**Planted Forests - A solution for Green Development**

Summary Report of the 4th International Congress on Planted Forests held in Beijing, China from October 23rd -27th, 2018

1. Introduction

The International Congress on Planted Forests (ICPF) is an international academic conference that is being organized by the International Union on Forest Research Organizations (IUFRO) with the technical support of the Food and Agriculture Organization of the United nations through its Planted Forests Programme. Three congresses have been held so far. The 1st and 2nd International Congress on Planted Forests were held in Chile in 1999 and in New Zealand in 2003; The 3rd was held in Europe in 2013, including Bordeaux, France, Dublin, Ireland, Porto, Portugal and Estoril where held separate satellite conferences and plenary sessions.

The 4th International Congress on Planted Forests (4th ICPF) entitled “Planted Forests-A solution for Green Development” was held from 23~25 October in Beijing, China with post-Congress excursions to the Northern China and Southern China from 26~27 October. The 4th ICPF was co-hosted and organized by the Food and Agriculture Organization of the United Nations (FAO), National Forestry and Grassland Administration (NFGA) of China, International Union of Forest Research Organizations (IUFRO), and Chinese Academy of Forestry (CAF) in collaboration with the International Bamboo and Rattan Organisation (INBAR), Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet), China Green Foundation (CGF), China Green Carbon Foundation (CGCF) and State Key Laboratory of Tree Genetics and Breeding (SKLTGB). In addition, there were four partners who provide generous technical and financial supports to the 4th ICPF, including European Forest Institute (EFI), New Generation Plantations (NGP), Journal of Forestry...
Research (JFR) and Journal of Plant Ecology (JPE). The IUFRO task force - Sustainable Planted Forests for a Greener Future provided most of the scientific committee with interaction of the task force on Forest Biomass Network.

The 4\textsuperscript{th} ICPF was the first time held in Asia and Oceania as well as the largest international event on planted forest ever held in China attracting the participation of over 701 scientists, professional foresters, policy-makers, forest practitioners and forest students from 70 countries, to explore the role of planted forests in the sustainability in the context of climate change and the role that can be played by planted forests in the sustainability of biological resources, environment protection and green development.

Among the 701 registered participants, 491 are from Asia (408 from China and 83 from other Asian countries), 78 are from Europe, 28 from North American and 17 from South America, 20 from Oceania, and 67 from Africa. In addition, another 180 forestry students also attended the Congress holding daily passes.

Participation at the 4th ICPF
Exhibition

Opening ceremony of the 4th ICPF
2. Opening Ceremony

The milestone Congress on planted forests attracted the high attention from the Chinese government and the interface between science and policy was well represented.

Mr. Liu Dongsheng, Vice Administrator of the National Forestry and Grassland Administration (NFGA), also acted as the Chair of the Organizing Committee of the 4th Congress on planted forests, hosted the opening ceremony, and introduced the basic situation of the congress to the guests.

Dr. Alexander Buck, Executive Director of IUFRO, emphasized that planted forests will become even more important in the future in order to mitigate climate change and to meet the increasing demand for forest products from growing populations and the emerging bio-economy. And furtherly, he addressed that the 4th Congress on Planted Forests will provide an excellent opportunity to interrogate the current state of knowledge about planted forests, and to enhance science-based solutions in the region and globally.

Dr. Vincent Martin, Representative of Food and Agriculture Organization of the United Nations (UN-FAO) in China and DPR Korea, underlined the great importance of planted forests in fighting against climate change, securing the livelihoods and food security of many of the world’s poorest people as well as supporting sustainable forest management and international processes, such as the UNCCD, CBD and the UNFF et al.

Ms. Monique Barbut, Executive Secretary of the UNCCD, urged to strengthen that the knowledge and benefits of reforestation and afforestation should travel across borders and generations, and the collaboration efforts on construction of forest shelter programme were in urgent need to attain the Sustainable Development Goals ultimately.

Mr. Zhang Jianlong, Administrator of the NFGA attended the opening ceremony and gave a speech, which provided a whole overview on the development process of planted forests in China, emphasized the significant role of planted forests in China's sustainable development. And also, he expressed the wish of both Chinese forestry authorities and forest scientists to cooperate with the international forest scientist to promote the sustainable development of planted forests.
3. Scientific contributions

The goals of the 4th ICPF are to discover the contribution that have been made and can be made by planted forests to green development under the global change, and to provide scientific support for pursuing the sustainable development of planted forests and adapting to and mitigating climate change. The following four themes are served for the goals of the event:

(1) genetic resources and tree breeding
(2) multi-purpose management of planted forests
(3) wood, fiber and non-wood forest products
(4) forest policy and socioeconomics in relation to planted forests

Focusing on these themes, a total of 2 plenary keynote speeches, 8 sub-plenary invited presentations, 4 special events, 52 parallel technical sessions with a total of 239 oral presentations and 48 posters were given. All these contributed to various components of the 4th ICPF exploring various aspects falling under the four themes as above.

3.1 Keynote speeches at plenary session

Two keynote speeches were delivered at the plenary session in the morning of 23rd October chaired by Dr. Christophe Orazio, Coordinator of Task Force on Sustainable Planted Forests for a Greener Future, IUFRO and Head of Planted forest facility, EFI, France.

Planted Forests in China for both Conservation and Production Purposes by Professor Shen Guofang from the Beijing Forestry University (BFU), Academician of Chinese Academy of Engineering, provided a comprehensive overview on the progress of planted forests in China in terms of its historical background and current status, its role in ecological conservation and rehabilitation, its capacity in the provision of timber and multiple non-timber forest products, and the achievements, lessons and prospect of the silviculture of planted forests. It was emphasized that more attention should be paid to the technical level, scientific research and hydrological condition in forest management, especially using deliberately refined silvicultural techniques and avoiding the mistakes of neglecting the scientific management in natural forests.

The Role of Forest Models and Simulators as a Support to Sustainable Forest Management in a Global Change Context by Dr. Margarida Tomé from the Instituto Superior de Agro-nomia (ISA), Universidade de Lisbon, Portugal, emphasized the importance of models that focus on the forest growth and dynamics in the development of sustainable forest management.
She provided an analysis of the evolution of growth models, from yield tables to the present models and of its implementation into forest simulators focused in different spatial scales, from the stand to management unit, landscapes or even larger regions. Particular emphasis was put on the relationship between researchers that develop the models and the several potential users that wish solve their day to day problems in the dynamic context in which today’s forests live, either environmental, economic or social.

In addition, Dr. Chen Peng, Secretary General and vice chairman of China Green Foundation, presented their ecological restoration plan of Populous Euphratica forests along the Belt and Road. Dr. Li Zhiyong, Deputy Director-General of INBAR, shared their experiences on land restoration in relation to Bamboo and Rattan.

3.2 Invited presentations at sub-plenary sessions

Eight Invited Presentations were delivered at the 4 sub-plenary sessions in the morning of 24th October with two for each of the four themes.

Sub-plenary session on Genetic resources and tree breeding

This session was moderated by James Pendlebury from Forest Research, UK. Prof. Yousry A. El-Kassaby from the University of British Columbia gave a presentation titled Tree improvement: from pedigree-based to genomic-based breeding. He introduced pedigree-based, marker-assisted and genomic-based breeding, indicated that genomics is a disruptive technology facing technical (genome size & bioinformatics) and environmental (climate change) challenges. Prof. Lu Mengzhu from the Chinese Academy of Forestry gave a presentation on Molecular breeding for better wood quality - bridging basic science to practical application. He pointed out that the classic breeding techniques had produced massive productive tree cultivars in the past 30 years, mainly in high yield, but less attentions had been put on wood quality due to the limited knowledge in its genetic controls, and stressed that the molecular breeding being as an efficient tool to develop tree cultivars with high yield and good quality, which will be applied in tree plantation for both wood productivity and property in the future, must be based on the understanding of the regulatory network of wood formation.

Sub-plenary session on Multi-purpose management of planted forests

This session was moderated by Dr. Vincent Gitz from the CIFOR. Prof. Tim Payn from the Toi Ohomai Institute of Technology and Scion Rotorua, New Zealand gave a presentation on Multi-functional forests, ecosystem services and spatial approaches - the New Zealand experience. He took New Zealand as a case study to explore some of the opportunities multi-functional forests present, discussing how we might frame them in the context of ecosystem service and criteria and indicator structures, what some of the benefits might be, and what we have learnt about integrating our forests into the wider landscape and communities. Prof. Lu Yuanchang from the Chinese Academy of Forestry gave a presentation titled Achieving multifunctional forest management.
through three-level hierarchically structured silvicultural regimes. He described the concept, scientific principles, technical processes and methodology for experimental verification of the silvicultural regimes (SRs) of multifunctional forest management (MFFM), addressing a three-level structured silvicultural technical system (STS) and Chinese MFFM development system, which showed a positive impact on the development of multifunctional forestry in China.

**Sub-plenary session on Wood, fiber and non-wood forest products**

This session was moderated by Prof. Yin Yafang from the Chinese Academy of Forestry. Prof. John (Jack) Saddler gave a presentation on *Advance/Drop-in biofuels and their potential to decarbonise long distance transport*. He emphasized that the drop-in biofuels will be increasing required to decarbonise aviation, long distance trucking, shipping and much of rail, and several technology pathways to make drop-in biofuels even though each with its own challenges. Accessing cheap/renewable Hydrogen to remove O2 in feedstocks will be a key challenge in upgrading “biocrudes”. The thermochemical pathway (“Advanced”) using biomass will likely supply drop-in biofuels in the longer-term, but technology and feedstock challenges remain. He indicated that the Vancouver/British Columbia well positioned to demonstrate the BioPort Concept. Prof. Xie Yanjun from the Northeast Forestry University, China gave a presentation on *Chemical modification of planted wood in China: research and industrialization*. He introduced the research history and technologies on wood modification in China, emphasizing that chemical modification is an important strategy for efficiently utilizing the low-quality plantation wood resources. The modified woods have been used to produce floor, furniture, decorative and landscape materials and the potential market has brought about extensive attention of wood industry to develop mature modification technologies, labelled with Green, Quality, and Cheap.

**Sub-plenary session on Forest policy and socio-economics in relation to planted forests**

This session was moderated by Prof. Peter Freer-Smith from the University of California, Davis, USA. Prof. Daowei Zhang from the FAO and Auburn University gave a presentation titled *Planted forest development: from theory to policy and practices*. He emphasized that planted forests are seen as a means to meet increasing demand for timber and environmental services and thus to achieve sustainable forest development at a macro- or landscape level. At micro- or stand level, he demonstrated factors influencing planted forest developments, including public policy instruments. He also reviewed the effects of these policy instruments on planted forest development in China, the U.S., Brazil, and France, and suggested that planted forests were emerged because of scarcity in timber and environmental services and developed in response to economic and policy and institutional instruments such as secure property rights, stable or rising stumpage prices, and efficient forestry governance and administration. Prof. Jintao Xu from the Peking University gave a presentation titled *Some economic thoughts on plantation forest development*. He stressed that it is critical for China’s economic transition toward a green and low carbon economy in the coming 5-15 years, and forest sector can play a more prominent role in terms of carbon sink as well as providing wood-based substitutes for metal and concrete, to help the economy to reduce overall carbon footprint.
Taking Eucalyptus plantation as an example he argued for better and enabling policy environment and enhanced protection of private property rights to sustain the trends in plantation forests.

Overview of sub-plenary sessions
3.3 Parallel technical sessions

A total of 52 parallel technical sessions were held on diverse topics under the four themes as above mentioned.

The theme **multi-purpose management of planted forests** gained an overwhelming attention with 27 sessions, discussing on sustainability assessment of plantations, management of degraded stands and in dry lands, multifunctional management, integrated risk management, resilience oriented management, teak and walnut management for timber production, Eucalypt plantation management, intensification, design and management of mixed plantations, landscape restoration, plantation productivity in relation to stand structure and environmental conditions, planted forest management for ecosystem services especially for carbon and water, new generation plantations for natural climate solutions, forest resource monitoring, modelling and simulators, forest management planning, pollution tolerance of planted forests in the context of climate change, pest and disease control and management strategy and etc.

**Forest policy and socio-economics issues in relation to planted forests** were also widely discussed with 10 sessions, including policies from improved contribution of planted forest to economies, societies and environment, contribution of planted forest to sustainable wood for a more sustainable world, assessment of the effectiveness of restoration programs, collective reform and rural development, green belt road, sustainable intensification in restoration and provision of forest products, landscape approach to planted forests and forest ecosystem services for decision making etc.

The theme **wood, fiber and non-wood forest products** was also well presented with 9 sessions such as green process, added value and bioproducts, chemical use of non-wood forest products, biofuel production, and development of circular bioeconomy.

The technologies on **genetic resources and tree breeding** were also presented with 6 sessions such as teak genetic resources, forest genetics and genomics for climate change, selection of the appropriate genetic material to plant, nutrient balance, genomic based breeding.
3.4 Special events

In addition to the parallel technical sessions, there were four special events, of which three focused on specific issues of the forestry in China:

- China-CEECs special event on multi-purpose forest management for a greener future-from science to industry, moderated by the Department of International Cooperation, NFGA

- Special event on co-building the green great wall and sharing development achievements organized by the Bureau of the Three-North Shelterbelt Programme of NFGA

- Special event: The 40th Anniversary of the Construction of the Three North Program in China - Approaching Beautiful Three North of Green China, co-organized by the Bureau of Three-North Shelterbelt Programme of NFGA, the Forestry Economics and Development Research Center (FEDRC) of NFGA, the Information Office of NFGA and the Green China.

One event was World Café -- *A collective experience on building the future of our forests*, led by the representatives of WWF’s New Generation Plantations (NGP) platform and the IUFRO Task Force on Planned Forests for a Greener Future, with the aim to harvest opinions among participants about the findings on the four themes that have emerged during the 4th ICPF, and the challenges that would need further research, especially what gaps the conference did not cover and need further research. In addition, this initiative wishes to pave the road to a larger audience, the 2019 IUFRO World Congress in Curitiba. Around 50 people attended the world café event, which was held in a large room where tables were specially prepared to conduct the exercise. The analysis result of this
event was partly drawn by this report and the details are available online at https://newgenerationplantations.org/.
3.5 Take-home messages and challenges ahead

The 4th ICPF witnessed the high interests on planted forests from the high number of registration and the active interactions by the participants. The take-home messages proposed from the conclusive remarks included the following statements:

a) Planted forests are increasingly important for both conservation and production purposes globally in the changing environment;

b) Increasing emphasis will have to be placed on balancing the economic, social and environmental sustainability of planted forests in a broader landscape perspective;

c) Integrated approaches and models are requirement of sustainable multi-purpose forest management;

d) There is a need to preserve endangered genetic resources & biodiversity for higher productivity and smart use of planted forests;

e) Sustainable management and utilization of planted forests for value-added bioproducts are to be developed in a context of an integrated bioeconomy;

f) Planted forests are vulnerable to both natural and economic hazards, which requires resilience and adaptive capacity;

g) Long-term monitoring and research on the relationship of productivity and environmental factors should be strengthened, and the contribution of planted forest to trickle climate change should be addressed.

The challenges and research gaps were identified from the World Café event as follows:

a) **Genetic resources and tree breeding**: the challenge for researchers, industry, NGOs and consumers is to deal with the perception of risks, and engage the public to explain the benefits of tree breeding and genetic technologies as an opportunity to develop precautionary production strategies. Further research needed includes enhanced breeding technologies to shorten the breeding and selection cycle; genetic technologies for forest restoration and biodiversity, for the improvement of food trees and non-timber forest products, and to address invasive species risks as well as to improve their utility to local people. In addition, there is a need to more clearly report economic and social gains, as well as the trade-offs in using genetic technologies from a landscape perspective and all possible interactions of the outcomes of these programs with vital ecosystem elements.

b) **Multipurpose management of planted forests**: The main challenge is in orchestrating so many different fields in the areas of silviculture, economics and other social, political and ecological sciences, and to involve all stakeholders to perceive the multipurpose potential of planted forests at landscape level. Further research needed includes full consideration of all positive and negative externalities of planted forests at landscape level, landscape scale multi-objective
planning and analytical methods, involvement of local communities in mapping and identifying potential for the multipurpose use and in participating in policy and decision making processes that promote the multipurpose management of planted forests.

c) **Wood, fiber and non-wood forest products:** the challenge facing researchers, policy makers, NGOs and consumers is to satisfy all future demands of wood, fiber and non-wood forest products from planted forest, and to integrate with biorefineries and bioenergy markets in a sustainable manner. Further research needed includes innovation in the bioeconomy that effect silviculture, management and forest operations, solutions for small scale farming and forest plantations to fit into future bioeconomies and decarbonized market scenarios, and new markets and trade in emerging markets and etc.

d) **Forest policy, land use regulation and socio-economics:** A major challenge is to make sure that good policies are enforced and improved over time, and to address land use competition and land use planning to organize the best valorization of planted forests. Further research needed includes forest policies for benefit sharing, gaps between policy and operational implementation, whole value chain and integration of forests into the landscape, sustainable intensification dilemma of planted forests, engagement with small-scale properties/small holders and etc.

It was also concluded at the World Café event that some topics have not been addressed during the 4th ICPF on human dimensions and participatory forest management strategies, insurance, perception and governance, which requires more advertising of the Congress to social scientist in the future.

4. Post-Congress Excursions

The post-Congress excursions were organized for 55 participants in following two routes:

- **Northern Line: Ecological public welfare planted forests in North China**

The delegates visited the Saihanba Mechanical Forest Farm (hereinafter referred to as Saihanba Forest) and the Mulan Weichang Management Bureau of State-owned Forest Farm (hereinafter referred to as Mulan Forest), Hebei province. Since the establishment of the Saihanba Forest in 1962, three generations of the foresters have increased forest cover from 11 percent to 80 percent, successfully blocking the succession process of forest to grassland and grassland to desert degradation in this area. At present, the Saihanba Forest has successfully built a large-scale forest ecosystem base, which has changed the local natural landscape. After more than 50 years of development, the Mulan Forest has become an important ecological support to block the southward impact of sandstorms. Recently the Mulan Forest has been actively exploring innovative forest management techniques by applying the concept of close-to-nature forest management based on its own conditions, establishing “Demonstration Area on Forest Management in Northern China” covering more than 10,000 hectares with more than 40 different models.
Delegates at the trip to the Northern line
Southern Line: Commercial industrial plantations in South China
The delegates visited the Hainan Jinguang Group Asia Pulp and Paper (China). APP-China has set up a series of pulp and paper mills with state-of-the-art technology and equipment, in the meantime, modern fast-growing, large-scale plantation has been established as well. In the process of continued to step up sustainable management APP-China Forestry has its commitment to stand by management legality, scientific and technological innovations, eco-friendly practices, social responsibility and sustainable development to be a green-circulation and sustainable forestry company.

5. Next step: the 5th ICPF in 2023
At the closing plenary session on 25th afternoon, it was announced by Dr. Christophe Orazio that the member of IUFRO Task Force on Sustainable Planted Forests for a Greener Future, Tom Fox from the Rayoner company supported by other American colleagues, volunteered to host the next edition of ICPF2023 in Florida, USA. So let’s get ready to participate in the next edition in 2023!