Sino-ASEAN Network of Forestry Research Institutes (SANFRI)

Report of the First Early Career Academics Forum

Pu'er, Yunnan, China

29 October - 1 November, 2019

Contents

Overview

China and ASEAN economies are neighboring economies with each other and share several similarities in terms of natural resources, especially tropical forest resources, which make forestry cooperation and communication become an important driving force for Sino-ASEAN cooperation. In this context, APFNet proposed to establish the Sino-ASEAN Network of Forestry Research Institutes (SANFRI) to advance forestry research by facilitating collaboration among forestry research institutes and to upgrade sustainable forest management among ASEAN economies and China.

In accordance with the adopted General Guidelines for Actions under SANFRI, the Early Career Academics Forum is one of the key components of SANFRI activities. APFNet organized the First Early Career Academics Forum during 29 October - 1 November 2019 in Pu'er, Yunnan Province of China together with Yunnan Academy of Forestry and Grassland (YAFG). In line with the consensus reached during the First SANFRI Steering Committee Meeting in March 2018, the theme of the Forum was decided as "Tropical Forest Restoration".

To prepare for the implementation of related actions under SANFRI, namely Early Career Academics Forum, APFNet Conference Attendance Support and APFNet Small Research Grant, a Young Scholar Team has been formally established by end September 2019. 24 young scholars recommended by the SANFRI Steering Committee are in the Team. As planned, 22 members of the Team (2 scholars from Vietnam were not able to come due to overlapping schedule) participated in the Forum and present their research works focusing on tropical forest restoration. In total 45 participants attended the Forum.

Opening Session

The opening session of the Forum was attended by 45 participants, including the members of SANFRI Young Scholar Team, members of SANFRI Steering Committee and representatives from various governmental agencies of China including the National Forestry and Grassland Administration, municipal government of Pu'er City and Yunnan Forestry and Grassland Administration.

Mr. Xia Jun, Assistant Executive Director of APFNet, gave an opening remark to the Forum. He briefly introduced APFNet including its mandates, function, and main activities APFNet has supported. He also provided insights on the importance of establishing SANFRI, emphasizing forestry research can play critical and catalytic role in expanding forest cover and improving forest ecosystem quality in the region. Although ASEAN have demonstrated dynamic economic growth over the last two decades and is endowed with rich and unique forest ecosystems, its level of forestry research still falls behind. SANFRI was therefore proposed by APFNet and formed 2018 with the purpose of strengthening effectiveness and efficiency of forestry research in ASEAN economies and China through information exchange, capacity development and collaboration. It also serves as a platform for forestry research institutes to exchange research information and share research resources.

Mr. Li Rong, Deputy Mayor of Pu'er City, Yunnan Province of China, delivered his speech which provided a thorough introduction of Pu'er City in terms of social and economic development as well as development in forestry sector specifically.

Mr. Xie Shou'an, Assistant Director General of Yunnan Forestry and Grassland Administration, conveyed his congratulation to the forum for its successful commencement. He briefed the participants on forestry development and achievements in Yunnan Province and the long term cooperation between the Province and APFNet in forest restoration and sustainable forest management.

Mr. Peng Youdong, Vice-administrator of National Forestry and Grassland Administration of China, delivered his opening remark which outlined China's achievements and progresses in forestry science and technology development and emphasized the importance of cultivation of young talents, which is the key to success of SANFRI.

Keynote Presentations

Forest Restoration in Vietnam: Achievements and Challenges

Vo Dai Hai

President of Vietnamese Academy of Forest Sciences, Vietnam

Dr. Vo Dai Hai, President of Vietnamese Academy of Forest Services, gave an overview of forest restoration in Vietnam. In his presentation, Dr. Vo Dai Hai reviewed the past and ongoing restoration programs, key achievements, lessons learned and challenges that Vietnam is facing. Dr. Vo Dai Hai summarized in his presentation the following past restoration programs:

- Program 327 of the Vietnam government emphasized on rehabilitation of protection forests (1992-1997),
- Program funded by World Food Program (WFP) focused on re-greening bare-land & degraded land (1995-1998),
- Five million hectare reforestation program (1998-2010) and
- Forest protection and development plan (2011-2015).

Among the above programs, the Five Million Hectares Reforestation Program (known as 5MHRP) is deemed as a milestone of reversing the trend of deforestation in Vietnam. The program was launched by the Vietnamese government in 1998, with the objective of rehabilitating five million ha of forests and protecting existing forests in order to increase forest cover rate from 28% to 40% by 2010. The program aimed to transform bare and degraded lands into smallholder forest plantations to have both environmental and economic benefits with an emphasis on improving sustainable livelihoods for the poorest rural areas. Among the planned five million ha, two million ha were planned as protection forests and the other three million ha as production forests.

He presented as well the ongoing restoration programs, which include:

- Target program on sustainable forestry development (2016-2020),
- Restoration of mangrove & sandy coastal forests for climate change mitigation and adaptation (2016-2020),
- Saw-logs plantation development (2015-2020) and
- Vietnam Forest certification scheme aims to have 3 million hectare of Forest Management certified forests (2016-2025).

Some key targets of the ongoing programs towards 2020 can be summarized as below:

- Increase forest cover to 42%,
- Protect effectively the existing natural forests (10.2 Million hectare),
- Establish 290,000 ha of large timber plantation,

- Reforestation and restoration of 21,600 coastal protection forests for climate change mitigation,
- Increase growth rate of plantation up to 25 m^3/ha/year, and
- Create 25 million jobs.

In addition to the programs mentioned above, payment for forest ecosystem services (PFES) is another important strategy that the Vietnamese government has been promoting during the past two decades. The strategy aims to enhance the participation of private sector in forest protection and sustainable forest management and scale up community forestry activities at central level. The PFES policy was first put forward in the Vietnam Forestry Development Strategy 2006-2020 and piloted in Lam Dong Province and Son La Province since 2008. Following forestry development trend, the government keeps improving the policy interventions to match with market needs, for instance, making modifications of the prices of services and expanding the scope of the policy to cover carbon trading. Until 2018, the total PFES revenue in Vietnam has reached 126.1 million USD.

Dr. Vo Dai Hai remarked that all the achievements in forest restoration should owe to, firstly, the strong political commitment of the government (strategies & policies etc.) and financial investment on reforestation and restoration; secondly, the integration of restoration efforts with poverty reduction and livelihood enhancement for local communities, particularly forest dependent communities; last but not least, clear land allocation to different stakeholders and clear tenure in order to ensure the engagement of local people.

He also emphasized Vietnam is still facing the challenges as follows:

- Low economic benefits from forests, especially natural forests as those are very strict to timber harvest,
- Lack of financial investment, particularly investment from private sector in protected forests as high cost of restoration & low timber benefits,
- Poverty & population growth pushing increasing demand on land for subsistence crops, and
- Lack of alternatives and incentives for sustainable livelihood in the forest areas for forest dependent people.

Restoration of Degraded Secondary Tropical Forests in South China

Zhang Qian

Vice-president of Guangdong Academy of Forestry, China

Dr. Zhang Qian, Vice-president, Guangdong Academy of Forestry, China, specially shared a case of restoration practice the Academy has done in degraded secondary tropical forests in Guangdong Province, China.

To start with, he pointed out that generally, China's forest resource is in shortage with

uneven distribution and large areas of forests in China are in poor quality. China's average stock volume per hectare is 89.79 m^3, accounting for 84% of the average worldwide, and the forest biomass is about 69.5% of the total within terrestrial vegetation ecosystems, which is much less than the average worldwide (94.0%). Mature forests are in small proportion and the average DBH of natural forests is only 13.6 cm. Of plantations, over 60% are monoculture forests and 80% still stay at early or middle phase of ecological succession. In terms of forest resources in Guangdong Province, based on data by 2018, there is in total 10.53 million hectare forest across Guangdong Province, and the forest cover rate is 58.59%. The stock volume per hectare is 50.51 m^3 which is only 56.3% of China's average stock volume per hectare. Secondary tropical forests account for 50.6% of forests in tropical region of China and are majority parts of forests in Guangdong Province. However, there is an urgent need of quality improvement of secondary tropical forests in Guangdong Province to enhance the forest ecosystem services both in ecological and economic aspects.

Under such circumstance, Guangdong Academy of Forestry lunched a project on "Study and Demonstration of the Management of Secondary Forests in Tropical Regions for the Purpose of Enhancing Economic and Ecological Benefits" in 2008. The project used close-to-nature management methodology to restore 1,000 hectare degraded secondary tropical forests in Xinhui County of Guangdong Province, aiming to enhance yield of non-timber forest products and high-value timber, increase biodiversity and bring ecological benefits. The project team first selected 98 tree species from natural forests based on forest-community investigation. The species included 68 native broad-leaf trees, for example, *Castanopsis fissa*, *Schima superba*, *Cinnamomum camphora*, *Michelia macclurei*, *Liquidambar formosana* and so forth. For each species, target trees were then determined using selective breeding strategy, and the seeds of which were subject to progeny test for the identification of improved varieties. The improved varieties of the tree species were propagated using tissue-culture technology. More than 29,000 seedlings were inter-planted in the target forests and the overall survival rate was higher than 80%. It shows that 41 species were highly adaptive to the environment in secondary tropical forests and the majority of planted saplings doubled (or more) their height within two years. Seven species were inter-planted in the target forests for collecting non-timber forest products, including *Millettia dielsiana*, *Acidosasa villosum*, *Litsea cubeba*, *Daemonorops margaritae*, *Artocarpus heterophyllus* Lam, *Euonymus fortunei* Hand. and *Sapium discolor*. These trees had an annual economic output ranging from 183.3 USD/ha to 495 USD/ha. After around 8 years, the quality of target forests has obviously improved.

The audience discussed some questions with Dr. Zhang, particularly if any benefit sharing mechanism available with the local communities. "At beginning of the project, all actions are on the negotiation base and partnership with the local communities. We signed contracts with the local communities including benefit sharing, hired labors as forest management hands and rangers. The local communities are real our friends and partners", Dr. Zhang explained.

Forest Research Development, Trends and Challenges for Sustainable Forest Management of Thailand

Suwan Tangmitcharoen

Acting Expert of Royal Forest Department, Thailand

Dr. Suwan Tangmitcharoen, Acting expert on forest plantation promotion, Royal Forest Department of Thailand, introduced forestry development in Thailand in terms of forest research, development trends and challenges of sustainable forest management. Following the Sustainable Development Goals, especially responding to SDG 1, 12, 13 and 15, Thailand issued its National Strategy (2018-2036) in 2018, in which strengthening an environmentally friendly life pattern of people to fully consider the sustainability of natural resources is underlined as a vital part of the Strategy. Guided by the National Strategy (2018-2036), the National Strategy for Eco-friendly Development and Growth was issued with the target of increasing the area of forest and green area to 55% of Thailand's territory. Among all types of forest and green area, Forest Area for Utilization, in other words, the plantation is one of the most important resources to support the sustainable development of society. In this regard, an Action Plan for Extension of Integrated Economic Trees (2018-2036) was made, which also provided a direction of Thailand's forest research development.

As one of the important economic tree species, teak has been receiving attention on its gene conservation in Thailand. Except the in situ conservation of target individual teak trees, various ex situ conservation methods have been applied, including establishing tree improvement plot, gene bank, seed orchard and seed production area etc.. Until now, in total 784 ha of teak seed orchard and 225 ha of teak seed production area have been established in Thailand. Researches focusing on teak provenance trails, progeny test and clonal test have been launched and pursued on track. Other than teak, there are several other tree species listed as top priority species on forest genetic resources conservation in Thailand, including *Dalbergia cochinchinensis*, *Afzelia xylocarpa*, *Dipterocarpus alatus*, *Hopea odorata*, *Pterocarpus macrocarpus*, *Tectona grandis* and other 20 species. Numbers of researches are on-going for these species in terms of species improvement, carrying out activities such as controlled pollination, vegetative propagation, silvicultural techniques for improving yield production of plantations and so forth.

The trend of sustainable forest management in Thailand is turning to be more emphasizing the multi-functions of forest, strengthening value-added from forests and forest products, conserving natural forests while extending full potential of plantations in terms of timber production and trade, promoting forest certification and equipping forestry practitioners with addition skills and cutting-edge technologies. Aiming at achieving the ambitious target of 55% territory covered by forests and green areas, there are still plenty of space for Thailand to improve its forest research, especially research on advanced technologies to enhance plantation productivity and timber utilization. There is also a need to develop a long-term breeding strategy and provide continuous support to distribute improved germplasm to local foresters.

Session One：Forest Cultivation

Alternative Technology for Reforestation and Land Rehabilitation: Bio-pot and Seed Briquette

Dede Jajat Sudrajat, Indonesia

The reforestation and land rehabilitation require multiple human interventions and the utilization of adequate methods. Predominant methods of tropical forest reforestation use nursery-raised tree seedlings, which has been the most largely applied method in Indonesia and many other tropical economies. In this research, application of bio-pot seedlings and direct seeding using seed briquettes were assessed as alternative methods for reforestation and land rehabilitation. Both bio-pot seedling and seed briquette has potential to use for reforestation and degraded land rehabilitation. Bio-pot seedling had the highest growth performances in nursery and field test for several tree species, followed by containerized seedling, and direct seeding using seed briquette. However, seedling grown from direct seeding using seed briquette tended to have better root formation, especially in tap root length, tap root biomass and below-ground biomass. Based on the cost estimation, direct seeding was twice lower compared to transplanting of containerized and bio-pot seedlings. However, planting of bio-pot seedlings was more effective in rapidly growth and establishing canopy, especially in very critical lands. Direct seeding using seed briquette was a promising alternative method for reforestation and land rehabilitation, especially for remote areas.

Tree Seed Sources Management and Utilization Assessment in Lao PDR

Khamphoumi Bounpasakxay, Lao PDR

Recently, development of plantation for production purpose is highly required in Lao PDR due to the increasing demand of timber caused by population increasing and local development. The market demand for endangered tree species seeds stays high both domestically and worldwide. This study was conducted for supporting on production of high quality tree seeds in both short term and long term to meet the social demand.

The tree seed source evaluation was conducted for the whole territory of Lao PDR. Involved species were *Afzelia xylocarpa, Pterocarpus macrocarpus, Dalbergia cochinchinensis, Eucalyptus camaldulensis, Tectona grandis, Pinus merkusii, Dipterocarpus alatus, Hopea odorata* and so forth. The evaluation included field data collection, interview of local staff, analyses and documentation works with joint efforts from central government and local government. The result shows 76 seed sources (75%) remained in 2016 comparing with the data in 2002, which means that during 2002 to 2016, 26 seed sources (25%) were damaged. Among the 76 seed sources in 2016, 22 sources (29%) are able to produce seeds while the other 54

sources (71%) are not. There are 4 major reasons for tree seed source damage: 1) infrastructure development (29%), 2) forest fire or natural disasters (6%), 3) disturbance from government and private projects (6%) and 4) illegal logging (59%).

Primary data analysis illustrated that local government still lack regular monitoring of the seed sources, because budget for monitoring is insufficient. 95% of interviewed local staff indicate that lack of budget for field survey and regular monitoring was the most important issue that hindered the sustainable management of tree seed sources, in the meanwhile 72% of them consider the need for establishing more seed sources is urgent.

Department of Forest under the Ministry of Agriculture and Forestry together with forest research institutes are searching for budget for recovering seed sources and issuing regulations on utilization and management of existing tree seed sources.

Research Results on Potential Rehabilitation of Natural Evergreen Broad-leaved Forests After Overexploitation in Cau Hai, Phu Tho Province, Vietnam

Nguyen Van Tho, Vietnam

Natural evergreen broad-leaved forests undergo long-term regeneration and rehabilitation process after natural forest degradation. The purpose of the study was to evaluate quality of forest rehabilitation by natural regeneration and enrichment plantings after 18 years of restoration in Cau Hai, Phu Tho province, Vietnam. After 18 years of proper rehabilitation, forest communities are able to recover well. At present, the forest stands have been restored from IIA or IIIA1 to IIIA3 status. Stand average diameter is ranging from 13.7 to 14.8 cm, stand volume is ranging from 101.6 to 176.7 m^3/ha. The species richness is very high, which could up to 71 species per hectare. Dominant tree species are *Ormosia balansae, Quercus platycalyx, Castanopsis cerebrina, Erythrophleum fordii, Cinnamomum burmanni,* and *Engelhardtia roxburghiana*. Stand density is very high, ranging from 1083 to 1173 tree per hectares. Forest stands supplied the soil 9.6 to 16.6 tons of dry branches and leaves. Microorganisms have increased both number and species after 18 years of restoration, particularly phosphorus solubilizing microorganisms. Therefore, rehabilitation of the natural forest is very well, but it is necessary to be thinned and decreased stand density to promote growth of tree diameter.

Practical Approaches on Forest Restoration on Encroached National Reserved Forest in Thailand

Pinyarat Chayaporn, Thailand

Forest restoration in Thailand is one of the key practices that Thai government is promoting in order to achieve 55 percent forest cover rate goal (35 percent under conservation forest, 15 percent under economic or production forest, and 5 percent under urban forest). Royal Forest Department (RFD) is responsible for increasing

economic or production forest areas through forest restoration. However, forest restoration in Thailand is not as successful as expected although there are acts and regulations. Two main causes are lack of participation of local people and short of good management.

The main task of RFD is not only to increase forest areas but also manage forest areas, which involve allocation of land tenure for inhabitants. Therefore, forest restoration in the context under RFD is related to allocate land unavoidably. In this regard, RFD designs the new forest restoration pattern in degraded forests which allows local people claim the tenure of forest lands. Transformation of forest restoration pattern is based on the present government policies, cabinet resolution and watershed classification. Watersheds are divided into 5 classes, 1 and 2 are in high priority for preservation and restoration. Furthermore, Cabinet Resolution of 30 June 1998 is a main criterion for designing the forest restoration pattern and the right of land tenure. As a result, the forest restoration framework can be set for implementing for each area. This framework provides RFD the way of rehabilitating forest areas while people have shelter and arable land.

The new practical approaches on forest restoration have many advantages, such as making a win-win situation for both government and local communities by making agreements instead of strict rules. These approaches can also be the solution of conflicts between the state and local people--local people have participated in restoring and maintaining National Reserved Forest (NRF) while they can also utilize forest resources under regulation and agreement, which lead to reduce poverty and sustainable NRF management.

With all the advantages the NRF management still faces many challenges, such as forest have been cleared and utilized before declaration as forest reserves; policies changing from time to time, alternating between compromise and strict enforcement of rules and increasing demand on land, etc.

Lessons learned from the past show that disallowing people to utilize forest may not be a main solution of encroachment of reserved forest. Reconciliation and participation can be a solution that meets the national goals such as increasing forest areas and people's well-being.

Good Quality Seedling of Muna Teak for Forest Restoration

Ratna Uli Damayanti Sianturi, Indonesia

During the 2015-2018 period, the government conducted rehabilitation activities with a total area of 102,838 hectares. These activities were in the form of development of Community Plantation Forests, Community Forests, Village Forests, Community Forests and Industrial Plantation Forests. The success of the planting program is rooted in the provision of good quality seeds and sufficient quantities when needed. In general, the level of quality of seeds and seedlings is determined by 3 main factors, namely genetic, physical and physiological factors. One of the efforts made to obtain

high quality seedlings is the selection of plant species. Species that are often used for the rehabilitation of degraded land are fast-growing plants. One of the species that has the potential to be developed in rehabilitation is teak. In Muna Island, teak has a place in the hearts of its people, because it contains socio-historical value as well as high timber selling value. Currently, teak in Muna is almost extinct, as a result of overexploitation. In an effort to prevent the extinction, the Forest Technology Seed Technology Research Institute developed Muna teak as a type of plant for rehabilitation on Muna Island.

As an initial stage of rehabilitation, exploration of teak seeds in Muna has been carried out through a research to get good quality Muna teak seedlings. One technique used to obtain good quality seedlings is gamma ray radiation. Seedlings from gamma ray radiation are selected and propagated using vegetative techniques and then planted in the field. Planting was carried out in two locations, namely in the community plantations in Muna, Muna Regency, Southeast Sulawesi and community forests in Cariu, West Java, Indonesia. The research obtained 7 candidate clones for muna teak that are different morphologically and genetically. Seedlings produced from these seven clones are 45% higher and 27% larger in diameter than teak without taking radiation.

Forest Rehabilitation and Improvement of Seed Supply System in Cambodia

Sreng Syneath, Cambodia

Forests are invaluable natural resources, which provide many economic and social benefits such as timber and other forest products, watershed protection, mitigation of floods and droughts, carbon storage and wildlife habitats. During 1960s, Cambodia used to be one of the economies with rich forestry resources--around 73% of the economy's total land area was covered by forests. Nevertheless, in 2016, it was decreased to 48.14% and the main causes of deforestation include 1) direct drivers: illegal logging, commercial wood products, land clearing for commercial cultivation, fuel wood consumption and charcoal production, land clearing for subsistence cultivation, new settlements/migration, human induced forest fire and 2) indirect drivers: limitation of law enforcement, land tenure and right issue and population growth, limited documentation on the information of the seed sources and nursery managers are collecting seeds from unreliable mother trees/seed sources.

To avert the forest loss and promote the sustainable use of Cambodia's forests, the promotion of forest reforestation and forest rehabilitation and improvement of seed supply system need to be tackled to ensure that the suitable model of forest rehabilitation have established, the seed source in natural forest have identified and all the stakeholders who are involved in tree planting program feel easy to find the good quality of seeds/planting material and promote the local people to involve in selling seeds and seedlings. The current endeavors to achieve this ultimate goal have been made as follows:1) identified seed sources in natural forest and seed distributors; 2) established a tree seed laboratory with supporting facilities and trained staffing; 3)

established seed production area; 4) established demonstration plot for forest restoration; 5) training the potential seed collector on seed collection, handling and marketing; 6) improving of seed supply system through workshop, distribution of leaflet and booklet, and established seed laboratory and 7) cutting propagation of *Dalbergia cochinchinensis*.

Conservation of Forest Genetic Resources and Forest Rehabilitation in Cambodia

Seab Kimsrim, Cambodia

Since the forest cover change in Cambodia has declined from 73% in 1965 down to 48.14% in 2016, the government has made efforts to recover the forests back through various models of forest restoration and rehabilitation. Despite the implementation of a series of restoration projects in Cambodia, the fundamental issue regarding the source of seeds is still being questioned. Most of the time, seeds have been collected or purchased at different places without clear genetic information. Especially for the major timber species such as *Dalbergia cohinchinensis*, the quality of seeds in terms of its genetic superiority (e.g. phenotype and productivity) cannot be guaranteed. With limited financial resources, for more effective and efficient restoration of the major timber species in Cambodia, it is necessary to produce the genetically improved seeds within Cambodia through a long-term tree breeding plan. However, there is limited experience and knowledge on tree breeding in Cambodia.

Since 2016 in collaboration with Asian Forest Cooperation Organization (AFoCO), the Institute of Forest and Wildlife Research and Development (IRD) of Forestry Administration (FA) of Cambodia, initiated a research project which is focusing on genetic improvement of seed orchard. The research is targeted 3 native major timber species: *Dalbergia cochinchinensis, Pterocarpus macrocapus* and *Dipterorcapus macrocapus* which are the most valuable tree species with high demand in the market. The purposes of the research are 1) to implement a long-term tree breeding plan, and 2) to strengthen the restoration and tree breeding capabilities of FA's staffs. Two project sites, 15 hectares each, have been established for carrying out the ground experiment in Siem Reap province.

Seeds were collected from plus trees stand in the forests distributing in 11 provinces to set up the progeny test plantation (24 ha) while the seed orchards (6 ha) have been established by the grafted seedlings producing from matching the scions of plus tree and root stock of young seedlings in the nursery.

As the project will last until 2025, the project team has continued collecting growth information (root collar diameter, height, crown cover, no. of branches, straightness of trunk) from progeny plantations for evaluation the good mother trees in seed orchard (seed source) at the end of the project. In the future, mother trees are matching with the selection criteria will be kept as good seed source while the failure will be removed from the seed orchard.

On the other hand, the genetic improvement project is not yet considered as a successful selection of good mother trees since it can produce only 1st generation. Thus, the seed from seed orchard after removal of unconsidered ones, will be used for establishment of demonstration forest and conducted the second round of selection.

Reforestation for Generate Income Project: A Case Study in Na Haeo, Loei, Thailand

Sutida Maneeanakekul, Thailand

Reforestation for Generate Income Project is a project of Her Royal Highness Princess Maha Chakri Sirindhorn. The project aims to restore forest areas and enhance people's life quality by providing the community income from planting forest trees together with economic crops.

The concept of the project is to mix annual and perennial crops together with forest trees and shrubs and plant on the degraded forests to increase crop yield, wood production and conserve soil and water. This project began by building relationships with local communities on the basis of proper land management to create a stable and sustainable livelihood and income. Four layers of tree canopy were design to plant include: forest trees, fruit trees, shrubs and herbs.

In Haeo District, Loei Province, a site of the project was established since 2015. The project covered an area of 5,493 rai (880 hectares) in 34 villages, five sub-districts in Na Haeo District, Loei Province. 33 species of economic crops and 16 species of forest tree were planted in this area. Vetiver grass was promoted to be planted along the ditches for solving erosion problems. The people who participated in the program have gained sustainable family income.

Diversity and Importance of Macrofungi in the Restoration of Tropical Forest at Bidor, Malaysia

Thi Bee Kin, Malaysia

Research Station Bidor, located in Perak, is a man-made mixed forest established through restoration of an ex-tin mine by planting tropical rainforest species. Presently, little is known about tropical fungi found in ex-tin mines in Malaysia. Thus, it is important to document the diversity of macrofungi and their importance in restoration of forest ecosystem. Two collecting trips to Bidor were carried out during the mushroom fruiting season in May and August 2018. A total of 14 macrofungi were collected, namely four *Agaricales*, four *Polyporales*, three *Boletales*, two *Russulales* and one *Cantharellales* species. Two new records of macrofungi were also found at this site, namely *Macrolepiota dolichaula* and *Spongispora temasekensis*. *Macrolepiota dolichaula* had been reported to prefer growing in slightly alkaline to neutral forest soil, thus it was uncommon to find this genus growing in Bidor, which has acidic forest soil. *Spongispora temasekensis*, an ectomycorrhizal fungus, was

found growing under mixed dipterocarp and non-dipterocarp tree stands established in Bidor. Macrofungi of *Polyporales* and *Agaricales* found in Bidor are saprophytic fungi. These macrofungi help to break down the complex organic matter into nutrients for trees. Ectomycorrhizal fungi, namely *Boletales*, *Russulales* and *Cantharellales*, were associated with tropical trees and directly promote tree stand health and growth.

The importance of macrofungi in Bidor can sum up as follows: 1) fungi benefit plants by increasing nutrient availability and contributing to the formation of a well-structured porous soil; 2) ectomycorrhizal fungi has mutualism association with tree host; 3) enhancing nutrient and water uptake for healthy growth of trees and 4) increasing the resistance of their host trees against water shortage and high concentrations of heavy metals. In exchange, host trees provide ectomycorrhizal fungi with carbohydrates. Ectomycorrhizal fungi-have been shown to be very important to artificial regeneration, not only in logged over forests but also in the reclamation of adverse sites, such as mine spoils. Saprophytic fungi which grow on decaying litter help to break down the complex organic matter into readily available food for trees. Association between plants and fungi facilitate plant establishment under hostile conditions, and against the stagnation of the succession.

This study documented the diverse macrofungi community in the reforested ecosystem and has shown the ecological roles of macrofungi in the rehabilitated forest, established using various tropical rainforest species on ex-tin mine. Successful of forest restoration in Bidor not only encourages regeneration of rainforest species but also increases the diversity of fungi. Besides, macrofungi play important roles in nutrient recycling and to promote tree stand health and productivity in ecosystem and with no doubt forest restoration is important to conserve the diversity of fungi, flora and fauna.

Nevertheless, further collections need to be carried out to have better understanding of the macrofungal diversity in restoration forest and Collaboration between FRIM and YAFG on the research related to mycorrhizal fungi (ectomycorrhizal and endomycorrhizal fungi) is needed.

Session Two: Forest Management

Fourier Transform Infrared Spectroscopy Analysis of Humic Acids from Red Soil under Broad-leaved and Coniferous Forest

Hu Qing, China

Humic substances are important sources of soil carbon. This study collected surface and subsurface soil samples from red soil under 40 years old broad-leaved and coniferous forests. Difference within soil humic substances under long-term forest, the influence from soil type and depth were studied. Surface and subsurface soil samples collected from red soil under broad-leaved (*Quercus*) and coniferous (*Pinus yunnanensis*) forest were defined as QO and QA, PO and PA, respectively. Humic substances were separated as fulvic acid (FA), humic acid (HA) and humin (HM), used by Fourier transform infrared spectroscopy (FT-IR). Results showed that humic substances in 40 years old broad-leaved (*Quercus*) and coniferous (*Pinus yunnanensis*) forest soils is influenced by soil depth and forest type, especially in HA and HM fractions. Key results the number of broad-leaved increased aromatization degree of soil humus and humus fractions distinctly. The authors could estimate soil humus evolvement of different forest type with infrared spectroscopy.

The study results provide guidance for the quality improvement and sustainable management of soil fertility increased in tropical forest.

Mechanical Properties Assessment of Laminated Veneer Lumber from Teak Plantation in Laos

Khonethong Soukphaxy, Lao PDR

Wood industry plays an important role in Lao economy. In 2016, the value of wood production export was 0.24 million US dollars from timber, 21.71 million US dollars from sawn wood and 11.25 million US dollars from furniture. Main wood processing industry in Laos consists of primary and secondary processing. In 2005 there were 160 wood factories and 2 plywood mails in Laos. The primary processing is focused on producing sawn wood, but the recovery rate of product from raw materials utilization is low. In 2009 plantation timber consumption is more than 300,000 m^3 and it might be increased to 600,000 m^3 in 2020.[1]

The first recorded teak plantation was started in 1680 in Sri Lanka and then distributed to many economies in Asia and outside Asia. In Laos, teak planting originated in Luang Prabang province, northern part of Laos. In the late 1950's, teak was planted on small scale in home gardens. By 1996, more than 80% of villagers in Luang Prabang had planted teak. The impetus for growing teak plantation in Laos was the policy instruments provide by Lao government and funding from UNDP and FAO.

[1] Source: Department of Forestry, MAF 2007; Ministry of Industry and Commences, 2016

The study on mechanical properties assessment of laminated veneer lumber from teak plantation in Laos aimed to investigate the most influenced level of pressure and time for modulus of rupture (MOR) and modulus of elasticity (MOE) of teak laminated veneer lumber (LVL). Laminated Veneer Lumber (LVL) is known as new type of structural engineering wood materials and was first produced in early 1970's, now LVL has been developed as an alternative to solid wood. Raw material is veneer from medium or small diameter logs. It is composed of dried and graded wood veneer and waterproof adhesive. LVL cured in the heated press, is typically available in various thicknesses and widths and easily worked in the field using conventional construction tools.

Teak LVL derived from Faculty of Forestry's forest plantation in Vientiane, Laos. The peeled veneer's thickness was 2.3 mm. The veneer has been air-dried until the moister content reached in the range of 6 to 10%. Teak LVL panels were assembled from 9-ply panels of veneer with using PL116- Liquid phenol-formaldehyde resin adhesive. The temperature of 120°C was tested at three different pressure level, i.e. 1.5 MPa, 2 MPa and 2.5 MPa and level of time, i.e. 9 min, 11 min and 13 min. The experiment was conducted based on ISO16978. Intron Machine Model 5569 has been used for bending test of LVL with dimension of 20 mm x 20 mm x 360 mm. The results of bending test on teak LVL showed that there were significant different for MOR and MOE based on time and pressure pressing levels. However, the MOR and MOE of teak LVL was lower than solid teak timber.

Biomass and Carbon Stock Assessment of Peat Swamp Forest Ecosystem: A case study in Permanent Reserve Forest (PRF) in Pekan Pahang, Malaysia

Mohd Afzanizam Bin Muda, Malaysia

Tropical peatland is a unique dual ecosystem mixed by tropical rainforest and wetland, which may act as a carbon sink and/or carbon source. Field data on biomass and carbon stock changes provide a baseline information in regard to tropical forest restoration and therefore are very significant to address climate change and mitigation. The study was conducted in Compartment 75 beginning from 2016 until 2020. The results estimated the total biomass was 248.83 t/ha in 2016 and 317.51 t/ha in 2018 using allometric equation which employ 3 predictor, i.e. diameter, height and wood density. Biomass increment were approximately 69 t/ha in 2 years of monitoring. Stock increment were largely influenced as a result of growing diameter and height and new recruits (for DBH 10 cm and above). Recruitments or new growth were 17 stems/ha in 2 years of monitoring while growth rate ranged between 0.1 to 1.8 cm per year.

Peat swamp forest may act as carbon sink and/or carbon source depending on the management scheme, for instance draining activities, timber extraction, lowering/increasing water table and so on. All 5 carbon pools are still being estimated in this 5-year study, the question whether the net carbon accumulation is equal to net primary productivity for the forest ecosystem under pristine condition may be answered after the study concluded.

Pest Surveys in Coastal Restoration Projects in Peninsular Malaysia

Ong Su Ping, Malaysia

In the aftermath of 2004 Indian Ocean tsunami, mangrove and coastal tree planting programmes were initiated to establish and enhance natural buffer zones along the coastlines in Malaysia. Pest surveys were conducted in 30 restoration sites of mangrove and coastal tree species along Peninsular Malaysia coastline from 2007–2009 to obtain baseline information on the incidence of infestations. From the general surveys, pest species occurring on the replanted trees were represented by 6 insect feeding guilds, which were the defoliators, leaf miners, sap-suckers, fruit borers, wood borers and wood feeders. Non-insect pest includes the barnacles as biofouling pests of mangrove seedlings. Overall damages by these plant pests were minor with reports on occasional pest outbreaks. Therefore, pest monitoring and management were conducted at 4 selected sites with moth outbreak and termite infestations from 2009–2011 and 2016–2017, respectively. In the monitoring of these sites, percentage of defoliation by the snout moth (*Streblote lipara*) ranged between 3–90% while 1–6% of *Casuarina equisetifolia* trees were infested with the Asian subterranean termite (*Coptotermes gestroi*). Environment-friendly techniques were used to manage the moth and termite problems. Regular tree inspection is essential to ensure early detection of pest infestations that harm tree health.

Integrated Forest Ecosystem Management Planning and Demonstration Project in Great Mekong Sub-region, Cambodia

Sem Rida, Cambodia

The Cambodian sites of Integrated Forest Ecosystem Management Planning and Demonstration Project in Greater Mekong Sub-region are located in three provinces, i.e., Kampong Speu, Siem Reap, and Phnom Penh provinces. In Kampong Speu Province, the Damrey Chakthlork Community Forest (CF) in Dokpor village, Krangdeivay Commune, Phnum Srouch District, with a total area of 1,452 hectares, is selected to demonstrate the improvement of CF management through developing restoration technologies and demonstrating integrated management models. In Siem Reap and Phnom Penh provinces, two sets of forest watcher systems are to be installed and demonstrated in Khun Ream Forest Research Station and Ta Khmao Zoo Forest respectively, through which a total of 4,368 hectares of state-owned forests is to be on-time monitored.

The goal and objectives of the project is to rehabilitate ecological services and product provision of forests in Cambodia through improvement of community forest management and strengthening state-owned forest conservation, so as to contribute to sustainable forest management in Greater Mekong Sub-region. The objectives are to develop a model for community forest management by strengthening CF management and testing appropriate restoration and silviculture technology. Main activities that have been implemented include:

1) The CF boundary demarcated and patrolled. The poles measure 15 cm x 15 cm x 150 cm. The poles were made of concrete and painted with dark green and yellow colour. Codes in Khmer were emblazoned in horizontal way on every pole to indicate the boundary of the community.

2) Restoration and silviculture models established. In the community forests, three types of degraded forestlands, i.e., Deforested Area, Severely Degraded Forest, and Moderately Degraded Forests were identified for pilot restoration. Each category covers an area of 4 hectares. All in all, the demonstration plot covers an area of 12 hectares.

3) Planting and maintenance of saplings are crucial in the success of the project. This activity involved backfilling of soil, application of fertilizers, planting of seedlings, watering during planting, and maintenances of plantations. For the Deforested Area block, *Pterocarpus macrocarpus* (1 ha), *Dalbergia cochinchinensis* (1ha), *Dalbergia oliveri* (1 ha) and *Tectona grandis* (1ha) were planted. For the Severely Degraded Forest block, *Cassia siamea* were planted. For the Moderately Degraded Forest block, *Pterocarpus macrocarpus* and *Dalbergia cochinchinensis* were planted.

To mitigate the dependence of community to forests by improving household farming systems, a 5,000 liter capacity tank was installed in a 10 meter concrete tower to establish the water supply system provide water for irrigation of the home gardens as well as for in house needs. A room was also built to serve as stock room and guard house for villagers.

Research on Classification of Low-function Forests

Wang Lei, China

There remain many questions concerning the classification and identification of low-functional forests. To solve this problem, a study was proposed to establish a complete and quantifiable classification technique system for low-functional forests on the basis of analyzing forest ecosystems functioning in different ecological functional regions and site conditions, according to the notions of forest naturalness, forest ecosystem services and ecosystem multi-functionality. The identification and evaluation of low-functional forests is considered a possibly new research direction of forestry field in the future.

The study has just been proposed and is still in its initial stage.

Advance and Retreat of an Important Pioneer Tree Species in Southwest China

Wei Wei, China

In subtropical regions, when the typical zonal vegetation - evergreen broad-leaved forest degenerates, the pioneer tree species with developed root, huge crowns, strong adaptability and drought and barren-resistant characteristics will occupy the dominant position of the ecosystem. At present, the pioneer tree species, *Pinus yunnanensis*

forest, is one of the most important forests distributed in subtropical China, and has a certain area in Myanmar. It is an important forest ecosystem and plays a vital role in providing various ecosystem services at this stage.

However, because of the long-term plantation management mode, young and middle forests account for a large proportion, resulting in low productivity. In particular, the use of a single tree species makes the plant community simpler, the succession level lower, and the stability of the community is obviously different from that of the zonal vegetation - evergreen broad-leaved forest.

Recently, the study chose Tengchong County, Yunnan Province, where the zonal vegetation and *Pinus yunnanensis* forests both grow well, to conduct a comparative study on the community structure of *Pinus yunnanensis* at different forest ages. The preliminary results provide guidance for sustainable management of this important forest.

The research results show that the dominance of *Pinus yunnanensis* is obvious in the forests and the dominant position is and only obvious in the upper layer. In the lower layer, the IV (importance value) of *Pinus yunnanensis* is decreasing sharply. The number of *Pinus yunnanensis* saplings (65-130 cm) and seedlings (0-65 cm) is decreasing, while the number of other species is increasing. With the development of succession the dominant species in the lower layer determine the succession dynamics and direction of the community. The pioneer tree *Pinus yunnanensis* forest will take succession of lower layer of mature forest.

Assessment on the Forest Tending Operations for the Natural Regeneration in the Restoration Process of Degraded Deciduous Forest

Zar Chi Hlaing, Myanmar

Degraded forests and secondary forests cover significant area throughout the tropics. Their functionality reduced a lot in terms of supplying of goods and services and maintaining biological diversities. If these degraded forests could be properly and effectively rehabilitated, they would provide more wood and non-wood forest products. The need to restore and rehabilitate these areas to improve their productive capacity, environmental functions, and biodiversity value has been widely recognized. In this point, the tending operations both scientific and forest dependent communities' traditional practices, are shown as important to restore and rehabilitate the degraded forests. Forest managers require to choosing the suitable and effective tending operations for the degraded forests restoration. By applying the effective tending operations in the forest, the natural regeneration (NR) can be enriched to grow faster through the effective tending operations). The enhancement of NR is used as an effective and low cost method for the rehabilitation and restoration of forest and improving forest density, biodiversity and ecosystem services. This research aims to describe/examine the forest diversity conditions to explore the effective tending operations both scientific and forest dependent communities' traditional practices for enhancing NR and to compare the forest diversity conditions before and after applying the tending operations.

Session Three: Social Forestry and Forestry Policy

Gold, Farms and Forests: Enforcement and Alternative Livelihoods are Unlikely to Disincentivize Informal Gold Mining

Aye Chan Maung, Myanmar

Informal gold mining (IGM) is a major driver of deforestation and source of global mercury emissions. Policy makers may seek to control the spread of IGM by enforcing rules and/or providing alternative livelihoods. The study investigated the dynamics and drivers of IGM in Northern Myanmar to shed light on the conditions needed for alternative livelihood and enforcement interventions to succeed. The study surveyed 226 respondents who practiced mining and/or farming. It was found that mining and agriculture provided complementary livelihoods for many respondents as they met different livelihood needs, and that many of the miners were economic migrants. Livelihood-based suggests that livelihood-based interventions are unlikely to scale well-mining may simply be displaced to other regions, or new migrants might replace old migrants. It was estimated that current enforcement efforts were insufficient and that a much higher level of enforcement--either constant presence of enforcement officials at each informal mining site, or confiscating equipment every month--would be required to make informal mining unprofitable. Enforcement effectiveness was further undermined by corruption in the guise of informal payments to local authorities. The study is the first to estimate costs that enforcement imposes and the level of enforcement required to deter informal gold mining, and adds to the growing body of evidence that enforcement and alternative livelihood approaches alone are unlikely to deter informal gold mining interventions based on agriculture/plantations--as currently planned by the regional government--are thus unlikely to provide true substitutes.

Stakeholder Collaboration for Tropical Forest Restoration: Case Studies in Indonesia

Desmiwaty, Indonesia

Total of tropical forest in Indonesia is 12,063 million hectares. However, the degradation and deforestation keep increasing. Restoration through the participation of multi-actors is believed as one of the formula to restore the forest. Regarding to that, this research leave from the question of: how is the collaboration scheme which has capability to manage the forest effectively and in sustainable manner? Through two cases, i.e. Community Forest Plantation of Muna, Southeast Sulawesi and Reasearch Forest of Parungpanjang, West Java, this qualitative research use PIL (Power, Interest, and Legitimacy) framework and Ostrom's polycentric configuration to identify the governance of both forest areas. Data were collected through in-depth interview with the actors, observation and supported with previous research literatures. The result shows, the role of central government (represented by Research,

Development and Innovation Agency and Directorate General of Social Forestry and Environmental Partnership) together with regional governments gives significant contribution. However, the government also relied on the contribution of Public Service Agency Center for Forest Development Financing and private sector as a capital source. The other important role is the Multipurpose Cooperative and Forest Farmer Group as motor of implementation body. The polycentric synergy between actors is provenly having capacity to support the individuals as well as the community organizations to restore the tropical forest in a sustainable manner which is economically viable, socially accountable, and reclaim the ecological function in both forests.

Assessment of Community-based Reforestation Program in Community Forestry: Case Study in Dry Land Area of Myanmar

Ei Ei Swe Hlaing, Myanmar

Community Forestry Program started in Myanmar with the issuance of Community Forestry Instructions (1995) to address basic needs and environmental degradation through reforestation. The program has been developed to provide livelihood opportunities from subsistence to commercial scale (Revised CFI 2016/2019 and CF strategic plan 2018-2020) and it is targeted to establish 919,000 ha of community forest (CF) by 2030s in 30 years Forestry Master Plan.

The study on assessment of community-based reforestation program in community forestry examines 28 community forest user groups (CFUGs) in order to assess the effectiveness that how community forest in dry land area of Myanmar help achieve economic, environmental and social needs at the community level. Assessment was done by using conceptual framework to assess community forestry in terms of 5 principles: availability of natural resources, effective governance and participation, rights and institutional settings, addressing community needs and adaptive management and learning, which were adopted by the ASEAN Social Forestry Working Group in 2019. The challenges to achieving economic, environmental and social needs are 1) the different interpretation of cutting trees by field level forest department staff, meaning that some staffs seem not to allow cutting trees from community forest along the road side; 2) weakness in matching community forest products with community forest user group priority needs for livelihood; and 3) weakness in understanding concept of community forestry. The recommendations of this study provide implementation lessons for other type of community-based reforestation program.

The recommendations are that 1) in comply with Community Forestry Instructions 2019, five management committee members consists of Chairman, Secretary, Accountant and two members should be elected/revitalized to lead the user group; 2) there is gap of capacity and knowledge in relation to concept of community forestry so that strengthening extension activities have to be carried out in collaboration with civil societies and international organizations; 3) 50% of households are farmers who

have been cultivating in the Reserved Forest areas for long time and there is no one who will abandon the existing cultivation land in reserved forest as it is their main livelihood and no alternation options for another job. This is likely to be good opportunity for Forest Department (FD) staff to enhance the program; 4) degraded natural forest conserved by CFUG members traditionally around CF areas are not recognized by CF certificate. According to survey, CFUG members are willing to include that area under CF. FD should consider how to address their needs; 6) Monitor and evaluation of established CF have to be carried out in order to support necessary matters in time; 7) General assembly of CFUG members at District or Regional level once a year would be useful for motivation of CFUG members and networking.

Perspective of Villagers on Climate Change Affected to Income Sources of Households of Sakok Village in Nam Et — Phoulouey Protected Area, Hiem District, Huaphan Province

Khamsing Keothoumma, Lao PDR

More than 80% of Lao population is working on agriculture and almost 70% of these people live in the mountainous remote area. The main income sources are from agricultural products and collecting NTFPs. Mostly agriculture depend on natural system and several shocks related to climate affected people income sources severely.

The objectives of the study are to analyze the capital of livelihood of villager based on the sustainable livelihood concept of DFID (1999) and to inquiry the income shock from the climate change and the strategies that villager applied to solve the income shock.

The data collection at the field was generated from 3 group discussions, which were the village authority group, women group and youth group. The household survey was selected with 55 households by using random sampling method for interview.

The data analysis gathered the information of the income shocks which related to the environment and not related to the environment that affected the income to reveal the strategy that the villagers was applied to solve the shock by using the percentage to show the outcome.

The result of the study revealed the shock that related to the environment which occurred and affected the income of villagers was the crop disease (47.3%), drought (36.5%), the household's member got sick (16.3%) and losing of livestock (10.9%).

The strategies which villagers applied to cope with the income shock was the income from selling forest products, selling livestock, money saving, money from weaving, selling crop products, borrowing, heir labor and donor from the government and NGOs.

The study revealed that the main income of villagers depended to cope with the income shock was enough in general, certain households were not able to because of the scale of shock. The way forward is to research the best model project for forest rehabilitation that could be implementing at this area.

Participatory Forest Conservation of Plant Genetic Conservation Project under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn at Yang Koh Community, Songkla Province

Thanaporn Trakuldit, Thailand

This research explored the gap between foresters and villagers. Case study conducted in Songkla province (South of Thailand), the area of Plant Genetic Conservation Project Under the royal initiative of Her Royal Highness Princess Maha Chakri Sirindhorn at Yang Koh village. Researcher focused on the characteristic of foresters who can build trust with the community. In addition, the generation gap of foresters (older and younger staff) who work with villagers led to different perspective of working with local people. The study conducted focus group discussion and in-depth interviews with forester, head of forest community group and member.

The findings showed the key point of participatory forest conservation of study area from both side (foresters and communities) is that sincere, dedicate and easy living foresters can build trust of local people. Furthermore, one of key success is that the foresters and the villagers spent more time together both working and non-working period.

Group Discussion

SANFRI Young Scholar Team members were divided into two groups for a 40 minutes discussion guided by three questions prepared by the APFNet Secretariat. Each of the groups elected a group leader, who facilitated the discussion and reported the outputs back to the audience, and a secretary was also elected to take note for the group discussion. Summary of the discussion on each guiding question is highlighted as below:

What activities do you expect the Forum can support?/In which ways do you expect the Forum can be organized?

All members suggest to remain connected regularly through email and social network software (SNS), e.g. WeChat or Messenger etc., for frequent communication and information sharing among Team members and secretariat both during and in the interval of the biennial Forum and develop an active, energetic, explorative community of young researchers. One recommendation to the Forum organizer is to circulate abstracts of presentations prior to the Forum commencing so that participants can grasp basic ideas of the topics and be well prepared to join the discussion session. Many have suggested to diversify the form and style of the Forum in addition to indoor presentations and discussions, suggested activities may include world café for poster exhibition, capacity building workshops for research skills and academic article writing, field study for in-depth case sharing, "Best Presenter Award" to encourage the Team members keep enhancing their presenting skills etc..

In terms of the APFNet Small Research Grant & International Conference Attendance Support, do you have any initial idea on how you would like to participate in?

One suggestion to APFNet is to extend the one-year timeframe of Small Research Grant since most research works will take longer time period to accomplish. Some also mentioned that more time is needed to elaborate before a research proposal is developed for Grant application. Topics such as high value timber tree species cultivation, forest quality improvement, timber plantation management, social forestry and so forth, are of special interests to members and mentioned for concrete proposals in future. Members also suggested APFNet to provide its research priority together with its Grant announcement. All members expressed their high interest to the International Conference Attendance Support, with the suggestion that APFNet keep the Team updated periodically on the vacancy for international conference attendance since the exact number of applicants to be funded each year through the program is subject to APFNet budget availability.

As SANFRI encourages joint efforts in conducting research activities, do you have any preliminary thought on potential cooperation among the Young Scholar Team members?

The Team members acknowledged the high importance of cooperation in conducting researches. It is deemed a very practical method to promote technology and

experience exchanges among different economies in the region. Currently, it is still early to bring up any specific idea on what kinds of form and research topic the Team members could cooperate with each other. Further communications and discussions will be made among the Team members via the email group and the SNS group to figure out the potential research cooperation.

Annex I - Agenda

Day 1 - 29 October, 2019	
Time	**Agenda**
09:00 - 18:00	Visit APFNet project site in Wanzhangshan Forest Farm

Day 2 - 30 October, 2019			
Time	**Agenda**	**Speaker**	**Facilitator**
08:30 - 09:00	Registration		
Opening Session: 09:00 - 09:50			
09:00 - 09:40	Opening remarks	• **Mr. Xia Jun**, Assistant Executive Director of APFNet • **Mr. Li Rong,** Deputy Mayor of Pu'er City • **Mr. Xie Shou'an**, Assistant Director General of Yunnan Forestry and Grassland Administration • **Mr. Peng Youdong,** Vice-administrator of National Forestry and Grassland Administration of China	**Ms. Zhong Mingchuan** President of Yunnan Academy of Forestry and Grassland (YAFG)
09:40 - 09:50	Unveil the brand of APFNet Center for SANFRI Young Scholar Exchange in YAFG		
09:50 - 10:20	Group Photo & Coffee break		
Keynote Presentations: 10:20 - 11:50			
10:20 - 10:50	Forest restoration in Vietnam: Achievements and Challenges	**Vo Dai Hai** President, Vietnamese Academy of Forest Sciences	**Dr. Zhou Dequn** Professor of Kunming University of Science and
10:50 - 11:20	Restoration of Degraded Secondary Tropical Forests in South China	**Zhang Qian** Vice-president, Guangdong Academy of Forestry of China	

11:20 - 11:50	Forest Research Development, Trends and Challenges for Sustainable Forest Management of Thailand	**Suwan Tangmitcharoen** Acting Expert, Royal Forest Department, Thailand	Technology
Lunch: 11:50 - 14:00			
Session One: Forest Cultivation			
14:00 - 14:20	Alternative Technology for Reforestation and Land Rehabilitation: Bio-pot and Seed Briquette	**Dede Jajat Sudrajat** Forest Research Development and Innovation Agency, Indonesia	**Dr. Zhou Dequn** Professor of Kunming University of Science and Technology
14:20 - 14:40	Tree Seed Sources Management and Utilization Assessment in Lao PDR	**Khamphoumi Bounpasakxay** National Agriculture and Forestry Research Institute, Laos	
14:40 - 15:00	Research Results on Potential Rehabilitation of Natural Evergreen Broad-leaved Forests After Overexploitation in Cau Hai, Phu Tho Province, Vietnam	**Nguyen Van Tho** Vietnamese Academy of Forest Sciences	
15:00 - 15:20	Forest Restoration Framework on Encroached National Reserved Forest Areas in Thailand	**Pinyarat Chayaporn** Royal Forest Department, Thailand	
15:20 - 15:40	Good Quality Seedling of Muna Teak for Forest Restoration	**Ratna Uli Damayanti Sianturi** Forest Research Development and Innovation Agency, Indonesia	
15:40 - 16:00	Coffee Break		
16:00-16:20	Forest Rehabilitation and Improvement of Seed Supply System in Cambodia	**Sreng Syneath** Institute of Forest and Wildlife Research and Development, Cambodia	**Dr. Zhou Dequn** Professor of Kunming

16:20-16:40	Conservation of Forest Genetic Resources and Forest Rehabilitation in Cambodia	**Seab Kimsrim** Institute of Forest and Wildlife Research and Development, Cambodia	University of Science and Technology
16:40-17:00	Reforestation for Generate Income Project: A Case Study in Na Haeo, Loei, Thailand	**Sutida Maneeanakekul** Sukhothai Thammathirat Open University, Thailand	
17:00-17:20	Diversity and Importance of Macrofungi in the Restoration of Tropical Forest at Bidor, Malaysia	**Thi Bee Kin** Forest Research Institute Malaysia	

Day 3 - 31 October, 2019			
Time	**Agenda**	**Speaker**	**Facilitator**
Session Two: Forest Management			
09:00 - 09:20	Fourier Transform Infrared Spectroscopy Analysis of Humic Acids from Red Soil under Broad-leaved and Coniferous forest	**Hu Qing** Yunnan Academy of Forestry and Grassland, China	**Dr. Zhou Dequn** Professor of Kunming University of Science and Technology
09:20 - 09:40	Mechanical Properties Assessment of Laminated Veneer Lumber from Teak Plantation in Laos	**Khonethong Soukphaxy** National University of Laos	
09:40 - 10:00	Biomass and Carbon Stock Assessment of Peat Swamp Forest Ecosystem: A Case Study in Permanent Reserve Forest (PRF) in Pekan Pahang, Malaysia	**Mohd Afzanizam Bin Muda** Forest Research Institute Malaysia	
10:00 - 10:20	Pest Surveys in Coastal Restoration Projects in Peninsular Malaysia	**Ong Su Ping** Forest Research Institute Malaysia	
10:20 - 10:40	Coffee Break		

10:40 - 11:00	Integrated Forest Ecosystem Management Planning and Demonstration Project in Great Mekong Sub-Region Cambodia	**Sem Rida** Institute of Forest and Wildlife Research and Development, Cambodia	**Dr. Zhou Dequn** Professor of Kunming University of Science and Technology
11:00 - 11:20	Research on Classification of Low-function Forests	**Wang Lei** Yunnan Academy of Forestry and Grassland, China	
11:20 - 11:40	Advance and Retreat of an Important Pioneer Tree Species in Southwest China	**Wei Wei** Yunnan Academy of Forestry and Grassland, China	
11:40 - 12:00	Assessment on the Forest Tending Operations for the Natural Regeneration in the Restoration Process of Degraded Deciduous Forest	**Zar Chi Hlaing** Forest Research Institute, Myanmar	
12:00 - 14:00	Lunch		
Session Three: Social Forestry and Forestry Policy			
14:00 - 14:20	Gold, Farms and Forests: Enforcement and Alternative Livelihoods are Unlikely to Disincentivize Informal Gold Mining	**Aye Chan Maung** Forest Research Institute, Myanmar	**Dr. Zhou Dequn** Professor of Kunming University of Science and Technology
14:20 - 14:40	Stakeholder Collaboration for Tropical Forest Restoration: Case Studies in Indonesia	**Desmiwaty** Forest Tree Seed Technology Reserach and Development Institute, Indonesia	
14:40 - 15:00	Assessment of Community-based Reforestation Program in Community Forestry: Case Study in Dry Land Area of Myanmar	**Ei Ei Swe Hlaing** Forest Research Institute, Myanmar	
15:00 - 15:20	Coffee break		

15:20 - 15:40	Perspective of Villagers on Climate Change Affected to Income Sources of Households of Sakok village in Nam Et – Phoulouey Protected Area, Hiem District, Huaphan Province	**Khamsing Keothoumma** National University of Laos	
15:40 - 16:00	Participatory Forest Conservation of Plant Genetic Conservation Project Under The Royal initiative of Her Royal Highness Princess Maha Chakri Sirindhorn at Yang Koh community, Songkla Province	**Thanaporn Trakuldit** Royal Forest Department, Thailand	
16:00 - 17:00	Group discussion		
17:00 - 17:30	Wrap-up		

Day 4 - 1 November, 2019	
Time	**Agenda**
09:00 - 18:00	Visit Puwen Tropical Forestry Research Institute, Xishuangbanna

Annex II - List of Participants

Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet)			
No.	**Name**	**Organization**	**Position**
1	Xia Jun	APFNet	Assistant Executive Director
2	Kong Zhe	APFNet	Director of Communication and Outreach Division
3	Wang Jiayi	APFNet	Program Coordinator of Communication and Outreach Division
Cambodia			
4	Sreng Syneath	Institute of Forest and Wildlife Research and Development	Researcher
5	Seab Kimsrim	Institute of Forest and Wildlife Research and Development	Researcher
6	Sem Rida	Institute of Forest and Wildlife Research and Development	Researcher
China			
7	Peng Youdong	National Forestry and Grassland Administration (NFGA)	Vice-administrator
8	Hao Yujun	Science and Technology Department of NFGA	Director General
9	Chen Lie	National Forestry and Grassland Administration (NFGA)	Secretary to the Vice-administrator
10	Xu Zhijiang	Yunnan Forestry and Grassland Administration	Director of International Cooperation Office
11	Xie Shou'an	Yunnan Forestry and Grassland Administration	Assistant Director General
12	Li Rong	Pu'er City Government	Deputy Mayor
13	Zhong Mingchuan	Yunnan Academy of Forestry and Grassland	President
14	Zhang Qian	Guangdong Academy of Forestry	Vice-president

15	Zhang Jingfeng	Yunnan Academy of Forestry and Grassland	Research Professor
16	Pei Yanhui	Yunnan Academy of Forestry and Grassland	Researcher
17	Zhang Qun	Yunnan Academy of Forestry and Grassland	Researcher
18	Jing Yuebo	Yunnan Academy of Forestry and Grassland	Researcher
19	He Ju	Yunnan Academy of Forestry and Grassland	Deputy Director of Administrative Office
20	Fang Xiansheng	Yunnan Academy of Forestry and Grassland	Research Assistant
21	Chen Zhonghua	Yunnan Academy of Forestry and Grassland	Research Assistant
22	Wang Lei	Yunnan Academy of Forestry and Grassland	Associate Research Fellow
23	Wei Wei	Yunnan Academy of Forestry and Grassland	Research Associate
24	Hu Qing	Yunnan Academy of Forestry and Grassland	Assistant Research Fellow
25	Zhou Dequn	Kunming University of Science and Technology	Professor
Indonesia			
26	Dede Jajat Sudrajat	Forestry and Environment Research Development and Innovation Agency	Researcher
27	Ratna Uli Damayanti Sianturi	Forestry and Environment Research Development and Innovation Agency	Young Researcher
28	Desmiwaty	Forestry and Environment Research Development and Innovation Agency	Junior Researcher
Laos			
29	Vongvilay Vongkhamsao	National Agriculture and Forestry Research Institute	Director of Forestry Research Centre
30	Khamphoumi Bounpasakxay	National Agriculture and Forestry Research Institute	Deputy head of Silviculture Unit
31	Khamsing Keothoumma	National University of Laos	Lecturer

32	Khonethong Soukphaxay	National University of Laos	Lecturer
Malaysia			
33	Thi Bee Kin	Forest Research Institute Malaysia	Research Officer
34	Mohd Afzanizam Bin Muda	Forest Research Institute Malaysia	Research Officer
35	Ong Su Ping	Forest Research Institute Malaysia	Forest Entomologist
Myanmar			
36	Yu Ya Aye	Forest Research Institute	Assistant Director
37	Ei Ei Swe Hlaing	Forest Research Institute	Assistant Director
38	Zar Chi Hlaing	Forest Research Institute	Staff Officer
39	Aye Chan Maung	Forest Research Institute	Staff Officer
Thailand			
40	Suwan Tangmitcharoen	Royal Forest Department	Acting Expert on Forest Plantation Promotion
41	Sutida Maneeanakekul	Sukhothai Thammathirat Open University	Lecturer
42	Pinyarat Chayaporn	Royal Forest Department	Forestry Technical Officer, Practitioner Level
43	Thanaporn Trakuldit	Royal Forest Department	Forestry Technical Officer, Practitioner Level
Vietnam			
44	Vo Dai Hai	Vietnamese Academy of Forest Sciences	President
45	Nguyen Van Tho	Vietnamese Academy of Forest Sciences	Principal Researcher