



RESEARCH
PROGRAM ON
Forests, Trees and
Agroforestry



Forests, trees and agroforestry for diverse sustainable landscapes

International Conference
22–24 June 2021

Kunming, China and Online

OUTCOMES AND RECOMMENDATIONS



Outcomes and Recommendations

The CGIAR research program on Forests, Trees and Agroforestry (FTA) organized with the Kunming Institute of Botany, Chinese Academy of Science (CAS), and the Research Institute for Resource Insects, Chinese Academy of Forestry (CAF), an international conference in Kunming, China, on the 22nd–24th of June 2021, on the theme of Forests, trees and agroforestry for diverse sustainable landscapes. It is part of the road towards the 15th Conference of the Parties of the UN convention on Biological Diversity (CBD 15) also to be organized in Kunming, 11–24 October 2021.

The conference gathered close to 400 participants both on site in Kunming and online, with close to 100 scientific presentations, to make the state of the evidence towards the implementation of the CBD, and in the objective to better link science and research to policy, development and implementation, around six technical themes:

1. Trees for agroecology and circular agriculture
2. Tree diversity: realizing economic and ecological value from tree genetic resources to bridge production gaps and promote resilience
3. Trees in the framework of the CBD
4. Mountain ecosystems and food security
5. Assessing benefits of landscape restoration
6. Trees for a circular green economy

Forests, trees and agroforestry exemplify the contributions of biodiversity and agrobiodiversity to sustainable and resilient landscapes, to green and circular bioeconomy and to sustainable agriculture and food systems for healthy diets. Conserving and sustainably managing biodiversity is indispensable for the future of our planet. Conserving and planting trees is a concrete investment for future generations.

There is an urgency to act, to genuinely mainstream biodiversity in other sectors and objectives, as one of the primary considerations and not only as an ancillary objective. As much as biodiversity conservation is an end in itself, it is also a critical means to many objectives for managed ecosystems and landscapes, their productivity and resilience: agriculture, rural and urban environments, food systems and the economy as a whole.

The conference showcased latest findings from FTA, CAF, CAS, CAAS and partners on the roles of Forests, trees and agroforestry for diverse sustainable landscapes.

Session 1 covered seven key aspects: agroforestry, biodiversity conservation, animal husbandry and nutrition, sericulture, soil remediation, and plastic wastes degradation by fungi. Agroforestry is a highly developed form of agroecology because trees are functionally distinct from annual crops and livestock and so when incorporated within agricultural systems create more scope to manage interactions amongst components to achieve synergistic outcomes, but knowledge and implementation gaps constrain widespread uptake. Trees in agricultural systems represent an investment in ecological infrastructure that can increase farm income from high value products and diversify production to increase resilience as, for example, with moringa, magnolia, phyllanthus, rattan, rubber and coffee, with the first three providing fodder and contributing to animal health and productivity in integrated systems. There is a huge potential for fungi to be used in soil remediation and the degradation of plastic wastes contributing to the circularity of agriculture.

Session 2 recalled that the diversity of tree products (fruits, nuts, vegetables, timber, medicinals, fodder, gums and resins, etc.) and services (carbon sequestration, biodiversity, soil biomass, erosion control, water catchment/filtration etc.) is associated and adapted to the local social, cultural, economic and ecological values, needs, and landscapes. Human disturbances, habitat degradation, over-exploitation and climate change have increased the risk of genetic erosion and extinction of tree diversity, many

of which are of high value to local communities. To halt and reverse this, many ambitious global and national targets have been set to restore degraded habitats, diversify farming systems and generating a range of income generating opportunities. A rising enthusiasm around the world for tree planting is leading to a cascade of ambitious initiatives. And no wonder: trees don't just absorb CO₂, hence mitigating climate change, but they help farms and rangelands adapt to climate change. Trees help rural families boost their financial, and nutritional, security through the products and services they provide and the increased resilience they offer. But in the rush to get tree seedlings into the ground, planting the wrong trees, in inappropriate places, or planting poor seed of poor quality can do a lot of damage: they can harm existing ecosystems, or simply fail to deliver what the grower was hoping. A grower who had to deal with the consequences and disappointment of investing in the wrong tree is unlikely to try again. A range of knowledge products, decision prototypes, support tools, technologies and methodologies (genetic, biophysical, ecological, socio-economic, indigenous knowledges) are being developed and used to assess the genetic and biological characteristics, value, use, threats to tree diversity, and provide guidance for the provision of quality planting material and building-up solid tree seed and seedlings systems.

Session 3 noted that agricultural land must be recognized for its multiple contribution to sustainable use and conservation of biodiversity:

- as habitat for species and varieties, cultivated or otherwise, used by humans (agrobiodiversity, including agricultural species and beneficial species), to support food production;
- as habitat for wild biodiversity for those species that use agricultural landscapes to fulfil all or part of their niche requirements, as well as strictly forest dwelling species that use the agricultural matrix to disperse between forest fragments;
- for ecosystem services that support human health, food security, climate change mitigation and water supply.

International trade agreements have important effects on the diversification through both behavior-leading and obligation rules on the producers, transformers, buyers and consumers. High Conservation Value Forest, remnant patches of natural forests and integrated landscape management are crucial to increase landscape resilience, biodiversity conservation and other environmental and sustainable development goals. Agroforestry, reforestation and related ecosystem services are allies, not adversaries of biodiversity in needed native forest restoration.

Session 4 recalled that mountains occupy more than a fifth of the Earth's land surface and are home to some 12% of the world's population. They encounter key challenges: the constraints of terrain and climate, high production and transportation costs, low productivity, poor infrastructure, limited access to markets, physical isolation, vulnerability to natural risks. Around 245 million people living in mountain areas are estimated to be vulnerable to food insecurity. A wide range of issues were covered in this session from soil, cropping system, management, landscape restoration, livelihood system, governance, etc. Mountain systems in Northwestern Vietnam have seen a shift from grain production to cash crop farming represented by fruit tree cultivation. This shift has shown positive impacts on farmers' income, but challenges remain as to ensuring the socioeconomic and environmental benefits of this ongoing land use change. Varieties of indigenous and captive crops are cultivated under the traditional mixed-farming systems in the Eastern Himalayas, and they can contribute to nutritional and food security of the region. In the mountains of the Indonesian archipelago, as for example in Timor-Leste, traditional agroforestry systems help to protect the soil against erosion, crops against violent rains, to conserve biodiversity, to store carbon and sustain basic needs of households; however, it is necessary to evolve and to better valorise their productions, for the young generations of farmers to preserve and extend these secular systems. Use of endophytic fungi as biocontrol agents and biofertilizers can play an important role in suppressing pathogens (reducing damage at pre- and post-harvest stages), enhancing agricultural productivity, and protecting the mountain ecosystems.



In session 5 it was noted that using native and mixed species in forest landscape restoration can maintain regional carbon stocks and increase other related ecosystem services, including the prevention of invasive species, while native and often neglected and underutilized tree species (NUS) can also provide great economic benefits for smallholders. There are growth-promoting bacteria in the soil that are beneficial to the growth of legumes and help improve the environment for plant growth. The establishment of leguminous shrubs on farmlands can contribute to multiple benefits, including carbon storage, climate change mitigation with adaptation, biodiversity conservation, poverty reduction and food security.

Session 6 showed that non-timber forest products, such as mushrooms, bamboo and wood twigs charcoal production, and rattan products, can be used to generate income and can contribute towards rural development programs. Forests can be used as natural capital in context of reduced carbon emissions, which can also provide revenues that can be shared amongst stakeholders. Woody plants have potential for use as animal feed, adding to the diversity of products coming out of forest systems. Biomass energy is an important use of wood and bamboo from both natural regeneration and planted forest ecosystems. The use of woody residues for mushrooms cultivation, charcoal production increases resource efficiency and provides value-addition to local rural livelihoods.

The proceedings from the conference will be available at www.foreststreesagroforestry.org

Presentations and discussions allowed to identify a set of concrete, actionable solutions, to now scale up biodiversity mainstreaming in a real transformative way.

The following are 12 key recommendations resulting from the technical and plenary sessions. These are formulated to the attention of governments and all actors, public and private, the Rio platforms and conventions (CBD, UNFCCC, UNCCD), trade related bodies, international organizations such as FAO.

To support all the recommendations below, for transformational change, there is a need for conducive policies, to establish a proper enabling environment for research, innovation, capacity building, to facilitate integration across sectors and scales. Equally critical will be long term observatories, and to link global information with local contexts and engagement of research with stakeholders and citizens. Some key measures will also necessitate innovative financing mechanisms. And all measures can benefit from a reinforcement of international cooperation, for solutions that can be engineered and shared globally.

1) Protect forests and acknowledge their contributions to biodiversity conservation, climate change action and sustainable food systems

Forests are a major reservoir of biodiversity worldwide. They are an important source of food for many communities all over the world. Not only do they provide wild fruits, leaves, nuts, and mushrooms – they also provide homes for game animals, insects, and fish that contribute key sources of nutrients for vulnerable populations. They are a main source of energy for cooking as well as for the provision of renewable packaging materials. Their indirect role in food production is equally important; forests provide important ecosystem services for agriculture – pest control, pollination services, water regulation, flood prevention, and soil enrichment. These important benefits of forests need to be better understood and appreciated so that forests are no longer seen as barriers to food production, but as key components of sustainable food systems. More work on the potential contribution of Non Timber Forest Products towards sustainable development is required to leverage the true value of forest products to rural communities.

2) Support Forest and landscape restoration

It is estimated that, at the global level, up to 25 percent of all land (forests, cropland, rangelands and grassland) is highly degraded and 36 percent is slightly or moderately degraded. Degraded lands provide less ecosystem services, contribute to climate change and biodiversity loss, are less productive, causing



hunger, poverty and conflicts and driving further deforestation and land degradation in an effort to compensate for lost productivity. Restoring and sustainably manage land is a major way to improve the environmental, economic and social sustainability of food systems. Fast growing species like bamboo can provide bioenergy and biomaterials for renewable food packaging. Fungi can play an important role for soil reclamation and remediation. Forest and landscape restoration requires long term action, with multiple actors including the government and private sector, driven by the needs and priorities of local actors that depend on and manage the land to be restored. It requires participatory management, and attention to the right set of tree species for restoration, favoring indigenous species. It will be facilitated by more accurate assessments of costs and benefits of specific restoration interventions. Landscape approaches involving local communities shall be adopted in ecological restoration in order to meet not only environmental needs but also social and economic needs.

3) Promote agroecological transformation

Agroecological approaches can make a key contribution to transitioning to sustainable food systems but have been underinvested in. They are based on the principles of: input reduction, renewable inputs, better use of ecological processes and the biodiversity underpinning them, preservation of plant, animal and soil health, diversification, synergy, co-creation of knowledge, social values, better connectivity between farmers and consumers, equitable governance and participation. Agroecological transitions are conducive to preserving biodiversity, to leveraging the role of biodiversity for farmers, and to help reconnecting producers and consumers. These transitions at scale require, in many contexts, to reform policies and to install a proper enabling environment, technical support, markets incentives and regulations.

4) Recognize and promote the benefits of diversity from field and landscape to systems and diets

Diversity in production systems, from plot to landscapes, contributes to the preservation of biodiversity, allows for better, more adaptive use of natural resources and provides livelihood opportunities including for women and vulnerable social groups. It is an essential component of the resilience of landscapes, farming systems and households to shocks whatever their origin, climatic, biological (pests and diseases) or economic (price volatility), or for species (e.g. ecological corridors). Diversity is one of the main ways to ensure a balanced and healthy diets. The considerable pressure for simplification, driven by economies of scale and facility from production to transformation and distribution, needs to be counteracted by efficient measures that preserve and foster diversity all over food systems, from production to consumption.

5) Leverage the full potential of Trees on farms for agrobiodiversity, ecosystem services, resilience and productivity and to meet national and global biodiversity targets

Trees in agro-ecosystems play a critical role in contributing to biodiversity conservation in agricultural landscapes through in-situ conservation, by providing habitat to wild species, connecting fragmented habitats, providing steppingstones between protected area networks. Trees and forest patches are also useful and profitable to farmers as they provide a range of goods and services from soil health and fertility, fuelwood, management of pest and diseases, to controlling erosion and water runoff. There is a huge potential that the new biodiversity framework can leverage, for trees on farms to contribute to biodiversity objectives as well as resilience and long term, environmentally-sound productivity of agricultural landscapes. This will require appropriate information about agroforestry species and their uses, building upon local knowledge, as well as proper mainstreaming in agricultural policies, economic incentives, technical back-stopping and appropriate tree tenure regulations. It will also require to invest in production, delivery and use of quality tree seeds/seedlings. It will also require appropriate market development downstream to give maximal value to the range of tree produce.

6) Mainstream orphan crops into cultivation

Many tree foods found in forests are 'orphan crops', also called "neglected and underutilized species", that have been neglected by researchers and industry, but have great potential to diversify farming systems to support both human and environmental health. The application of new methods provides opportunities for modest investments to transform the status of these species under cultivation, when supported by policies that encourage their production and consumption. Broad gene pools, with new selection methods, provide for rapid productivity gains, while consumer-based interventions, when handled properly, support local use and integration into domestic and global markets. From a scientific perspective, ethno-biological studies need to be supported to avoid the loss of knowledge on the use of orphan crops.

7) Support innovations in knowledge, technology and institutions for a resilient mountains' future

Mountain ecosystems are hotspots of biodiversity and a crucial area for natural resources management, such as water, quantity and quality, soil, nutrients, genetic resources and adaptation to climate change. They are also particularly vulnerable to global change, climate change, anthropogenic pressures, land-use change, and inappropriate management. How mountains are managed often conditions the environmental and productive health of the whole landscapes downstream, including its resilience to climate change. Due to their specificity, mountains are also a place where the relations between nature and livelihoods are specially tied, often carved by thousands of years of land, farm and forest experience, knowledge and practice within communities, in a holistic way. There is a potential to combine local knowledge and scientific research to support innovations in knowledge, technology and institutions for a brighter and resilient mountains future.

8) Better mainstream biodiversity in climate change related discussions, instruments, and implementation

Climate change is a major threat to biodiversity conservation (including to biodiversity hotspots), and ecosystem services. Biodiversity conservation and sustainable management, as well as leveraging ecosystem services, are essential, but often overlooked, in climate change mitigation and adaptation. In forests, biodiversity is grounding climate-change adaptation, is key to forest health that enables long term mitigation. There is a need for appropriate tools and mechanisms to monitor and assess changes in ecosystems, particularly in forests, mountains, small islands, coastal areas, arctic zones, arid and semi-arid areas, and other highly vulnerable areas. To do so, engaging indigenous peoples and local communities, citizen science will allow at the same time broad observation, awareness raising, and societal ownership. There is also a need for appropriately integrating biodiversity concerns and prioritizing biodiversity hotspots in climate-change related measures. Forest, trees and agroforestry systems play a key role in climate change adaptation and mitigation, that can be strengthened by better integrating biodiversity conservation and sustainable management into climate action.

9) Promote fruits, nuts, vegetables and mushrooms consumption and production, and leverage the potential of insects as a resource for sustainable food systems

Fruits, nuts, vegetables are among the most nutrient-dense foods but they are under-consumed in most countries. Mushrooms are low in calories and fat, and contain modest amounts of fiber and various nutrients. Edible insects contain high quality protein, vitamins and amino acids. Their high food conversion rate makes them particularly interesting as a source of high protein food and feed for sustainable food systems. The gathering and production of all these foods can allow to increase and diversify income particularly for small holders. Agricultural and food policies that are often focused on staple crops need to be reoriented to integrate the specificities and benefits provided by the production of fruits, nuts, vegetables and mushrooms, and to leverage the potential of insects as a resource for food systems.

10) Understand, recognize, support and draw lessons from indigenous culture, traditional production systems and indigenous food systems

Indigenous food systems, including the knowledge and values embedded in them, are a model of sustainable use of natural resources. Their preservation is essential to protect and sustainably manage forests, biodiversity and other natural resources. They can provide a source of inspiration to bring a global transformation of food systems towards more sustainability in terms of values (sustainable management of resources, reduced waste, social values, sharing, link to health...), responsibility (towards land and biodiversity, society, future generations), and practices. The contributions of traditional diets, rich in diverse nutritious foods, to health and sustainable food systems, need to be better understood and promoted. This needs to be supported by research and ethno-biological studies.

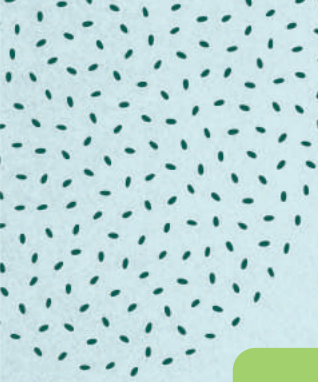
11) Harness the potential of forests, trees and agroforestry to transition to a circular bio-economy

Forests, trees and agroforestry and associated biodiversity have a considerable potential for the development of bioenergy and biomaterials including by the utilization of coproducts and waste. Fungi and insects can recycle waste and transform it in feed, plant nutrients and biomaterials. Food systems are major producers of waste: food losses and waste, non-edible waste, and also food packaging that is increasingly non-renewable, one of the main sources of plastic waste. Trees, bamboo and rattan can provide alternative sources of fiber and packaging material. Circular bioeconomy is more reliant on the cycling and recycling of bio-based natural products and residues, optimizes material fluxes, storage and processing, reduces post-harvest losses and waste. It calls for enlarging the notion of value chains to value webs, where multi-cropping systems give rise to several products. A holistic approach to all material fluxes optimizes input/output flows in agriculture, forestry and fisheries, and diversifies farm and forest revenues, thus reducing risks. These developments require supportive regulations, public procurement, incentives and consumer engagement

12) Promote instruments that facilitate joint consideration of landscapes and value chains for sustainable management of natural resources

It is at landscape level that diverse land uses and human activities can be best managed to sustainably manage natural resources and optimize the production of ecosystem good and services. This requires adequate knowledge and information, evidence based, inclusive and transparent decision processes as well as governance mechanisms and instruments to maximize synergies and manage trade offs between different objectives. Such processes need to be conducted in the landscapes, in value chains (including related to trade and markets) and at the intersection between landscapes, that are by nature local, and value chains that can have much broader scales, national, regional and global. There is thus a need for appropriate mechanisms to facilitate interactions between levels and scales as well as the integration of local concerns in investment decision and international trade instruments.





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The CGIAR Research Program on Forests, Trees and Agroforestry (FTA) is the world's largest research program to enhance the role of forests, trees and agroforestry in sustainable development and food security and to address climate change. CIFOR leads FTA in partnership with ICRAF, the Alliance of Bioversity International and CIAT, CATIE, CIRAD, INBAR and TBI.


FTA thanks all the donors who supported this research through their contribution to the CGIAR Trust Fund: cgiar.org/funders/



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