There are around 16,000 ha of pine plantations in wet and intermediate zones of Sri Lanka. They are managed for watershed protection, timber production and resin production. Pine plantations located in sensitive areas such as steep slopes and watersheds are managed for protection and rest of the plantations are managed for production.

Pine plantations located in intermediate zone of Sri Lanka remain as monoculture plantations while wet zone plantations consists some mixture of species. The main reason for remaining pine as monoculture in the intermediate zone is regular forest fires in pine plantations. Forest fires which take place during the dry season do not damage large pine trees but remove under growth and leaf litter exposing soil. As a result soil erosion takes place during the subsequent rainy season.

Therefore, the monoculture pine plantation does not contribute to accomplish watershed protection objectives and they could not well provide homes for plants and animals. Further, these plantations do not provide benefits for adjoining communities and the contribution of pine plantations to provide ecosystem services is poor. Therefore, this project is expected to improve species composition of the existing protective pine plantations in order to obtain wide array of ecosystem services emphasizing soil and water conservation, community benefits and enhancement of biodiversity.

Pine plantations located in Badulla, Nuwara Eliya and Matale districts have been selected for the project since monoculture pine plantations are located mostly in these districts and they are important upper watershed areas of Sri Lanka.

## **Goal of the Project**

The goal of the project is to enhance ecosystem services provided by existing pine plantations.

## **Objectives of the Project**

To enrich 350 ha of pine plantations in intermediate zone of Sri Lanka with multiple species to obtain multi-functional benefits.

## **Expected Outputs**

- 350 ha monoculture pine plantations converted into multi species forests
- NTFP composition of above 350 ha of forests improved
- 500 families permitted to collect NTFPs.
- Community based ecotourism programme established

## **Key Activities**

- Establishment of the baseline
- Forest fire control
- Enrichment planting
- Assisted Natural Regeneration
- Ecotourism Development
- Collection of Non Timber Forest Products

**Main Stakeholders**

Forest Department

Adjoining communities

**Methodology**

Species composition of Monoculture pine plantations will be improved by enrichment planting, and assisted natural regeneration. Community support will be obtained involving them in NTFP collection and ecotourism.

## **Abbreviations and acronyms**

amsl – Above mean sea level

CBO- Community Based Organization

DFO-Divisional Forest Officer

GPS- Geographic Positioning System

NGO-Non Governmental Organization

NTFP – Non Timber Forest Products

PRA- Participatory Rural Appraisal

## **Project details**

### **1. Background and Rationale**

Sri Lanka is a tropical country which occupies land area of 65,610 square kilometers. The total population is 21 million and the population density is 310 persons per square kilometer. The natural forest area of the country is 1.9 million ha which is 29.7% of the total land area. Sri Lanka is one of the few countries of the world which maintains forest cover more than 29% of the total land area and high population density over 300 persons per square kilometer.

In addition to natural forests, there are around 75,000 ha of forest plantations. Teak, eucalyptus, pine and mahogany are the main plantation species. Teak plantations are managed for timber production while pine and eucalyptus plantations are managed for both conservation and timber production depending on the location. Some of the pine plantations are used for resin extraction.

There are around 16,000 ha of pine plantations and they are located in wet and intermediate zones in Sri Lanka. Pine plantations are distributed from low elevations (100 m amsl) to higher elevations up to 2000 m amsl. Large scale of pine plantation was commenced in around 1967 to produce long-fibred pulp for paper industry. After 1978, Pine was selected as the main tree species in upcountry watershed reforestation. However, in 1990s planting of pine was stopped due to social pressure. Pine plantations are not used for pulp production at present due to technical problems in paper industry.

The primary aim for planting pine in watershed areas was to conserve watershed by reducing soil erosion and maintaining base flow of streams. These pine plantations were established on heavily eroded degraded lands, where no other tree species can be established. Pine is the only species so far successfully used to cover barren eroded and denuded lands with a tree cover. Over last few decades these pine plantations have grown well, providing tree cover to degraded barren lands. A mat of pine leaves on the ground protects soil surface from erosion. In addition, pine trees have developed a micro climate that is suitable for the other species to grow.

Pine plantations are subjected to periodic burning especially in intermediate zone due to manmade fires. Loosely packed pine litter with low moisture content and inflammable nature provide highly combustible environment within pine plantations. Forest fires remove nutrients in the litter directly through volatilization. It results poor nutrient availability in the soil. The light condition and water availability in pine plantations are very poor due to dense tree cover of the plantations. Since birds do not prefer pine plantations, due to lack of vegetation complexity and poor food availability, birds do not come and disperse seeds in the pine plantations. Therefore, wind dispersed seeds are the major contributor to the seed input. Presence of pine leaf litter and fires also reduce seed germination. Due to all above reasons, most of the pine plantations remain as

monoculture plantations in the Intermediate Zone of Sri Lanka. In contrast, most of the pine plantations located in wet zone has good undergrowth.

Pine plantations of Sri Lanka are managed for two main objectives which are conservation and production. So there are three main working circles are operated to achieve the above objective. Three working circles are Protection Working Circle, Timber and Resin Tapping Working Circle and Resin Tapping Working Circle. Protection Working Circle is implemented to protect watershed areas and conserve bio diversity. However presence of monoculture pine plantations in Protection Working Circles do not contributed for intended objectives since such plantations do not provide adequate ecosystem services.

Ecosystem services provided by mono culture pine plantations are limited. Due to forest fires and subsequent rains soil is subjected to erosion. Low level of biological diversity, occurrence of forest fires, unavailability of multiple benefits and reduction of ground water level are the main disadvantages associate with pine plantations. People who live around the pine plantations cannot get any material benefits from them. Therefore, social acceptance for pine plantations is low and there are requests to replace pine plantations with broad leaved native species. Since the soil condition and microclimate of the pine plantations have been improved at present compared to the initial stage of planting, there is a potential to improve the species composition of these plantations through series of interventions.

Planting of indigenous species in pine plantations and subsequent protection and management will improve the biodiversity of the pine plantations. Planting of Non Timber Forest Products species will help to provide income generation opportunities among local communities so that relationship between forests and local communities will be improved. Promotion of community based ecotourism in potential sites will further improve the community support for forest management. This will undoubtedly reduce manmade forest fires. And thus will improve regeneration of native species and reduce soil erosion. Therefore, the project aims to convert mono-culture pine plantations into multi-functional forests.

Above facts show that, this project directly relevant to the vision, mission and objectives of the APFNet. The project will support to improve forest ecosystem quality and promote the multiple functions of forests. Since the project aims to manage pine-mixed plantations in a sustainable manner, sustainable forest management and forest rehabilitation objectives of APFNet will also be fulfilled. The project expects communities to harvest NTFP following the management plan, so that the project will enhance social and economic benefits of forests.

The National Forest Policy of Sri Lanka has identified controlled collection of Non Timber Forest Products as a method to promote sustainable use of forests. The same policy emphasizes the rehabilitation of degraded forests for conservation and multiple

use production where it is economically and technically feasible, mainly for the benefit of local people. The Forest Conservation Act of Sri Lanka has provisions for local people to use forests products according to a management plan. Therefore, this project is relevant to APFNet's priorities, Sri Lanka National Forest Policy and Legislations.

Pine plantations identified for conservation objectives ( Plantations under protection working circle) will be improved by using series of interventions. The main interventions are prevention of plantation from fires, promotion of natural regeneration and under planting of mixture of species. Since light and water are limiting factors to implement above interventions, thinning will be done to overcome these constrains. Subsequently, mixture of species will be planted including pioneers and late succession species. Natural regeneration will be promoted by improving seed dispersal and creating a suitable environment for seed germination and growth. People of the adjoining villages will be involved in the establishment, maintenance and benefit sharing of this planting programme. Collection of NTFP and oleo resin extraction in remaining pine trees will be main benefits for the community. Promotion of community based ecotourism in potential sites will be additional benefits to community.

## **2. Goal(s) and Objectives**

### **Goal of the Project**

The goal of the project is to enhance ecosystem services provided by existing pine plantations.

### **Objective of the Project**

To enrich 350 ha pine plantations in intermediate zone of Sri Lanka with multiple species to obtain multi-functional benefits.

## **3. Outputs and Strategic Activities**

### **Expected Outputs**

- 350 ha monoculture pine plantations converted into multi species forests
- NTFP composition of above 350 ha of forests improved
- 500 families permitted to collect NTFPs.
- Community based ecotourism programme established

### **Output 1 350 ha monoculture pine plantations converted into multi species forests**

Out of 16,000 ha pine plantations of Sri Lanka, around 4,000 ha are located in watershed areas and high slopes. These plantations should be protected and converted into multispecies forest to obtain wide array of ecosystem services. This project expects to convert 350 ha of such plantations into multispecies forests. In order to achieve this output, following activities and work packages will be carried out.

#### **Activity 1.1 Selection of pine plantations for conversion**

Natural regeneration and undergrowth is fairly good in Pine plantations located in wet zone due to high soil moisture content and less forest fires. These plantations require little efforts and minimum interventions to improve the species composition. In contrast, pine plantations located in intermediate zone has poor undergrowth due to undesirable environmental factors such as forest fire and moisture stress, so pine plantations located in the Intermediate Zone require more interventions to improve the species composition. Therefore, plantations located in the Intermediate Zone are selected for this project.

Since plantations under timber working circle are harvested and replanted with timber species, we have not selected such plantations for the project. Plantations under resin tapping working circle are also not selected since removal of pine trees reduce the resin yield. So plantations under protection working circle in the Intermediate Zone are selected.

We considered the accessibility of the plantation and suitability as a demonstration site for the final selection of plantations. Selected plantations are located in Badulla, Nuwara Eliya and Matale districts of Sri Lanka. The selected pine plantations should be surveyed and boundaries should be verified before implementing the project. Range Forest Officer will be responsible for ground survey of the selected pine plantations.

#### **Activity 1.2 Establish the baseline of the plantations**

The baseline situation of each plantation will be studied and recorded before any intervention. The baseline information include age, growing stock, area, availability of other species, undergrowth, status of natural regeneration, proximity to natural forests and occurrence of forest fires events. This information will be collected using secondary data and primary data. This information will be used to identify interventions more precisely and to establish the baseline to evaluate the performance of the project. Circular shape sample plots with the diameter of 12.62 m will be selected randomly to collect primary data. Number of sample plots depends on the variation of the plantation but as a thumb rule six sample plots are recommended for one plantation. The GPS coordinates of each sample plot center will be recorded in order to visit the same samples in future. This task will be done by the Range Forest Officer of the Forest Department.

#### **Activity 1.3 Validation of methods for rehabilitation for specific sites**

Field observations and discussions with forest officers, experts and local communities were done to identify methods to rehabilitate the pine plantations. However, these methods will be finalized with the analyzing specific site factors and existing species composition in plantation sub blocks. It is proposed to obtain the service of experts of the forest department in the validation of interventions to specific site condition. Interventions identified by the planning team are described below.

#### **Activity 1.4 Forest Fire Control**

Since forest fire is identified as the main cause for reducing natural regeneration in pine plantations, fire prevention and suppression will be done as a key activity. Following activities will be done to reduce forest fires.

#### Activity 1.4.1 Establishment of Fire lines

The project will establish fire lines around and within the pine plantation in the dry season in order to prevent entering of external fire to the plantation. Internal fire lines will be established to prevent spreading of fires within the plantation. The thick litter layer and ground vegetation will be completely removed in these fire lines. These fire lines will be maintained annually.

#### Activity 1.4.2 Formation of Vigilant Groups

It is proposed to form vigilant groups for fire prevention. The group will be consisted of forest officers, community members and other government officers. Their main task is to prevent fire initiation. They will communicate the message to fire fighting group when fire incident occurs. The group will be in operation during the dry season.

#### Activity 1.4.3 Awareness creation

Since all fires are manmade, awareness programs will be conducted to reduce human actions which originate forest fires. These will be done during the dry season for people who are living in adjoining villages.

#### Activity 1.4.4 Fire Fighting

Firefighting groups will be formed to suppress forest fires. Armed forces, vigilant groups, community members, other government organization and CBOs will work together in these groups. In order to make efficient fire suppression, the project will equip vigilant group with firefighting equipment such as water sprayers, fire rakes and fire flaps. The community members of these groups will be motivated for fire prevention and suppression. They will be provided opportunities to collect non timber forest products as an incentive.

#### Activity 1.4.5 Removal of Pine Cones

Burnt pine cones roll along the slope spreading forest fires to other places. In order to remove these pine cones, communities are promoted to produce handicraft out of them. As a marketing tool they can make a slogan meaning that “Buying of this handicraft contributes to forest fire prevention”. It will create a good market for this handicraft among environmentalists.

### **Activity 1.5 Canopy Opening**

Removal of pine trees will be done either by stripped felling or random thinning. According to the field observations, around 30% to 50% of the existing pine trees should be removed. Pine trees will be felled in strips of 10m-20m wide along the contours at 10m-20 m interval. Striped felling cannot be done in some pine plantations due to presence of some under growth vegetation. In such situations, 30% of the

existing trees will be removed randomly to open the canopy. Trees will be marked by the Forest Department and felling will be done by the State Timber Corporation. This task will be done at the beginning of the project. If random felling damage the undergrowth trees will be removed by girdling.

### **Activity 1.6 Under planting**

Under planting with pioneer species and late succession species will be done in strips or gaps. The project expect to under plant 350 ha during the project period. The species combination includes fast growing short lived pioneers, fire resilient species, fruit bearing species (to attract seed dispersers), poorly dispersed species, nitrogen fixing species and Non Timber Forest Products species. The active participation of the community will be obtained in selection of species. Preference will be given to tree species available in the locality. Around 600 to 800 seedlings per hectare of above mixture will be planted. Since nutrient availability is poor in most of the pine plantations, planting will be done with an additional care.

The seedlings should be raised at least one year in the nursery and planting hole should be 1.5 ft in depth. Normally seedlings produced in 9 inch x 4 inch poly bags are planted in 1ft x 1ft x 1ft planting holes in Sri Lanka. Research findings and field experience have found out that large planting hole improves the growth performance of the plants. Soil in pine plantations is eroded and compressed. We have planned to plant indigenous species. According to our experience performance of indigenous species is on degraded lands is poor. Considering these limitations we propose to prepare large planting holes to plant indigenous species in pine plantations. The planting hole will be filled with soil before one week of planting to make the stable planting hole. Unnecessary materials such as gravel, stone and dead roots will be removed in filling holes. It has been observed that falling of pine leaves on the young seedlings affect their growth. Therefore, care will be taken to remove such obstacles for the plant growth. Planting will be done with onset of north-east monsoon rains from October to November.

### **Activity 1.7 Promotion of natural regeneration**

Reason for the absence of natural regeneration in pine plantations are forest fires, shade, limitation of soil moisture and nutrients, thick layer of leaf litter and insufficient seed in the soil seed bank. As mentioned in section 1.4 and 1.5 many of the above limitations will be overcome by forest fire prevention and canopy opening. With reducing forest fires, colonization by indigenous and naturalized species will take place in the open spaces of the plantation. Wind dispersed pioneer species such as *Alstonia macrophylla* and *Pterospermum canescens* (welang) and shrub species can grow in such cases. Once the process of colonization is triggered, seeds of other species will be dispersed due to attraction of birds to the plantation. Emerging species will be protected and their growth will be promoted by removing obstacles. In order to ensure natural regeneration, thick leaf litter and unwanted plants that hinder natural regeneration will be removed. Ultimately, conditions will be favorable for natural regeneration so more seedlings will be emerged within the pine plantation.

### **Activity 1.8 Continuous management**

Planted seedlings and naturally regenerated plants will be tendered and managed at least for five years. In addition, maintenance of fire lines, removal of pine leaf litter will also be done at least for five years. Canopy manipulation in the later stages can be done using girdling.

### **Activity 1.9 Performance Assessments**

After one year of implementation, performance of the interventions will be evaluated using sample data collection and this will be done annually. The samples plots which were used to establish the baseline will be revisited again to evaluate the effects of the intervention.

### **Activity 1.10 Seedling Productions**

About 280,000 seedlings will be produced in Forest Department nurseries in 9”x6” poly bags for planting and vacancy filling. Seedlings of pioneer species such as *Macaranga peltata*, *Trema orientalis*, and NTFP species such as *Terminalia chebula*, *Phyllanthus emblica* will be will be produced in these nurseries.

## **Output 2. NTFP composition of 350 ha of pine plantations improved**

### **Activity 2.1 Identification of NTFPs species which are suitable for the area**

As mentioned in section 1.6 rural communities will be consulted to identify suitable multipurpose species for planting.

### **Activity 2.2 Seedling Production and Planting**

Seedlings of the NTFP species will be produced and planted them in appropriate places in the plantation as described in section 1.6. NTFP species will planted where soil is suitable for planting NTFP species.

### **Activity 2.3 Tending and Management**

NTFP seedlings along with other seedlings will be managed with the participation of local communities.

## **Output 3. 500 Families are permitted to collect NTFP**

### **Activity 3.1 Identification of beneficiaries for NTFP collection and group formation**

Suitable community members will be selected with the consultation of local communities to collect NTFPs and community groups will be formed for NTFP collection. The people who were involving in planting, fire suppression and fire prevention will be given the priority for NTFP collection.

### **Activity 3.2 Oleo resin extraction**

#### Activity 3.2.1 Identification of Users

Community organizations will be identified for resin tapping in remaining pine trees of stripped felled or randomly thinned pine plantations. People who are involving in fire protection and other management activities voluntary will be given priority to in selecting users.

#### Activity 3.2.1 Training and awareness

These members of the organization will be encouraged for resin extraction and trained on resin extraction. Training will be including skill development in resin tapping, maintenance of resin tapping plantations and some important theoretical background of resin tapping.

#### Activity 3.2.2 Allocation of resin tapping for users

Identified plantations block for resin tapping will be will be allocated for community organizations.

#### Activity 3.3.3 Linking community organizations with Commercial resin tapping companies

Community organizations will be linked to the existing commercial resin tapping extraction companies to sell their products. These companies are encouraged to train the communities continuously.

### **Activity 3.3 Preparation of NTFP collection plan**

Sustainable NTFP collection plan will be developed with the community.

### **Activity 3.4 Issue permits to community members for NTFP collection**

Forest Department will issue permits to collect NTFP for individuals of communities. At present only pine cones can be collected by the individuals.

### **Activity 3.5 NTFP collection and monitoring**

Individuals of the community will collect NTFPs according to a plan and community group along with forest officers monitor the process. Record keeping will be done to find out the collected amount by each individual. This will be done by the community groups.

### **Activity 3.6 Benefit sharing**

The communities are allowed to sell the collected forest products. At present main forest products are Oleo Resin and pine cones. Oleo resin will be sold to the commercial resin tapping companies and the Government will charge the royalty from the community according to the Forest Conservation act of Sri Lanka. There is no established market for handicraft produced using pine cones. So Forest Department will assist to find new market opportunities for them.

Almost all the financial benefits obtained by the collection of forest products will go to the individuals of the community. They have to pay nominal royalty as mentioned above. The society will obtain non monetary benefits such as soil erosion control, protection of watersheds and biodiversity conservation.

#### **Output 4 Community based ecotourism programme established**

##### **Activity 4.1 Formulation of ecotourism plan**

There is a potential to develop ecotourism in Ella pine plantation in Badulla district since Ella is a popular tourist destination. In order to implement ecotourism programme in the above pine plantation, we will prepare comprehensive ecotourism plan with the adjoining community. Divisional Forest Officer Badulla along with his staff will prepare this plan.

##### **Activity 4.2 Formulation of the group and signing agreement**

The community group will be formed and registered as a legal entity to implement the programme formulated under section 4.1. Forest Department will sign the agreement with the community to implement the programme and benefit sharing.

##### **Activity 4.3 Implementation of the plan**

The plan will be implemented according to the agreement by both parties. According to the field observation we have identified following ecotourism activities within the Pine plantation.

- i. Opening nature trails for visitors through different attractions of the forest.
- ii. Provide facilities for camping.
- iii. Provide opportunities to take part in environmental conservation activities.

##### **Activity 4.4 Benefit sharing**

Benefit sharing mechanism will be clearly indicated in the agreement. The community will be allowed to collect the entry fee from the visitors and they will pay a royalty based on the proportion agreed upon in the agreement. Community organization will clean and maintain the trail. The proposed camping site will be maintained and managed by the Forest Department including camp bed and camping tent. The community will provide other facilities such as kitchen utensils, assistance for cooking and protection. The community can earn money by providing these services. There is no necessity to pay royalty for these earnings. The benefits of the tourism will be shared among community members based on their investment and contribution. The community will support Forest Department to protect the pine plantation from all human interventions.

#### **4. Risks and Assumptions**

There is a negative social pressure for existence of pine plantations in intermediate zone of Sri Lanka. There are requests from provincial governments to replace pine plantations with indigenous species. Therefore, conversion of pine plantation into multi-functional forests will be socially acceptable, so general public and political leaders will support this project. As a result, manmade forest fires and other negative human interventions will be

reduced. There is a risk of wildlife damages for some of the indigenous species after planting. In order to mitigate that we will select species that will not be damaged by wild animals. In addition, measures will be taken to protect seedlings from wild animals. Long dry spells can increase the risk of forest fires and moisture stress. It will reduce the growth of the established seedlings. In order to overcome fire risk, the project will introduce fire prevention measures. Seedlings of one year old will be planted on the field to mitigate moisture stress. It is assumed that no landslides will occur in the area.

## 5. Institutional Management and Communication

The project will be implemented by the Forest Department of Sri Lanka. Three Divisional Forest Officers have the key responsibility to implement this project. Forest Department Head Office and the Central-Uva Regional Offices will provide technical assistance for the implementation. Figure 1 describe project management chart.

### 5.1 Project Management Chart



### 5.2 Project Steering committee

The implementation of the project is guided by the project steering committee at the top level. The composition of the steering committee is presented in Table 1. Conservator General of Forests will be the chairman of the committee and Conservator of Forests, (Silviculture and Forest Management) will be the Project Director.

### 5.3 Project Implementation team

The project is implemented in three districts namely Badulla, Matale and Nuwara Eliya. Regional Deputy Conservator of Forests, Central and Uva will be the head of the implementation team. The members of the implementation team are given in Table 2.

Table 1. Project Steering Committee.

Name	Company/Department	Position	Note
Mr. Anura Sathurusinghe	Forest Department	Conservator General of Forests	Chairman
Mr. Sarath Kulatunga	Forest Department	Addl. Conservator General of Forests	
Mr. W.A.C. Wergoda	Forest Department	Conservator of Forests	Project Director
Ms. Lathisha Liyanage	Ministry of Mahawali Development and Environment	Director/Forestry	
Mr. H.P.S. Nawaratna	State Timber Corporation	Deputy General Manager	
Mr. Ananda Jayaratna	Forest Department	Deputy Conservator of Forests	
Mr. Nishantha Edirsinghe	Forest Department	Deputy Conservator of Forests	
APFNet		Observer	

Table 2 Project Implementation Team

Name	Department /Company	Position	Responsibilities
Mr. Ananda Jayaratna	Forest Department	Deputy Conservator of Forests	Adopting technology and obtain feedback and rectification. Find out resource needs and ensure allocation of resources in time. Overall supervision of the project at sub national level.
Mr. R.M. Wijepala- Badulla Ms. Thulani Kularatna- Nuwara Eliya Mr. Ashoka Herath	Forest Department	Divisional Forest Officer	Land identification, District Level planning, transferring the technology, allocating officers, Implementation and monitoring the plan, Field supervision, Obtain feedback and rectification. Communicate with regional and national level.

Staff categories mentioned in Table 3 who work for Forest Department and State Timber Corporation full time are the key staff involve in the project. Forest Department officers have experience in plantation establishment and forest restoration. However, little experience in enrichment of pine plantations. Therefore, Forest Department

requires the training to on enrichment of pine plantations. In addition the Forest Department and other supporting agencies require forest fire fighting equipments to suppress forest fires.

Table 3. Responsibilities and required capacity

Staff Category	Responsibility	Capacity
Conservator General of Forests	Overall supervision, Staff allocation. Fund allocation.	Capacity to evaluate the performance and guide the project.
Additional Conservator General of Forests	Supervision of the project	Technical Knowledge, coordinate other agencies.
Conservator of Forests Silviculture and Forest Management:	Identify Technology, Allocate resources in time, develop a monitoring mechanism, implementation.	Technical knowledge in the enrichment of pine plantations and capacity to monitor and evaluate the programme.
Conservator of Forests Environment Management	Implement Ecotourism plan	Technical and legal knowledge about the ecotourism and benefit sharing mechanism.
Deputy Conservator of Forests Central Uva Region Deputy Conservator of Forests (Silviculture and Forest Management)	Adopting technology and obtain feedback and rectification. Find out resource needs and ensure allocation of resources in time.	Work at National and Regional Level. They should have the capacity to find out new knowledge of the subject and transfer to field level. They should be able to monitor the programme and rectify issues.
Divisional Forest Officer	Land identification, District Level planning, transferring the technology, allocating officers, Implementation and monitoring the plan, Field supervision, Obtain feedback and rectification. Communicate with regional and national level.	Should be able to understand the silviculture of pine enrichment. Should have the capacity to understand and transfer the technology and evaluate the performance. Should be able to guide subordinates to implement the plan. Ecotourism development.
Range Forest officer	Organizing all field activities such as fire prevention, thinning, nursery preparation, planting, community need assessment, motivation of communities, issuing permits for NTFP collection according to the plan. Preparation of ecotourism plan with the community.	Work at the range level. Should have the capacity to undertake silvicultural activities and understand the performance and problems, finding out solutions. Ability to identify suitable tree species. Ability work with communities. Should be able to implement ecotourism development.
Beat Forest Officer	Carry out all field activities, such as	Practical experience in

	opening fire belts, fire suppression, planting, promotion of regeneration, planting, monitoring of NTFP collection, maintain of plantation journal for each pine plantation under intervention. Establishment of nature trail and camping site.	implementing silvicultural activities, fire prevention and suppression, Identification of regeneration process, NTFP collection, work with communities. They should have fire fighting equipments.
Forestry Extension Officers	Organizing community groups, motivating communities for fire prevention, participation in maintenance and ecotourism development. Monitoring of NTFP collection.	Ability to work with communities
Forest Field assistants (Full time)	Forest Fire control, Forest Protection, Reporting changes,	Capacity to protect forest from fires and
Regional Manager of State Timber Corporation	Thinning of Pine plantations.	Capacity to fell selected pine trees without damaging to remaining trees.
Officers of Army, Polices, Local government, Disaster Management Center	Forest Fire control	They should have the fire fighting capacity with forest firefighting equipment.

In addition to above officers, local communities involve in collection of NTFP, oleo resin extraction and forest fire control. In addition, community will involve in ecotourism development. Local communities require training on oleo resin extraction, fire protection and ecotourism.

There should be an effective communication among and within partners of the project. The communication between Forest Department, Communities and NGOs will be done by regular meetings at village level. The communication between Forest Department, Local Government Institutions, Police and security forces will be done through meetings, letters and informal discussions at the district level. District Coordination Committee meetings are held with all government agencies once a month to discuss the issues of the district as a government rule. The progress of the project will be discussed in this meeting.

The communication within the partners is important. Therefore, the project will form community groups and facilitate groups to conduct meetings and discussions at regular intervals. These group discussions will be a tool for communication within the community members. Monthly progress review meetings are held in the Forest

Department at Range and District level. It ensures communication within the department. In addition, field visit and monthly progress reports are other communication tools. Plantation Journal will be maintained for each plantation selected for the project. All activities and events implement in the plantation will be recorded in the journal and it is available for reference. These communication systems ensure timely information shearing about activities, performance and threats.

## 6. Project resources and financial management

The total cost of the project is 596,800.00 US\$ for 36 months period. It is expected obtain 477,300.00 US\$ as APFNet grant and the contribution of Sri Lankan Government is 119,500. In order to maximize the cost-efficient use of resources, the plan is monitored regularly and efficient use of funds is ensured. The funds will be utilized according to the provisions of Financial Rule and Regulation of Government of Sri Lanka. The expenditure of the project is annually audited by the Government Audit. Annex F and G, presenting funding resources secured both from APFNet and other channels.

## 7. Monitoring and evaluation

Indicators to evaluate the project objectives are described in the LogFrame Annex B. They are organized in to different criteria and presented in Table 4.

Table 4. Criteria indicators and monitoring mechanism

Criteria	Indicators	Monitoring Mechanism
Extent of forest resources	Area of pine plantation enriched	Plantation Journals Progress reports Maps
Bio diversity	Species composition of the plantation compared to the base year	Comparison of baseline and performance using samples
	Number of birds found in the plantation compared to bases year	Direct observation
	Number of species planted in each plantation	Plantation journal, Progress report
	Number of species naturally regenerated	Plantation journal, sample survey
	Number of seedlings present	Plantation journal, Sample
Forest Health and vitality	Forest Fire events in each plantation	Plantation journal
	Number of invasive plant species present	Sample survey, Direct Observation
	Abundance of invasive species	
	Forest area covered by fire lines	Plantation Journal and progress report, Direct observation
	Length of the fire line established	
Number of vigilant groups established for fire protection	Social survey, Group meetings records, progress reports	

Socio economic functions of the forest	Area enriched with multiple use trees	Plantation journals, progress reports
	Number of NTFP species per ha	Participatory assessment with people
	Number of Permits issued to NTFP collection	Permit counter foils maintained in Forest Department
	Income from NTFP collection	Social survey/PRA
	Income from oleo resin collection	Social survey/PRA
	Income from ecotourism	Social survey/PRA

### **8. Dissemination, duplicability and sustainability**

The output of the project will be disseminated to Forest Officers, Policy makers, National and local level politicians, communities, other Government officers, academia, school children, environmentalists and researches. It is expected to disseminate the technical and social feasibility of converting pine plantations in to multi species and multi-functional forests at the end of the project. The effect of this demonstration would be used to replicate the project in to other pine plantations. Annex F shows the detail Dissemination programme. It is expected to obtain funding support from funding agencies to continue the project.

## Annex A: Project sites map and relevant information

9. We have identified 12 pine plantations for this project in intermediate zone of Sri Lanka. They are located in Badulla, Nuwara Eliya and Matale districts. The map showing the project sites is shown on the map of Sri Lanka (Figure 1). Figure 2 shows the project sites on forest cover map of Badulla, Nuwara Eliya and Matale districts. The size and description of the identified plantations are given in Table 3.

No	District	Area Ha	Description
01	Badulla	40	Pinus carebia has been planted. Ground vegetation is absent. Damaged by fires. Plantation located vicinity of the tourist destination.
02	Badulla	10	Pinus carebia has been planted. Ground vegetation is absent. Damaged by fires. Social pressure to remove pine trees.
03	Badulla	25	Pinus carebia has been planted. Ground vegetation is absent. Damaged by fires. Slope is high.
04	Badulla	7.5	Pinus carebia has been planted. There are small shrubs. Located water in a source. There is social request to convert the pine plantation to multi species forest.
05	Badulla	45.5	Pinus carebia has been planted. There are small shrubs. Located water source. There is social request to convert the pine plantation to multi species forest
06	Badulla	22	Pinus carebia has been planted. There are small shrubs. Located water source. There is social request to convert the pine plantation to multi species forest
07	Nuwara Eliya	10	There is vegetation in the gaps of the plantation dominated by shrubs and few saplings. Fire damage is less last few years. Located in a watershed of a Major reservoir.
08	Nuwara Eliya	60	Fire damage is high. Poor under growth. Located in a watershed of a Major reservoir.
09	Nuwara Eliya	35	Fire threats present. Poor under growth.
10	Matale	41	Located in a hilltop of the Urban area. Water sources are present. Forest fires occur. Poor under growth. There are many requests to convert the plantation in to mixed forest.
11	Matale	8.3	Located closer to the Knuckles Conservation Forest which is a property of Central Higlands of Sri Lanka, World Natural Heritage Property. Poor under growth. Fire threats present.
12	Matale	50	Located within Knuckles Conservation Forest which is a property of Central Higlands of Sri Lanka, World Natural Heritage Property. Undergrowth is good. Need support to maintain the growth. Trip felling is not recommended but creation of using girdling of selected pine trees is recommended.

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.

# Annex A: Project sites map and relevant information

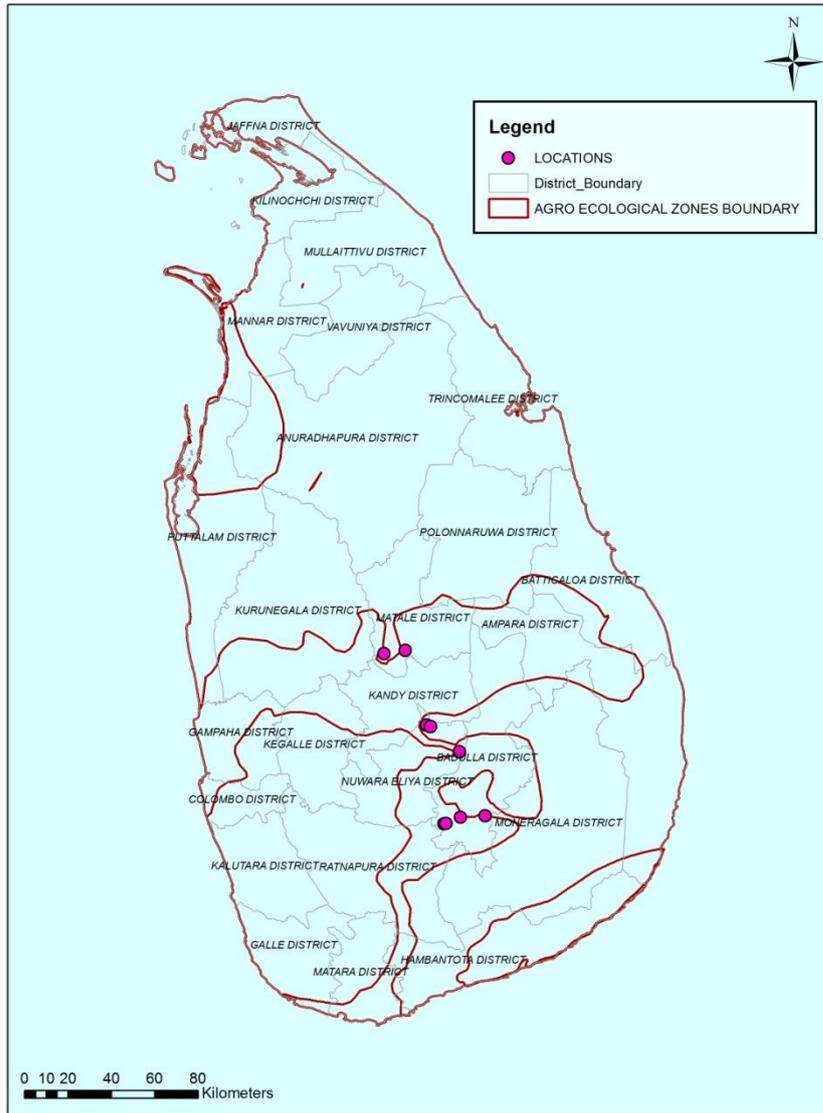


Figure 1. Location of pine plantations proposed for the project

## Annex B: Project logical framework

Items	Intervention logic	Objectively verifiable indicators of achievement <sup>5</sup>	Sources of information and means of verification <sup>6</sup>	Assumptions <sup>7</sup>
<b>Goal(s)<sup>1</sup></b>	The goal of the project is to enhance ecosystem services provided by existing pine plantations.	List of ecosystem services provided by enriched plantations. Ecosystem services obtained by adjoining communities	Impact assessment study	Pine plantations will not be converted in to other land use
<b>Objectives<sup>2</sup></b>	350 ha of pine plantations in intermediate zones of Sri Lanka enriched to obtain multi functional benefits in the year 2023	Area of Plantations rehabilitated Species composition compared to the base year Number of birds found compared to bases year Attitude of the people living in the adjoining area Number of invasive species Abundance of invasive species	Progress report Biodiversity assessment in plantations Bird study Household survey	No unusual droughts No landslides No pest and disease outbreak
<b>Expected outputs<sup>3</sup></b> Output 1	350 ha monoculture pine plantations converted into multi species forests.	Area of the pine plantations Number of species planted Number of plants established Number of species naturally regenerated Number of seedlings naturally regenerated	Progress reports Field observations Sample survey	
<b>Activities<sup>4</sup></b> Activity 1.1 Activity 1.2	1.1 Selection of pine plantations for conversion 1.2 Establish baseline of the plantations 1.3 Validation of methods for rehabilitation for specific sites 1.4 Forest Fire Prevention 1.5 Canopy Opening 1.6 Promotion of natural regeneration	List of plantation Plantation Maps Baseline situation report Identified methods list of interventions Length of the fire line Percentage trees removed  Number of naturally immerged seedlings Number of plants established	Monthly Progress reports of each activity Maps	

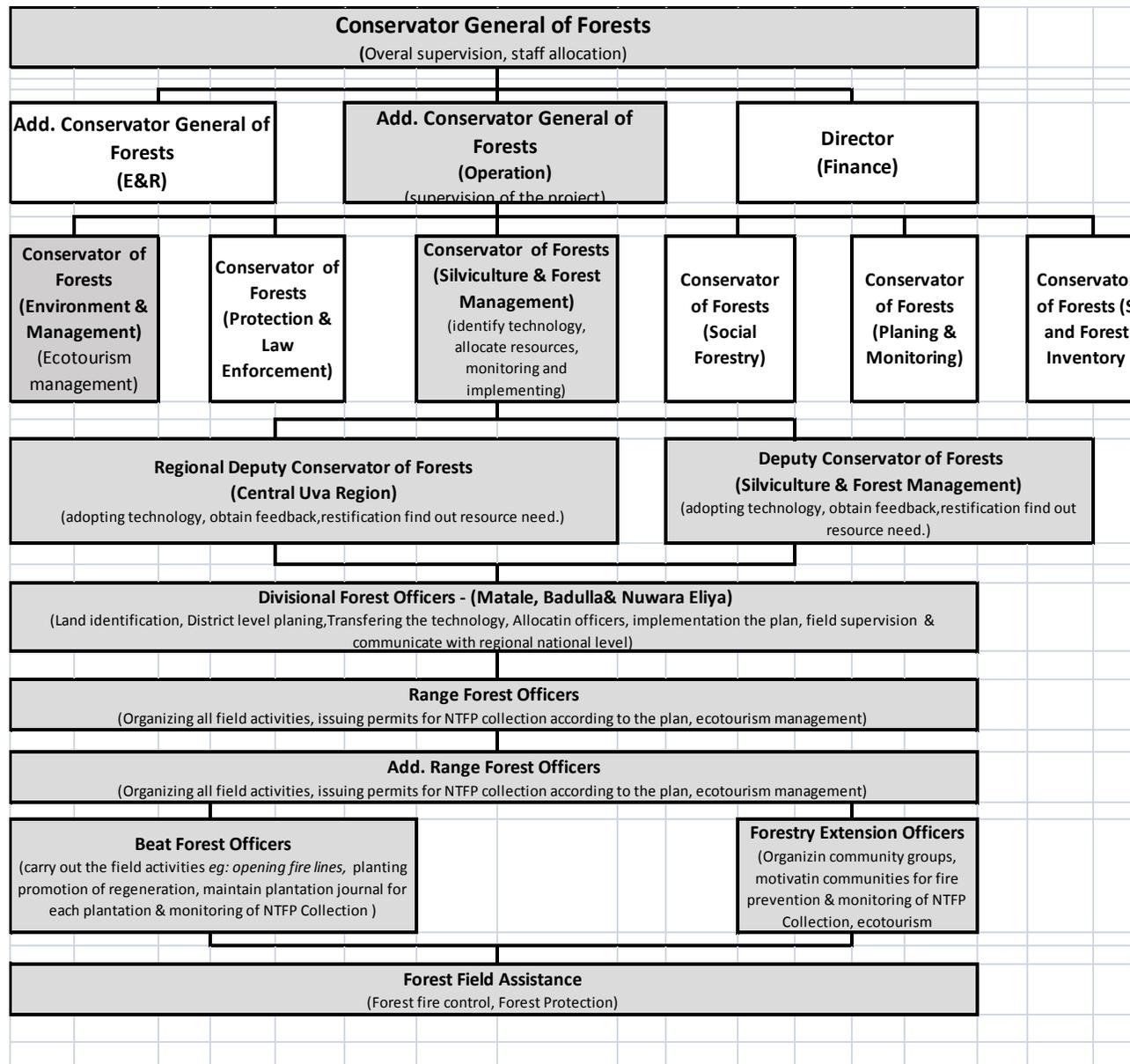
## Annex B: Project logical framework

	1.7 Under planting 1.8 Continuous management 1.9 Performance Assessment	Maintenance activities completed		
Output 2	2. Improvement of NTFP composition of 300 ha of pine plantations	Area enriched with multiple use trees	Field observations Progress reports Sample survey	
Activity 2.1 Activity 2.2	2.1 Identification of NTFPs species which are suitable for the area 2.2 Seedling Production and Planting 2.3 Tendering and Management	List of species for different locations. Number of seedlings produced Number of species planted in each location. Area under tendering and management	Nursery Record Progress Report	
Output 3	500 Families are permitted to collect NTFP	Number of Families received permit to collect NTFP	Social Survey PRA	Communities are willing to collect NTFP
Activities	3.1 Identification of beneficiaries for NTFP collection and group formation	The list of beneficiaries Number of group	Progress Report Social Survey PRA	
	3.2 Oleo resin extraction in pine plantations	Number of Groups extract oleo resin Number of members benefited. Annual income	Social Survey PRA	
	3.2 Preparation of NTFP collection plan	NTFP Collection plan	Plan	
	3.3 Issue permits to community members for NTFP collection	Number of Permits issued	Permit counterfoils	

**Annex B: Project logical framework**

	3.4 NTFP collection and monitoring	NTFP collected annually by types.	Record Maintained by community groups	
Output 4	<b>Output 4. Community based ecotourism established in Ella pine plantation</b>			
Activities	4.1 Formulation of ecotourism plan	Ecotourism Plan	Progress report	
	4.2 Formulation of the group and signing agreement	Agreement No. of members of the Group	Progress report	
	4.3 Implementation of the plan	Community Organization active No of visitors arrive Facilities developed	Progress reports	

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





### Annex Communication strategy

Objectives	Target audience	Key message	Communication tools	
			Products/Tools	Media/Channels/Activities
Project objective				
1. To enrich 350 ha of pine plantations in intermediate zone of Sri Lanka with multiple species to obtain multi functional benefits				
Communication objectives				
1. To develop confidence of Government officers on techniques of converting mono culture pine plantations in to multifunctional, multi species forests.	Forest Officers of National level to field level.	Due to various reasons pine plantations remains as monoculture plantations. Using combination of interventions, these pine plantations can be converted in to multi species and multi functional forests. Therefore, forest department can implement forest pine enrichment programme.	Meetings and workshops Website	Audio Visual Internet

2. To show the feasibility of improving pine plantations to obtain ecosystem services to environmentalists, government officers, politicians, school children and teachers and other stakeholders	Environmental NGOs Free lance environmentalists District level government officers Teachers School children	Conversion of pine plantations in to multispecies is feasible so environmental lobby of Sri Lanka will support this programme by creating good social environment.	Broachers and Leaflets	Printed
3. To create research opportunities in conversion of pine plantations among academics and researchers	University lecturers University students Res	Enrichment of pine plantation creates a knowledge gap so researchers can conduct research programmes to fill the gap.	Meetings and workshops Website	Audio Visual Internet
4. To develop positive attitude towards pine plantations developed in adjoining communities and local level politicians	Adjoining communities Local level politicians	The existing negative attitude about pine plantations among community and local people change towards	Community Discussions Social Network	Audio Visual Internet

		positive. So these people will engage in pine conversion programme.		
5. To obtain support to convert mono culture pine plantations in to multifunctional form the donor agencies .	National and international donor agencies	Donor agencies realize the success of pine plantation conversion So that they support future efforts .	Reports Website	Printed Internet
6. To motivate local people to protect pine plantations from forest fire.	People who set fires to pine plantations.	People understand the effect of forest fires so they will not set fires to forests.	Posters Community Discussions	Printed Audio Visual