“Innovative technologies in forestry and forest management in Asia and the Pacific”

Revised version of the scoping note based on the feedbacks received during the inception workshop

The ‘Third Asia-Pacific Forest Sector Outlook Study’ (APFSOS III) (FAO, 2019), launched in June 2019 at the Asia-Pacific Forestry Week in South Korea, highlighted that the use of **innovative technologies -** including ICT technologies, processing technologies and new wood-based products - creates huge opportunities and challenges for sustainable forest management in the Asia-Pacific region. Nearly 300 forestry students and young professionals from more than 30 countries, consulted for this Outlook Study, found that the uptake of new technologies in the forest sector has been too slow and called for better opportunities for young people to learn and apply these new technologies.

Following-up on the APFSOS III, FAO and CIFOR, lead center of the CGIAR research programme on Forests, Trees and Agroforestry (FTA), are developing a roadmap on innovative forest technologies. In particular, FAO and FTA will prepare and co-publish a technical paper, with key recommendations (for policy and concrete actions) informed by science, on the use of innovative technologies to advance sustainable management in the forest sector in the Asia-Pacific region[1]. A policy brief, directed to key decision-makers, will gather the main findings and concrete recommendations emerging from this work.

This note describes the scope of this publication and the methodology to be followed for its development.

Framing: scope and definitions

Multiple and very diverse definitions of forest and wooded areas are used around the world, reflecting both the diversity of forest ecosystems and the diversity of human perceptions and uses of forests. This paper will use the FAO definition of forest used for the latest FAO Global Forest Resources Assessment (FRA2020): “*land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ”* (FAO, 2018). This widely used and recognized definition allows compared analysis across countries at regional or global levels.

In the APFSOS III, the terms “forestry” and “forest sector” are used interchangeably to encompass “all economic activities that mostly depend on the production of goods and ecosystem services from forests” (FAO, 2019). During its 28th session (17-21 June 2019) held in Incheon, South Korea, the Asia-Pacific Forestry Commission (APFC), considering the “impacts of technological advancements on forests and forestry”, also used this broad definition of forestry and the forest sector covering not only forest management but also forest industries (APFC, 2019).

For the purpose of this roadmap, the term “innovative” technologies embraces: (i) new technologies either in the generation phase, or in the pre-pilot or pilot phase, that could become mainstream or mature before 2030, as well as (ii) recent technologies emerging for new purposes or in new contexts.

[1] The geographical scope of the roadmaps covers the countries of the FAO region of Asia and the Pacific (see: http://www.fao.org/asiapacific/countries/en/). However, it excludes France and the United States of America (USA) mainland, situated outside the region. The Russian Federation, although covering 29 percent of Asia, is also excluded because issues related to Russian forests are usually discussed within the European Forestry Commission.

These technologies could perform better than currently utilized technologies, or even provide new functions.

In a note distributed during this session (APFC, 2019), the APFC's Secretariat distinguished two types of innovative technologies impacting forestry: (i) those developed outside the forest sector, for example, information and communications technologies (ICTs) as well as geospatial technologies; and (ii) those developed within the forest sector, for example, production of new-generation wood-based materials such as engineered wood products, bioplastics, natural chemicals, bioenergy products, and pharmaceuticals.

ICTs, remote sensing and big data analysis are revolutionizing forest management, allowing real time forest monitoring and precision management. Governments are beginning to leverage new technologies to improve land mapping, the management of land-ownership information, and forest governance. Huge volumes of forest data will be generated and collected in the future, requiring increased human-resource capacity in data processing and analysis. Product and process innovations can contribute to reduce waste and improve productivity and efficiency in forest products processing. A new generation of wood-based materials and forest products including engineered wood products, bioplastics, biochemicals and biomaterials are enabling new uses and applications for forest products including in general construction, tall buildings, energy, packaging and medicine. Among other things, this dynamic has the potential to contribute to reduced CO_2 emissions, low-carbon economies, and the circular bioeconomy; by substitution of biological products for fossil fuels or energy-intensive products like cement and concrete (IPCC, 2014).

Content and objectives of the technical paper

Building upon APFSOS III, this paper will discuss "innovative technologies", "innovation process", technology transfer, uptake and upscale, as applied to "forestry", the "forest sector", and "sustainable forest management", to further refine the scope of the analysis. Examining innovations, the study will distinguish: incremental vs. transformative and disruptive innovations; product vs. process innovations; technological vs. institutional innovations. It will describe different categories of innovative technologies applied in the forest sector in the region, along with illustrative examples, including:

- *Digital technologies*, including ICTs and geospatial technologies, such as: social media, video-conferencing, big data analysis, cloud computing, artificial intelligence, drones, satellite-based observations and other remote-sensing technologies, light detection and ranging (LIDAR), RADAR, acoustic and camera monitoring, early warning systems, global positioning systems and geographic information systems;
- *Biological technologies*, including: tree breeding, genetic selection, biotechnologies, DNA identification and tracking;
- *Technical innovations*, within this category we can further distinguish: *process innovations* in forest exploitation (such as improved chainsaw or reduced impact logging) and wood transformation; and *product innovations* (such as cross-laminated timber as construction material or wood-based bioplastics for packaging);
- *Innovative finance technologies* (e.g. blockchain) and mechanisms (e.g. blended finance, green bonds, responsible investments or crowdfunding).

The paper will examine how the application of innovative technologies affect different functions throughout the value chain and the extent to which this contributes to sustainable management in the forest sector. Among these functions are (not an exhaustive list): germplasm selection, production and breeding; forest monitoring; forest management (tree planting, tree growing, forest protection); wood harvesting; wood processing (first and second transformation); quality control; traceability; transport; distribution; final use of wood-based or non-wood forest products (for e.g. medicine, energy, packaging, construction material, furniture…); reuse and recycling; waste management; marketing; etc.

Assessing the strengths and weaknesses of each innovative technology in performing these different functions will ground an analysis of their advantages and disadvantages in different contexts. Such an assessment can offer a framework to compare very different innovative technologies, whether "modern" or "traditional", and help identify and categorize the most promising innovative technologies for the forest sector in the coming decade. Innovative technologies can not only perform existing functions better than currently utilized technologies but may also provide completely new functions, products and services. The way one technology performs one function, as well as its positive or negative impacts for people and the planet, may vary significantly across contexts and, even in the same context, may be perceived differently by different stakeholder groups. In addition, the social, economic and technical contexts are also evolving.

The Fourth Industrial Revolution,[2] through extraordinary technological advances (e.g. artificial intelligence, digital twins, etc.), is merging the physical, digital and biological worlds in ways that create both huge opportunities and threats. The study will describe the main challenges and opportunities, advantages and disadvantages, associated with the application of innovative technologies in the forest sector in different contexts. The study will also consider the potential negative impacts of new technologies on local communities (access to natural resources, food security and livelihoods), natural ecosystems and biodiversity.

Innovative technologies can provide new products and services, reduce operational costs and improve productivity, thus generating further income and employment opportunities in the forest sector. The adoption and dissemination of innovative technologies will likely generate major shifts in forest value chains, modifying wood demand, including increased needs for high quality and diverse planting material, and the labour market. Innovative technologies have the potential to generate new skilled jobs (e.g. drone operators, ICT developers and operators, etc.). Innovative, safer and greener jobs can, in turn, help make the forest sector more attractive, in particular to young professionals. However, innovative technologies, including automation, might also lead to the loss of many unskilled jobs. This might marginalize traditional practices and impact negatively people, with limited human or financial capacity to adapt, involved in traditional labour-intensive management systems, common in the region. Innovative jobs might benefit external people with a different set of skills rather than local communities, exacerbating social inequalities.

Innovative technologies can also reduce waste and improve energy- and resource-use efficiency, thus increasing profitability of the forest sector and contributing to the sustainable management of natural forest resources. Precision technologies can also limit or avoid collateral environmental damages to ecosystems (e.g. pollutions, destruction of untargeted organisms or species). Product and process innovations can help preserve natural and primary forests by opening new markets for certain wood products (e.g. small-diameter timber or fast-growing tree species). On the other hand, innovative technologies, if not used wisely, can accelerate deforestation and forest degradation, habitat destruction and species extinction. Digital technologies and institutional changes can help strengthen participation, transparency and accountability in forest governance, thus advancing the sustainable management of natural resources.

The study will analyze the process of dissemination of innovative technologies and the actors involved (without overlooking the gender dimension). The rate of uptake of innovative technologies is far from uniform in the region, with use varying by country and sub-region. There is also a greater uptake of technologies to increase forest productivity and industrial efficiency in the planted-forest sector than in the management of natural forests.

The paper will analyze the technical, economic and social barriers preventing the uptake and upscale of innovative technologies in the forest sector. In particular, the study will explore: (i) the lack of capacity (e.g. limited access to natural resources, limited access to information, limited access to credit and markets, limited transparency and limited participation in decision making); and,

[2] See: https://www.weforum.org/focus/fourth-industrial-revolution

(ii) restrictive policies and regulations lagging behind the rapid evolution of technologies and the rapid shifts in wood demand.

It will also consider the institutional changes needed in forest sector governance (land planning, land tenure and other relevant development policies), to overcome these barriers, to support the uptake and upscale of innovative technologies in the region, and to ensure that these technologies will effectively contribute to sustainable forestry and sustainable forest management. Regional cooperation, investment, infrastructure development, education and capacity building will be key to support technology transfer and dissemination, and accompany the populations at risk of being marginalized by these technological advances. The public and private sectors will have to work hand-in-hand to address these issues.

The paper will finally suggest key recommendations (policy and concrete actions) to ensure that the use of innovative technologies effectively contribute to sustainable development.

Method of work: process and provisional timeline

This study will build upon recent FAO publications, in particular the abovementioned APFSOS III and the latest FRA (FAO, 2020), as well as on preparatory reviews of the existing scientific literature. It will mobilize FAO and FTA experience, expertise and knowledge.

The roadmap will be developed through a participative process, launched with an online inception workshop co-organized by FAO and FTA on July 30th, 2020[3], involving key regional stakeholders and technical experts from governments and intergovernmental organizations, from the private sector and civil society organizations, as well as from academia and research institutions.

Technical information on the application of innovative technologies in forestry and forest management, will be gathered through interviews with key stakeholders (face to face and/or online) and through online open consultation.

Technical intermediate workshops will be organized as appropriate at critical steps of the process of development of the roadmap. In particular, the November 2020 workshop on innovative forest technologies will be the occasion to discuss the application of innovative technologies in forestry and forest management, as well as the results of the call for abstracts for the youth (students and young professionals) competition.

A final validation workshop will be organized at the end of the process to discuss and validate the main findings and key recommendations of the study. This workshop could be organized back-to-back to the XV World Forestry Congress, to be held on 24-28 May 2021 in Seoul, to gain visibility. The final draft of the technical paper will be submitted in parallel to an independent scientific peer-review.

The whole process will give special attention to the contribution of students and young professionals of the forest sector in the Asia-Pacific region. Specifically, a competition will be organized to gather their ideas and suggestions. The intermediate workshops will include a substantial participation from youth. The validation workshop could be the occasion to present not only the main findings of the technical paper, but also the best contributions from students and young professionals, emerging from the competition.

The objective is to publish the technical paper and the corresponding policy brief by end November 2021.

[3] More details in the inception workshop report available at: https://www.foreststreesagroforestry.org/wp-content/uploads/2020/10/FAO-FTA_Roadmap-Inception-Workshop-Report_30-07-2020.pdf

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