
National Research Priorities in Plantation Forestry



National Committee on Organic Agriculture and Forestry
Sri Lanka Council for Agricultural Research Policy
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Authors of priority document

Dr. S P Nissanka (Chairman)

Senior Lecturer, Department of Crop Science, Faculty of Agriculture,
University of Peradeniya, Peradeniya

Mr. Mahinda B. Sakalasooriya (Secretary)

Research Officer, Sri Lanka Council for Agricultural Research Policy,
114/ 9 Wijerama Mawatha, Colombo 07

Dr. N D R Weerawardena

Chief Research Officer,
Forest Research Centre, Forest Department
Kumbalpola, Boyagane

Prof. Hemanthi Ranasinghe

Professor, Department of Forestry and Environmental Sciences,
Faculty of Applied Science, University of Sri Jayewardenepura, Nugegoda

Mr. Thilak Kariyawasam

President, Lanka Organic Agriculture Movement,
Wata Mawatha, Gangodawila, Nugegoda

Dr. Daya Wijewardena

CEO, National Organic Certification Guarantee Limited,
Govijana Mandiraya, Rajamalwatte Lane, Battaramulla

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Abbreviations and Acronyms

CARP	Council for Agricultural Research Policy
CC	Climate change
CDM	Clean Development Mechanism
CGIAR	Consultative Group on International Agricultural Research
DEA	Department of Export Agriculture
DOA	Department of Agriculture
FAO	Food & Agriculture Organization of the United Nations
FD	Forests Department
FORDATA	Database of the Forests Department of Sri Lanka
FRMP	Forest Resources Management Project
IPCC	Intergovernmental Panel on Climate Change
JEDB	Janatha Estate Developmental Board
JFM	Joint Forests Management
LOAM	Lanka Organic Agriculture Movement
LRC	Land reform Commission
Mg C ha ⁻¹	Mega Gram Carbon per hectare - A unit of mass equal to 1,000,000 grams
NCOA &F	National Committee on Organic Agriculture and Forestry
NFP	National Forest Policy
NGO's	Non- Governmental Organizations
NTFP	Non- timber Forests Products
PGIA	Postgraduate Institute of Agriculture
PMMD	Plantation Management Monitoring Division (PMMD) of the Ministry of Plantation Industries
PMMD	Plantation Management Monitoring Division of the Ministry of Plantation Industries
RPCs	Regional Plantation Companies
SLSPC	State Plantation Corporation
STC	State Timber Cooperation
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNREDD	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries

Preface

Among the Goals in Mahinda Chintana “Vision for the future” document, raising forest coverage from 28 to 43 percent in Sri Lanka by year 2016 and, reforesting all the catchments areas to conserve water have been given particular emphasis.

However, with heavy demand for timber and other non- timber forest products, attaining those goals would be a great challenge to the nation where, still the existing stock of plantation forests does not adequately meet the national timber and fuel wood demands of the country.

The National Committee on Organic Agriculture and Forestry, of the Sri Lanka Council for Agricultural Research Policy, as a national level policy making body addresses this issues by preparing the national plantation forestry research priority document. This document has proposed a pathway how research agencies may take this challenge by developing our plantation forests strategically to fulfill the nations’ timber demand at commercial level simultaneously providing more sound biological and environmental benefits with conservation philosophy.

To prepare this research priority document, the committee conducted series of consultation meetings, forums and open discussions with wide range of experts in Sri Lanka and abroad. It welcomed reviews, comments and suggestions by environmentalists, academics and foresters. CARP strongly believe that this effort will be utilized by researchers of Sri Lanka who are engaged in the forestry related research in future.

The CARP gratefully acknowledges the contribution of Dr. S P Nissanka and all members of the National Committee on Organic Agriculture and Forestry in getting the leadership to prepare this document. There were several other scientists and stakeholders who participated in our forums and meetings and contributed their knowledge to this national document. The CARP also wishes to acknowledge the valuable contribution of all the stakeholders, scientists for.

We appreciate, Audio – Visual Center of Department of Agriculture also for designing the cover page of this document. Similarly, our sincere thanks go to all the line agencies, Forest Department, Department of National Botanic Gardens, Department of Agriculture, Ministry of Plantation Industries and Ministry of Agriculture for various assistance and contribution to make this policy document.

Dr. J D Samarasinghe
Chairman,

Mr. Prabath Wimal Kumara
Secretary/ Director
Sri Lanka Council for Agricultural Research Policy

FOREWORD

Sri Lanka is the 5th nation in the world reporting the worst deforestation rate of clearing primary forests during 2000-2005 as per the FAO statistics. Sri Lanka has already lost 70 percent of the original natural habitats and at the current deforestation rate; biodiversity will be in a severe vulnerable position (FAO, 2005). To address the nation's demands for forest products, Sri Lanka has made comprehensive strategies to promote plantation forests. Establishment of commercial scale plantation forests began in the early 1880's to provide timber for railway sleepers, fuelwood for industries (Subasinghe, 2007). Exotic fast growing tree species did not provide adequate supplies to meet the growing demand for high valued timber especially for furniture. Most of these plantation forests did not yield the potential productivity due to genetic variation of the planting material or inadequate management measures implemented. Some of the exotic tree species used in plantation forests was subject to criticism by environmentalists due to their negative impacts on biodiversity, water and soil.

The government policy document "Mahinda Chintana" targeted an increase in the country's forest cover to at least 35 percent by the year 2020 and also to establish 1.9 million ha. new forest plantations by 2016 (Mahinda Chintana , 2010) to address the demand for forest products while conserving the current stock of natural forests.

Assurance of a constant supply of timber to guarantee a return on the capital investment is another important aspect. Plantation forests are mainly targeted for industrial activities, hence good management practices are very important aspects to gain the maximum commercial benefits for the investors. Thus, research on forestry and related sectors is a fundamental necessity to gain maximum benefits from it.

The National Committee on Organic Agriculture and Forestry, under the Sri Lanka Council for Agricultural Research Policy, listed the national level research needs for the plantation forestry sector. In order to identify research gaps, policy issues and needs, the National Committee prepared a priority document after several consultations with stakeholders and researchers. The Committee highlighted the main thematic areas, research needs, research strategies and activities.

The Committee stressed the need for re-directing research priorities of Research Institutes, Universities and other related sectors to align with the National program, the importance of promoting

collaborative research programs with cutting-edge research, avoidance of duplication and speedy delivery of research recommendations to the stakeholders.

The Committee and the Council for Agricultural Research Policy solicit the fullest cooperation of all stakeholders to consider this as a guideline when designing research programs for their respective institutes.

BACKGROUND

Identification and prioritization of agriculture research is one of the key mandated functions of the Council for Agricultural Research Policy (CARP) set by the CARP- Act (1989). The national research prioritization is the common method conducted by the national agriculture research management institutes and also with the Consultative Group on International Agricultural Research (CGIAR) to give policy directives to the Government and funding agencies to focus on research with national interests and the effective utilization of funds in a much accountable and transparent manner. It is expected to provide strategic directives for Donors and the Government to plan the research investments in the agriculture and related sectors to deliver economic, social and environmental benefits to the Country.

The Council for Agricultural Research Policy (CARP) established the National Committee on Organic Agriculture and Forestry (NCOA & F) during its 8th Technical Sub-Committee in 2011 to prepare the national level research priorities and to formulate the sub- sectoral policies. The Committee consists of 12 members representing universities, research institutes, related Government departments and private sector business entrepreneurs. The Committee is entrusted with the responsibility to prepare the national research priority document in Organic Agriculture and Plantation Forestry. The Committee wishes to prepare two separate priority documents for the sub-sectors of Organic Agriculture and Plantation Forestry.

This document is referring to the research priority aspects of the plantation forestry sector in Sri Lanka.

Objective

The objective of this effort was the prioritization of research needs in the plantation forestry and related sectors for effective and efficient use of limited resources. Plantation Forestry Sector includes forest plantations with exotic fast growing high yielding tree species, home gardens/ agro-forestry systems including Kandyan forest gardens, social / community forestry programs and landscape forestry.

Outputs

The outputs of this priority document are expected to

- Provide priority research themes to provide guideline/s for researchers
- Provide a base to the research institutes who are involved in plantations forestry and allied fields to redirect their research programmes
- Provide strategic directions for the national research programmes/funding organizations in the funding of research in the Plantation forestry and allied fields.

Methodology adopted

This document is the result of a series of consultations with the stakeholders in the plantation forestry and related sectors at the national level. The major events conducted in research need identification and priority setting was as follows;

- The National Stakeholder Consultation held in 17th October, 2011 in Colombo
- The Expert Consultation Meeting held at the Postgraduate Institute of Agriculture (PGIA), University of Peradeniya in 23rd March, 2012
- Expert Consultation Forum held in the Royal Botanic Gardens, Peradeniya in 11-12th October, 2012

Following institutes participated in the preparation of this document;

- University of Peradeniya
- Forest Department
- University of Sri Jayewardenepura
- Lanka Organic Agriculture Movement (LOAM)
- Ministry of Agriculture
- Ministry of Plantation Industries
- Department of Agriculture
- Department of Export Agriculture

1. State Sector Plantation Forestry (Forest Department)

Assessment of forest resources of 1992 of Sri Lanka by the Forest Department, indicates that the total forest cover including forest plantations is around 32.2 percent of its total land area (6.616 million ha.). The percentage of closed-canopy natural forest areas is 23.9 percent, sparse and open forests is about 7.0 percent, and that of the forest plantations is about 1.3 percent of total land area in Sri Lanka (Legg, 1995) Rest of the land is under agriculture (about 35 %), Trees Outside Forests (about 24%), and other land use (about 9%).

Large areas of natural forests in Sri Lanka have been degraded by illicit felling, chena cultivation, repeated burning, clearing of forest for agriculture and other purposes. Various measures are taken to rehabilitate degraded forests depending on their severity of degradation. For example, severely degraded forests are converted to forest plantations while moderately degraded forests are restored with enrichment planting or assisted natural regeneration. A logging ban of natural forests was imposed in 1990 and is still continuing. Therefore, no wood supply is obtained from any natural forest in the country and they are assigned purely for biodiversity and environmental conservation and managed accordingly.

Most of the forest lands in the country are located in the dry zone. In the dry zone, deforestation and forest degradation have led to formation of scrub forests. Large areas of scrublands are available in the dry zone which can be developed by reforestation with plantation species. If proper management practices are not adopted, they may remain as it is, and will be invaded by invasive species. Reforestation with suitable species can convert these degraded forests to productive plantations.

The Forest Policy in 1980 emphasized the great need for sustainable management of forest resources to supply timber and fuel wood and the involvement of local communities through social forestry programs. National Forest Policy (NFP) was developed in 1995 taking into consideration the depletion of forest resources at global and national levels. The main objectives of Forest Policy are:

- To conserve forests for posterity, with particular regard to biodiversity, soils, water, and historical, cultural, religious and aesthetic values
- To increase the tree cover and productivity of the forests to meet the needs of present and future generations for forest products and services
- To enhance the contribution of forestry to the welfare of the rural population, and strengthen the national economy with special attention to equity in economic development

The Policy directs that the forests will be brought under sustainable management both in terms of the continued existence of important ecosystems and the flow of forest products and services. Forest buffer zone development will also be important for sustainable forest management. When compared with other Asian countries, the dependency of peripheral communities on forests as a means of livelihood is lower in Sri Lanka and those who are living around the forest are primarily dependant on agriculture (Dissanayake, 2010). The Policy also emphasizes the importance of homestead and other agro-forestry development, which will be encouraged as a main strategy to supply wood and other forest products.

1.1 Forest Plantations and wood supply

Forest plantation establishment in Sri Lanka which commenced in 1870s has been continued for more than 100 years establishing about 79,941 ha. plantations to date. Initially plantation establishment was done in degraded natural forests formed as a result of shifting cultivation. In the wet zone and up-country, establishment of plantation forests was done in patana grasslands in the early stages. These activities are being continued and currently plantation establishment is mainly done in second rotation areas where previously established plantations are harvested for reforestation. Major plantation species and the cultivated extents are given in the Table 1.

As the establishment of new plantations is currently confined to second rotation areas and also with the demarcation of permanent forest estates, the total area under forest plantations will be more or less constant in the future. Teak is planted in the dry zone and considered one of the important timber species. However, elephant damage to Teak in some areas has limited the cultivation of this species. As an alternative, *Khaya senegalensis* (African Mahogany) is planted now in large scale in the dry zone.

Eucalypts are considered as one of the important timber species in the up country and several species of Eucalyptus (e.g. *Eucalypt microcorys*, *E. grandis*) are planted extensively for reforestation in the up country. Pinus has been planted in large scale in the Wet and Intermediate Zones. Nevertheless, this species is not planted now due to the pressure from environmentalists. Mahogany mixed plantations have

Table 1. Extent of forest plantations by species

Species	Extent (ha)
Teak	26,333
Eucalypts	22,268
Pine	9,954
Mahogany	5,505
Khaya	1,765
Others	14,116
Total	79,941

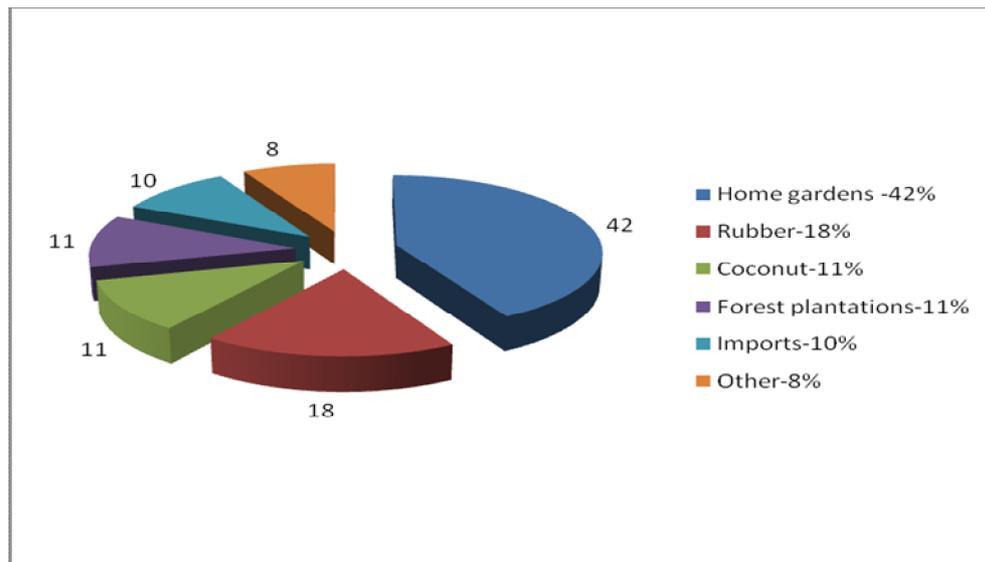
Source: Forests Department- Plantation database (FORDATA) 2011

been established in the Intermediate Dry Zone from 1930s. These plantations are maintaining a continuous forest cover due to absence of complete or clear felling in contrast to other plantation species. In addition to these exotic plantations, various native tree species such as Neem (*Azadirachta indica*), Halmilla (*Berrya cordifolia*), Hora (*Dipterocarpus zeylanicus*) have been planted by the Forest Department in small scale.

The Forest Department as the umbrella organization for forestry in the country continues to engage in several projects to develop the forestry sector and to increase the forest cover in the country with the assistance of government, foreign development partner agencies and the private sector. The Forest Resources Management Project (FRMP) among other projects was implemented to promote the activities of forest maintenance and management and reforestation. Accordingly, an extent of 720 ha. was reforested and 2,332 ha. of young plantations was maintained while successfully completing the survey and demarcation of forest boundaries of 11,200 kilometers. Up to 2009, the Forest Department has reforested 5486.86 ha. with primarily Teak, Khaya, Mahogany, Halmilla, Eucalyptus etc.

In spite of large scale forest plantation establishment, they contribute only 11% of total wood supply for the total demand of the country. A larger portion of timber is provided from home gardens (42%). Coconut and rubber plantations also supply a significant amount of timber or firewood as shown in the Figure 1. This shows the importance of promoting home gardens for the timber supply in the country and this has been emphasized in the National Forest Policy in 1995 . Among the species which are most sought after Teak, Mahogany, Albizzia, Eucalyptus can be mentioned.

Fig 1. Wood supply from different sources -2006



Source : Asia-Pacific Forestry Sector Outlook Study II (FAO, 2009)

1.2 Research on Plantation Forestry

Forest research is one of the important biological research areas in the country. Forests distributed in diverse ecosystems warrants the necessity of extensive research programs for the scientific development and management of these resources. With the new developments in the forestry sector, it is important to identify new research areas to suit the requirements of the country. Research Division of the Forest Department is mainly responsible to cater to the requirement of the Forest Department which is the major agency responsible for the scientific development and management of the forest resources in the country. In addition, universities, NGOs and other organizations are also actively involved in conducting forestry research. Therefore, a clear guideline indicating the priorities of the forestry research in the country is required for all the researchers to develop their research projects in accordance with the country's needs.

Forestry Sector Master Plan (FSMP) developed in 1995 identified following major research areas for the Forestry Sector (Forestry Planning Unit, 1995);

1. Biodiversity Conservation : Participatory management of forests, biodiversity surveys, ecological studies, mangrove conservation, eco-tourism, ex-situ conservation of indigenous species
2. Soil and Water Conservation : Participatory watershed management, soil conservation measures, Tree species for rehabilitation of degraded catchments
3. Multiple-use Forests: Partnership development in forest management, silvicultural system development for various forest types, eco-physiological studies, inventorising stocks, rehabilitation of degraded forests

4. Home garden and other non-forest tree resources : Agro forestry systems, socio-economic studies related to forestry, multipurpose trees, growth and yield studies, ethno-botanical studies
5. Forest Plantations : Species composition, management to increase productivity, growth and yield studies, site assessment and species selection, mixed planting, introduction of high quality seeds, fertilization, genetic improvement
6. Wood Products: Market information, wood preservation, seasoning, utilization, wood processing
7. Non-wood forest products: Resource inventories, indigenous knowledge, growth and yield studies, propagation techniques, market studies
8. Bio-energy: Inventory of biomass stocks, consumption of fuel wood and other bio-energy sources, development of alternative source of energy, wood-saving stoves

Forest Department has been engaged in forestry research for a long period of time. In terms of plantation forestry, identification of suitable species for degraded sites has been a priority area in the forestry sector. Screening of local as well as exotic species has been implemented for a long period of time. With these results, large scale reforestation programs have been implemented in the country. In addition, the management of those species from the field planting to the final harvesting has been done with the scientific input from the research. Along with these programs, tree genetic improvement research has been conducted and this has led to development of tree seed orchards with the objective of producing genetically superior seeds for the plantation development in the country. One of the challenges that the Forest Department is facing in the last decade or so is plantation establishment in second rotation areas which means establishing plantations for the second time in the same site after complete felling of the previous plantation. The main difficulty in such sites is land degradation and associated poor growth and low productivity in plantations. Forest pest and disease control and spread of invasive species are some emerging issues in the forestry sector identified by the Forest Department. Carbon stock management in forests and related studies including climate change mitigation has attracted attention in most developing countries including Sri Lanka and Forest Department in Sri Lanka is the focal point for the proposed UN-REDD Plus Project which aims at curtailing forest degradation and deforestation.

1.3 Future scenarios

With the new developments throughout the world, certain challenges will have to be faced by the forestry sector in future. Climate Change and its impacts will have greater influence on stability of forests, soil erosion, forest fire, wind damage, incidences of pest and diseases, and invasive species etc. Forest productivity may decline in second rotation sites due to poor soil conditions unless necessary inputs are provided to increase soil fertility. Degradation and decline of the forest estate especially the ones that are not gazetted which comes under the category 'Conservation Forest' under the 5/2001 Circular due to development projects can be expected. Increasing demand for timber will be experienced due to increasing population. Participatory forest management practices will have to be adopted to cater to the needs of rural population. Forestry research will have to be focused to address these issues.

2. Plantations forests of the Regional Plantation Companies (tea, rubber and coconut plantations)

The Regional Plantation Companies (RPC's) were formed in late 1992 as the first phase of the privatization of fully state owned estates managed by the State Plantation Corporation (SLSPC) and Janatha Estate Developmental Board (JEDB). A total of 408,487 ha. of land was acquired by the Land Reform Commission LRC under the Land Reforms Act in the year 1972. Of this extent more than 50% was given over to 23 plantation companies for management.

As per the records available at the Ministry of Plantation Industries, presently all the RPC's own a total of 23,071 ha. of forest plantations with commercial value. As these lands are lease holdings, they need to prepare forest management plans including inventory of stocks, harvesting schedules, reforestation programmes. The areas that are identified for protection/conservation should be delineated from those for production/harvesting. These forest management plans need to be approved by the Forest Department. Table 2 shows the extents of forest lands under the privatized Regional Plantation Companies.

Table 2. Plantation forestry extents of the privatized Regional Plantation Companies

RPC	Estate Total Extent (ha.)	Forested Extent (ha.)	As a parentage (%)
Agalawatte	10,926.47	578.71	5.30
Agarapathana	10,111.52	922.13	9.12
Balangoda	12,411.56	1,927.97	15.53
Bogawantalawa	15,803.20	1,222.01	7.73
Elpitiya	8,838.02	808.45	9.15
Hapugastenne	16,500.76	3012.94	18.26
Horana	6,515.90	356.19	5.47
Kahawatte	12,334.04	2,124.49	17.22
Kegalle	9,753.39	269.89	2.77
Kelani Valley	13,069.70	1,012.17	7.74
Kotagala	12,009.10	783.48	6.52
Madulsima	7,371.80	1,516.24	20.57
Malwatte valley	11,334.61	1,368.97	12.08
Maskeliya	10,192.18	1,290.67	12.66
Maturata	11,546.43	962.79	8.34
Namunukula	11,781.15	1,025.55	8.71
Pussellawa	11,607.80	1,209.97	10.42
Talawakelle	6,497.55	736.46	11.33
Udapussellawa	5,961.84	560.47	9.40
Watawala	12,434.31	1,382.34	11.12
Total	217,001.32	23,071.89	10.63

Source : Plantation Management Monitoring Division (PMMD) of the Ministry of Plantation Industries 2012

3. Plantation forests of private companies and NGO or communities

Establishment of forest plantations by the private sector commenced about 12-15 years ago. This was a very positive move as up to this time, forest plantation establishment was predominantly carried out by the Forest Department and the state sector. Species of high commercial value were selected and planted primarily for profit. Based on the available information on the leading companies, details of private sector reforestation/aforestation programs are shown in Table 3.

Table 3. Status of Private Sector Reforestation Program up to 2008

Company	Species planted	Extent (ha).
Touchwood Investments	Mahogany	295
	Mahogany and Vanilla	92
	Mahogany, Vanilla and Teak	75.7
	Vanilla	13.3
	Sandalwood	139.6
	Sandalwood and Vanilla	19
	Sandalwood, Coconut and Mango	151.4
	Vanilla, Mahogany and Rubber	22.6
	Coconut	243
	Teak	19.8
Help Green	Teak	1909
Sadharitha Investments	Teak	303.64
	Sandalwood	121.45
	Mahogany	4.04

Source: The Annual Reports of the Companies 2012

In order to meet the future demand for timber, wood fuel, biomass etc. in a sustainable manner, identification of major issues/problems that the plantation forest industry has been facing and providing viable solutions is essential. In this task, identification of research needs and prioritization, developing strategies and action plans to execute them at national levels is essential. The National Committee on Organic Agriculture and Forestry of the SLCARP is mandated with achieving this task to assist the plantation industry. The Committee used stakeholder consultations to gather necessary information and formulate the priority research needs which may be used by the national funding bodies as a guideline for fund disbursement.

A Stakeholder Consultative Workshop was organized by the Committee in October, 2011 at SLCARP. Important stakeholders such as Forest Department, Regional Plantation Companies of Tea, Rubber and Coconuts, Private Companies involved in commercial forestry, Research Institutes, Universities *etc.* were invited. Based on the outcomes of the group discussions, present status of the forest industry, major and specific issues that the respective stakeholders are experiencing were identified. All these issues/problems/constraints collected were categorized in to seven (7) thematic areas by the expert committee comprising of the scientists from the forestry sector and the NCOA & F. For each thematic area, major issues and specific issues per major issue, research strategies and activity plan per each issue were formulated.

Thematic Area 1. Establishment and Management of Plantation Forests while Ensuring Sustainable Land Use

Establishment and management of plantation forests for various purposes are currently being undertaken by the government departments and private sector organizations. These are established mostly on degraded or abandoned lands which are exposed to heavy erosion, frequent fires, human influences etc. Although large number of local and exotic species are generally available for plantation purposes, most suitable species for these conditions should be selected for different purposes after screening at the field. In order to meet this requirement, identification of new species is required to broaden the available species base for different purposes. In addition to this, high quality planting materials are required to get maximum benefits. Genetic improvement programs are needed to cater to this need and such programs that are already being conducted by the Forest Department and other Institutes must be strengthened to suit new requirements. Seed orchard establishment for each species is another task which is needed as a part of the genetic improvement program. At present, Forest Department has established seed orchards mainly for Teak and Eucalypts and more seed

orchards will have to be established to get quality seeds for the requirements in the country. Improvement of nursery practices and establishment of certified nurseries are also needed to get quality planting materials, mapping of lands available and possible land improvements programs are also addressed under this thematic area.

Forest management from the field planting up to harvesting is very important to get a quality final product. Forest management practices for common timber species are well established and documented by the Forest Department. However, certain information gaps are present in terms of volume, yield tables etc in some species. When new species are selected for certain purposes, these information are needed to be newly developed. These information has to be generated by field assessments. Harvesting techniques are also needed to be improved in order to minimize wastage and conservation of environment. Currently large scale timber harvesting in government plantations is done by the State Timber Corporation (STC). With the expansion of plantations, particularly monocultures, pest and diseases are becoming more important. With the consequences of climate change, these problems may be expected to become serious as experienced in other countries. Currently important pest and diseases are documented and control measures have been recommended by the Forest Department. More studies will be needed for new pest and disease incidences and their control in future.

Major Issue 1. **Narrow species base and lack of quality planting material and availability**

Specific issues

Lack of sufficient information on identification, improvement, propagation, and management measures of suitable species (with special reference to native species) for

- a. Timber and industrial wood
- b. Biomass (energy)
- c. Environment. Conservation
- d. Non Timber Forest Products (NTFP)
- e. Recreation and Ecotourism
- f. Urban forestry
- g. Agroforestry
- h. Phytoremediation
- g. Growth rates of native and certain exotic species

Research Strategies:

- Broadening of species base for identified areas and development of silvicultural techniques and their management
- Develop high quality planting material through genetic improvement
- Introduction of tree based models for industrial wood, biomass (energy), environmental conservation, non timber forest products (NTFP), urban-forestry, agro-forestry, recreation and ecotourism suited for different agro climatic regions
- Conduct growth performance studies with respect to different site conditions

Activities

1. Screening of potential tree species for different ecological regions for identified purposes including the value addition options.
2. Develop species specific silvicultural and management protocols.
3. Carry out genetic improvement program (genetic conservation, breeding and propagation) for commercially important tree species.
4. Establishment of seed orchards (clonal and seedling) and development of clones.
5. Develop agro-ecological region based models for industrial wood, biomass (energy), environmental conservation, non timber forest products (NTFP), urban forestry, agro forestry, recreation and ecotourism.
6. Establish/develop planting material supply mechanisms (based on demand driven) when and where project proponent wanted (certified nurseries, information centers).

Major Issue 2. Marginal or unproductive land available for forestry

Specific issue

Degraded lands

Research Strategy

- Categorization of lands available for forestry, and identification of land improvement and conservation measures.
- Identification of suitable species for specific site conditions

Activities:

1. Land classification and categorization, mapping and development of site quality indices.
2. Identify effective soil improvement and conservation measures.
3. Site species matching.

Major Issue 3.

Poor forest management practices

Specific issues

- a. lack of sufficient growth, development, volume and yield tables for specific species
- b. Improper stock management and land use
- c. Improper harvesting and log handling
- d. Lack of sufficient knowledge on forest pest and disease control measures
- e. Lack of appropriate forest protection methods (soil and water)

Research Strategies

- Develop appropriate forest management techniques

Activities

1. Establish and maintain permanent sample plots to procure required data.
2. Develop growth, yield and volume tables.
3. Develop proper management guidelines i.e. fertilizer application, irrigation, pest and disease management, thinning and pruning, weeding, intercropping.
4. Identification of proper harvesting and log-handling technologies.

Thematic Area 2. Improve Value Chain System in Forest Plantation Sectors

With the increase of world's population and the escalation of the living conditions, there is an ever increasing demand for timber based products. In order to meet this demand on a sustainable manner without incurring irreparable damage to the natural forests, it is important to establish forest plantations and also to have more efficient timber utilization methods. In a global environment where sustainability and green consumerism are very much in vogue, producing timber in the most sustainable and environmentally friendly manner and making the products available on the market in a more efficient and effective manner is needed. Further, another important dimension in this scenario is brought on by the thrust of the industrial sector and others to reduce their ecological foot print which calls for securing green energies thus wood as biomass or fuel is very much in vogue. However, despite these thrust areas, the level of awareness as well as operationalisation of the above are still not optimal and thus should be improved by research, extension and having conducive policy and legislative environments.

Major Issue 1.

Poor understanding of value chain process

Specific issues

- a. Poor knowledge on forestry related trading (local and international)
- b. Lack of economic analysis and diversification options
- c. Lack of knowledge and emphasis on product and process certification for value addition
- d. Lack of knowledge on value system analysis
- e. Poor knowledge on wood processing technologies and value addition

Strategies:

- Establish species-specific value chain systems
- Develop appropriate mechanisms to acquire market information
- Develop diversified products with high market values
- Develop advanced wood processing and value addition measures.
- Establish local standards and certification systems

Activities:

1. Conduct economic analysis for plantation species and tree based cropping systems.
2. Establish central market information system to disseminate information to stakeholders.
3. Investigate appropriate advanced technologies for wood processing and value addition.
4. Setting up local standards for certification for the forestry sector.

Thematic Area 3. Biodiversity Conservation

Forest plantations were established primarily to provide the timber, fuelwood and other requirements of the people and for this exotic fast growing tree species which provided higher returns within a short time were used and they were mostly monocultures. Biodiversity and related ecological values did not take a higher priority. However, selection of a narrow species base, use of species having some environmental imbalances (fire hazards, soil and water erosion) *etc.* has caused negative impacts on forest biodiversity. However, it has been noted that maintenance of biodiversity in a forest plantation may produce a multitude of benefits including economic, ecological and social. For example, when a catchments area or a community area is reforested, a mixture of species rather than monocultures will have to be planted. When tree species are planted to improve landscape values, biodiversity can be improved by planting tree mixtures. When planting tree mixtures, identification of compatible species, methods of maintaining biodiversity etc will have to be studied.

Major Issue 1. Poor biodiversity due to narrow range of species

Specific issue: Lack of knowledge on species compatibility in mixtures and their management

Research Strategies

- Promote biodiversity in forest plantations
- Establish bio-corridors and conservation of sensitive sites where appropriate

Activities

1. Identify compatible species focusing on tree species diversity and management systems.
2. Establish bio-corridors and conserve sensitive sites where appropriate.
3. Develop landscape biodiversity.

Thematic Area 4. Impacts, Adaptation and Mitigation of Climate Change (CC) in Forestry Sector

Concern about the consequences of a changing climate has led us to explore the carbon cycles of terrestrial ecosystems, especially forest ecosystems, because of their importance for the global carbon balance (IPCC, 2000). Compared to other types of vegetation, forest and woodland systems generally can store larger amounts of carbon and it is also likely that natural forests accumulate more carbon than those that are planted. In the context of carbon storage, native vegetation communities therefore have considerable significance (Wilson, 1990).

Each year the world's terrestrial ecosystems withdraw carbon from the atmosphere through photosynthesis and add it again through respiration and decay. The withdrawals and additions of carbon can be seen in the regular seasonal oscillation of CO₂ concentrations in the atmosphere (Woods Hole Research Center, 2013)

Carbon sequestration in plantations can play an important role in mitigating the build-up of atmospheric CO₂. The actual magnitude depends on natural and management factors, social barriers, and the time frame considered. In addition, there are a number of ancillary benefits for local communities and the environment (Minnen, 2009).

According to Dewar (1992), in a forest plantation, total Carbon storage (at equilibrium) was generally in the range 40-80 Mg C ha⁻¹ in trees, 15-25 Mg C ha⁻¹ in above and below ground litter, 70-90 Mg C ha⁻¹ in soil organic matter and 20-40 Mg C ha⁻¹ in wood products (assuming product life time = rotation length). Rate of carbon storage during the first rotation in most plantations was in the range of 2-5 Mg C ha⁻¹year⁻¹.

Therefore, at global level, policies were formed to overcome these issues and many actions have been taken to minimize carbon emissions. As a result, carbon trading mechanisms (CDM and REDD+) have been introduced to promote forest conservation and establishment with a view to sequester atmospheric carbon in vegetations, where stored carbon could be traded with developed countries. Therefore, it is important to assess the impacts of Climate Change on forest productivity to identify suitable species and to develop management improvements to tolerate the changing climate better.

Major Issue 1. Enhanced CC impacts on forest plantations and CC associated disaster risk in forestry sector

Specific issue

- a. Increased vulnerability in plantation forests due to climate change
- b. Lack of information on
 - 1. Species adaptability to climate change.
 - 2. Carbon sequestration rates of plantation forests.
 - 3. CC associated disaster risk in forestry sector.

Research Strategies:

- Reduce vulnerability on plantation forests for CC and associated disasters
- Improve mitigation potentials for CC in the forestry sector.

Activities:

- 1. Assess climate change impacts on plantation forests in different agro ecological regions.
- 2. Identify suitable species and management measures adaptable to CC.
- 3. Develop species specific carbon quantification methods (annual accumulation rates).
- 4. Calibrate the existing carbon sequestration estimation methods to local species and conditions.
- 5. Explore carbon trading potentials qualifying under UNFCCC and voluntary mechanisms.
- 6. Investigate on Life Cycle Assessment in forest industries.

Thematic Area 5. Joint Participation in Plantation Forestry

Joint Forest Management (JFM) can be categorized as a Community-based Natural Resource Management intervention, which ideally consists of 3 main components: (i) resource management by the lowest possible devoluted management body, (ii) livelihood development and (iii) organisational and institutional development including promoting good governance and democratic decision making. JFM is based on the creation of a management partnership between authorities and the local community, with the process of empowering community groups being critical to the success. JFM aims at enhancing community participation and the realization that decentralized and inclusive resource management has better results in terms of conservation and utilization which need to be introduced to plantation forests.

Major Issue 1. Poor collaboration among stakeholders involved in the plantation forestry sectors

Specific issue Lack of information on joint participation in plantation forestry

Research Strategies

- Encourage joint participation in the plantation forestry

Activities

1. Assess possibilities and benefits for joint ventures.
2. Identification of conflicts that may arise due to joint forest management & their resolutions.
3. Develop models for joint forest management.

Thematic Area 6. Social/Environmental Aspects and Investor Related Aspects of the Surrounding Plantation Forest Industry

Plantation forests have been established in the country mainly by the Forest Department, Regional Plantation Companies and few Private Sector Organizations on a commercial scale. Planning and designing were mostly done based on the mandates of the respective institutes with little participation from the surrounding communities and without investigation of long- term environmental impacts (The Social Forestry programmes of the Forest Department involves communities at least in the implementation stage). As a result, public unrest and criticisms have been leveled by ecologists and environmentalists on species used and management planning adopted. Therefore, need for proper investigation of social and environmental aspects are essential for the plantation forest industry to avoid many of the negative issues raised.

With regard to investments in plantation forestry, there are many debacles faced by prospective investors which discourage the investments in forest plantations for fuelwood/energy, timber and related products. Therefore it is required to probe into these aspects methodically and arrive at proper solutions.

Major Issue 1. Poor integration of social and environmental aspects in project designing and implementation and Poor facilitation of prospective investors in forest plantation establishment

Specific issues

- a. Long gestation period
- b. Lack of awareness on alternative income generation during the rotation period and other forestry related issues
- c. Poor institutional collaboration
- d. Lack of investment security schemes
- e. Land and related issues
- f. Lack of information on impacts of exotic species
- g. Biodiversity losses
- h. Lack of a one-stop shop to assist potential investors

Research Strategies

- Socially acceptable, investor favorable and environmentally sustainable plantation forestry sector is established

Activities

1. Development of possible intermediate income generation opportunities.
2. Introduce insurance schemes to safeguard investors to mitigate unforeseen effects.
3. To pool information required by investors in a central location having easy access.
4. To have a land bank.
5. Investigate environmental impacts of exotic species.
6. Educate public on economical and ecological importance of respective forestry species.

THEMATIC AREA 7. STRENGTHENING POLICY AND LEGISLATIVE FRAMEWORK

One of the major concerns of investors in the plantation forestry sector is the uncertainty of their investments due to adhoc policy changes especially regarding harvesting and transporting of forest products. The regulations for the management of forests lies with the Forest Department but some other institutions also share the responsibility which causes conflict of interest sometimes. Forest zonation is inconsistent and not optimally operational especially on the face of acceleration development in the country. Poor implementation of existing laws and regulations as well as conflicting interest between institutions cause degradation of the forests ie. soil, water environment etc. Except in international business poor adoption of standards in planting and forest products.

Major Issue 1.

Poor implementation of regulations/inappropriate policies, adhoc policy /regulation changes

Specific Issues

- a. Shortcomings in demarcating and gazetting forest lands and implementation of related rules and regulations
- b. Conflict of interest between parties sharing responsibilities in forestry
- c. Inconveniences to investors due to inconsistent policies
- d. Land encroachment
- e. Increased vulnerability to natural hazards due to unplanned clearing/replanting
- f. Lack of strategic planning

Research Strategies

- Appropriate policy and regulation measures are in place

Activities

1. Review current status of policies, regulations and acts pertaining to the forestry and related sectors and identify gaps, weak areas.
2. Formulate appropriate policy, regulations, guidelines and acts for the forestry sectors.

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**MEMBERS OF THE NATIONAL COMMITTEE ON ORGANIC AGRICULTURE &
FORESTRY (AS AT 1ST DECEMBER 2012)**

Dr. S P Nissanka (Chairman)

Senior Lecturer, Department of Crop Science,
Faculty of Agriculture
University of Peradeniya, Peradeniya,

Dr. N D R Weerawardena

Chief Research Officer, Forest Research Centre
Kumbalpola, Boyagane,

Mr. R S Kulathunga (From June, 2012)

Senior Deputy Conservator of Forests
Social Forestry and Extension Division
Forests Department, P O Box 3, Sampathpaya,
Battaramulla

Mr. Anura Silva (Up to May, 2012)

Senior Deputy Conservator of Forests
Social Forestry and Extension Division
Forests Department, P O Box 3 Sampathpaya,
Battaramulla

Mr. T L P Raj,

Managing Director, Lanka Organics
23, Braybrook Street, Colombo 2,

Dr. A P Heenkende

Director (Research)
Research Station
Department of Export Agriculture, Matale,

Dr. K G Premathilake

Head, Agronomy Division
Tea Research Institute
Talawakelle

Dr. W M J Bandara

Rice Research & Developmental Institute
Batalegoda, Ibbagamuwa,

Prof. Hemanthi Ranasinghe

Professor, Department of Forestry and
Environmental Sciences
Faculty of Applied Science, University of Sri
Jayawardenapura, Nugegoda

Ms. Kumudu Herath

Program Officer
International Union for Conservation of Nature
53, Horton Place, Colombo 07

Dr. Priyantha Weerasinghe

Senior Research Officer
HORDI
Gannoruwa, Peradeniya

Mr. Thilak Kariyawasam

President, Lanka Organic Agriculture Movement
Wata Mawatha, Gangodawila, Nugegoda

Dr Daya Wijewardena

CEO, National Organic Certification Guarantee
Limited, Govijana Mandiraya, Rajamalwate Lane,
Battaramulla

Mr. Mahinda B Sakalasooriya (Secretary)

Research Officer
Sri Lanka Council for Agricultural Research Policy

Ex- Officio Participants from CARP

Dr. Jayantha D. Samarasinghe

Chairman
Sri Lanka Council for Agricultural Research Policy

Mr. Prabath Wimal Kumara

Secretary/ Director
Sri Lanka Council for Agricultural Research Policy

**Dr. Kumudini Gunasekera (up to January,
2013)**

Deputy Director
Sri Lanka Council for Agricultural Research Policy

THE EXTERNAL EXPERTS CONSULTED FOR THE PREPARATION OF PRIORITY DOCUMENT

Dr. K M A Bandara

Research Officer (Tree Breeder)
Forest Research Centre,
Passara Road
Badulla

Dr. Upul Subasinghe

Senior Lecturer
Faculty of Science, University of Sri
Jayawardenapura, Gangodawila, Nugegoda

Dr. K S Hemachandra

Senior Lecturer
Department of Agricultural Biology
Faculty of Agriculture
University of Peradeniya
Peradeniya,

Dr. T Sivananthawerl

Senior Lecturer
Department of Crop Science
Faculty of Agriculture
University of Peradeniya
Peradeniya,

Ms R M D Alawathugoda

Research Officer
Forests Department, Forest Research Centre,
Kumbalpola, Boyagane

Ms S H Bandumala

Research Officer
Forests Department, Forest Research Centre,
Kumbalpola, Boyagane

Mr A LM Zuhry

Research Officer
Forests Department, Forest Research Centre,
Kumbalpola, Boyagane

**SPECIAL INVITEES WHO DELIVERED PRESENTATIONS / STATUS REPORTS TO
THE NATIONAL CONSULTATION FORUM**

Dr. W M A D B Wickramasinghe

Director
Natural Resources Management Centre
Department of Agriculture
Peradeniya

Dr. Gamini Gamage

Addl. Secretary (Environmental Policy)
Ministry of Environment
82, Sampath Paya,
Rajamalwatte Road, Battaramulla.

Mr. A. Sathurusinghe

Conservator of Forests (Research & Education)
Forests Department
Sampathpaya
Battaramulla

PARTICIPATES IN THE STAKEHOLDER CONSULTATION

Mr. A. N. Baminiwatte
Independent Consultant
92/1B, Rubberwatta road, Gangodawila, Nugegoda

Ms R.M.D. Alawathugoda
Research Officer, Forests Department
Forest Research Centre, Kumbalpola, Boyagane

Ms S.H. Bandumala
Research Officer, Forests Department
Forest Research Centre, Kumbalpola, Boyagane

Mr A.L.M.Zuhry
Research Officer, Forests Department
Forest Research Centre, Kumbalpola, Boyagane

Mr. Ajantha Palihawadana
Operation Manager, SriCert
546/3 Wata Mawatha, Gangodawila, Nugegoda

Mr. Roshan Rajadurai,
Deputy Chairman, Ceylon Planters Association
CEO, Kahawatte Plantations Ltd.
No 52. Maligawatte Road, Colombo 10

Mr. F W Perera
Manager/ Forestry
Agrapatana Plantations Ltd.
53 1/1 Sir Baron Jayathilake Mawatha, Colombo
01

Dr. M Jayasooriya
Consultant
National MAB Committee
NSF, Vidaya Mawatha, Colombo 07

Mr. Sidath Bandara
Research Officer
Hector Kobbekaduwa Agrarian Research and
Training Institute
114, Wijerama Mawatha, Colombo 07

Dr.N. Ruwanpathirana
D.G.M-(Research , Development & Training),
State Timber Cooperation
Samapathpaya, Rajamalwatte, Battaramulla

Dr. T. Sivananthawerl
Senior Lecturer
Faculty of Agriculture
University of Peradeniya, Peradeniya
Dr. Jagath P Kirthisinghe
Senior Lecturer
Faculty of Agriculture

University of Peradeniya, Peradeniya

Dr. W M A D B Wickramasinghe
Director
NRMC
Department of Agriculture, Peradeniya

Ms. Indu Wattege
Centre for Environmental Justice
20A, Kuruppu Road,, Colombo 08

Mr. Sarath Premalal
Department of Meteorology
383 Baudhaloka Mw - Colombo 07,

Mr. H M Weerasinghe
Plantation Management Monitoring Division,
Ministry of Plantation industries
55/75 Vauxhall Lane,, Colombo 02

Ms Lakmini Senadheera,
Consultant ,
Carbon Consulting Company
No-15, Ramya Road, Colombo 5,

Mr. Sathis Navarathne
CEO
Sadaharitha Plantations Limited.
6A, Alfred Place,, Colombo 03,

Mr. Priya Gunawardena
Hapugastenna Plantations Ltd.
P O Box 02 Nambapana, Ingiriya,

Dr. Upul Subasinghe
Senior Lecturer
Faculty of Science
University of Sri Jayawardenapura, Gangodawila,
Nugegoda

Mr. K G S Karunarathne,
Foresry Officer,
Kotagala Plantations
53 1/1 Sir Baron jayathilake Mawatha
Colombo 01

Mr. Dan Seevaratnam
CEO
Watawala Plantations Ltd.
No 60, Dharmapla Mawatha, Colombo 03

Mr. Akila Dalpathado
Manager/ Forestry

Kelani Valley Plantations Ltd.
No 400, Deans Road,, Colombo 10

Mr. Manik Weerasinghe
Maturata Plantations Ltd.
No 168, Negombo Road, Peliyagoda

Mr. Ravi jayasinghe,
General Manager,
Kegalla Plantations Ltd.
310, High level Road, Navinna, Maharagama

Dr. M A Wijeratne
Senior Research Officer
Tea Research Institute
Talawakelle,

Ms. W M R S K Warnasooriya
Lecturer
Faculty of Agricultural Sciences
Rajarata University of Sri Lanka, Piliyankulama,
Anuradhapura

Mr. N Kuruppuarachchi
SriCert
546/3 Wata Mawatha, Gangodawila, Nugegoda

Mr. Anura Sathursinghe
Senior Deputy Conservator of Forests
Forests Department
Samapathpaya, Rajamalwatte, Battaramulla

Dr. K. M. A. Bandara
Research Officer (Tree Breeder)
Forest Research Centre,
Passara Road, Badulla

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