Asia-Pacific Forest Sector Outlook: Roadmaps for primary forests conservation and innovative forest technologies

Report of the validation workshop, held online on 23-24 November 2021

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Disclaimer

FAO and CIFOR, the lead center of the CGIAR research programme on Forests, Trees and Agroforestry (FTA), have collaborated on developing two inter-related roadmaps for the Asia-Pacific region, focusing on: (i) primary forest conservation; and, (ii) innovative forest technologies. As part of these roadmaps, two technical papers were elaborated, one each on (i) primary forest conservation and (ii) innovative forest technologies, through an inclusive and participative process associating a wide range of key regional forest experts and decision-makers.

On November 23-24, 2021, FAO and CIFOR co-organized an online expert validation workshop to present and discuss the main findings and key recommendations emerging from these technical papers.

This non-edited document reflects the views expressed during this workshop. It does not necessarily reflect the views or policies of FAO or CIFOR.

The two technical papers will be finalized based on the feedbacks received during the workshop. Two policy briefs for decision-makers, will also be published gathering the main findings and concrete recommendations emerging from this work.

Acknowledgements

Summary of the discussions

Following the recommendations of the 'Third Asia-Pacific Forest Sector Outlook Study' (FAO, 2019), FAO and CIFOR, lead center of the CGIAR research programme on Forests, Trees and Agroforestry (FTA), have collaborated on developing two inter-related roadmaps for the Asia-Pacific region, focusing on: *(i) primary forest conservation;* and *(ii) innovative forest technologies*. These roadmaps, which also included preparing a technical paper on each topic, were developed through an inclusive and participative process which involved about 425 key regional stakeholders and technical experts. Specific attention was also given to reflect the voice of students and young professionals who will be the forest guardians and managers of tomorrow. At the end of this process, an expert validation workshop was held online, on 23-24 November 2021, to present the main findings and key recommendations emerging from these papers and discuss the way forward. The workshop attracted a diversified audience of 85 experts, from 26 different countries, representing all the key stakeholder groups, including: international organizations, governments, private sector, civil society, research and academia (see the full list of participants in **Annex 1**).

This workshop report presents the main results of the discussions. Its structure follows the agenda that was distributed ahead of the workshop and is reproduced in **Annex 2**.

Opening remarks

First, **Sheila Wertz-Kanounnikoff,** Senior Forestry Officer and Secretary of the Asia-Pacific Forestry Commission, FAO Regional Office for Asia and the Pacific, welcomed all participants to the validation workshop on behalf of FAO.

Distinguished delegates, experts and participants, colleagues,

On behalf of the Food and Agricultural Organization of the United Nations, I am delighted to welcome you here to this two-day Validation Workshop on the roadmaps for primary forests conservation and innovative forest technologies in the Asia-Pacific region.

As most of you are aware, FAO launched this initiative last year, together with our partner CIFOR, the Center for International Forestry Research, as a follow up to the recommendation from the last session of the Asia Pacific Forestry Commission (APFC) and the Third Asia-Pacific Forest Sector Outlook Study that was launched at the same time.

In fact, the continued loss of primary forests continues to be a big concern for the region. Their conservation is urgently needed to safeguard biodiversity, ecosystem services and the quality and health of people and the environment in the region.

At the recently concluded UN Climate Change Conference - COP26 - in Glasgow, more than 140 countries, accounting for about 90% of global tree cover and most of the world's primary tropical forests, have signed the *Glasgow Leaders' Declaration on Forests and Land Use*[1], pledging to "halt and reverse forest loss and land degradation" by 2030.

The Post-2020 Global Biodiversity Framework, expected to be adopted during Part II of the UN Biodiversity Conference in Kunming next year, is also placing high emphasis on the conservation of primary ecosystems, including forests.

Better knowledge on primary forests including the ways and means of their conservation is therefore critical in our progress towards the attainment of the sustainable development goals (SDGs) as well as the global climate and biodiversity commitments.

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[1] See: https://ukcop26.org/glasgow-leaders-declaration-on-forests-and-land-use/

Similarly, enhancing the uptake and scaling-up of innovative technologies in the forest sector is key to increased productivity, profitability, and generating new products and services and jobs, basically to make the sector more productive, more inclusive and more efficient.

Since the inaugural inception workshop last year, FAO and CIFOR organized two technical workshops, one on each on these two topics, where many of you participated and significantly contributed. We also had several expert consultations, secondary research and analysis, open online submissions, and an exclusive engagement with youth in the region that had already resulted in a publication (Pingault et al., 2021).

Relatedly, just last week, FAO, with the support of the Government of Australia, organized an expert workshop on improving reporting on Asia-Pacific primary forests to inform the next reporting cycle of the Global Forest Resources Assessment 2025.

At this juncture, I would really like to appreciate the tremendous effort and support received for this work during the entire process from governments, intergovernmental organizations, private sector, civil society, academia and research institutions.

Dear colleagues,

This validation workshop is a culmination of these efforts. The objective is to present now the key findings and receive your valuable feedback.

I also hope that this gathering will generate additional momentum to pursue these topics further, and pave the way for implementing the recommendations to further strengthen our efforts to advance sustainable forest management in the region.

Thank you.

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Then, **Robert Nasi**, Director General of CIFOR and Managing Director of CIFOR-ICRAF, recalled the main steps of the process and introduced the two studies on (i) innovative forest technologies; and (ii) primary forest conservation.

Welcome to all of you, esteemed colleagues, online for this final workshop on our work on the roadmaps on primary forests conservation and innovative forest technologies in Asia and the Pacific.

As Sheila said, we started this process with FAO about 18 months ago, in the wake of the Third Asia-Pacific Forest Sector Outlook Study. And, thanks to many of you online, a considerable work has been done.

I would like to emphasize three key facts, already highlighted by Sheila, that support this collective process:

- It gathered over 350 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.
- We conducted four technical workshops including this one, all online, two open online consultations, and did close to 100 bilateral interviews with key experts.
- And we gave an important room to the youth, the forest managers of tomorrow. This culminated into a premium publication of 13 essays by youth that was featured at the GLF Climate Hybrid Conference in Glasgow two weeks ago (Pingault et al., 2021).

Today, we are presenting you for some final discussion, the two technical papers that are delineating these two roadmaps. And, of course, these papers propose the roadmaps for your wisdom but they also constitute the first step of future implementation and the way forward by all relevant actors.

I will not, in my short introduction, look into the substance of the work, as James M. Roshetko (today) and Yves Laumonier (tomorrow) will do this for you. Let me, however, highlight some points that seem important from my perspective, and that emerge as common points from both studies.

The first point is that we need to break the image of forestry as a low-tech, non-innovative sector. The roadmap shows amply how high-tech, how vibrant the perspectives are for forestry. And we will need innovations and new ways of thinking, because our agenda is at the same time to save and to grow. We need to save our remaining tropical forests, especially primary untouched ones, and to grow forestry to deliver at scale wood resources for the bio-economy. We also know that these two challenges are particularly acute in Asia and the Pacific, which is the region of the world with the lowest percentage of remaining primary forest and, at the same time, with the lowest wood production per capita and some of the highest population densities.

The second point is that we, all stakeholders (countries, international research organizations, forestry schools and universities, forest agencies) need to think deeply into the implications of these roadmaps, to revisit our roles and agendas, implicate the young generation and reconsider how we work with the private sector, but also with all local actors, citizens and populations, to make sure these agendas work first for them, and are elaborated with them.

The final point is on implementation. All actions will need to be country-specific, and locally grounded. Yet, there is also much that we need to learn across contexts, between countries. We will also need a lot of solidarity for capacity strengthening across countries. We therefore hope that these two roadmaps can also fuel a revived agenda for international and regional cooperation in forestry in our large Asia-Pacific region. Along with many others, we, at CIFOR-ICRAF and FTA, stand ready to play our role.

In conclusion, let me extend my warm thanks to Yves Laumonier and James M. Roshetko and the FTA and FAO teams, for their dedication during the preparation of these technical papers. I wish you a fruitful workshop. Thanks for your attention and now over to you, James, for introducing today's discussions on innovative forest technologies.

Day 1: Roadmap on innovative forest technologies

During the **first session**, **James M. Roshetko,** Senior Agroforestry Systems & Integrated Natural Resources Management Scientist, at CIFOR-ICRAF, presented the main findings of the innovative technologies study. His full presentation is reproduced in **Annex 3**.

After a short presentation of the collective process of development of the roadmap, he illustrated the four main categories of innovative technologies as identified in the study: (i) digital technologies; (ii) biological technologies; (iii) technical innovations on processes and products; and (iv) innovative finance and social innovations.

Sustainable forest management involves a series of functions along forest value chains (from monitoring, management, harvest to transformation and final utilization of forest products and services) and requires stakeholder engagement and strong governance mechanisms. The study suggests a framework to assess the strengths and weaknesses of innovative technologies in performing these different functions, thus helping decision-makers to identify the most appropriate technologies to match specific objectives in a given context and address the specific needs and priorities of various stakeholder groups. **Figure 1** below was developed as a mind map to illustrate this assessment framework.

Figure 1. Potential contributions of innovative technologies to sustainable forest management: a mind map.
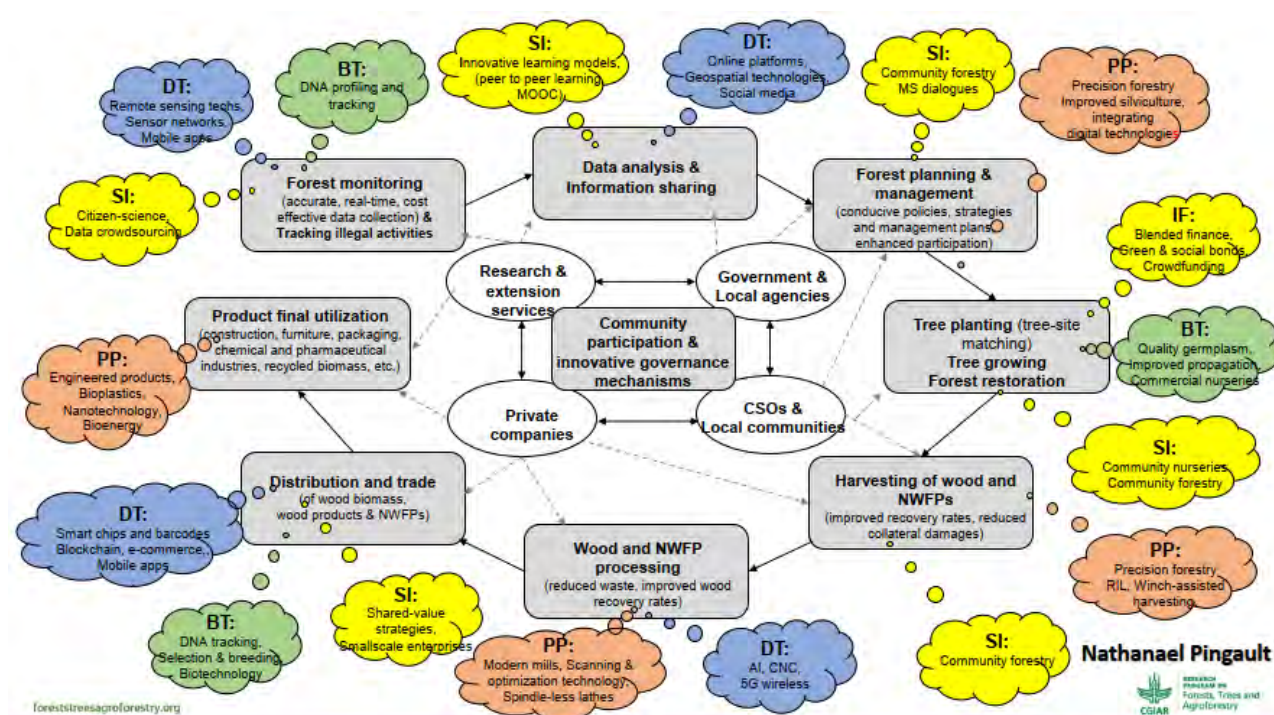
Source: Roshetko et al. (in preparation)

The study also explores the opportunities and challenges associated with innovative technologies. Innovative technologies have the potential to revolutionize forest management and to make critical contributions to sustainable development along forest value chains. It illustrates with specific examples, how innovative technologies can contribute to: improve forest monitoring and forest management; reduce waste and increase resource-use efficiency, productivity and profitability along forest value chains; enable the development of a bioeconomy contributing to climate change mitigation and SFM; create new skilled job opportunities making the forest sector more attractive in particular for youth; provide new products and services or develop new uses for previously under-utilized and under-valued wood species; enhance traceability and transparency along forest value chains; support participation, capacity development and information sharing; and enable new governance and investment models.

Innovative technologies are often considered as inherently beneficial, with advantages largely outweighing the risks. However, innovative technologies can also generate significant negative social, economic and environmental impacts, including: the loss of unskilled jobs; the destruction of natural ecosystems; or the loss of access to natural resources for indigenous peoples and local communities. These collateral damages are likely to affect disproportionately the most vulnerable groups and communities, which risk to be further marginalized by technology adoption and, hence, need a specific support. When considering the adoption of an innovation it is thus essential to consider not only the main objective for its adoption but also all its potential impacts, whether positive or negative, as well as all the potential synergies and trade-offs with other development objectives. This can lead to establish environmental and social safeguards or, as appropriate, to design compensatory or accompanying measures to leave no one behind.

The study highlights, through some proxy measures, the high capacity and potential for innovation in Asia and the Pacific. Building upon previous workshops' discussions, the study identifies two main barriers to innovative technologies uptake and scaling-up: (i) the lack of capacity (in terms of human, natural, physical, financial and social capital); and (ii) rigid legal frameworks (policies and regulations) often lagging far behind rapidly evolving technologies. The study then reviews the enabling conditions

likely to facilitate innovative technologies uptake and scaling-up, highlighting the importance of: capacity-building, education and training; improved access to credit and markets; improved transparency and participation; clear and secure land tenure and access rights; innovative governance and supportive policies and regulations.

During the subsequent discussion, moderated by **Keiran Andrusko** from the Australian Department of Agriculture, Water and the Environment, participants praised FAO and CIFOR-ICRAF team for this very timely, rich and comprehensive report, covering a wide range of innovative technologies and related issues. Innovation, they noted, will be key, in the coming decades, to meet an increasing demand for wood and forest products while halting and reversing deforestation in line with the commitment taken at COP26 in Glasgow by the international community. The challenge is to translate in the forest sector the favorable economy-wide innovation potential existing in the region. Examples from other sectors, particularly agriculture, that can be a source of inspiration for innovation in the forest sector, deserve to be covered in the report. Participants highlighted the mismatch sometimes existing between political commitments and the required resources to make these commitments really happen on the ground and called particularly for further investments in education and better coordination and cooperation among countries and actors.

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During the **second session**, **James M. Roshetko**, presented the ten broad areas of recommendations for decision-makers emerging from the study and presented the four-step collective process (**Figure 2**) proposed in the report to implement the roadmap and articulate it at different scales, from the regional to the local levels, in collaboration with all actors involved. His full presentation is reproduced in **Annex 3.** The subsequent discussions, moderated by **Keiran Andrusko**, raised the issues of property rights and benefit sharing. Actors need to find an interest in innovation. The private sector has a key role to play to support innovation but private actors need to get a return on their investments. So, the question is how to ensure that other actors (governments, civil society and local communities) can also benefit from innovation? This issue has no simple solution and needs to be handled with flexibility, on a case-by-case basis. Blended finance and public-private partnerships can open new perspectives. Mike May, Vice-president of FuturaGene Suzano, explained for instance how his company has already provided free licenses to public institutions and civil society organizations wishing to use their technology for non-competitive purposes. Another question was how to take on board the very deep knowledge of indigenous peoples and local actors about forest ecosystems and forest resources and limit the potential conflicts with the private sector. This question is particularly critical for the development and utilization of high-quality genetic material. Finally, participants agreed that governments and forest agencies may be reluctant, or lack the required skills, to use innovative technologies for law enforcement and that inadequate policies and regulations often restrict the use of innovative technologies and limit their potential contribution to sustainable forest management.

Figure 2. **Four-step practical way forward for roadmap implementation**

1 Diagnosis: initial assessment of the current situation (5b)

Identify the challenges and needs for sustainable forest management (SFM) (5b)

Assess the potential contribution of innovative technologies to SFM: opportunities and challenges (5a)

Identify the actors affected (positively or negatively) by the implementation of innovative technologies in the forest sector (5b)

Identify the main barriers to technology dissemination and adoption.

2 Develop a strategy: set priorities

Identify research priorities, including priority areas for action and investment, as well as priority transformations needed in policies and regulations (5a; 5c), [focusing on/paying a specific attention] to:

- 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.

3 Create an enabling environment

Raise awareness and enhance citizen participation in forest monitoring and sustainable forest management (2)

Elaborate conducive policies and regulations (7) to address/overcome 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)

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

Source: Roshetko et al. (in preparation)

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At the end of the day, **Vincent Gitz** (CIFOR-ICRAF), Director of the CGIAR research programme on Forests, Trees and Agroforestry (FTA), underlined the main points emerging from the discussions.

Thank you Keiran, James and all.

There would be a lot to say to wrap-up but here are just a few points I have noted among the highlights I retain from today's discussion.

First, there is a broad agreement that the topic is very timely. It has been launched a year and a half ago out of the Third Asia-Pacific Forest Sector Outlook Study but so many things are happening in the meantime that make it even more important and more timely as ever before. There is also a need to

emphasize that there are also productive challenges to address the growing demand in the region. It is also good that FAO, as a public organization, has launched with us a study process and an initiative on that topic because often technologies are seen as supply driven, the "technology push". But all these opportunities need to be confronted in fact to the demand. What are the objectives of countries, of stakeholders, of local populations? This is where the intersection of both sides needs an informed dialogue, to prepare action and make a solid ground for it. This is one of the objectives of these reports to ground this dialogue.

The second take-home message is that the private sector is very much involved, the corporate sector, smallholders, but it is not only a private sector matter. We have seen that there are key roles and mandate from the different public sectors and agencies, very often due to the specificities of the forestry sector that is quite different than other sectors. There is also the role of education. We had very interesting discussions on the question of forestry education. I think this deserves a deeper analysis of training courses and facilities available for training in innovative technologies. And there is a potential for collaboration between universities that was highlighted with the example of student exchanges between Vietnam and Germany.

And overall, there is a need to build-up on this general favorable environment in the region for technologies and use that in forestry to prioritize and drill down the opportunities, the challenges and look at the "policy voids", and at what would be the best enabling environment for businesses and investors. And it was good that there was broad agreement here on the content and the identification of challenges for upscaling, also in relation with the real needs of local communities, e.g. domestication of species for non-wood forest products – NWFPs – and so many other examples.

On funding: the recognition that funding will need to come also from the overall economy and the investors economy-wide, and, perhaps that is an opportunity, to reach beyond the traditional investors in the forestry sector. This agenda can help grow the base for a broader interest of the overall economic actors into forestry, be it for conservation and also for production, the two challenges Robert Nasi mentioned in his opening. It can help show in fact the investment value into the sector broadly.

To conclude on the roadmap, I retained what Rao has said in one of his interventions, that there will be three levels that will need to be associated: (i) a strong multistakeholder component; (ii) which require support by national level initiatives; and then (ii) a call for a strong regional cooperation, capacity building, exchanges agenda. To these three circles we can add (iv) the opportunity to also fuel a more global agenda. There is the region but there are also more global issues to be tackled. Then, how to move forward? What I retain is that FAO recalled that innovation is a very important topic for the organization. I think this gives a real opportunity with the Asia-Pacific Forestry Commission (APFC) to trigger a policy process in different forms at the regional level.

Rao Matta, Forestry Officer in FAO Regional Office in Bangkok, concluded this first day of work by suggesting the establishment of a multistakeholder platform or community of practice at the regional level to help all actors involved exchange on innovative technologies and address related issues, such as intellectual property rights.

First of all, I want to thank James and all the colleagues for the excellent paper and also the presentation. The paper has received very positive notes from a number of our colleagues and partners. I want to share that feedback with everyone. Actually, it advanced from what was presented, like a ten-page note in the Third Asia Pacific Forest Sector Outlook Study to this big, very well nuanced, and clearly laid out roadmap. It's a great advancement. Once it is finalized, the next step is to put some of these recommendations on the ground and help drive the objectives further. In this context, we definitely need the support of APFC members, Heads of Forestry, important countries with advanced technologies, such as Australia, New Zealand, Japan, and the Republic of Korea to support this work. Also, colleagues have mentioned different scales like the country level and the regional level. In particular, it would be great to build a platform or a community of practice, that could support exchange of experiences on these technologies and also address those issues like

intellectual property rights. The decision is with you, and FAO is definitely ready to progress this further. As I said, at the corporate level we have strong support. They are linking this with a new FAO initiative on science and innovation that is coming out with an elaborate strategy, as Mike May mentioned. This gives opportunity for us to work with the private sector, government agencies, local communities, and also important organizations, specifically organizations like CIFOR and ICRAF, and those who are particularly working on these technologies like Google which James has already mentioned. I look forward to another exciting day of this workshop tomorrow to which you are all welcome. Thank you.

Day 2: Roadmap on primary forest conservation

Vincent Gitz opened the discussions on the roadmap on primary forest conservation, highlighting two points. First, the report is purposely technical. It is not directed to Ministers but to the experts in ministries working on these issues, to give them more information, and new data at finer scales to look at forest fragmentation and ecological quality and better understand the dynamics at stake. A policy brief will be written after the workshop for high-level decision-makers. Second, the study focuses on "primary forests" as per the FAO definition. It applies this definition using a unique, comprehensive remote-sensing method across the Asia-Pacific region. This remote sensing method does not necessarily lead to the same results given by official data on primary forests as reported by countries to FAO for its Global Forest Resources Assessments (FRA). To avoid any confusion, the study uses the term "intact forests", also used in the scientific literature, to designate these forests identified by remote sensing as best reflecting FAO definition of primary forests. He thanked all the people involved in this roadmap, with a special thanks for the young CIFOR remote sensing team that assisted Yves Laumonier for the preparation of the study. This team was reinforced for this study which has also been, for CIFOR, an important capacity-building exercise.

Yves Laumonier, Senior Scientist in CIRAD, seconded to CIFOR and **Alexandre Meybeck**, Senior technical adviser in CIFOR/FTA, presented the main findings of the primary forest study. Their full presentations are reproduced in **Annex 3**. The study is organized along six chapters.

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The **first three chapters**, presented by **Yves Laumonier**, highlight the huge potential offered by remote sensing technologies and open-access datasets to generate large scale (high resolution) data, using consistent methodologies over large areas at a relatively low cost. Such information, collected in the Asia-Pacific region, can help assess forest status, diversity and trends, as well as the threats they face in a much more precise way.

In **Chapter 1**, we first identified natural forest areas in the region as opposed to planted forests. We then used Landsat time series to assess deforestation and forest degradation trends over the past two decades with the view to identify deforestation hotspots and delineate the remaining areas of "intact forests". Between 2000 and 2020, natural forest area decreased in the Asia-Pacific region, from 667 to 609 million ha. Out of these, 519 million ha can be considered as "intact forests" according to our methodology across Asia and the Pacific. A large part of these intact forests falls outside of legally protected areas. We also looked at fragmentation trends over the past two decades, testing different size thresholds to separate fragmented vs. contiguous intact forests. Using a 100,000-ha threshold, we found 379 million ha of contiguous intact forests in the region.

Overall, our methodology obtained very good results, consistent with the results found in the literature, with the work of the European Union Joint Research Center (e.g. Vancutsem et al. 2020), and, in the case of Indonesia, with the official data from the Indonesian Ministry of Forestry. Results are particularly robust in the humid tropics across south and southeast Asia, while degradation is more complex to assess in more open seasonal forests and in mountain boreal forest formations. However, remote sensing technologies also present some limitations and can be complemented as appropriate by drone or field surveys. For instance, they may not be able to recognize "empty forests",

where wildlife has already disappeared and that, hence, can no longer be considered as primary forests.

Beyond this binary approach (natural vs. planted; intact vs. degraded; contiguous vs. fragmented), **Chapter 2** characterizes finely the huge diversity of forest types in Asia and the Pacific. The region covers 4 biogeographic realms (i.e. the Palearctic, Indomalayan, Australasian and Oceanian realms) and contains ten of the world's biodiversity hotspots.[2] Building upon existing classifications and knowledge, the study identifies and describes 25 main forest formations in the region in relation with local bioclimatic, topographic and edaphic conditions. All these forest types deserve to be protected before it is too late. The study provides a huge wealth of information to help countries understand the dynamics at stake in various forest ecosystems in various contexts, and hence, better prioritize their conservation efforts. Chapter 2 also highlights the considerable lack of knowledge about eco-floristic variation across and within forest types and about species distribution and population dynamics, especially in the tropics and recommends that large-scale (high resolution) ecological vegetation mapping become a standard for the Asia-Pacific countries.

Chapter 3 analyzes the biophysical and socio-economic drivers of deforestation and forest degradation in the Asia-Pacific region. Among the main socio-economic drivers, the study highlights: population growth, globalization and economic growth, urbanization and infrastructure development, agriculture and planted forest expansion, land grabbing and land tenure conflicts, migrations, conflicts and wars, weak governance, inappropriate policies and regulations as well as lack of capacity and loss of traditional wisdom. Climate change is expected to have huge impacts on the region, with temperatures increasing by up to 3°C by 2070 and profound modifications of rainfall patterns. Other biophysical stressors include: fires, pollution and invasive species. Considering all these pressures, intact forest area is predicted to decrease to 415 million ha in 2050 and intact contiguous forest area to 275 million ha.

During the discussion on these first three chapters, moderated by **Lobzang Dorji**, Director of the Department of Forests and Parks Services, Ministry of Agriculture and Forests, Bhutan, participants acknowledged the richness of this very detailed and very interesting study. They discussed the advantages and limitations of remote sensing methods to assess deforestation and forest degradation and delineate primary forest areas. Such methods can cover much larger areas at a much lower cost than field surveys. However, both approaches must be used in combination, as field surveys can detect aspects that remain invisible from the sky. Participants called for pilot-studies at the country level to double check the results obtained and improve the methodology. They highlighted the importance of integrated landscape approaches and of indigenous and local knowledge to preserve intact forests which, for a large part, are not legally protected.

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Most threats to primary forests are immediately or ultimately linked to or influenced by human activities. Hence, addressing them is mainly a matter of governance (actors and institutions). This is the focus of **the last three chapters**, that were presented by **Alexandre Meybeck**.

Chapter 4 reviews the actors, instruments and institutions involved in primary forest conservation, as well as the way they are articulated at different scales, from international and regional, to national and local levels. Interactions among local actors are influenced by actors acting at different scales (national, regional, global). We need to find ways to launch a virtuous cycle and orient the existing dynamic towards conservation instead of deforestation and degradation. The national level is central as it provides the political and legal framework. Ultimately, actions take place at the local level.

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[2] For more information on the world's 36 biodiversity hotspots, see: https://www.conservation.org/priorities/biodiversity-hotspots

A significant area of intact forests is located outside protected areas and is, in fact used for various human activities, be it production or conservation. Moreover, protected areas are often established in remote places where the level of threat is lower. Finally, even legal protection is not always sufficient for primary forest conservation because of poor governance and weak law enforcement. Hence, as shown in **Chapter 5**, there is a need to combine properly protected areas with other measures, including other effective area-based conservation measures (OECMs) at different scales to achieve effective conservation of primary forests. Conserving primary forests requires an evidence-based, integrated landscape approach, coordinated across sectors, actors and scales, that involves local actors in decision-making and considers not only the forest to be preserved, but also what happens around it. This is the only way to manage threats coming from outside the forest and to enhance primary forest conservation, including through the judicious localization and sustainable management of protected areas, buffer zones, forest fragments and ecological corridors connecting them. A critical question for effective conservation is how to effectively translate global and national benefits into benefits for local actors: governments are interested in primary forest conservation to fulfil their international commitments; large private companies use their conservation efforts to strengthen their reputation and image. But how to interest and engage local actors into conservation? Conservation cannot be effective if its environmental and social benefits are not shared with local actors, indigenous peoples and local communities. Innovative funding mechanisms able to blend public and private resources and to channel money from big funds to small projects, including payments for ecosystem services, will be key to address this question.

Chapter 6 presents six broad areas of recommendations for decision-makers to enhance primary forest conservation in Asia and the Pacific, emerging from the study and from the extensive consultations conducted during the elaboration of this roadmap: (i) explore innovative ways to improve monitoring and reporting on natural forests; (ii) improve knowledge and understanding of forest dynamics within broader landscapes to orient land-use planning, management and conservation efforts; (iii) build a compelling narrative and consolidate new coalitions of actors; (iv) ensure policy coherence across sectors and scales and promote integrated landscape approaches; (v) align sustainable land use, climate action and biodiversity objectives with the conservation of primary forests; and (vi) strengthen regional and international cooperation for conservation and management of primary forests. This study also suggests a practical four-step process through which these six general recommendations can be operationalized at different scales, local, national and regional, and adapted in different countries, forest types and contexts, to the priorities and needs of different categories of actors.

During the subsequent discussion, moderated by **Lobzang Dorji**, participants praised the presenters for the efforts put in this comprehensive study and for their very clear summary of the huge amount of information included in the report. They agreed on the need to consider integrated landscape approaches for land-use planning: this is particularly important in the Pacific given the small size of some islands. They underlined the importance of financing and resource mobilization to enhance primary forest conservation and suggest this aspect be given more visibility in the recommendations. They underlined the importance of prioritization. Participants also recalled that we need to be concerned not only about the protection of primary forests, but also about the livelihoods of forest-dependent communities and about their legitimate development aspirations. Hence, they called for a community-based and people-centered approach of primary forest conservation. The question then is for whom the forest is to be preserved, and how to help people protect their own forest? Payments for ecosystem services emerged in the discussions as a way to sustain local forest-dependent communities and enhance primary forest conservation. If we want conservation to be effective, it needs to work for the people and local populations, who have been the stewards of primary forests for centuries, and who need to be involved and find an interest in their protection.

Conclusion and next steps

Vincent Gitz (CIFOR-ICRAF/FTA) and **Sheila Wertz-Kanounnikoff** (FAO) explained the next steps of the process. They announced the preparation of this workshop report and informed that the papers will be finalized after the workshop to integrate all the feedbacks received from participants and from peer-reviewers. Two policy briefs for decision-makers, gathering the main findings and main recommendations emerging from the two technical reports, will also be published and launched in 2022 during the World Forestry Congress, or during another high-visibility event, taking advantage of the momentum generated by UNFCCC COP26 in Glasgow, as well as by the preparation of CBD COP15 next year. This workshop is a call for initiating a collective process to implement the two roadmaps. This process could be led at the regional level by the APFC and needs to be articulated at different scales. Pilot studies could be conducted next year in some countries, involving local actors and local communities and giving the floor to people to see how primary forests can be conserved.

Sheila Wertz-Kanounnikoff, on behalf of FAO, reaffirmed the alignment of these two studies with FAO priorities on innovation and biodiversity conservation and her wish to see these roadmaps deployed and implemented on the ground. This implementation, she said, will depend on the interest and engagement of APFC member countries. The roadmaps will be disseminated to relevant colleagues, internally and externally, to inform the formulation of new and the implementation of already funded field activities at national and regional levels. The FAO team will report back on these studies during the next APFC meeting, seek guidance from member countries and evaluate their appetite for possible next steps, keeping in mind the implications in terms of financial resources. Sheila Wertz-Kanounnikoff then expressed FAO's interest to test the methods and tools proposed in these studies and fine tune the two roadmaps in some pilot countries.

Robert Nasi concluded the workshop, on behalf of CIFOR-ICRAF, extracting the main points of the discussions and highlighting the availability of CIFOR-ICRAF teams in the coming months to work at regional and national levels, with national governments and other relevant actors, in collaboration with FAO, to assist the APFC and its member countries for the deployment of the two roadmaps.

It was a very rich workshop and, at the end of these two days, besides thanking you all for your time, expertise and contributions, I got a few points, not necessarily the same for everyone.

First, in terms of innovative forest technologies, it was clearly shown that the forestry sector is not a backlog low-tech sector and that there is a lot of potential innovative technologies to be used to improve the performance of the sector. Therefore, this report is very timely because it is not necessarily known. The report and the roadmap show what is possible, the opportunities and challenges, and how to scale these technologies.

We do have to consider however that the technologies are very much at this stage supply driven, it is the "technological push". We need to see if there is a demand, and we have been looking at that for quite a while. We need to work for people and people should see a benefit of using these technologies and not simply a cost. For that we will probably need a dialogue, a multistakeholder dialogue, between all sectors and stakeholders to prepare action and make a solid ground to implement technologies. Also, we need to see who is willing to finance because, as Sheila said, we cannot do much without any funding.

On the other side, remember that the COP26 declaration in Glasgow is accompanied by a USD 20 billion pledge of funding, including part coming from the private sector which may be more sensible to new technologies. We therefore need: (i) a multistakeholder platform to discuss that; (ii) support from the national level and country policies; and also (iii) a strong regional cooperation in terms of capacity development and exchanges (which is where FAO has probably the greatest potential impact). Finally, these efforts could fuel something interesting in the global agenda in terms of innovative technologies because a lot of what I said is true for Asia and the Pacific region but is certainly also valid for the Congo basin or the Amazon basin.

In terms of primary forest conservation, we need to use good and shared methodologies to assess and use whatever innovation we can to solve the various problems we have evoked, including about the limitations of remote sensing tools and about the need to use an appropriate combination of tools and technologies.

It is also very important to consider that not all primary forests are equal. Some are more threatened than others so that they need more active, proactive conservation. At the same time, we need to act now. We could spend the next 25 years discussing about definitions: we foresters have a tendency to be like that, I have been talking about forest definitions since I started in business more than 40 years ago. But I also remember vividly a discussion I had with David Ganzin Malaysia years ago: we were studying the lowland dipterocarp rainforests and we knew everything about it until we realized that there were no more lowland dipterocarp rainforests. So, we should act now, to avoid this problem. We need to conserve whatever primary or intact forest is left and act in the context of a broader landscape approach and also looking at the livelihood of people. This is mainly a political decision. If you see Indonesia, the President announced a moratorium in new concession in primary forests whatever, the definition. That resulted in 66 million ha of primary forest conserved. This does not cost money; it does not cost cash. It costs money in eventual foregone revenue if you plan to degrade the forest. We should not simply reward people that were bad actors and become better actors because they deforested but we should also reward the people that conserve what is already standing.

There is no silver bullet and we know that protected areas alone cannot work: they are part of a system. So, there will be a need to mobilize a combination of measures and policies and actions on the ground, involving all stakeholders and to really make sure that local communities and indigenous peoples are part of this co-construction.

Then, because we are unlikely to have enough funding to do everything that we want to do, we will have to do some prioritization and some "triage" and to decide where we want to start, where it is going to have the biggest impact or the "biggest bang for the buck[3].

These are the main points that I'm taking back home from this workshop.

For the next steps, you heard about that but I think that, given the COP26 declaration, we do have, somewhat, a legitimacy, a mandate to go to some of the donor countries and to tell them: ok, this is what we have done, this is what we have identified, this is the roadmap that we propose: are you willing to help us and fund us to do that? I think this is something we could do, in the same way that we did for another topic with our colleagues in FAO in terms of sustainable management of wildlife.

So, thank you very much again. I hope to see the finalized products soon. At this stage, we stand ready, CIFOR-ICRAF and the various partners of FTA, to support FAO and to engage with any forum needed, the Asia Pacific Forestry commission, member countries and all stakeholders to make this happen. So that we have an innovative technology rich forestry sector that contributes to the livelihood and the development of the countries in the region and, at the same time, conserve our primary forests.

Thanks a lot. Stay safe and take care. Bye.

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[3] Value for money

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Annex 1. List of participants

The table below contains basic information on the people that registered for or attended to the validation workshop, as filled by the participants themselves in the registration form.

Name Surname	Gender	Country	Organization
Almoite Clarence Gio	Male	Philippines	Benguet State University
Andrusko Keiran	Male	Australia	Australian Department of Agriculture, Water and the Environment
Arjunan Elayaraja	Male	India	Aalamaram-banyan tree
Azzu Nadine	Female	Italy	CIFOR-ICRAF/FTA
Bajaj Megha	Female	Nepal	Asian Institute of Technology
Bounithiphonh Chaloun	Male	Lao PDR	National Agriculture and Forestry Research Institute (NAFRI)
Branthomme Anne	Female	Italy	FAO
Bull Lyndall	Female	Italy	FAO
Coccia Federica	Female	Italy	CIFOR/FTA
Coroza Oliver	Male	Philippines	Center for Conservation Innovation Ph Inc.
De Lu	Male	China	APFNet
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Durst Patrick	Male	Thailand	Independent consultant
Esguerra Elise Gabrielle	Female	Philippines	Forest Management Bureau
Faisal Hussain	Male	Maldives	Ministry of Fisheries, Marine Resources and Agriculture
Gabriel Marie Jessica	Female	Philippines	University of the Philippines Los Baños
Game Edward	Male	Australia	The Nature Conservancy
Gan Kee Seng	Male	Malaysia	Asia-Pacific Association of Research Institutions (APAFRI)
Gerrand Adam	Male	Indonesia	FAO
Gitz Vincent	Male	Italy	CIFOR-ICRAF/FTA
Hansen Eric	Male	USA	Oregon State University
Inthirath Baisone	Female	Lao PDR	National Agriculture and Forestry Research Institute (NAFRI)
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Jalonen Riina	Female	Malaysia	Alliance of Bioversity International and CIAT
Johnson Kristofer	Male	United States of America	FAO
Kamran Shahrukh	Male	Germany	Eberswalde University for Sustainable Development
Kasturi Devi Kanniah	Female	Malaysia	Universiti Teknologi Malaysia
Keenan Rodney	Male	Australia	University of Melbourne
Kotru Rajan	Male	India	Trestle Management Advisors
Lama Sony	Female	Nepal	Red Panda Network
Laumonier Yves	Male	Indonesia	CIFOR-ICRAF/FTA
Li Yanxia	Female	China	International Bamboo and Rattan Organisation
Louman Bas	Male	Netherlands	Tropenbos International
Machida Yutaka	Male	Japan	Forestry agency
Mackey Brendan	Male	Australia	Griffith University
Maharjan Sajeen	Male	Nepal	Environment Nepal
Mandawali June	Female	Papua New Guinea	Papua New Guinea Forest Research Institute
Masigan Jennica Paula	Female	Philippines	Center for Conservation Innovation Ph Inc.
Mateboto Jalesi	Male	Fiji	Pacific Community (SPC)
Matta Rao	Male	Thailand	FAO
May Mike	Male	Spain	FuturaGene Suzano
Meybeck Alexandre	Male	Italy	CIFOR-ICRAF/FTA
Nair C T S	Male	India	Freelance Consultant
Nasi Robert	Male	Indonesia	CIFOR-ICRAF

Name Surname	Gender	Country	Organization
Negi Vikram	Male	India	Govind Ballabh Pant National Institute of Himalayan Environment
Oyunsanaa Byambasuren	Male	Mongolia	Department of Environment and Forest Engineering, National University of Mongolia
Palomar Jamila Audrey	Female	Philippines	Center for Conservation Innovation Ph Inc.
Park Joowon	Female	Republic of Korea	Asian Forest Cooperation Organization
Patriarca Chiara	Female	Italy	FAO
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Perkin Scott	Male	Thailand	IUCN Asia Regional Office
Pham Thu Thuy	Female	Vietnam	CIFOR-ICRAF
Phongoudome Chanhsamone	Male	Lao PDR	National Agriculture and Forestry Research Institute (NAFRI)
Piazza Marco	Male	Thailand	FAO
Pin Kar Yong	Male	Malaysia	Asia-Pacific Association of Research Institutions (APAFRI)
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Sarzynski Thuan	Male	Vietnam	CIRAD
Satkuru Sheam	Female	Japan	International Tropical Timber Organization
Sihanath Dalaphone	Female	Lao PDR	IFC
Silori Chandra Shekhar	Male	Thailand	RECOFTC
Sobhan Md Istiak	Male	Bangladesh	World Bank
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Tenneson Karis	Female	United States of America	Spatial Informatics Group
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Xi Luo	Female	China	APFNet
Yudi Setiawan	Male	Indonesia	Environmental Research Center, IPB University
Zangpo Dawa	Male	Bhutan	Department of Forests and Parks Services, Ministry of Agriculture and Forests
Zhang Shiyi	Female	China	APFNet

Annex 2. Agenda of the workshop

This validation workshop will consist of two online Zoom sessions, to be held on **23-24 November 2021,** from **13.00 to 15.30** Bangkok time (UTC+7).

The workshop is open upon registration. If you have not registered yet, please follow this link:

https://forms.gle/8UzuGWePbf74sdd26

The workshop targets an audience of about 100 regional experts, from research organizations, governments and intergovernmental organizations, the private sector or civil society organizations.

This online validation workshop will be the occasion to present the main findings and recommendations emerging from the two studies and gather comments on them.

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Day 1 (Tuesday 23 November 2021): Roadmap on innovative forest technologies

Introduction of the workshop

13.00:   Opening and welcome, by Sheila Wertz (FAO)

13.05:   Introduction, by Robert Nasi (CIFOR-ICRAF)

Presentation of the roadmap: work done, expected outcomes of the workshop.

Session 1. Main findings

13.10:   Innovative forest technologies, by James Roshetko (CIFOR-ICRAF/FTA)

Structure and main findings of the technical paper.

13.30:   Q&A: Discussion facilitated by Keiran Andrusko (Australia)

Session 2. Key recommendations

14.15:   Key recommendations emerging from the study, James Roshetko (CIFOR-ICRAF/FTA)

14.30:   Global discussion on recommendations, moderated by Keiran Andrusko (Australia)

15:15:   Wrap-up, by Vincent Gitz (CIFOR-ICRAF/FTA)

15: 20: End of day 1.

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Day 2 (Wednesday 24 November 2021): Roadmap on primary forest conservation

Introduction

13.00:   Opening of Day 2, by Vincent Gitz (CIFOR-ICRAF/FTA)

Session 1. Main findings

13.05:   Primary forests in Asia and the Pacific: diversity, status, trends and threats,

by Yves Laumonier (CIFOR-ICRAF/FTA)

Structure and main findings of the technical paper.

Mapping forest types, threats, and priority areas for conservation.

13.25:   Q&A: Discussion facilitated by Lobzang Dorji (Bhutan) TBC

Session 2. Key recommendations

14.15: Key recommendations emerging from the study, by Yves Laumonier and Alexandre Meybeck (CIFOR-ICRAF/FTA)

14.30: Global discussion on recommendations, moderated by Lobzang Dorji (Bhutan) TBC

Session 3. Conclusion and next steps

15.15: Next steps: finalization, implementation and outreach, by Vincent Gitz (CIFOR-ICRAF/FTA) and Sheila Wertz (FAO)

15.20: Conclusion by Robert Nasi (CIFOR-ICRAF)

15:30: End of Day 2, end of the workshop.

Annex 3. Presentations displayed during the workshop

This annex gathers the presentations displayed during the workshop:

1. James M. Roshetko, CIFOR-ICRAF/FTA, Innovative technologies: Main findings. 23 November 2021. [PDF]
2. James M. Roshetko, CIFOR-ICRAF/FTA, Innovative technologies: Recommendations. 23 November 2021. [PDF]
3. Yves Laumonier, CIFOR-ICRAF/FTA, Primary forests in Asia and the Pacific: diversity, status, trends and threats. 24 November 2021. [PDF]
4. Alexandre Meybeck, CIFOR-ICRAF/FTA, Towards a roadmap for primary forest conservation. 24 November 2021. [PDF]

Innovative Technologies
Main Findings

James M Roshetko, CIFOR-ICRAF & FTA

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

23 November 2021

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Background

Third Asia-Pacific Forest Sector Outlook Study launched June 2019 at the *Asia-Pacific Forestry Week in Seoul (ROK)* emphasized:

- *innovative technologies create both huge opportunities and challenges for sustainable forest management in the Asia-Pacific region*

- 300 students & young professionals (30 countries) stated that uptake of new technologies was slow and called for more opportunities for youth in the forest sector

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Roadmap

FAO and CIFOR-ICRAF implemented the roadmap on *innovative technologies* in forest sector of the Asia-Pacific region.

- **Online inception workshop (30 July 2020)**
- **Web- and email-based survey - technical input (Aug-Dec 2020)**
- **Expert interviews - technical input (Aug-Dec 2020)**
- **Online IT workshop - discussion-technical input (30 Nov-3 Dec 2020)**
- **Youth contribution – IT for SFM in the future – call for abstracts, research volume, & a session at GLF Climate Conference (5 Nov 2021)**
- **Validation workshop (*today's event*)**
- **'*Innovative technologies paper*' under peer review *(ongoing)***

350 stakeholders have contributed

Contents of the IT Technical Paper

Introduction - Background

Chapter 1 Framing: Concept & Definitions
Define: Geographic Scope, Forestry & SFM in Global Context, SFM (thus IT) are relevant to SDGs, Categories of Innovation

Chapter 2 Innovative Technologies in the Forest Sector
4 clusters: i) Digital technologies, ii) Biological technologies; iii) Process & product tech; & iv) Finance & social innovations

Chapter 3 Opportunities & Challenges in the Forest Sector – role of Innovative Technologies

Chapter 4 Enabling Uptake & Scaling-up of Innovative Technologies for sustainable forestry

Chapter 5 Recommendations

Digital Technologies

- **Satellites, LIDAR, GPS, GIS**
- **Drones and UAVs**
- **Online platforms – EOS, SEPAL Google Earth Engine, … global tree planting tools**
- **Geo spatial info for planning & manage**
- **Timber tracking, certification, monitoring**
- **Sensor networks – acoustic, optical, camera – focus on conservation**
- **Social media, video-conferencing**
- **Mobile phones & apps**
- **Crowd Sourcing & Citizen Science**
- **Artificial intelligence, machine learning, digital twin replica**

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Photos: S Karman, J Roshetko

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Biological Technologies

- **Genetic resources & germplasm**
  - **quality & quantity priority species**
  - **cutting garden, tissue culture techniques … broadly adopted**
  - **low-input & tree diversity breeding**
  - **collaboration with farmers, communities, civil society**
  - **effective germplasm dissemination**
  - **nursery & germplasm enterprises**
- **Commercial species remain a focus … expand to local priorities**
- **Biotechnology – genetically modified material**
- **DNA identification & tracking tech**

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Photos: T Page, A Lata, J Roshetko

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Processes & Products Innovations

- Improved planning & management
- *'Precision forestry', IPTIM & Heureka software packages -* using geospatial tech
- Aerial sowing ... right conditions
- RIL & other improved harvesting methods
- Improved processing - using 5G, CNC, AI (improve *efficiency, recovery, ...)*
- Engineered wood products – CLT, mass timbers, MDF, OSB, particleboards, ...
- Bamboo products (repl. wood & plastics)
- Bioplastics, biochemicals, pharmaceuticals
- Bioenergy products (resources, species)
- Nanotechnology

Photos: C. Roshetko, J Roshetko

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Innovative Finance & Social Innovations

- Blended finance
- Green, social and climate bonds
- Crowdfunding
- PES mechanisms
- Impact & responsible investments
- ICT-enabled banking & E-commerce
- Community Forestry & CBFM
  - local forest govern. & management
  - local involvement in forest monitoring
  - gender and minority advocacy (inclusive rights)
  - market & enterprise development

Photos: J Roshetko, J Tukan
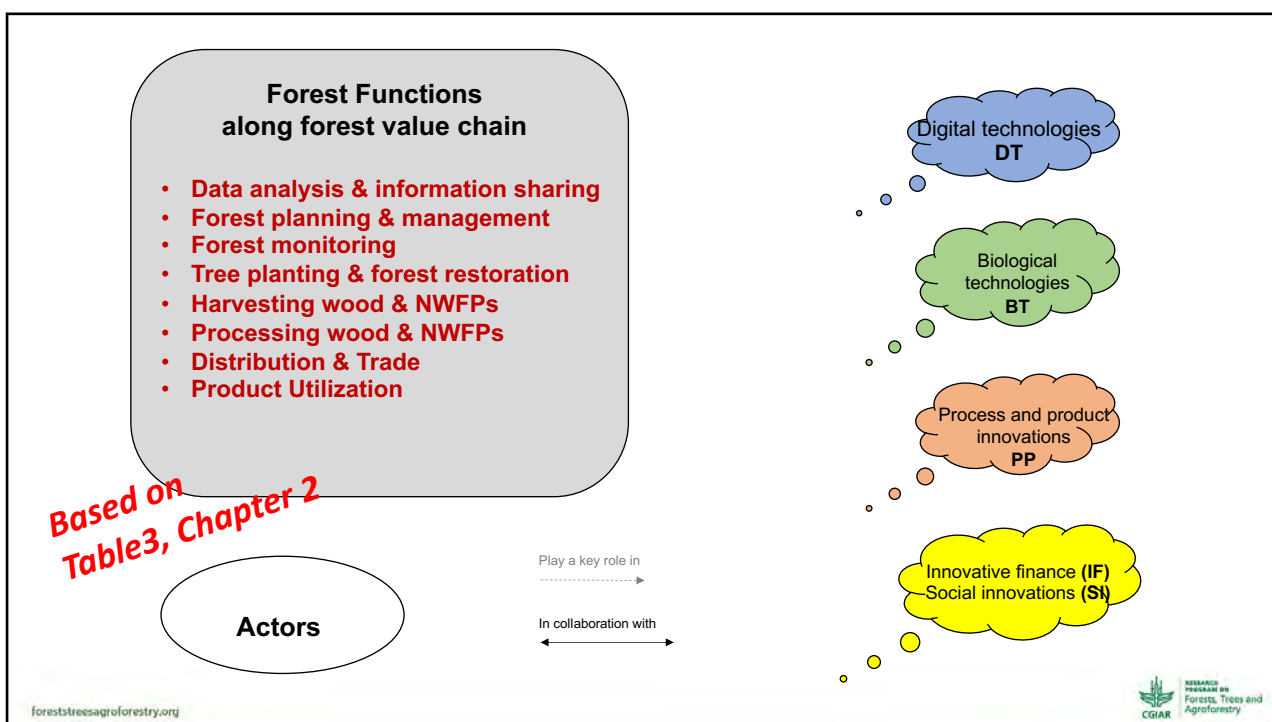
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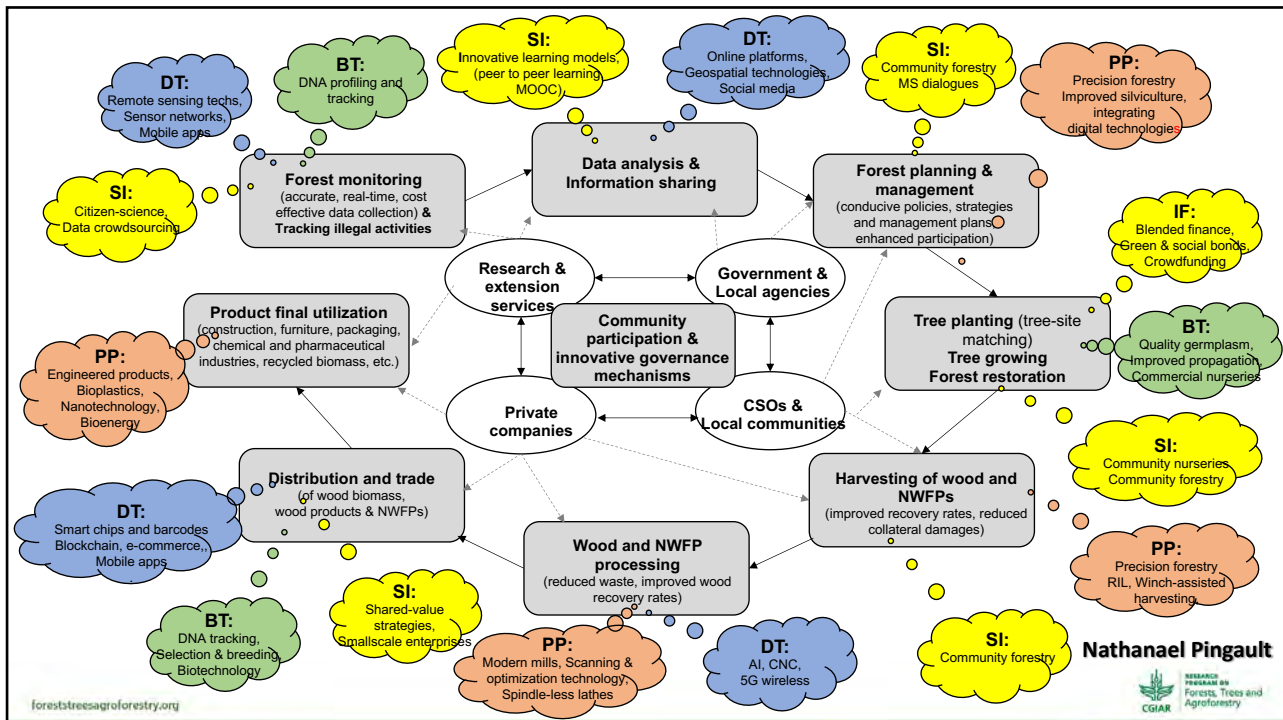|	Roles in Innovative Finance (example Blended Finance)
Public sector	- **Leveraging private finance** to achieve SDGs and related goals - **Enabling business environment** for private investors (reduce risks, transaction costs, etc.) - **Technical capacity-building** - Co-funding, **co-financing** and in-kind support of commercial and development activities - Dissemination, uptake and scaling-up of technology (general and innovative)
Private sector	- **Soft loans** (with below-market interest rates) - **Preferred market access**, premium price for quality commodity production - **Business training** and enterprise development - **Targeted technical trainin**g to enhance commodity production - Development and dissemination of innovative technologies
Development Cooperation (multi- & bi-lateral, foundations)	- **Infrastructure and human development**, assistance to government - **Technical and business planning, marketing** and financial literacy capacity-building - Supporting international development goals (**SDGs, other development & environmental goals**) - Development and **strengthening of SME**s (small- and medium-sized enterprises) - Promotion and adoption of innovative technology
Other Stakeholders (environmental, social, etc)	- **Community advocacy** and agrarian transformation - Facilitate **engagement with public and private sectors** - **Land access and land tenure** - **Environmental, socio-cultural and livelihoods objectives** - Promotion and adoption of innovative technology

Table 2, Chapter 2

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Forest Functions along forest value chain

- Data analysis & information sharing
- Forest planning & management
- Forest monitoring
- Tree planting & forest restoration
- Harvesting wood & NWFPs
- Processing wood & NWFPs
- Distribution & Trade
- Product Utilization

Based on Table3, Chapter 2

Actors

Play a key role in

In collaboration with

Digital technologies
DT

Biological technologies
BT

Process and product innovations
PP

Innovative finance (IF)
Social innovations (SI)

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Chapter 3. Opportunities & Challenges

Broad assumption that innovations are inherently beneficial, with advantages outweighing the disadvantages.

However, there are risks of negative social, economic and environmental impacts.

Chapter main positive and negative impacts in the forest value chains.

Chapter 3. Opportunities & Challenges

3.1 Shifts in the wood demand and forest value chains. Expanding role of region in forest resources/products supply.

3.2 Contributing to the circular bioeconomy

3.3 Enhancing monitoring & reporting

3.4 Facilitating improvement in forest management

3.5 Improving resource-use efficiency

3.6 Addressing the high quality & diverse planting material

3.7 Creating employment and livelihood opportunities

3.8 Considering all potential impacts of innovative technologies

Chapter 3. Opportunities & Challenges

Impacts	Economic	Social	Environmental
Digital tech-nology	(+) Enable efficient, accurate, cost-effective, real-time forest monitoring (+) Facilitate precision management of forests and value chains. (+) Improve productivity and profitability	(+) Facilitate data collection and analysis, info sharing, empower local communities & marginalized groups (+) Enable citizen-science initiatives (+) Enhance transparency and participation in monitoring and reporting (+) Generate new skilled job opportunities, making the forest sector more attractive (-) Can lead to the destruction of local unskilled jobs	(+) Allow more reactive, flexible and efficient conservation strategies (+) Support forest landscape restoration (via monitoring and information sharing) (+) Track illegal activities (-) Can increase the risk of overexploitation and degradation of natural ecosystems

Table 5, Chapter 3

Chapter 3. Opportunities & Challenges

Impacts	Economic	Social	Environmental
Bio-logical tech-nology	(+) Improve productivity and profitability (+) Provide high-quality genetic material for multiple uses (+) Contribute to the development of a circular bioeconomy *Table 5, Chapter 3*	(+) Increase traceability and transparency along forest product value chains (-) Can maintain or increase inequalities, further marginalize the most vulnerable groups and limit their access to natural resources and improved material (-) High costs may limit access by smallholders further increasing social inequalities	(+) Track illegal activities (+) Contribute to the development of a circular bioeconomy (-) High costs may restrict application to a few species (-) Genetic improvement may reduce intraspecific diversity (-) Access to improved genetic material & biotech products can be restricted (IPR & regulations (-) Can lead to unexpected collateral damages on natural ecosystems and biodiversity

Chapter 3. Opportunities & Challenges

Impacts	Economic	Social	Environmental
Process & Product tech-nology	(+) Reduce operational costs (+) Reduce waste and increase resource-use efficiency (+) Improve productivity and profitability (+) Provide new products and services or develop new uses for forest products (+) Contribute to the development of a circular bioeconomy (-) Direct and indirect costs of adoption (equipment, training, loss of productivity, etc)	(+) Generate new skilled jobs and new income opportunities, making the forest sector more attractive (-) Can lead to the destruction of local unskilled jobs (-) Can maintain or increase inequalities, further marginalize the most vulnerable groups and limit their access to natural resources *Table 5, Chapter 3*	(+) Increase wood recovery rate, thus reducing pressure on natural forests (+) Contribute to the development of a circular bioeconomy (-) Can increase the risk of overexploitation and degradation of natural ecosystems

Chapter 3. Opportunities & Challenges

Impacts	Economic	Social	Environmental
Finance & Social inno-vation	**(+)** Improve smallholder access to credit and markets **(+)** Facilitate resource mobilization and investments in the forest sector **(+)** Support livelihoods and enterprise development	**(+)** Support local communities' livelihoods and resilience **(+)** Enhance traceability and transparency **(+)** Support capacity-building and awareness raising **(+)** Foster participatory governance, empower farmers, communities, and marginalized **(+)** Enable innovative and inclusive governance and investment models **(-) C**aptured by local or external elites and perpetuate inequalities	**(+)** Contribute to SFM (e.g., community-forest management) **(+)** Support forest landscape restoration (through local empowerment and access to financial resources)

Table 5, Chapter 3

Chapter 4. Enabling Uptake & Scaling

4.1 Status of Innovation in Asia and the Pacific

- GDP growth in the region twice as high as global average
- 55% of the top 20 WIPO patent offices are in Asia-Pacific
- WIPO Global Innovation Index (GII) – Asia-Pacific shows steady increase in GII during the last 10 years
- Higher internet access, use & capacity than global average
- Forestry graduates highest in Asia (ROK, Viet Nam, China)
- *Proxy measures* … **shows high innovative capacity / potential**

World Intellectual Property Organization –
GII based on 80 indicators - economics, political environ., education, infrastructure & general knowledge

Chapter 4. Enabling Uptake & Scaling

4.2 – 4.3 Key barriers to technology uptake and scaling

Barriers	Constraints
Human capital	Lack of skills, knowledge & experience; wariness of 'new' technologies
Natural capital	Limited access to forests, land, natural resources; & their assets & products
Physical capital	Lack of infrastructure – roads, markets, electrical power, internet, etc – & suitable equipment and innovations to scale technologies to all stakeholders
Financial capital	Limited access to capital, credit, and value-chains
Social capital	Restrictive governance & tenure rights to forests, land, natural resources and their assets/products; & limited access to institutions, networks and information
Policies	Absent, weak or restrictive legal & regulatory frameworks; inappropriate application or enforcement of those legal & regulatory frameworks

Table 6, Chapter 4

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Chapter 4. Enabling Uptake & Scaling

4.4 Capacity-building, education & training

- Training in use and adoption of innovative technologies … also
- Institutional management, leadership, language proficiency, indigenous-tech knowledge, value-chains, business operations
- Demonstrations of the technologies
- Collaboration between government, private sector, civil society, communities and donors to address these issues
- ***Opportunities should be prioritized for those negatively impacted by IT, women, rural residents, poor, & minorities***

Big plus: youth tech savvy, & strong forestry/environ education

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Chapter 4. Enabling Uptake & Scaling

4.5 Value chains: increasing access to credit & markets

- Forest sector often considered high risk – innovative finance very important for private sector to local communities

- Shared-value business strategies – mutual beneficial linkage between private sector and farmers-communities-SMEs … reduce transaction costs, shorten value-chains, increase margins

- ICT-enabled banking & E-commerce (marketing) … reduce transaction costs, shorten value-chains, increasing margins

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Chapter 4. Enabling Uptake & Scaling

4.6 Forest sector governance & land tenure: improved transparency and participation

- DT – drones, GPS, GIC, mobile phones, apps, online platforms greatly enhance community & civil society involvement

- DNA identification & tracking – conservation & law enforcement

- Blended finance, social & green bonds, crowdfunding, impact investment, PES … can/do specific local participation & develop.

- **Community Forestry** – facilitates governance & management (Asia leader in CF); environment & cultural conservation; inclusive rights (gender, poor, minorities) … *evolving stronger emphasis commodity products, enterprise develop., & market integration*

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Chapter 4. Enabling Uptake & Scaling

4.7 Supportive Policies, Regulations & Policy Environment

- Policies regarding IT … absent, weak or inappropriate
- Lag-behind quick innovation development & focus macro conditions
- Policymakers proactive … policies conducive to IT adoption … & considering what's required to include farmers, civil society & SMEs
- Role for private sector, civil society to support the process (input to Gov)
- **Ex Policy voids** – i) drone & data use, regs not applicable & used to restrict use & application for multiple reasons, conflicting regs;
  ii) forest regs restrict local timber trade & germplasm business
- **Ex Dynamic environments** – i) Nepal CF regs; ii) Viet Nam & China promote IT in processing industries; iii) Malaysia space agency support NR sector;
  iv) forest R&D agencies support smallholder nursery sector

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Thank you !!

Photos: J Roshetko

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Innovative Technologies Recommendations

James M Roshetko, CIFOR-ICRAF & FTA

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

23 November 2021

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?

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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

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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

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Recommendation Topics

7

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

8

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

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9

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

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10

Thank you !!

Photos: J Roshetko

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Specific Recommendations

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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.

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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.

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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.

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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.

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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.

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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

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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.

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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.

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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

CGIAR RESEARCH PROGRAM ON Forests, Trees and Agroforestry

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).

CGIAR RESEARCH PROGRAM ON Forests, Trees and Agroforestry

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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15

1. **Historical extent and status of the Primary Forests in the Asia-Pacific region,**
2. **Diversity of Primary Forest types in Asia and the Pacific,**
3. **Pressures and threats on Primary Forests, modelling future risks,**
4. **Governance instruments for Primary Forests conservation in the Asia-Pacific region,**
5. **Mechanisms and tools for Primary Forests conservation,**
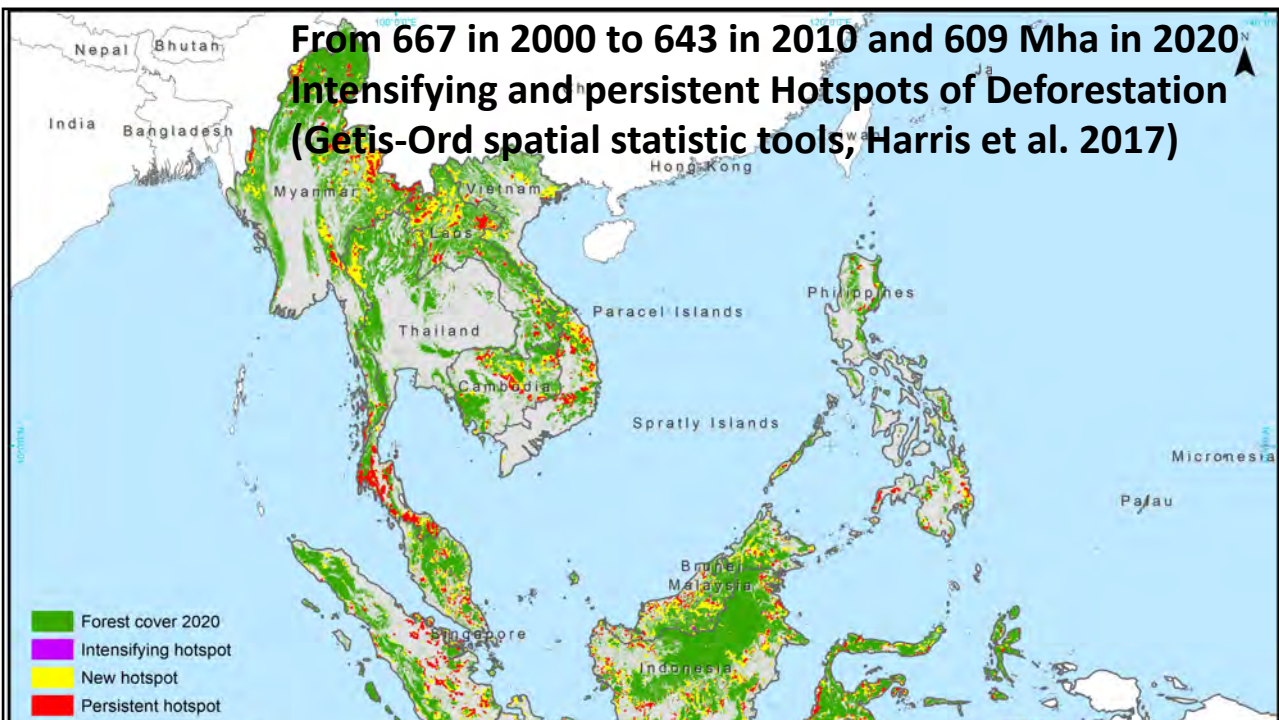6. **Recommendations and roadmap for Primary Forest conservation in Asia and the Pacific**

## 1. Historical changes in natural forest cover 2000, 2010 and 2020

- FAO definition
- Minimal mappable area 1 ha
- Forest cover analyzed by Ecological Zone (GEZ-FAO 2010), Humid vs. Seasonal vs. Temperate
- In line with the minimal 10% tree cover threshold of the FAO forest definition
- Includes logging 2000 - 2020 and old fallow forest ≥ 20 yrs old.

Natural Forest Cover 2020
Deforestation between 2011 - 2020
Deforestation between 2001 - 2010

3

From 667 in 2000 to 643 in 2010 and 609 Mha in 2020 Intensifying and persistent Hotspots of Deforestation (Getis-Ord spatial statistic tools, Harris et al. 2017)

Forest cover 2020
Intensifying hotspot
New hotspot
Persistent hotspot

4

Intact forest assessment using Landsat time-series trajectories
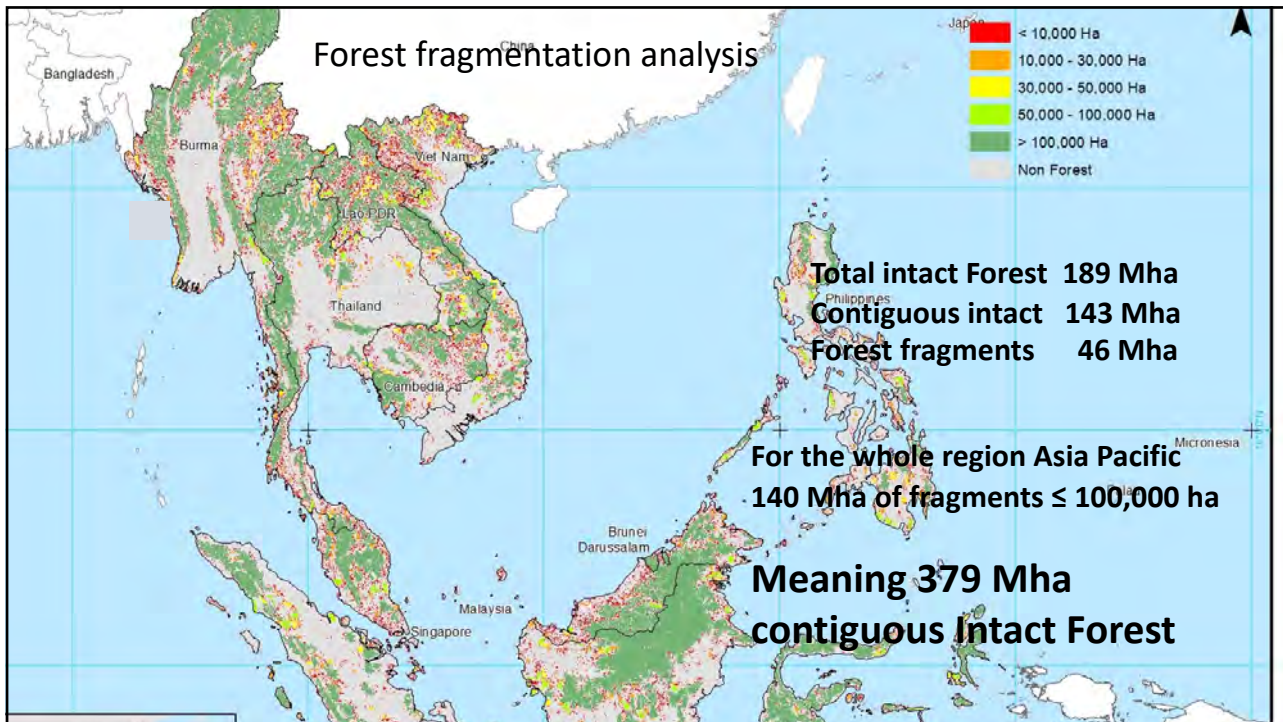(adapted from Wang et al. 2019)
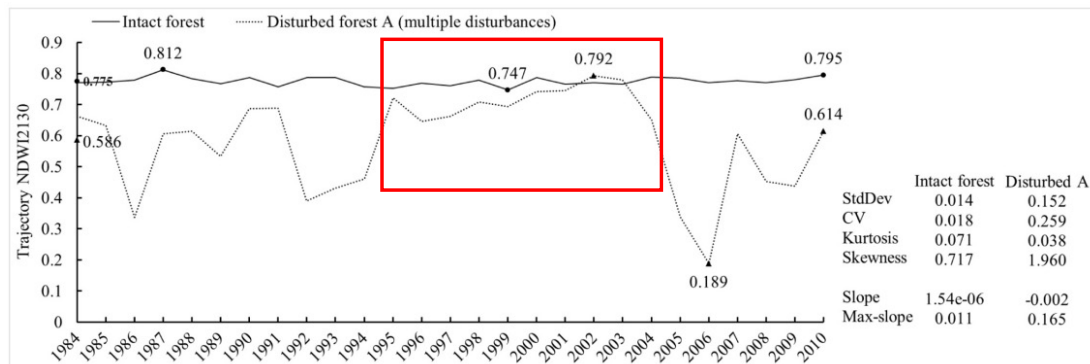
- Intact/undisturbed forest tend to have low slope of regression and low standard deviation of the NDWI.
- Forest experiencing large disturbances have higher coefficient of variation than undisturbed forests.
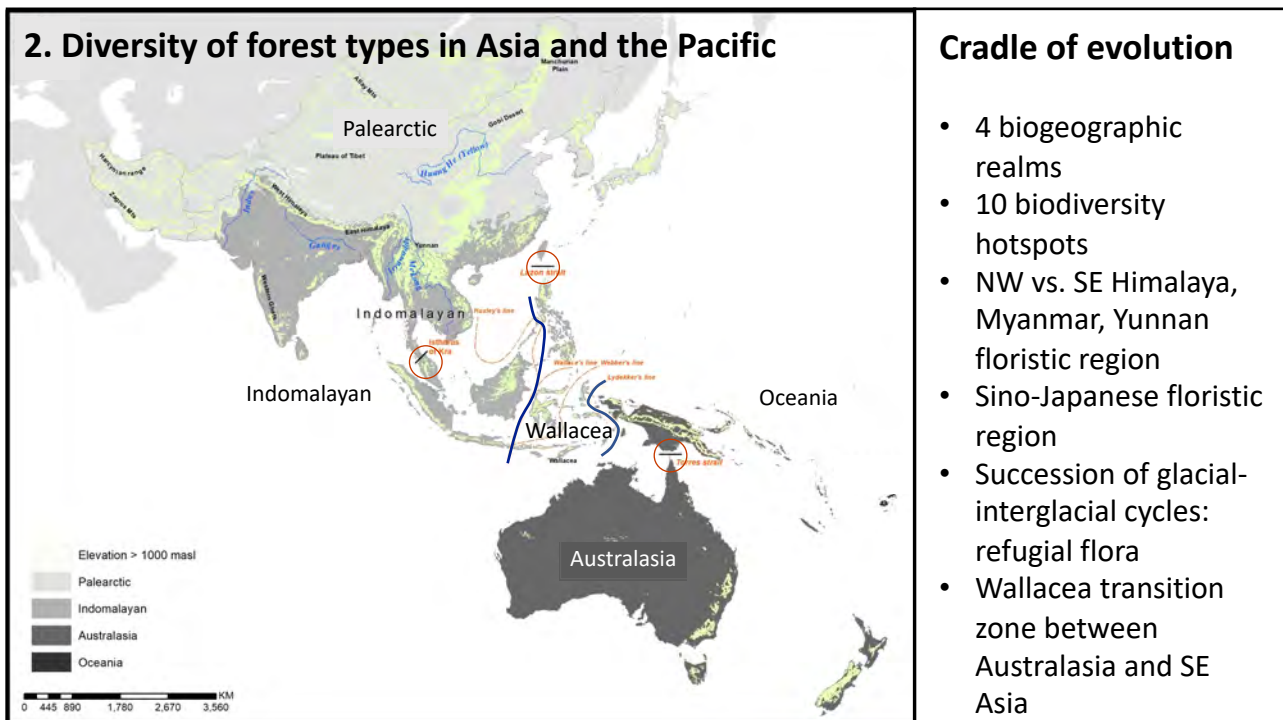
5

**Intact forests cover 519 million ha in the Asia-Pacific region
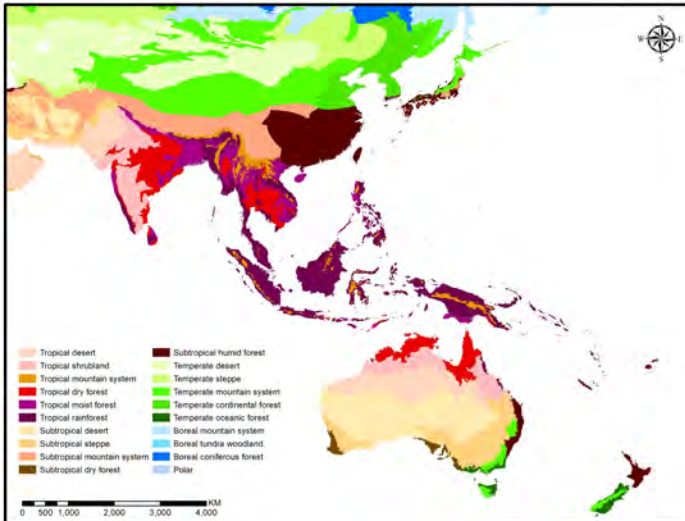Large intact forest surfaces outside the Protected Area**

6

Forest fragmentation analysis

Legend:
- < 10,000 Ha
- 10,000 - 30,000 Ha
- 30,000 - 50,000 Ha
- 50,000 - 100,000 Ha
- > 100,000 Ha
- Non Forest

Total intact Forest   189 Mha
Contiguous intact   143 Mha
Forest fragments   46 Mha

For the whole region Asia Pacific
140 Mha of fragments ≤ 100,000 ha

Meaning 379 Mha
contiguous Intact Forest

7

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2. Diversity of forest types in Asia and the Pacific

Elevation > 1000 masl
- Palearctic
- Indomalayan
- Australasia
- Oceania

Cradle of evolution

- 4 biogeographic realms
- 10 biodiversity hotspots
- NW vs. SE Himalaya, Myanmar, Yunnan floristic region
- Sino-Japanese floristic region
- Succession of glacial-interglacial cycles: refugial flora
- Wallacea transition zone between Australasia and SE Asia

8

4

Framework for a finer ecological zoning and mapping of the Asia Pacific Forest formations and types

UNESCO 1973

FAO Global Ecological Zoning (FAO 2010)

World Ecosystems (Sayre et al. 2020)

"An *alternative route for a new FAO Global Ecological Zoning map would be to determine EZs independently of the national or regional maps by using a more objective approach, notably by relying solely on climate and altitude data to delimit zones, taking into account potential vegetation, and vegetation classification"* (FAO, 2012)

9

Building upon existing classifications and knowledge, review the forest formations of the Asia Pacific region and their specificities

Classification derived from widely measured, simple parameters: Bioclimates, physiography, elevation, and main substrate

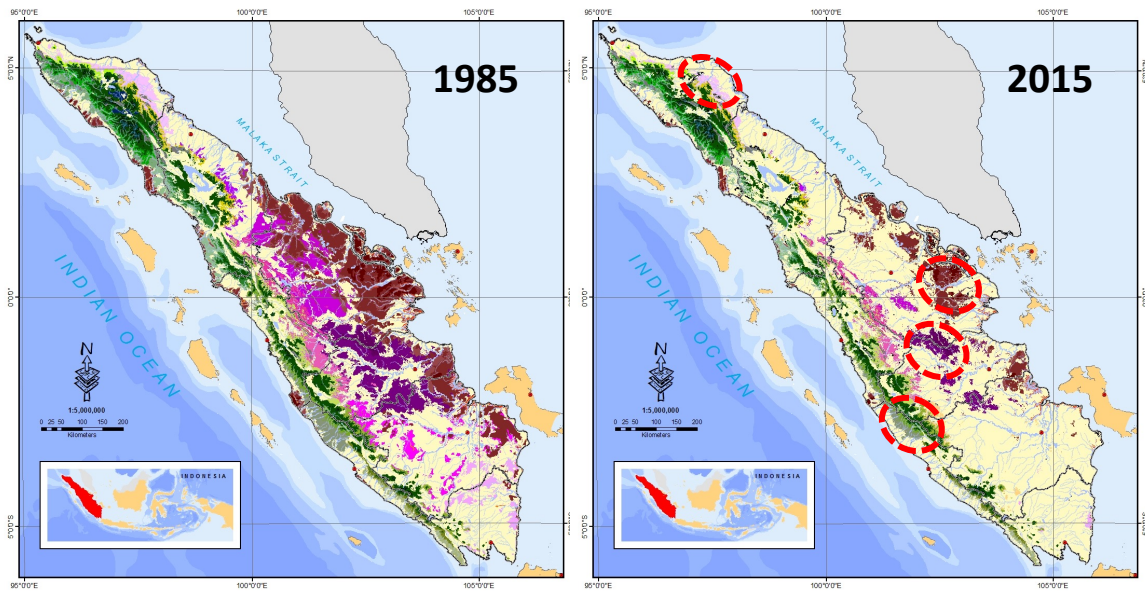25 forest formations and related forest types of the Asia-Pacific region identified in line with regional classifications

Provide basic information for encouraging further research into the eco-floristic pattern inherent to each forest type.
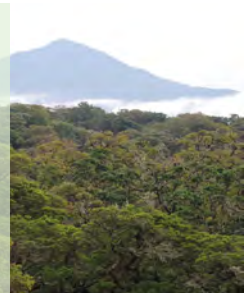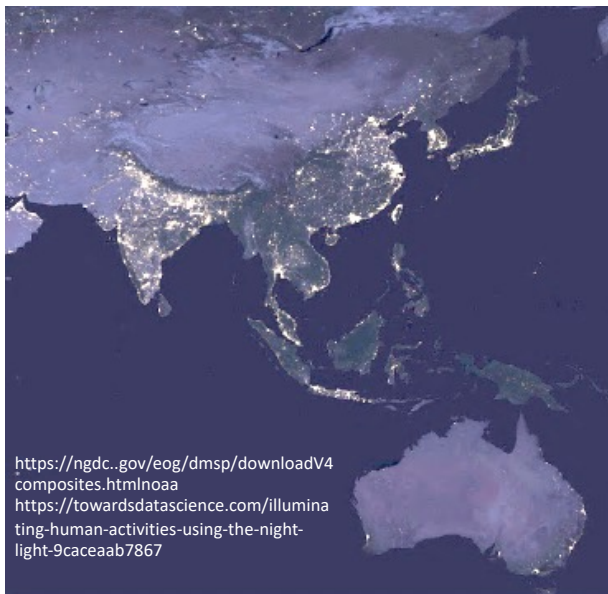
10

Ecofloristic zoning for conservation priorities in the Asia Pacific

1985 · **2015**

11

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3. Increasing pressures and threats on primary forests:

https://ngdc..gov/eog/dmsp/downloadV4
composites.htmlnoaa
https://towardsdatascience.com/illumina
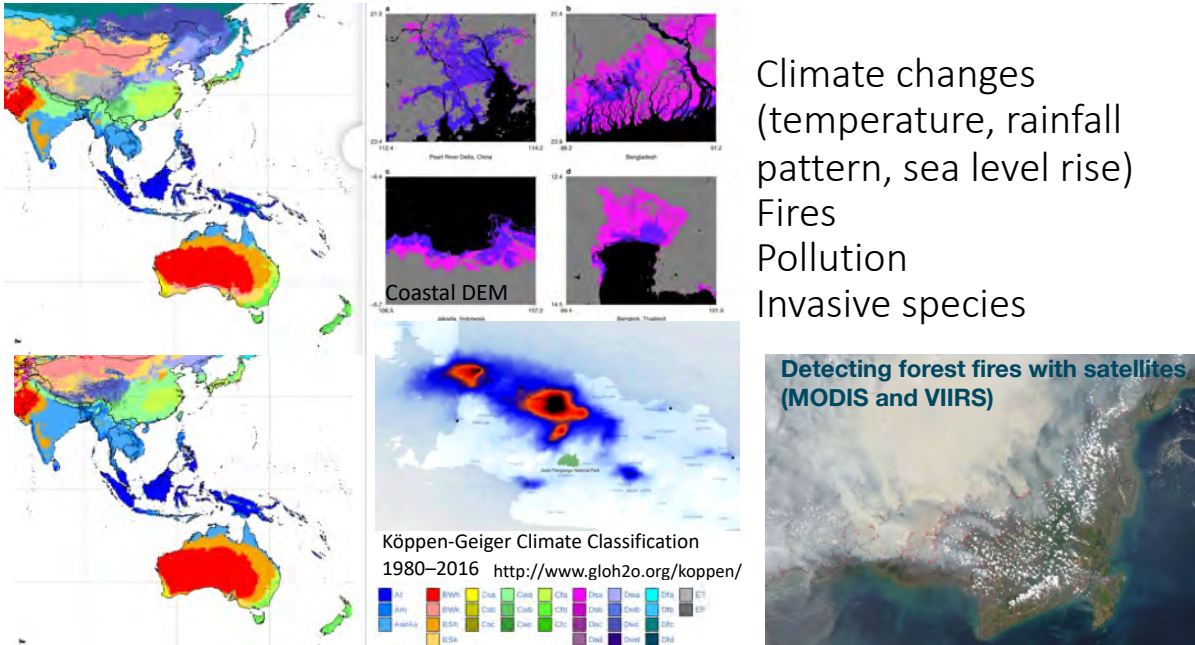ting-human-activities-using-the-night-
light-9caceaab7867

Socio-economics drivers
Political ecology

- Population growth (4.9 billions 2050)
- Migrations and conflicts
- Globalization and economic growth
- Urbanization and infrastructure development
- Agriculture and planted forest expansion
- Land grabbing and land tenure conflicts, war
- Loss of traditional knowledge and wisdom
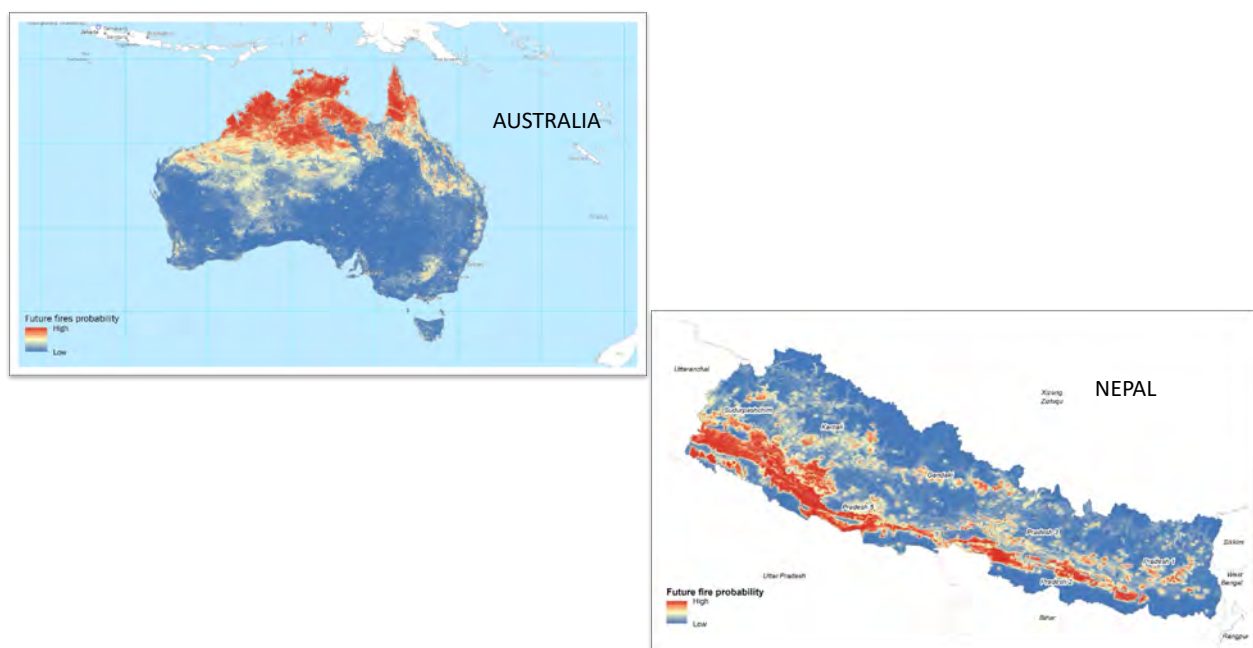- Lack of capacity, policy and regulatory framework

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3. Increasing pressures and threats on primary forests: biophysical drivers



Climate changes (temperature, rainfall pattern, sea level rise)
Fires
Pollution
Invasive species

Coastal DEM

Köppen-Geiger Climate Classification 1980–2016 http://www.gloh2o.org/koppen/

Detecting forest fires with satellites (MODIS and VIIRS)

13

Fire risk assessment

AUSTRALIA

Future fires probability
High
Low

NEPAL

Future fire probability
High
Low

14

Forecasting the primary forest cover in 2050 in Southern and South East Asia

"forestatrisk" Python package (Vieilledent, 2021)
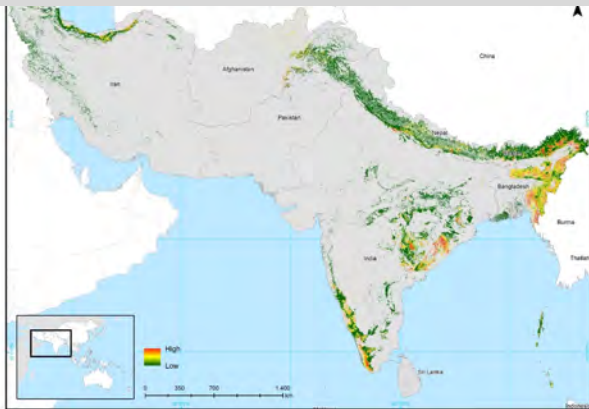
Intact forest area of the Asia Pacific is predicted to decline from 519 Mha in 2020 to 415 Mha in 2050

15

Among the main conclusions

- There are still important areas of primary forests in the Asia Pacific region

- A large part of these primary forests is not covered by any Protected Area network and represent identified regions for OECMs (**Other effective area-based conservation measures**) concept that IUCN and FAO are developing

- The diversity of forest formations and types in the region is unique, and many specific types of primary forests are particularly threatened by deforestation and degradation

- Lack of knowledge on the floristic variation with forest types, on the distribution of species, and on population dynamics, especially in the tropical zone

16
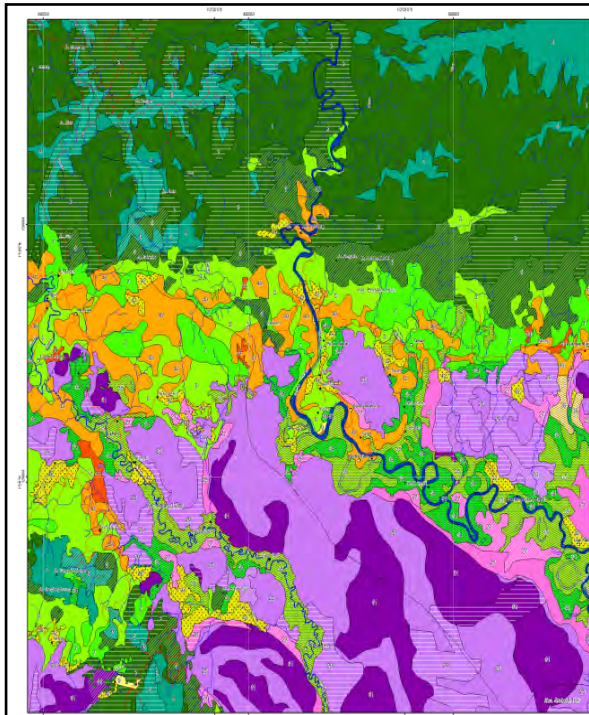
Large-scale ecological vegetation mapping (1:50,000) and related socio-ecological surveys

- New satellite remote sensing platforms
- Very high-resolution sensors
- Sentinel satellites series
- Protocol to initiate at sub-national level analysing rather large area, then zooming into specific with higher resolution, eventually completed by drone surveys
- Easily integrated with SEPAL platform

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Thank you

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Towards a roadmap for primary forest conservation.

Alexandre Meybeck, Nathanael Pingault,
Yves Laumonier, Nadine Azzu FTA/CIFOR

1

OVERVIEW

4) What governance instruments for primary forests conservation in the Asia-Pacific region

5) Mechanisms and tools for primary forests conservation

6) Recommendations

2

1

4 WHAT GOVERNANCE INSTRUMENTS FOR PRIMARY FORESTS CONSERVATION IN THE ASIA-PACIFIC REGION

4.1 Actors and institutions: an overview

4.2 International and regional agreements, instruments and processes

4.3 National level

4.4 At local level: implementation of landscape approaches to primary forest conservation.

3

Actors and institutions

- State actors
    - National governments, state authorities, intergovernmental organizations
- Non-state actors
    - Private sector, NGOs, CSOs, academia
- Local level
    - Local and indigenous communities
- National level
    - Legal frameworks, decisions
- Environmental NGOs and CSOs
    - Contribute to national policy and decision-making processes; local-level forest management.
- Academia
    - Providing science-based evidence
- Private sector
    - Logging concessionaries; small farmers
- Forestry management regimes
    - Co-management regimes, community forestry, smallholder forestry, large-holder forestry, companies granted concessions on state lands.
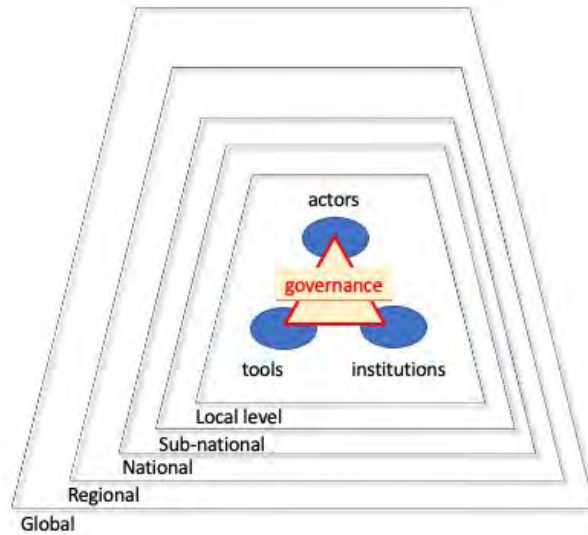
4

Actors and institutions

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International and regional agreements, instruments and processes

- No primary forest-specific international agreements
- Global sustainable development and environmental goals
- Global forestry instruments and initiatives
- Transnational trade
- Regional initiatives and institutions

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National rules and instruments

- Regulations combating overharvesting, illegal logging and illegal trade
- Legal incentives and market-based instruments
- Land tenure and access rights
- Multi-level governance: translate global objectives into national commitments, strategies and action plans
- Governments can improve local forest governance (e.g. supporting participatory forest management schemes, strengthening policies and legislation, improving tenure regimes)

Local level

- International and regional agreements + national policies, rules and instruments framing and orienting governance mechanisms at local level.

- Enhance local stakeholders' participation in the conservation and management of forest resources
  - Indigenous Peoples and Local Communities
  - Participatory approaches (CBF)
  - Linkages to market-based institutions

5 MECHANISMS AND TOOLS FOR PRIMARY FORESTS CONSERVATION

5.1 Protected areas

5.2 Complementary instruments for the protection of primary forests

5.3 Combining tools, means and scales for primary forest conservation.

5.4 Conclusion

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5.1 Protected areas

5.1.1 Categorization.

5.1.2 Management authority and governance

5.1.3 Enforcement

5.1.4 Aligned legislative frameworks

5.1.5 Effectiveness

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5.2 Complementary instruments for the protection of primary forests

5.2.1 Connectivity

5.2.2 Certification and voluntary agreements

5.2.3 Monitoring of changes and threats

5.2.4 Financial capacity

Protected Areas

- most widely used conservation mechanism
- Some main issues:
  - Important part of primary forests are located outside Pas
  - Pas often in remote areas where they are the less needed
  - Forest area in national parks and their conservation areas used as proxies for primary forest, in some country reporting.
  - IPLCs participation
    - Include in management
    - Include in PA establishment processes
  - Enforcement difficult

Complementary instruments

To:
- Support implementation of PAs
- Protect outside Pas
- Contribute to health of Pas (connectivity, protection against risks)

- Buffer zones and ecological corridors for connectivity
- Other effective area-based conservation measures
- Certification and voluntary agreements
- Monitoring of changes and threats
- Financial capacity

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Combining tools, means and scales for primary forest conservation

- Technical interventions within landscape context
- Engagement and coordinated action of the range of stakeholders across sectors and scales
- Addressing threats from outside the forestry sector
- Most mechanisms are national (e.g. logging bans, land tenure, PES)
- Forests as a means to achieve national and global objectives (e.g. CC and BD) >>> justifies support from national and global levels to local actors

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6) RECOMMENDATIONS

1. Explore innovative ways to improve monitoring and reporting on natural forests

2. Improve knowledge and understanding of natural forests to orient land-use planning, management and conservation efforts

3. Build a compelling narrative and consolidate new coalitions of actors

4. Policy coherence

5. Align sustainable land use, climate action and biodiversity objectives with the conservation of primary forests

6. Strengthen regional and international cooperation for conservation and management of primary forests

I) Monitoring and reporting

1. Support the uptake and upscale of innovative technologies to support real-time monitoring and data collection *[remote-sensing satellite or drone observations in inaccessible areas; acoustic monitoring; etc.].*

2. Support the uptake and upscale of innovative technologies to improve reporting, information sharing and data analysis, and develop near-real time alert systems *[Using open cloud-data platforms integrating various information and datasets collected by different actors; Develop near-real time alert systems on forest degradation focusing on various threats; e.g., existing fire alert systems].*

3. Support local actors and communities' engagement and participation in monitoring and data collection *[crowd-sourcing of field data; using digital technologies, such as mobile apps or open-data platforms, e.g., Hutanwatch, Urundata, etc.]* and uptake their observations in decision-making at higher levels.

4. Clarify and harmonize national definitions, criteria, and indicators used to monitor forest status and trends *[On definitions: primary vs. intact, old growth or natural forests. On criteria: size, level of importance, including biological diversity, level of threats, etc.].*

5. Improve transparency and replicability of reporting, in line with international processes and guidelines *[link with, e.g., ITTO guidelines or others].*

6. Improve monitoring and reporting on tenure status and rights, including on customary and traditional rights.

7. Link such monitoring (including of social impacts) to commodity value chains, and to incentives; both to gather data and give value to it.

8. Link the data gathered through reporting to other relevant contextual information (e.g., economic, etc.), especially at country level.

I) Improving knowledge

1. Dedicate increased resources to the knowledge and understanding of natural forests, their ecological diversity, status, fragmentation, dynamics and functioning,

2. Integrate local and indigenous actors' knowledge; co-produce knowledge with local actors *[e.g., citizen-science initiatives at local or national level]*.

3. Acknowledge and assess the different values (environmental, economic, social, cultural, religious and existence values) of natural forests and of the ecosystem services they provide, taking into account all available knowledge, including local and indigenous knowledge.

4. Use these assessments to reflect the value of natural forests and their ecosystem services in integrated systems of environmental and economic accounting, and to better ground conservation policies and actions *[UN-SEEA: See: https://seea.un.org/]*.

5. Use this knowledge to define and identify priority areas for conservation, based on clear criteria, agreed nationally and grounded on sound evidence, and to orient land-use planning. *[Criteria such as: size; level of importance - including ecological value, cultural value, ecosystems services -; and level of threats]*

6. Translate this knowledge into a compelling narrative and make it available, through training and capacity-building, to all actors involved in forest management and conservation, or in activities that impact it, and to the broad public

7. Identify the key knowledge and information gaps, that need to be addressed to support land-use planning and conservation efforts, including:

    -   Large-scale (minimum of 1:50,000 for all countries; 1:25,000 for small islands) ecological vegetation mapping including forest types within their surrounding landscape to adapt conservation efforts to the specificities of different landscape and ecosystems.

    -   Coordinated studies on fragmentation and configuration of landscapes (natural forests, remnant forests and other land-uses).

    -   Better and more transparent understanding of tenure.

    -   Better understanding of the PA status of different areas.

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III) Build a compelling narrative and consolidate new coalitions of actors

1. Build a compelling narrative, highlighting the amazing contributions of forest to sustainable development objectives (including climate change mitigation and adaptation, protection of biodiversity and poverty reduction).

2. Adopt a cross-cutting perspective and articulate this narrative consistently: over time (integrating short- and long-term); across sectors (identifying synergies and mutual benefits and addressing trade-offs); and, across scales (from local to global).

3. Pay a specific attention to forest margins and forest borders, as the frontier of conservation, and as the thin line where most conflicts are concentrated.

4. Use this compelling narrative, as well as the related knowledge and information (maps, data, plans), to: improve transparency, raise awareness and encourage buy-in; build large coalitions of actors and strengthen ownership across actors and sectors; gain traction on the political agenda and enable policy coherence; attract funding and deliver true impact.

5. Encourage and incentivize land-owners and private actors (including remote ones) to contribute to forest conservation, through regulation, standards and incentives

6. Strengthen ownership, and encourage participation of less powerful actors, including women, youth, indigenous peoples and local communities (IPLCs), in forest governance and decision-making processes, and make the forestry sector more attractive to them.

7. Secure the access and use rights of local communities and indigenous peoples dependent on primary forests for their subsistence and livelihood.

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IV) Policy coherence

1. Enhance policy coherence over time, as well as between land-use policies (forest, agriculture, infrastructures) and other sectoral policies that impact forests (energy, water, mining), at all levels (local, national, regional), and especially at the landscape level where all these policies interact.

2. Organize, as appropriate, dialogues at different scales, between foresters and relevant actors, in other sectors that impact primary forest conservation, and encourage actors in these other sectors to contribute to primary forest conservation.

3. Elaborate sustainable and integrated landscape management plans and strategies, at local and national levels, that strengthen synergies and address trade-offs across, land-uses, sectors and actors, and that articulate coherently short- and long-term objectives, challenges and opportunities.

4. Ensure that forests are recognized by themselves, not only as land reserve for agriculture and other sectors, and that forest management and conservation objectives are incorporated in broader integrated land-use planning and landscape management plans and strategies, at local and national levels.

5. Consider, in integrated land-use planning and landscape management plans, not only conservation areas but also the surrounding landscapes, as well as the need to create buffer zones and ecological corridors between forest fragments to reduce forest degradation, limit forest fragmentation and restore connectivity.

6. Mobilize sustainable and innovative finance mechanisms (green bonds, climate bonds, blended finance, impact finance) for integrated landscape management that contribute to primary forest conservation.

7. Design appropriate mechanisms to facilitate flows of financial resources towards local actors on the ground, connecting big funds, including internationally sourced, to small projects.

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V) Align objectives

1. Promote sustainable land-use, integrating primary forest conservation, in the policies and mechanisms related to climate action and biodiversity conservation and sustainable use.

2. Recognize the contribution of primary forests to overall adaptation to climate change and integrate primary forest conservation and management in National Adaptation Plans (NAPs).

3. Take into account, in Nationally Determined Contributions (NDCs), the vulnerability of primary forests, as well as their potential for climate action, both adaptation and mitigation.

4. Recognize, in the design and implementation of the NDCs, the specific biodiversity and conservation values of primary forests, in addition to their carbon sequestration potential.

5. Ensure consistency and maximize the synergies between NDCs and National Biodiversity Strategies and Action Plans (NBSAPs).

6. Consider primary forest conservation objectives in international climate finance mechanisms to orient and prioritize funding.

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VI) International and regional cooperation

1. Exchange knowledge and lessons learned across countries and categories of actors about defining, identifying and managing primary forests.

2. Transfer technologies, including for mapping, monitoring and managing primary forests.

3. Track and prevent illegal logging and illegal collection of wood and non-wood forest products in primary forests *[innovative technologies can help for wood species identification and tagging]*.

4. Facilitate capacity-development through appropriate means at regional level *[communities of practice, regional platforms]*.

5. Facilitate transboundary cooperation for conservation and management of primary forests *[e.g., peace parks]*

6. Promote international cooperation on deforestation-free commodities

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ROLLING OUT THE ROADMAP

- A process
- Deployed in parallel at regional, national and local levels
- For each specific priority forest type
- Regional and national levels: set regional and national priority areas and priority actions for primary forest conservation
- Local level: discuss and build a shared and integrated landscape approach, including primary forest area and surrounding landscape, and their dynamics

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FOUR STEPS

1. Make an initial diagnosis of the current situation
2. Develop a strategy: define priorities and means of implementation
3. Create an enabling environment
4. Act collectively and individually

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STEP 1

- Describe primary forest diversity, status and trends, building upon available scientific evidence
- Identify and assess the threats faced by primary forests, as well as their drivers
- Identify the actors involved or to be involved in primary forest conservation (e.g. public authorities, scientists, private forest companies, civil society organizations, indigenous peoples and local communities)
- Assess the performance of existing instruments (regulations, standards, economic

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STEP2

- Based on the initial diagnosis, identify priority areas for primary forest conservation, based on criteria including: size, level of importance, or level of threats
- Define a strategy and priority actions for primary forest conservation
- Define the means of implementation to be deployed (legal protection, other regulations, voluntary standards, economic incentives and governance mechanisms and adapt their articulation to the given context

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STEP 3

- Invest in research and development, extension and capacity-development to improve knowledge and understanding of primary and natural forests functioning to orient land-use planning management and conservation efforts [II]
- Raise awareness and enhance citizen participation in forest monitoring and primary forest conservation [I.3]
- Elaborate conducive policies and regulations to address/overcome the threats identified above and enhance primary forest conservation
- Mobilize the resources and develop the infrastructure needed for integrated landscape management that contribute to support primary forest conservation [IV.6], connect big funds to small projects [IV.7]

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STEP 4

- Define the roles and responsibilities of the different actors involved, build a compelling narrative and consolidate new coalitions of actors [III]

- Ensure policy coordination across sectors and scales and align sustainable land-use, climate action and biodiversity objectives with primary forest conservation [V]

- Promote integrated landscape approaches [IV], embracing not only the primary forest area to be conserved but also forest margins, as well as the surrounding landscape and its dynamics [III.3, IV.5]

- Exchange knowledge and lessons learned across countries, sectors and actors [VI.1] and adapt strategies and action plans accordingly

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