




THE SECOND REPORT
ON THE STATE
OF THE WORLD'S

FOREST GENETIC RESOURCES

SUBMISSION BY

APFORGEN



This report was prepared as a contribution to the FAO publication, *The Second Report on the State of the World's Forest Genetic Resources*.

Regional networks and international organizations were invited to submit written reports structured around the four strategic priorities of the Global Plan of Action for the Conservation, Sustainable Use and Development of Forest Genetic Resources (FGR)– (1) improving the availability of, and access to, information on FGR; (2) conservation of FGR (*in situ* and *ex situ*); (3) sustainable use, development and management of FGR; and (4) policies, institutions and capacity building.

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**CONTRIBUTIONS OF ASIA-PACIFIC FOREST GENETIC RESOURCES PROGRAMME TO THE
IMPLEMENTATION OF THE GLOBAL PLAN OF ACTION FOR THE CONSERVATION, SUSTAINABLE USE
AND DEVELOPMENT OF FOREST GENETIC RESOURCES**

2013 – 2020

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Introduction

Asia Pacific Forest Genetic Resources Programme (APFORGEN) is a regional programme and network of 15 member countries to advance the conservation and sustainable use of the region's rich forest genetic resources. Through its network of geneticists, forestry professionals and funding partners, APFORGEN shares knowledge and good practices, implements multi-country research and development projects, operates a Regional Training Centre and serves as a one-stop-centre on forest genetic resources information and initiatives in the Asia-Pacific. APFORGEN was established in 2003 through a collaborative initiative by FAO, the International Plant Genetic Resources Institute (currently the Alliance of Bioversity International and the Center for International Tropical Agriculture, Alliance for short), and the Asia Pacific Association of Forestry Research Institutions (APAFRI).

APFORGEN's broad membership and long-term experience in developing and implementing collaborative research and capacity development initiatives make it ideally placed for coordinating the implementation of the Global Plan of Action on Forest Genetic Resources (GPA-FGR) in the region in close collaboration with FAO and other relevant national, regional and international organizations. APFORGEN has developed a regional strategy with an explicit aim to support the implementation of the GPA-FGR in the network's member countries. The strategy was first developed in 2014 and updated in 2017. The strategy consists of four interrelated objectives and its contributions are mapped to 12 Strategic Priorities of the GPA-FGR (Table 1). The objectives were identified by APFORGEN's National Coordinators, building on the national and regional needs and priorities that emerged during the preparation of the first State of the World's Forest Genetic Resources report. Collaborative project proposals are developed for each objective to mobilise funding for implementing the work.

Between 2018 and 2021, APFORGEN pursued its objectives mainly through the following activities:

- Regional initiative “APFORGIS – Establishing an Information System for Conserving Native Tree Species and Their Genetic Resources in Asia-Pacific” (2017-2019). The project brought together 11 institutions and over 60 experts from 16 countries to improve the availability of information on native Asian tree species and their conservation status. It was coordinated by the Alliance of Bioversity International and CIAT and funded by the Government of Germany through the Federal Ministry of Food, Agriculture and Consumer Protection.
- Regional initiative “Conserving Rosewood Genetic Resources for Resilient Livelihoods in Greater Mekong” (2018-2021), implemented in Cambodia, Lao PDR and Vietnam. The project was led by the University of Oxford and implemented in collaboration with the Institute of Forest and Wildlife Research and Development, Cambodia; the National Agriculture and Forestry Research Institute, Lao PDR; the Agricultural Genetics Institute of the Vietnamese Academy of Agricultural Sciences; Chinese Academy of Forestry; University of Copenhagen, and the Alliance. Additionally, a related project “Conservation, integrated genetic evaluation and analysis on key germplasm resource of *Dalbergia* spp. in Asia and Pacific” (2018-2022), focusing on some of the same species, was implemented in China with funding from the National Natural Science Foundation of China and coordinated by the Research Institute of Forestry, Chinese Academy of Forestry.
- Regional Training Centre on Forest Genetic Resources which provides training workshops and distance learning opportunities for trainers, policy makers, forest managers and researchers on the conservation and management of forest genetic resources. The Training Centre was established in 2016 with funding from China Happy Ecology Ltd., a private company focusing on tree breeding and ecological restoration. Since 2020, the training centre is funded by Hainan David Investment Group, a Macao-based investment company.

- Regional workshops funded with support from the Government of the Republic of Korea and the CGIAR Research program on Forests, Trees and Agroforestry. Several of the workshops were organised in collaboration with the Asia Pacific Association of Forestry Research Institutions (APAFRI).

The main activities and results of these initiatives are described in the following sections by the Priority Areas of the GPA-FGR.

Table 1. APFORGEN’s objectives and the corresponding Strategic priorities in the Global Plan of Action on Forest Genetic Resources

APFORGEN’s objective	Strategic priorities in the GPA-FGR
1. Mobilize political and financial support for the implementation of the global plan of action on forest genetic resources in the Asia-Pacific region	19. Update FGR conservation and management needs and integrate them into wider policies, programmes and frameworks of action at national, regional and global levels 21. Establish and strengthen educational and research capacities on FGR to ensure adequate technical support to related development programs 24. Reinforce regional and international cooperation to support education, knowledge dissemination, research, and conservation and sustainable management of FGR 27. Strengthen efforts to mobilize the necessary resources, including financing, for the conservation, sustainable use and development of FGR
2. Make available information about the forest genetic resources in the Asia-Pacific region	4. Promote the establishment and the reinforcement of FGR information systems (databases) to cover available scientific and traditional knowledge on uses, distribution, habitats, biology and genetic variation of species and species populations 10. Identify priority species for action
3. Develop conservation and sustainable use strategies for regionally important and threatened tree species	1. Establish and strengthen national FGR assessment, characterization and monitoring systems 6. Promote the establishment and development of efficient and sustainable ex situ conservation systems, including in vivo collections and genebanks 11. Develop and implement regional <i>in situ</i> conservation strategies and promote ecoregional networking and collaboration)
4. Strengthen tree seed supply systems to facilitate ecosystem restoration, support local livelihoods and climate change adaptation and mitigation	12. Develop and reinforce national seed programmes to ensure the availability of genetically appropriate tree seeds in the quantities and of the (certified) quality needed for national plantation programmes 13. Promote restoration and rehabilitation of ecosystems using genetically appropriate material 22. Promote the participation of indigenous and local communities in FGR management in the context of decentralization

Priority Area 1: Improving the availability of, and access to, information on forest genetic resources

Strategic Priorities to which APFORGEN contributes through its activities:

- Establish and strengthen national FGR assessment, characterization and monitoring systems (Strategic Priority 1)
- Promote the establishment and the reinforcement of FGR information systems (databases) to cover available scientific and traditional knowledge on uses, distribution, habitats, biology and genetic variation of species and species populations (Strategic Priority 4)

Thousands of ecologically and socio-economically important tree species in Asia are threatened, yet very little information is available on their historical and current distribution, patterns of genetic diversity, intensity of threats across their distribution ranges, or availability of seed sources to support restoration. Effective conservation strategies for these species and their genetic resources cannot be identified without improving knowledge on the species' distributions and the threats they are facing.

Assessing species distributions is ideally suited for regional collaboration, given that the distribution ranges of many socio-economically important species span several countries. Through a regional collaboration between APFORGEN National Coordinators and other species experts, range-wide distribution, threat, and priority action maps were developed for 63 native, socio-economically important Asian tree species using species distribution modeling (Gaisberger et al. 2021). The maps take into account five threats in assessing species conservation status and identifying conservation and restoration priorities: overexploitation, land use change, fire, grazing and climate change. The distribution maps were validated with literature and by the network of over 60 experts, to distinguish suitable habitat within and outside of the species natural distribution. The validation exercise was made possible by the broad regional collaboration through APFORGEN and it improves the value of the maps for assessing genetic variation within the species' natural range.

An online information system was established that hosts the resulting maps and allows users to freely download distribution data¹ and data layers for follow-up analyses (www.tree-diversity.org). The information system also has the capacity to store and display information on the distributions of genetic diversity. A decision-support tool is under development that allows users to query the database to set conservation and restoration priorities for specific species, taking into account ecogeographic variation (www.tree-conservation.org). Among other things, the maps and tools help forest managers and conservation planners:

- identify centres of species diversity to optimise conservation efforts
- assess how well the current protected areas cover the priority areas for conservation
- identify areas where species populations may be most threatened by climate change
- identify seed transfer zones and adequacy of existing seed sources for tree planting and forest restoration
- plan studies on genetic diversity and provenance trials that are representative of the species' range and the variation in environmental conditions

The process of compiling and analysing species distribution data revealed large differences in data availability and data management systems between species and countries. Stable distribution maps could not be obtained for 14% of the initially selected species (9 of 72 species) because of lack of

¹ data for species listed in CITES Appendix II is randomised to protect their natural populations

data, although all species were identified as socio-economically important and prioritised by multiple countries.

Building on the experiences, regional guidelines for establishing a network of genetic conservation units were developed (Bioversity International and APFORGEN 2019). The guidelines have the following objectives:

- enable a regional assessment of the conservation status of native Asian tree species and their genetic resources using readily available information
- enable the identification and recognition of sites that already serve, or have the potential to serve, as genetic conservation units and seed sources for native tree species, so that relevant measures can be taken to safeguard them
- support the identification of priorities and collaboration opportunities for ecological and genetic research on native Asian tree species across country borders
- raise forest managers' and conservation practitioners' awareness about the importance of conserving genetic diversity, by highlighting related gaps and priorities that may differ from gaps and priorities identified solely at species or ecosystem level.

Priority area 2: Conservation of forest genetic resources (*in situ* and *ex situ*)

Strategic Priorities to which APFORGEN contributes through its activities:

- Identify priority species for action (Strategic Priority 10)
- Promote the establishment and development of efficient and sustainable *ex situ* conservation systems, including *in vivo* collections and genebanks (Strategic Priority 6)
- Develop and implement regional *in situ* conservation strategies and promote ecoregional networking and collaboration) (Strategic Priority 11)

One of APFORGEN's four strategic objectives is to support the conservation and sustainable management of regionally important, threatened tree species. During the strategy development process in 2016, APFORGEN National Coordinators identified the genera of *Dalbergia*, *Shorea* and *Tectona* to be of common interest and therefore, priorities for regional collaboration. A collaborative regional proposal was subsequently developed in 2017-2018 to support the conservation of *Dalbergia* spp. in Cambodia, Lao PDR, Vietnam and China. In 2021, APFORGEN established a regional Working Group on the Conservation and management of regionally important tree species. The group members identified *Aquilaria* as another priority genus for collaboration, given the species' threatened status and widespread interest for planting them across APFORGEN member countries.

Through the project APFORGIS, APFORGEN supported the identification of additional priority species for action in several ways. The project's target species were selected collaboratively by the APFORGEN National Coordinators and other experts they nominated, based on national priority species lists and focusing on native socio-economically important species with cross-country distribution within or between subregions (South Asia, mainland Southeast Asia and China, and Malesia region). The resulting threat and priority action maps for each species inform priority setting for *in situ* and *ex situ* conservation and restoration both within individual countries and at regional level (Gaisberger et al. 2021). The process also stimulated a review of national priority species lists in some countries, as some National Coordinators observed that priority species had changed since the early 2000s when the national priority lists were developed.

The priority setting process illustrated the geographic heterogeneity and vast species diversity of the Asia-Pacific region. For example, although the island nations of the Philippines and Sri Lanka shared many genera of interest with the region's other countries, the individual priority species within these genera were often different from those in the mainland countries. The APFORGIS project focused on widely distributed rather than endemic species precisely as assessing and improving their conservation status requires regional collaboration. At the same time, strengthening national capacities for conservation assessments of endemic and locally important species is crucial. A training course on species data management and distribution modeling was organised in 2018 to help countries apply the project's methods for endemic and other than regionally prioritised species.

The project *Conserving Rosewoods* that stemmed from the identification of regional priority species supported the development of *ex situ* and *in situ* conservation methods and strategies for *Dalbergia* spp. in Cambodia, Lao PDR, Vietnam and China. Species distribution modeling and threat mapping were used to identify ecoregions where the species most required conservation or restoration. Five new *in situ* conservation units were designated in forest reserves, national parks and community forests. Ecoregions that were predicted to become largely unsuitable for the species under climate change were prioritised for *ex situ* conservation, and 4 new *ex situ* conservation units were established, including seed orchards and provenance trials. Regional provenance trials were planned but could not be implemented during the project timeline because of the regulations on material transfer agreements.

A related project *Analysis and mapping of genetic diversity of key species of Dalbergia spp. in Asia and the Pacific region*, funded by the National Natural Science Foundation of China (2018-2022), aims to assess the genetic diversity of selected *Dalbergia* spp. across the region. Two genetic marker systems of *Dalbergia* spp. were developed to assess genetic diversity within the species distributions in China. The observed reduced genetic diversity of *Dalbergia* populations may be attributed to historical climate fluctuation and recent over-exploitation, based on genetic analysis and field surveys. Population genomic analysis provides finer patterns of genetic variation for *Dalbergia* spp. These genetic data will be useful for guiding conservation and breeding strategies. One new *ex situ* conservation unit was established as a provenance trial in Fujian province, not only for species conservation but also for breeding and genetic improvement.

Priority area 3: Sustainable use, development and management of forest genetic resources

Strategic Priorities to which APFORGEN contributes through its activities:

- Develop and reinforce national seed programmes to ensure the availability of genetically appropriate tree seeds in the quantities and of the (certified) quality needed for national plantation programmes (Strategic Priority 12)
- Promote restoration and rehabilitation of ecosystems using genetically appropriate material (Strategic Priority 13)

Asian countries in general lag behind the other tropical regions in forest and landscape restoration: they have not formed regional FLR programmes similar to Africa and Latin America through which technical and financial support can be mobilised, and there are historically few tree seed centres that would have built national capacity and awareness of quality seed. At the same time, Asian countries face unique challenges: human population densities are high compared to the other regions, adding pressure on natural resources and need for sustainable use solutions, while the highly varied

geography and topography have given rise to extensive local variation within species and risks of maladaptation without appropriate matching of species and provenance with site conditions.

APFORGEN has actively sought funding for supporting the development of tree seed programmes for forest and landscape restoration and submitted three regional project proposals since 2018. However, so far the network has not succeeded in obtaining specific funding to implement its objectives under this Strategic Priority Area.

National Coordinators and experts have collaborated on several desk studies to assess current status of tree seed programmes and capacities, specifically in the context of forest and landscape restoration. Recently, experts from India, Indonesia, Malaysia and the Philippines published a joint analysis of seed programmes across the four countries which have set national targets for restoring in total 47 million hectares of degraded lands by 2030. The study highlighted the overall lack of native tree seed for meeting the ambitious restoration targets, lack of quality assurance mechanisms to ensure quality and site suitability of planting material, and lack of understanding of the impacts of climate change on native tree species and implications for seed sourcing and provenancing strategies (Bosshard et al. 2021).

Some activities related quality seed production were also implemented as part of the regional project *Conserving Rosewoods*. Over 50 forestry professionals and over 100 local community members and farmers across Cambodia, Lao PDR and Vietnam were provided training on seed quality, seed collection and marketing. Farmer-led seed source establishment was piloted in 2020 and 2021 for two Rosewood species, *Dalbergia cochinchinensis* and *D. oliveri* in Cambodia, using grafted plants that mature and produce seed earlier than plants grown from seed. First seed yields are expected after 3-4 years from planting. Availability of material for grafting was limited for the severely threatened *D. oliveri*, and the genetic diversity of the seed source needs to be augmented in subsequent years by introducing new material.

Priority area 4: Policies, institutions and capacity-building

Strategic Priorities to which APFORGEN contributes through its activities:

- Update FGR conservation and management needs and integrate them into wider policies, programmes and frameworks of action at national, regional and global levels (Strategic Priority 19)
- Establish and strengthen educational and research capacities on FGR to ensure adequate technical support to related development programs (Strategic Priority 21)
- Promote the participation of indigenous and local communities in FGR management in the context of decentralization (Strategic Priority 22)
- Reinforce regional and international cooperation to support education, knowledge dissemination, research, and conservation and sustainable management of FGR (Strategic Priority 24)
- Strengthen efforts to mobilize the necessary resources, including financing, for the conservation, sustainable use and development of FGR (Strategic Priority 27)

As the above-described activities demonstrate, APFORGEN plays an important role in supporting knowledge dissemination, research, conservation and management of forest genetic resources in the Asia-Pacific region. Since 2013, APFORGEN has organised 13 regional workshops and events (Table 2). In addition, an international symposium on forest genetic resources was planned for March 2020 in

Yogyakarta, Indonesia, but had to be cancelled due to the Covid-19 pandemic. Since 2017 APFORGEN has mobilised over US\$1 million of project funding for its activities through partnerships.

The Regional Training Centre on Forest Genetic Resources organised 3 trainings between 2016 and 2018, with 105 trainees from 16 countries. Training topics included genetic conservation and restoration strategies and spatial analysis methods for species conservation assessments. The training centre was supported in 2016-2018 by China Happy Ecology Ltd and since then by Hainan David Investment Group.

APFORGEN's role and efforts were recognised in 2017 when the Asia Pacific Forestry Commission endorsed its current strategy and encouraged Commission members to contribute to APFORGEN's activities (Box 1). APFORGEN reports about the progress of implementing its strategy to the Commission at the Commission Sessions.

Table 2. Workshops, events and trainings organised by APFORGEN 2013-2021.

Year	Event
2013	Regional Planning Workshop to Support the Implementation of the Global Plan of Action for Forest Genetic Resources (Kuala Lumpur, Malaysia)
2015	Preparatory meeting for the regional FGR training center (Binzhou, Shandong, China)
2016	First regional training of the training centre (Binzhou, Shandong, China)
2016	Side event at the Asia Pacific Forestry Week: Highlights of Regional Collaboration in Implementing FAO's Global Plan of Action on Forest Genetic Resources (Clark, Philippines)
2017	APFORGEN Strategy Development Week (Kuala Lumpur, Malaysia)
2017	Second regional training of the training centre (Binzhou, Shandong, China)
2018	Expert workshop: Enhancing Conservation and Sustainable Use on Endangered Tree Species in Asia-Pacific (Kunming, China)
2018	APFORGIS inception workshop: Distributions and Biology of Asian Tree Species (Putrajaya, Malaysia)
2018	Third regional training of the training centre (Binzhou, Shandong, China)
2019	APFORGIS validation workshop: Conservation priorities for Asian tree species and their genetic resources (Colombo, Sri Lanka)
2019	APFORGIS results workshop: Distributions and biology of Asian tree species: Translating research results into conservation plans (Beijing, China)
2020	International symposium: Genetic Conservation and Restoration of Endangered Forest Tree Species in Asia-Pacific (<i>cancelled due to Covid19</i>) (Yogyakarta, Indonesia)
2021	Annual virtual workshop
2021	Results workshop: Asian Rosewoods: Conservation needs and livelihood opportunities in Greater Mekong (virtual)

Box 1. APFORGEN's strategy supported by the Regional Forestry Commission

In 2017, APFORGEN was invited to present the draft of its current strategy (2018-2022) to the Asia-Pacific Forestry Commission, at the Commission's 27th Session, Colombo, Sri Lanka, October 2017. The Commission adopted the following decision:

- a) welcomed the development of an Asia-Pacific strategy for implementing the Global Plan of Action on Forest Genetic Resources;
- b) highlighted the lack of adequate capacities in many countries to carry out the demanding task of identifying and conserving the multitude of forest species in the region;
- c) recognized that the strategy offers substantial opportunities for collaboration among countries;
- d) invited APFORGEN to regularly report on the progress made in implementing the Asia-Pacific strategy and its other activities to the Commission at forthcoming sessions;
- e) recommended that FAO continue its collaboration with APFORGEN and other relevant initiatives on forest genetic resources in the region including capacity building support for forest genetic resources conservation and seed preservation.

Source: FAO (2018). Report of the Twenty-Seventh Session of the Asia-Pacific Forestry Commission, Colombo, Sri Lanka 24-27 October 2017. Regional Office for Asia and the Pacific, Food and Agriculture Organization of the United Nations, Bangkok, 2018

Concluding remarks

APFORGEN's current strategy is expiring at the end of 2022, and it will be updated during 2022 through regional consultations. The updated strategy will most likely continue to be organised around the GPA-FGR to support its implementation in the Asia Pacific region, and will be communicated to the regional Forestry Commission. APFORGEN welcomes collaboration from national and regional organisations and institutions in developing and implementing the new strategy. Mobilising funding and support for the continuation of APFORGEN's activities continues to be a priority, as projects developed under the current strategy are coming to an end.

One key activity starting from 2022 is to further develop the Regional Training Centre. Moving forward, the main themes of the Center include (1) strengthening the capacity for conservation and sustainable use of forest genetic resources; (2) sharing theoretical knowledge and technologies for FGR inventory, collection and conservation, and (3) technologies for large-scale commercial propagation of FGR. The potential trainees include forest managers, researchers, lecturers and practitioners from APFORGEN member countries and other Asia-Pacific countries. The fourth regional training course on forest genetic resources is planned to be implemented in the first half of 2022, possibly as a virtual training. APFORGEN is keen to collaborate with other organisations and funding partners (including but not limited to FAO and the Asia Pacific Association of Forestry Research Institutions, APAFRI), to help extend training opportunities to forest researchers, forest managers and conservation and restoration practitioners across the region.

Publications

Biodiversity International and APFORGEN. 2019. Draft Regional Guidelines for Genetic Conservation Units. Available from: <https://www.apforgen.org/resources/publications/publication/draft-regional-guidelines-for-genetic-conservation-units>

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Databases and tools

www.APFORGEN.org – Repository of publications and reports from APFORGEN's projects and activities

www.tree-diversity.org – Interactive map and freely downloadable datasets on the distributions of and threats to native Asian tree species

www.tree-conservation.org – Decision support tool designed to help forest managers and conservation practitioners identify priority areas for conserving and restoring target tree species (under development as of January 2022).

Annex 1: APFORGEN Board Members

Each member country of APFORGEN appoints a national coordinator as a link between the country and the network. National coordinators elect among themselves a chair and up to two vice chairs, as well as a secretary to coordinate the network's activities.

From 2021 to 2024 these positions are held as follows:

Co-chairs:

Professor Zheng Yongqi, Chinese Academy of Forestry

Dr Rekha R. Warriar, Institute of Forest Genetics and Tree Breeding, India

Vice Chair: Professor Enrique Tolentino Jr., University of the Philippines Los Baños

Secretary: Mr Chaloun Bountihiphoh, Forest Research Centre, Lao PDR

From 2017 to 2021 the Board members were:

Chair: Professor Zheng Yongqi, Chinese Academy of Forestry

Vice Chairs:

Dr. Suchitra Changtragoon, Department of National Parks, Wildlife and Plant Conservation, Thailand

Dr. Bandara Kangane, Sri Lanka Forestry Institute

Secretary: Professor Enrique Tolentino Jr., University of the Philippines Los Baños

Annex 2: APFORGEN National coordinators and Regional Experts

Bangladesh	<i>National Coordinator</i> Md Baktiar Nur Siddiqui Bangladesh Forest Department
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Cambodia	<i>National Coordinator</i> Mr Chann Sophal Forestry Administration Forestry and Wildlife Research Institute
India	<i>National Coordinator</i> Dr C. Kunhikannan, Director Institute of Forest Genetics and Tree Breeding <i>Assistant National Coordinator</i> Dr Rekha R. Warriar Division of Plant Biotechnology Institute of Forest Genetics and Tree Breeding
Indonesia	<i>National Coordinator</i> Dr Vivi Yuskianti Forest Research and Development Center, Ministry of Environment and Forestry
Republic of Korea	<i>National Coordinator</i> Dr Hong Kyung Nak National Institute of Forest Sciences
Malaysia	<i>National Coordinator</i> Dr Lee Soon Leong Forest Research Institute Malaysia
Myanmar	<i>National Coordinator</i> Mr Aung Zaw Moe Forest Research Institute
Nepal	Vacant
Pakistan	Vacant
Philippines	<i>Regional Expert</i> Prof Enrique Tolentino, Jr College of Forestry & Natural Resources University of the Philippines Los Baños
Sri Lanka	<i>National Coordinator</i> Dr K. M. A. Bandara Forest Department

Thailand
National Coordinator
Dr Suwan Tangmitcharoen
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Royal Forest Department

Regional Expert
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Department of National Parks, Wildlife and Plant Conservation

Vietnam
National Coordinator
Dr Nguyen Hoang Nghia
Vietnam Academy of Forest Science

Lao PDR
National Coordinator
Dr Chanh Samone Phongoudome
National Agriculture and Forestry Research Institute

Assistant National Coordinator
Mr Chaloun Bounithiphonh
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