Innovative Technologies Recommendations

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Roadmaps for Primary Forests Conservation and Innovative Forest Technologies in Asia and the Pacific

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Overview

The recommendations developed over the course of the roadmap. Key input received during IT workshop from 5 main actor groups: 1)international organizations; 2) government agencies; 3) private sector; 4) civil society & local communities; 5) research & academic institutions.

Actors suggested recommendations organized by: intended use/impact; thematic domain; or context *(not by actor groups)*

Recommendations are structured to address the following:

(i) Why, for what objectives, do we need to harness the potential of innovative technologies?

(ii) How can we overcome the current constraints to support the uptake and scaling-up of innovative technologies in the forest sector?

Recommendations

10 recommendations topics
with 59 individual recommendations (3-8 / topic)

To facilitate the implementation of the recommendations at different scales FAO and CIFOR/ICRAF suggest two complementary tools for governments and other actors to develop roadmaps to address their specific circumstances (context, priorities and needs):

- A practical four-step guideline towards roadmap implementation (**Section 5.3**)
- A detailed table linking each recommendations to the evidence and case-studies (**Annex 8**)

4-step guideline for practical implementation

Step 1 – Diagnosis: assess the current situation

- Identify the challenges and needs for sustainable forest management (SFM) (5b)
- Assess the potential opportunities & challenges of innovative technologies to SFM (5a)
- Identify the actors affected (+, -) by innovative technologies implementation (5b)
- Identify the main barriers to technology dissemination and adoption

Step 2 - Develop a strategy: set priorities

Identify research priorities, including priority areas for action and investment, incl. priorities policies and regulations transformation (5a, 5c), focusing on:

- the most promising innovative technologies given the identified challenges and needs (5c);
- the most vulnerable groups of actors (e.g. indigenous peoples, local and rural communities, small-scale producers, women, youth);
- the forest ecosystems or forest value-chains that are the most fragile, socially, economically and/or environmentally.

4-step guideline for practical implementation

Step 3 – Create enabling conditions

- Raise awareness and enhance citizen participation in forest monitoring and sustainable forest management (2)
- Elaborate policies needs (7) to address the barriers identified above.
- Mobilize the resources and develop the infrastructure needed to boost innovation and sustainable development in the forest sector (6f; 7)
- Support/Invest in research and development, extension and capacity-development (6)

Step 4 – Act collectively and individually

- Define the roles and responsibilities of the different actors involved (5c)
- Develop action plans at different levels (regional, national, local), in different sectors, for different stakeholder groups.
- Ensure policy coordination across sectors, actors and scales and create innovative governance mechanisms at all scales (5)
- Experiment and share the lessons learned
- Adapt strategies and action plans accordingly

Recommendation Table – links to evidence

#	Rec.	Key Actors	IT Cluster	Forest Function	Report Section	Report Box	Youth Paper
1 Improve the monitoring of forest resources & track illegal logging & illegal trade of forest products							
1.a	Enhance the use of digital technologies for more efficient, cost-effective, accurate and real-time monitoring of forest and land; and facilitate data collection & sharing	Gov, Res/Acad, Extension Agencies, Private, Civil Soc, Comm,	Digital tech	Forest monitoring	Sec 1.2.2, Sec 2.1 Sec 3.2 FAO (2019)	All boxes under Rec #1	#1 Bahar et al #2 Lama et al #3Sarzynski et al
1.b	Facilitate the use of drones to monitor forest status, trends and threats, particularly in remote & inaccessible areas	Gov, Res/Acad, Civil Soc,	Digital tech	Forest monitoring	Sec 2.1	Box 5	#6 Lee #7 Saputra et al #8 Kamran et al

Examples – Annex 8

Recommendation Topics

Why harness the potential of innovative technologies?

1. Improve the monitoring of forest resources and track illegal logging and illegal trade of forest products
   - 6 specific recommendations
2. Raise awareness and enhance citizen participation to forest monitoring and sustainable forest management
   - 5 specific recommendations
3. Improve productivity and resource-use efficiency
   - 6 specific recommendations
4. Generate new job opportunities & support livelihoods
   - 8 specific recommendations

How to support the uptake and scaling-up for innovative technologies?

5. Ensure coordination across sectors, actors & scales & create innovative governance mechanisms at all scales
   - 4 specific recommendations
6. Invest in innovative research, extension & capacity-development models
   - 7 specific recommendations
7. Elaborate conducive policies & regulations; and develop the infrastructure needed to boost innovation and sustainable development in the forest sector
   - 7 specific recommendations

How to support the uptake and scaling-up for innovative technologies?

8. Consider the economics of innovation to facilitate the adoption of innovative technologies across contexts & scales
   - 6 specific recommendations
9. Assess the negative impacts of innovative technologies and establish appropriate social and environmental safeguards
   - 3 specific recommendations
10. Strengthen regional cooperation
    - 7 specific recommendations

Thank you !!

Photos: J Roshetko

Specific Recommendations

1. Improve the monitoring of forest resources & track illegal logging and trade of forest products

a) Encourage the use of **digital technologies to allow more efficient, cost-effective, accurate and real-time monitoring of forest and land resources, and facilitate data collection, pooling and sharing**.

b) Facilitate the use of **drones to monitor forest status, trends & threats**, part. in remote inaccessible areas.

c) Deploy optical, acoustic or other sensor networks to monitor physical, biological or climatic parameters in forest stands and provide real-time information on forest conditions, while minimizing collateral disturbance to wildlife and their habitats.

d) Combine **remote sensing and geo-spatial technologies; social media, open-source tools, mobile applications and collaborative platforms**; with big data analysis, deep learning models and AI, to develop **real-time monitoring and early warning systems that can track and help combat various natural or human-induced threats**, such as wildfires or climatic events; pest, disease or invasive species outbreaks; deforestation and illegal activities.

e) Develop mobile applications to make spatial datasets and alert systems easily accessible in the field, even offline, to optimize forest patrol routes, and to facilitate data collection, sharing and centralized reporting.

f) Encourage the use of DNA profiling and of advanced microscopy identification technologies to track illegal logging and illegal trade of forest products.

2. Raise awareness & enhance citizen participation to forest monitoring and SFM

a) Encourage the use of social media and other communication innovations to raise awareness regarding the importance of SFM and conservation, facilitate participation and enhance transparency and accountability in forest monitoring, forest management and along forest value chains.

b) Develop mobile applications, as well as open and collaborative online platforms and tools, to encourage citizen-science initiatives and facilitate citizen and local communities' participation in forest monitoring, forest patrolling and SFM.

c) Use mobile applications and online platforms to connect small-scale producers to forest value chains (e.g., banks, traders, processing companies, distribution networks and consumers), facilitating their access to markets and credit.

d) Develop innovative finance mechanisms, e.g., crowdfunding platforms or impact investments, that facilitate citizen investment in forest conservation or sustainable management and create a stronger link between borrowers and lenders, thus strengthening stakeholder engagement and sense of ownership.

e) Support and scale community-forestry, community nurseries, multi-stakeholder fora, focus group discussions, and other social innovations, that empower local communities, indigenous peoples, women and other marginalized actors, improve their access to information, give them a stronger voice in decision-making processes, strengthen their control over local forest resources, and support their livelihoods.

3. Improve productivity and resource-use efficiency

a) Harness the potential BT and PP technologies to: reduce operational costs; increase productivity and profitability; improve energy- and resource-use efficiency, reduce waste and preserve natural resources; and open new markets and new uses for forest products.

b) Invest in the low-input multiple species domestication, selection and breeding approaches, exploring more systematically the potential of native or under-utilized forest wood and non-wood species, to produce germplasm of high genetic and physical quality, with improved characteristics adapted to different uses and to different climate change scenarios, and to preserve biodiversity, especially of threatened or endangered species.

c) Disseminate supplies of improved quality germplasm, adapted to local conditions, to farmers, local communities, and development agencies to enhance local livelihoods, facilitate land restoration, and secure sustainable supply of forest and tree commodities.

3. Improve productivity and resource-use efficiency

d) Optimize the use of forest resources by limiting collateral environmental damage during harvest and reducing waste along forest value chains through innovative processes such as: precision forestry, reduced impact logging (RIL), winch-assisted harvesting on steep slopes, computer numerical control (CNC), or spindle-less lathe technology.

e) Develop a new generation of innovative wood and non-wood bioproducts, more environment-friendly, or able to substitute more energy-, GHG- or resource-intensive materials for a wide range of uses, including: cross-laminated timber, mass timber, medium density fiberboard (MDF), particleboard (including binderless particleboard), oriented strand board (OSB), veneer and plywood, engineered bamboo products, bioplastics, modern bioenergy products, transparent wood and/or cellulose nanomaterials.

f) Develop innovative applications for previously under-valued woods, under-utilized species, small-diameter logs (including thinnings) from plantations and farms, or wood scraps from processing industry to meet an increasing demand for wood while reducing the pressure on natural forests

4. Generate employment & livelihood opportunities

a) Encourage the use of innovative technologies (e.g., digital technologies, biological, technical and social innovations) and innovative finance mechanisms (e.g., blended finance, green/social/climate funds, payments and rewards for ecosystem services) to generate additional income and employment opportunities, improve working conditions and reduce the workload.

b) Develop appropriate education courses at primary, secondary and tertiary levels, as well as initial and continuing training programs in forestry, natural resources and innovative technologies, paying a specific attention to young people, women, small-scale producers, ethnic minorities and other marginalized groups. Besides the use of innovative technologies, beneficial training topics could include: language proficiency, organizational and leadership skills, marketing, enterprise development, worker safety, and small-business operations.

c) Accelerate technology transfer and capacity-development to disseminate the new skills needed to apply for innovative, safer and greener jobs (e.g.: data collection and reporting through mobile applications, drone operation, remote sensing imagery interpretation, big data analysis, tree-nursery operation and maintenance, automated control of wood processing, engineering of bioproducts, or management of innovative funding and governance mechanisms).

d) Develop innovative job opportunities, internships and fellowships in the forest sector, to make it more attractive for youth.

4. Generate employment & livelihood opportunities

e) Seize the opportunities offered by the development of a circular bioeconomy to generate new and greener job opportunities, support the livelihoods and resilience of local communities, while reducing pollution, GHG emissions, and improving energy- and resource-use efficiency.

f) Facilitate the automation of physical tasks, building upon the new possibilities offered by digital technologies and technical innovations (e.g., wireless communications and remote-control technologies, robotics and AI, to reduce the workload and work drudgery, improve worker safety, and optimize wood processing, while saving energy and natural resources.

g) Use innovative finance mechanisms, such as green and social bonds, crowdfunding and impact investment, to prioritize and support capacity-development and employment generation in local communities and small-scale forest enterprises to enhance their resilience and livelihoods.

h) Develop shared-value business strategies, mutually beneficial for the private sector and local communities, that facilitate the efficient supply of high-value commodities that meet market specifications and bring local benefits

5. Ensure policy coordination across sectors; create innovative governance mechanisms at all scales

a) Establish a **national advisory group on innovative forest technologies**, gathering all relevant actors (from public and private sectors, civil society and research institutions; from researchers to final users), to assess the potential of available or emerging technologies in the national context; to identify priority areas of actions and investment, in an evidence-based way, as well as data needs; and to help the government adapt its policies and regulations to the rapid evolution of innovative technologies.

b) Conduct, in **collaboration with the other actors in the advisory group, an initial assessment of the current situation regarding the application of innovative forest technologies at national and sub-national levels**, as well as of their positive and negative impacts for different stakeholder groups, in order to identify the constraints and needs and define national priorities and plan of actions.

c) Elaborate & implement, in collaboration with the other actors in the advisory group, a national roadmap for innovative forest technologies uptake and scaling-up, articulating properly the relevant sectors, actors and scales, building upon the recommendations suggested here, and adapting them to their national circumstances, priorities and needs. This roadmap should identify: research priorities, priority technologies, priority actions and investments, the priority transformations needed in policies and regulations, as well as the roles and responsibilities of the actors involved.

d) Create innovative governance mechanisms at all scales and support social innovations that promote networking between governments and other actors, at national to local levels; & create enabling conditions for the engagement of all relevant actors, in particular youth, women, small-scale producers and local communities, in the development, dissemination and adoption of innovative technologies, as well as in their adaptation to different contexts and actors.

6. Invest in innovative research, extension & capacity development

a) Elaborate a national research, development and extension action plan to identify priority areas for research, facilitate the development, uptake and scaling-up of prioritized innovative forest technologies, enhance the coordination among different actors (e.g., ministries, private sector, research and academic institutions and civil society organizations), and facilitate/guide the allocation of limited available resources.

b) Adopt a “blended” multi-stakeholder R&D system, connecting private research to public needs, national priorities and global objectives and facilitating the application and dissemination of findings from public research institutions, including by private actors and civil society organizations.

c) Develop transdisciplinary, collaborative and participatory research projects (e.g., citizen-science initiatives), and offer internships and fellowships in research projects to people with field-experience, in order to better consider the specific context, priorities and needs of local actors in the field, particularly small-scale actors, better integrate scientific and local knowledge, and better support knowledge co-generation and sharing.

6. Invest in innovative research, extension & capacity development

d) Invest in research and development on emerging technologies (not yet commercialized), and on the conditions under which they can contribute to sustainable development.

e) Invest in innovative research, development, extension and capacity-development models regarding the use of innovative technologies in the forest sector (e.g., big data analysis; participative research and data collection; field and virtual demonstrations of innovative technologies; community of practices; farmer-to-farmer networks; massive open online courses -MOOCs- and other innovative learning models).

f) Mobilize additional resources for research, development, extension and capacity-development on innovative forest technologies, in particular in developing countries, including through blended finance, impact investments, corporate social responsibility (CSR) programs, and other innovative funding mechanisms.

g) Link national forestry education efforts (including research and extension aspects) with the emerging Global Forest Education Project.

7. Elaborate conducive policies & develop infrastructure needed to boost uptake ITs

a) Harness the improved monitoring capacities offered by innovative technologies (e.g., participatory data collection, drones, satellites, sensor-networks, automation or AI), to develop flexible policies, strategies and rules, able to address the multiple threats and challenges faced by forests and forest value chains in a more reactive and timely manner.

b) Ensure that the legal framework on intellectual property rights (IPRs): strikes the right balance between incentive to innovate and technology dissemination; considers national priorities and general public interest; and facilitates access of small-scale actors and marginalized groups to innovation. In particular, IPRs regulations (e.g., on biological innovations) should not infringe the rights/control of local populations and indigenous peoples over their local genetic resources, traditional crops or land.

c) Harness the possibilities offered by innovative technologies to facilitate law enforcement. In particular, the legal framework should facilitate the use of remote sensing or crowdsourced data, and of DNA profiling and fingerprinting as forensic evidence in legal cases.

d) Maximize the potential of drones while considering privacy and security issues, by adopting transparent regulations, adapted to various UAV models and various activities (e.g., forest monitoring, land tenure claims, pest and disease control, insect sampling, etc.), in various sectors

7. Elaborate conducive policies & develop infrastructure needed to boost uptake ITs

e) Develop national standards for the use of digital (geospatial and ICT) technologies for forest monitoring to ensure equipment (hardware and software) compatibility and facilitate cost-efficient data pooling and sharing.

f) Identify the physical, virtual and institutional infrastructure lacking, at national to local level, to boost innovation and facilitate technology transfer, dissemination and adoption (e.g., road network, electricity and energy grids, internet and communication infrastructure, markets and finance infrastructure, tree-nurseries and wood processing plants, R&D and extension systems, governance and institutions, law enforcement system, etc.); invest and mobilize resources on infrastructure modernization to address the identified gaps.

g) Use innovative finance mechanisms, such as blended finance, to mitigate the risks (biological, climatic, social, market and political), attract additional resources and facilitate the long-term investments needed to support technology uptake and scaling-up in the forest sector, including capacity-development and infrastructure establishment or improvement.

8. Consider the economics of IT & facilitate the adoption of IT across contexts & scales

a) Demonstrate the social, economic and environmental benefits of innovative technologies in different contexts, for different stakeholder groups, particularly for the youth, women, small-scale producers, local communities, ethnic minorities, and other marginalized actors.

b) Adopt a “bottom-up” approach to facilitate technology transfer and dissemination, starting from an assessment of the needs of smallholders, small-scale enterprises, and local communities, and considering their socio-economic context, traditions and culture.

c) Consider local culture and traditional knowledge, perceptions and experience of local actors to facilitate technology adaptation and adoption in a specific context.

8. Consider the economics of IT & facilitate the adoption of IT across contexts & scales

d) As appropriate, provide external support (technical, human, and financial) to small-scale enterprises, local communities or other targeted/vulnerable groups (e.g., youth, women, or indigenous peoples), to improve their access to information and to innovative technologies.

e) Support the dissemination of high-quality germplasm through participatory multiple species improvement and delivery programs with smallholders and local communities, including through donations or sales at affordable prices, as well as through the establishment of tree nurseries, seed orchards or clonal cutting gardens to develop local seed/germplasm production capacity.

f) Adopt innovative harvesting, transportation and processing technologies (e.g., portable sawmill) for use by smallholders and small-scale operators, considering small-business operations, on-site processing, and modern safety standards, and facilitating the use of small diameter logs and under-utilized species

9. Assess the negative impacts of IT & establish appropriate social and environmental safeguards

a) Governments should create and enforce necessary social and environmental safeguard measures to ensure that innovative technologies contribute to the SDGs and do not harm natural ecosystems and vulnerable and marginalized groups.

b) Private actors, as part of their CSR, should comply with these social and environmental safeguards and respect the culture and welfare of indigenous peoples, ethnic minorities and local communities when deploying and using innovative technologies.

c) Civil society, local communities, and research and academic institution, should join their efforts in assessing the various negative impacts of innovative technologies, improving monitoring and reporting, strengthening transparency and accountability of public and private actors, suggesting appropriate safeguards and defending the rights and welfare of small-scale actors, local communities and marginalized groups (including women and indigenous peoples).

10. Strengthening regional cooperation

a) Raise awareness on the potential of innovative technologies to advance the sustainable development goals (SDGs) and encourage global sharing of information on innovative technologies in forestry through all member countries and other relevant actors of regional importance (e.g., donors, private companies, research institutions, non-governmental organizations).

b) Develop regional plans on issues of regional importance (such as: technology transfer; international finance for innovative forest technologies; IPRs; interoperability of databases, data pooling and sharing; timber regional and international trade; prevention and tracking of illegal activities; forest conservation transboundary issues; conflicts over natural resources; cross-border challenges such as climate change, pest control, or water management) and on the possibilities offered by innovative technologies to address these issues.

c) Encourage and facilitate the exchange of experience and lessons learned across member countries about the dissemination and utilization of various innovative technologies in specific contexts.

d) Align and harmonize regional objectives and national efforts, investment plans, policies, regulations and standards regarding the dissemination and adoption of innovative technologies.

10. Strengthening regional cooperation

e) Assist member countries to develop a national roadmap for innovative forest technologies uptake and scaling-up, building upon these recommendations and adapting them to their national circumstances, priorities and needs.

f) Encourage, advise and support member countries to adapt their legal framework to maximize the social, environmental and economic benefits of innovative technologies, limit their negative impacts, and harness their capacities to facilitate data collection, reporting and analysis, improve monitoring and law enforcement; enhance participation, transparency and accountability; improve productivity and resource-use efficiency; generate income and employment opportunities.

g) Encourage south-south cooperation regarding the development, dissemination and utilization of innovative forest technologies and mobilize resources (human and financial) to support, in particular, the least developed countries in the region.

Thank you!

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