联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Alimentación y la Agricultura | منظمة الأغذية والزراعة للأمم المتحدة

COMMITTEE ON FORESTRY

Twenty-seventh Session

Rome, 22–26 July 2024

Enhancing the contribution of forestry to the bioeconomy – Opportunities and challenges

Executive summary

In 2021, the FAO Conference recognized "Bioeconomy for sustainable food and agriculture" as a Programme Priority Area within the FAO Strategic Framework 2022-31, highlighting the need for policy advisory services, capacity building, partnerships, and knowledge sharing.

This document responds to the request of the 43rd Session of the FAO Conference to stress the importance of the bioeconomy for sustainable agrifood systems and to discuss this topic within FAO Governing Bodies and Technical Committees.[1] It summarizes the status of global bioeconomy development including the forest-based bioeconomy, outlines key challenges to be addressed, provides a brief update on FAO's work on the topic and suggests actions and the way forward to enhance the contributions of forestry to the bioeconomy.

Suggested action by the Committee

The Committee is invited to:

a. encourage Members, and invite FAO to scale up technical support and capacity building to Members, upon request, to formulate and implement national, regional and global bioeconomy policies, strategies and action plans fully incorporating forestry, with a view to promote cross-sectoral collaboration and inclusive engagement of stakeholders, including small-scale producers and marginalized groups;

b. invite Members to incentivize sustainable practices, market development and investments in forest-based value chains, and invite FAO to provide technical assistance to Members in developing systems that assure legality and sustainability of forestry production, and fostering value-added innovation and material efficiency in the forest sector;

c. recognize FAO's leadership in advancing work to support the development of a sustainable bioeconomy, and encourage FAO to build upon its comparative advantages working across agricultural sectors to improve data, promote policy coherence and scale

[1] Retrieved from C 2023/REP, which reads: "stressed the importance of bioeconomy for sustainable agrifood systems and highlighted the need to discuss this topic within Governing Bodies and Technical Committees of FAO, bearing in mind the ongoing collaboration between COAG and COFO on the linkages between agriculture and forestry and the COFO–COAG joint work roadmap," and "recognized the importance of the inclusive consideration of diverse and regionally balanced perspectives in FAO's normative, policy and scientific work, by means of progressive integration, including through voluntary financial instruments."

up technical support and capacity building to advance sustainable bioeconomy practices across agrifood systems, including forestry, and to mobilize resources and initiate a multistakeholder global bioeconomy partnership to this end; and

d. invite FAO to convene an international conference on the role of the forest sector in the bioeconomy, subject to availability of extrabudgetary resources, and to present its results at the 28th Session of the FAO Committee on Forestry.

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I. Introduction

1. Over the past 50 years, material use has surged, with a further 60 percent increase expected by 2060, necessitating a shift towards sustainable resource utilization in line with the SDGs. Absolute extraction of biomass has nearly doubled.[2]

2. Population growth, urbanization, and economic development, especially in emerging countries, are expected to significantly increase the demand for forest products.

3. The anticipated rise in biomass demand for food, energy, housing, and other materials, particularly in construction and packaging, underscores the need for a sustainable bioeconomy. A well-developed sustainable bioeconomy provides an approach for managing the trade-offs in biomass[3] use, enhancing synergies across different sectors, to reach environmental, social, and economic sustainability objectives, while protecting biodiversity-rich and carbon-sequestering ecosystems, thereby aligning with the 2030 Agenda for Sustainable Development.[4]

4. The bioeconomy utilizes biological resources to replace fossil fuel-based resources with biobased goods, processes and services across all economic sectors. It is an economy driven by science and technology, harnessing biotechnological knowledge, representing not only a technological and economic shift but also a social transformation. It requires the inclusion of local communities, Indigenous Peoples, women and youth to ensure equitable benefits and address environmental and climate challenges, thus realizing the transformative potential of the bioeconomy.

5. FAO's work on the bioeconomy officially began with the issuance of the final communiqué of the seventh meeting of ministers of agriculture, held under the Global Forum for Food and Agriculture (GFFA) on 17 January 2015, who advocated that "FAO continues and intensifies its work on the primacy of food security in bioeconomy and provides information and pertinent policy advice for the benefit of its Members," and acknowledged that FAO, in collaboration with other partners, would provide the appropriate platform for "tangible action and international cooperation [that] are necessary to seize the opportunities provided by sustainable bioeconomy for agriculture and rural development while securing the primacy of food security and nutrition".[5]

6. In June 2021, the 42nd Session of the FAO Conference decided to elevate "Bioeconomy for sustainable food and agriculture" to the status of a Programme Priority Area (PPA) within the Organization's Strategic Framework 2022-31, under better environment (known as BE2). This makes FAO the first and, so far, only United Nations agency to have elevated bioeconomy to the level of a strategic priority. While PPA BE2 primarily focuses on SDG 12 Ensure sustainable consumption and production patterns, and particularly Targets 12.2, 12.4 and 12.5 related to sustainable resource management, reducing pollution and minimizing waste generation, the bioeconomy concept is an integrated approach for agrifood systems transformation as it provides a range of benefits across all other SDGs towards better production, better nutrition, a better environment and a better life.

7. The 42nd Session of the FAO Conference adopted the following definition: "Bioeconomy is the production, utilization, conservation, and regeneration of biological resources, including related knowledge, science, technology, and innovation, to provide sustainable solutions (information, products, processes and services) within and across all economic sectors and enable a transformation to a sustainable economy."[6] It furthermore specified that the term was "to be used without the addition of 'circular'".

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[2] UNEP. 2024. *Global Resources Outlook (2024): Bend the trend – Pathways to a liveable planet as resource use spikes*. Nairobi, International Resource Panel. https://www.unep.org/resources/Global-Resource-Outlook-2024

[3] Organic material (both living and dead), e.g. trees, crops, grasses, tree litter, algae, animals, manure and waste of biological origin excluding material embedded in geological formations and materials transformed to fossilized material and excluding peat [ISO/TS 14067:2013, 3.1.8.1]

[4] https://openknowledge.fao.org/items/0c46e9fb-5fec-4738-9db5-65b474f0b9b7

[5] Cited in: FAO. n.d. Overview | Sustainable and circular bioeconomy for food systems transformation. In: *FAO*. [Cited 26 April 2024]. https://www.fao.org/in-action/sustainable-and-circular-bioeconomy/overview/en/

[6] International Advisory Council on Global Bioeconomy & Global Bioeconomy Summit 2020. 2020. *Expanding the Sustainable Bioeconomy – Vision and Way Forward. Communiqué of the Global Bioeconomy Summit 2020*. Berlin. https://gbs2020.net/wp-content/uploads/2020/11/GBS2020_IACGB-Communique.pdf

8. This document responds to the request of the 43rd Session of the FAO Conference for FAO Governing Bodies and Technical Committees to discuss the topic of bioeconomy.[7] It summarizes the status of global bioeconomy development, including the role of forests, forestry and forest value chains in the bioeconomy, outlines key challenges to be addressed, provides a brief update on FAO's work on the forest-based bioeconomy and suggests actions to enhance the contributions of forests to the bioeconomy.

II. The global bioeconomy: towards common objectives

9. The bioeconomy can play an important role in advancing sustainable development and transforming agrifood systems. By enhancing resource efficiency, mitigating climate change, conserving biodiversity, preventing and combating land degradation and desertification, stimulating economic growth, driving innovation, minimizing waste and building resilience, the bioeconomy can foster more efficient, resilient, equitable and sustainable agrifood systems.[8]

10. The bioeconomy is gaining increased recognition. Currently, 21 countries and 3 regions are implementing specific bioeconomy strategies. Additionally, approximately 35 countries have strategies related to bioscience and biotechnology of relevance to the agrifood sector. This coverage is expanding rapidly with FAO tracking their development.[9]

11. Dedicated national bioeconomy approaches take on different forms depending on the context. Fifteen common sustainability objectives were identified across these strategies, touching upon environmental, social and economic dimensions of sustainability underpinned by a good governance dimension.[10] Among them are "safeguarding food security, substituting fossil fuel-based products with sustainable bioproducts, incentivizing the sustainable and efficient use of biological resources while protecting biodiversity, water and soil, and mitigating and adapting to the effects of climate change, creating jobs and revitalizing urban and rural economies, establishing fair and equitable value chains," and others.

12. While there is not one universally agreed-upon definition of what constitutes a bioeconomy and its progression is always context-specific, agrifood systems are commonly at the centre of all bioeconomy strategies. This aligns countries and regions to common objectives of enhancing food security and nutrition, reducing greenhouse gas (GHG) emissions, minimizing waste, driving competitiveness, and fostering inclusion through innovation. With bioeconomy strategies, countries not only aim to make agrifood systems more sustainable across all dimensions, but also to leverage their potential for advancing the whole economy, creating and connecting new industries, generating decent employment opportunities, and increasing social well-being.[11] However, to ensure that bioeconomy development is sustainable, social, economic and environmental objectives, as well as good governance principles, should be considered equally when analysing its benefits and trade-offs.[12]

13. A common element found in most of the strategies is the capacity of the bioeconomy to generate additional value within agrifood systems, leveraging existing resources more effectively and

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[7] Retrieved from C 2023/REP, which reads: "stressed the importance of bioeconomy for sustainable agrifood systems and highlighted the need to discuss this topic within Governing Bodies and Technical Committees of FAO, bearing in mind the ongoing collaboration between COAG and COFO on the linkages between agriculture and forestry and the COFO–COAG joint work roadmap," and "recognized the importance of the inclusive consideration of diverse and regionally balanced perspectives in FAO's normative, policy and scientific work, by means of progressive integration, including through voluntary financial instruments."

[8] von Braun, J., Afsana, K., Fresco, L.O. & Hassan, M., eds. 2021. *Science and Innovations for Food Systems Transformation and Summit Actions*. Papers by the Scientific Group and its partners in support of the UN Food Systems Summit. United Nations Food Systems Summit. https://sc-fss2021.org/wp-content/uploads/2021/09/ScGroup_Reader_UNFSS2021.pdf

[9] https://www.fao.org/in-action/sustainable-and-circular-bioeconomy/dashboard/en/

[10] Gomez San Juan, M. & Bogdanski, A. 2021. *How to mainstream sustainability and circularity into the bioeconomy? A compendium of bioeconomy good practices and policies*. Rome, FAO. https://doi.org/10.4060/cb5798en

[11] See footnote 9 and also: Meyer, R. 2017. Bioeconomy Strategies: Contexts, Visions, Guiding Implementation Principles and Resulting Debates. *Sustainability*, 9(6): 1031. https://doi.org/10.3390/su9061031

[12] FAO. 2021. *Aspirational principles and criteria for a sustainable bioeconomy*. https://openknowledge.fao.org/server/api/core/bitstreams/92d6ae7c-2257-427f-a5a1-1f1223c89a47/content

tapping into previously untapped resources such as waste, residues and by-products. Differences can be found in how countries aim to reach these objectives. For instance, in the Asia and the Pacific region, countries focus more on the development and application of biosciences and specifically biotechnology to improve the sustainability, productivity and resilience of agrifood systems. In Latin America and the Caribbean, the use of abundant biodiversity, for example through non-wood forest products (NWFPs) is central and aims to provide environmental, social, and economic benefits, especially in rural contexts and for Indigenous Peoples.

14. FAO has identified several major gaps and opportunities in the global bioeconomy landscape of relevance to FAO's work. One of the primary gaps lies in the lack of coherence between bioeconomy policies and national development strategies, including agrifood systems pathways. Policymakers should recognize the inherent interconnectedness of these domains and work towards strengthening the alignment between them. This will not only enhance the overall effectiveness of bioeconomy initiatives but also ensure that they are firmly rooted in the broader sustainability goals of the countries.

15. Another gap is the limited availability and analysis of bioeconomy-related data. Robust data on biomass availability and potential applications that support sustainability principles and criteria are crucial for informed decision-making and the development of targeted strategies. By enhancing the collection and analysis of these data, policymakers can gain a deeper understanding of the bioeconomy potential and tailor their policies accordingly.

16. Importantly, the path to a thriving bioeconomy must involve the active participation of local communities, Indigenous Peoples, women, youth and other marginalized groups of society. Co-designing inclusive bioeconomy strategies, policies, and programmes with these stakeholders can foster a bottom-up approach to technologies and practices selection and implementation and ensure their integration in bioeconomy value chains and associated markets, and that these communities receive sufficient benefits for their vital role in providing renewable materials and in maintaining healthy ecosystem services. This collaborative process not only ensures that the solutions are tailored to local needs but also promotes a sense of ownership and buy-in from these communities themselves.

17. The bioeconomy holds immense potential, but its realization is hindered by gaps in capacity development. While knowledge on best local innovations exists, there is a lack of initiatives actively deploying these solutions. By leveraging investments and enhancing coordination among bioeconomy projects, innovative ideas can be scaled up. This will allow proven technologies and practices to reach communities in need. Establishing platforms for knowledge exchange, cross-sectoral partnerships and South–South cooperation can amplify the collective impact of bioeconomy efforts.

18. To overcome the challenges of limited consumer uptake, the key lies in empowering diverse stakeholders through targeted efforts in science, education, and community engagement. Investments in strengthening scientific research and educational programmes related to the bioeconomy can help build a robust knowledge base and equip the next generation with the necessary skills and expertise to drive innovation in this field. Countries should ensure that bioeconomy-related capacity-building initiatives specifically target and empower youth, women, and Indigenous Peoples. These groups often face disproportionate barriers to accessing and participating in the bioeconomy. By empowering them, countries can unlock their vast potential as agents of change and make bioeconomy value chains and value webs more accessible and inclusive for all members of the community.

19. Globally, the current efforts on the bioeconomy are characterized by a lack of coherence in actions among various public and private sector stakeholders, at the global but also national level. This fragmentation hinders the effective deployment and scaling up of bioeconomy solutions. There is a need to establish dedicated global, national and local partnerships focused on the bioeconomy. These partnerships should bring together a diverse range of stakeholders across sectors, including governments, the private sector, research institutions and civil society organizations, to improve cooperation and knowledge sharing. By fostering these multilevel partnerships, the bioeconomy can gain greater societal acceptance and support. Collaborative efforts can help address concerns, raise awareness and demonstrate the tangible benefits of the bioeconomy to local communities, ultimately driving wider adoption and implementation.

20. At the global level, it is crucial to consolidate the role of FAO as a leading United Nations agency on bioeconomy support. FAO, working in partnership with relevant United Nations entities and international financial institutions, can leverage its long-standing technical expertise and convening power to foster stronger partnerships and facilitate cooperation at the global, regional and national levels.

III. Forests, forestry and forest-based value chains in the bioeconomy

21. As one of the most biologically rich terrestrial system,[13] forests provide a range of ecosystem services that support local communities, agriculture, food security and nutrition,[14] and various economic sectors. Sustainable forest management (SFM) contributes to biodiversity protection, climate adaptation and mitigation [15] (including through carbon storage in forest biomass, soil and wood products, and material substitution[16]); addressing land degradation and desertification; and sustaining and improving livelihoods, food security and nutrition, cultural values and human health. The forest sector is therefore in the forefront of an inclusive, low-carbon bioeconomy.[17,18]

22. Forest-based value chains are essential elements of the bioeconomy.[19] They provide sustainable and environmentally beneficial products that can substitute for non-renewable products and energy.[20] They support the food and agricultural, construction, pharmaceutical and bioenergy sectors, including by supplying wood, fibre, energy, NWFPs, biochemicals, bioplastics and manufactured cellulosic textiles.[21] The development of legal and sustainable forest-related value chains bears the potential to underpin carbon-neutral economies while generating decent employment and livelihoods for millions of people.[22,23,24]

23. Managing the production, utilization, conservation and restoration of forests and their associated value chains requires carefully balancing the interrelated objectives of social well-being, economic development, and environmental values. This is a complex and challenging undertaking, as these elements are deeply interconnected.[25]

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[13] CBD. 2008. *Forest Biodiversity: more than just trees*. COP 9 MOP 4, Bonn, Germany. UNEP. https://www.cbd.int/doc/meetings/cop/cop-09/media/cop9-press-kit-forest-en.pdf
[14] COFO/2022/4
[15] Nabuurs, G.-J., Masera, O., Andrasko, K., Benitez-Ponce, P., Boer, R., Dutschke, M., Elsiddig, E. *et al.*, eds. 2007. Chapter 9 Forestry. In: *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, Cambridge University Press. https://archive.ipcc.ch/publications_and_data/ar4/wg3/en/ch9.html
[16] Verkerk, P.J., Hassegawa, M., Van Brusselen, J., Cramm, M., Chen, X., Maximo, Y.I., Koç, M., Lovrić, M. & Tegegne, Y.T. 2022. *Forest products in the global bioeconomy: Enabling substitution by wood-based products and contributing to the Sustainable Development Goals*. Rome, FAO. https://doi.org/10.4060/cb7274en
[17] https://www.iufro.org/science/task-forces/bioeconomy-and-non-timber-forest-products/
[18] FAO. 2022. *Inspire for the future: the Role of Forests in Ensuring Sustainable Production and Consumption*. Rome. https://openknowledge.fao.org/server/api/core/bitstreams/f3c04e18-0c46-4b03-94ea-10fce64721af/content
[19] FAO. 2023. *Bioeconomy for sustainable food and agriculture*. Rome. https://openknowledge.fao.org/server/api/core/bitstreams/d8f82717-d3f1-495c-a788-863f7512fa89/content
[20] FAO. 2021. *Advisory Committee on Sustainable Forest-based Industries. Strategic Framework 2020–2030*. Rome. https://openknowledge.fao.org/server/api/core/bitstreams/ad5ec555-0a68-4509-a1fe-c60afec2e8a8/content
[21] FAO. 2022. *The State of the World's Forests 2022 – Forest pathways for green recovery and building inclusive, resilient and sustainable economies*. The State of the World's Forests (SOFO). Rome. https://doi.org/10.4060/cb9360en
[22] Lippe, R.S., Schweinle, J., Cui, S., Gurbuzer, Y., Katajamäki, W., Villarreal-Fuentes, M. & Walter, S. 2022. *Contribution of the forest sector to total employment in national economies*. Rome and Geneva, FAO and ILO. https://doi.org/10.4060/cc2438en
[23] FAO & UNECE. 2019. *Trends in green jobs in the forest sector in the UNECE region: Policy brief*. Rome. https://unece.org/fileadmin/DAM/timber/meetings/2019/20190327/draft-green-jobs-in-forest-sector-trends-2019-02.pdf
[24] Li, Y., Mei, B., Linhares-Juvenal, T., Formenton Cardoso, N. & Tshering, C. 2022. *Forest sector contribution to national economies 2015*. Rome, FAO. https://doi.org/10.4060/cc2387en
[25] Footnote 20 and https://www.fao.org/3/cb9360en/online/cb9360en.html

24. Increased use of wood products by 2050 may require the production of an additional 1 billion cubic metres of industrial roundwood. A greater area of planted forests will likely be needed if there is also an increased demand for forest-based feedstock to produce more biobased products such as bioplastics or bioenergy.[26]

25. Sustainably meeting higher demand for forest-based biomass will require deployment of policy, capacity building and investment support at national, regional and global levels. Actions should aim for four major goals: (i) increased sustainable supply of forest-based biomass through adequate strategies, including increasing the area and productivity of naturally regenerated and planted forests, as well as utilizing agroforestry and restoration approaches; (ii) improved value-adding, manufacturing efficiency and energy flows and promotion of the cascading use of forest products; (iii) a change of consumption patterns; and (iv) a transition to more sustainable economies. To achieve these goals, there is a need to scale up science-based innovation in forestry to increase the contribution of forestry to the bioeconomy.

26. Increasing forest-based production in naturally regenerated forests will require political decisions to mitigate and adapt to climate change, and the development of comprehensive policies that balance carbon sequestration, biodiversity, and the production of forest products. The expansion of planted forests could be achieved by better integrating commercial timber production into forest and landscape restoration approaches and agroforestry and tree crop plantation practices.[27] Simultaneously, leveraging tree-growing initiatives within restoration commitments can unlock the development of forest-based value chains and local business opportunities related to the provision of effective seed supply systems and genetic diversity in planting material (e.g. matching of seed origin to sites, local adaptation, seed collection process and nursery management)[28][29][30]. Engaging forest-based industries as well as smallholders and communities as producers in commercial wood or NWFP value chains can help expand the area of planted forests.[31]

27. Efficiency gains in forest-based production can be amplified through the cascading use of wood and other materials, which refers to the efficient and sequential use of forest resources with the goal of maximizing the overall utilization of the biomass, including residues and recycled materials, for material applications before final energy recovery. Adding value across the cascade of products can extend material lifespans, reduce original demand for materials, and enhance the sustainable use of forest products.

28. Currently, 27–34 percent of woodfuel extraction in tropical regions is unsustainable, affecting 275 million people.[32] This gap can be bridged by restoring degraded forests, establishing planted forests, improving residues use, and recovering post-consumer wood. Efficiency can be increased by improving wood properties, processing, and access to modern energy forms. Meeting future woodfuel demand will require to substantially improve resource allocation and a clear political vision, as scenarios range from a 19 percent decrease to a 400 percent increase by 2050.[33]

29. Promotion of sustainable consumption behaviours among consumers, such as increased demand for biobased and low-carbon products over fossil fuel-based alternatives can be achieved through awareness campaigns, ecolabelling and economic incentives. Policies and regulations such as

[26] FAO. 2022. *Global forest sector outlook 2050: assessing future demand and sources of timber for a sustainable economy. Background paper for The State of the World's Forests 2022. Provisional*. Forestry Working Paper No. 31. Rome. https://doi.org/10.4060/cc2265en

[27] While comprehensive data are lacking, these systems currently have substantial areas (45 million ha agroforestry, 7 million ha rubber plantations), which can be further increased as part of agricultural expansion for food production. More than 200 million ha of forest and landscape restoration pledges suggest potential for establishing planted forests for multiple purposes, including roundwood production.

[28] https://openknowledge.fao.org/items/4a384d7e-8c04-47b2-9800-1f1d8c7417a1

[29] https://www.fao.org/in-action/forest-landscape-restoration-mechanism/resources/detail-publication/ru/c/1678468/

[30] https://www.fao.org/in-action/forest-landscape-restoration-mechanism/resources/e-learning-courses/planning-seed-and-seedling-supply-for-forest-and-landscape-restoration/en/

[31] See footnote 25.

[32] Bailis, R., Drigo, R., Ghilardi, A. & Masera, O. 2015. The carbon footprint of traditional woodfuels. *Nature Climate Change*, 5(3): 266–272. https://doi.org/10.1038/nclimate2491

[33] See footnote 25.

carbon pricing, renewable energy targets, and green public procurement policies incentivize the use of sustainably sourced forest biomass for bioenergy, biobased materials, and other forest-derived products. Investment in research, development, and deployment of innovative forest-based technologies and products, such as mass timber construction, forest biorefineries, and biobased textiles and plastics create new markets and shift consumer demand. Stimulating local production and consumption of forest-based products to shorten supply chains and improve sustainability outcomes often results in new green job opportunities. Finally, there is a large scope for increasing awareness and knowledge among consumers, producers and policymakers on the benefits of a sustainable forest-based bioeconomy at all levels of society, which could align values and behaviours of producers and consumers across value chains.

30. It is crucial to further integrate the forest-based bioeconomy into the broader bioeconomy framework. This can be achieved through aligning policies, fostering innovation and promoting sustainable practices to strengthen positive agriculture–forestry linkages in land management and throughout value chains.[34] Governments should strive to establish coherent policy and regulatory environments that support the development of forest-based and other biobased industries. Additionally, expanding the applications and markets for forest biomass through innovative bioproducts can further strengthen the contributions of the forest sector to the bioeconomy. Finally, through participation in regional and global bioeconomy collaboration on sharing good practices, aligning standards and coordinating policies, the forest sector can leverage its unique strengths and contribute to the broader transformation towards a more sustainable, biobased future.

31. Numerous innovations can support these developments, for instance:

a. Sustainable forest management and restoration include the use of drones and remote sensing technology to provide data, and artificial intelligence to support management planning and value chain logistics as well as forest tree genetics, including in the context of adapting to climate change.

b. The use of wood in construction, such as through engineered wood products, provides benefits compared to the use of non-renewable, GHG-intensive materials (e.g. steel and concrete).

c. The pulp, paper and packaging industries, including expanding the use of recovered materials as a priority feedstock for pulp mills and the production of biochemicals, bioplastics, cellulosic textiles, pharmaceuticals and bioplastics from forest-based feedstock.[35]

d. The use and management of bioenergy in rural communities and the use of waste and residues for bioenergy.

e. Repurposing, adapting, sustainable use and improving NWFPs and their associated processes, as well as policies and social arrangements for twenty-first century users.

32. Many NWFPs like bamboo[36] and cork[37] are playing a growing role in replacing non-renewable, high carbon-footprint materials.[38] Established markets in the biotrade sector for cosmetic, personal care, flavours and fragrances, food and beverage, and botanical medicine sectors can also be significant.[39]

33. While the forest-based bioeconomy offers great potential to achieve sustainability, bioeconomy activities are not necessarily sustainable as any increased production and consumption of

[34] See also COFO/2024/3 on Scaling up actions on agriculture and forestry linkages.
[35] ECE/TIM/2023/8−FAO:EFC/2023/8
[36] Borowski, P.F., Patuk, I. & Bandala, E.R. 2022. Innovative Industrial Use of Bamboo as Key "Green" Material. *Sustainability*, 14(4): 1955. https://doi.org/10.3390/su14041955
[37] Gil, L. 2015. New Cork-Based Materials and Applications. *Materials*, 8(2): 625–637. https://doi.org/10.3390/ma8020625
[38] Wolfslehner, B., Prokofieva, I. & Mavsa, R., eds. 2019. *Non-wood forest products in Europe: Seeing the forest around the trees*. What Science Can Tell Us 10. EFI. https://efi.int/sites/default/files/files/publication-bank/2019/efi_wsctu_10_2019.pdf
[39] Lawson, C., Rourke, M. & Humphries, F., eds. 2022. *Access and Benefit Sharing of Genetic Resources, Information and Traditional Knowledge*. London, Routledge. https://doi.org/10.4324/9781003301998

biological resources can lead to negative environmental, social and economic impacts.[40] The increased production and consumption of forest or agricultural products can generate risks of deforestation and forest degradation, competition with other elements of agrifood systems, biosecurity threats, loss of ecosystem services, and undermine biodiversity conservation and climate change actions. These risks can be identified, assessed and addressed, including with support of scenario modelling and foresight.

34. To promote forest-based contributions to the bioeconomy, comprehensive safeguards covering environmental, economic and social aspects are essential. Existing assurance systems can help verify or certify compliance with legal, social and environmental standards within forest-based value chains. These assurance systems include monitoring and complaints mechanisms to evaluate and mitigate impacts on ecosystems, local communities and their livelihoods.

35. Cross-sectoral approaches can enable improving synergies and addressing trade-offs between different sustainability objectives. For instance, use of wood in the building sector can help address the housing deficit while supporting engagement of forest farmers in ecosystem restoration and creating higher value-added opportunities for small and medium enterprises. Sustainable sourcing of feedstock to support the bioeconomy could be achieved through different pathways with different impacts, including through increased forest and processing productivity, expansion of planted forests and increased processing of wood from trees outside forests and agroforestry systems.

36. Another key challenge is that information needed for developing the forest-based bioeconomy is incomplete, for key aspects such as the relationship between supply and demand on a global scale,[41] the costs and benefits of introducing new and innovative forest products, the relationships between forest-related bioeconomy activities and employment, and the implications of changing demand for ecosystem services other than biomass.[42] Knowledge of recent developments in forestry and forest-based value chains and their applicability and scalability to national and regional bioeconomy contexts, particularly in relation to managing risks, remains limited.

IV. The bioeconomy for sustainable food and agriculture: update on FAO's work on the bioeconomy

37. FAO's bioeconomy activities are closely aligned with the goals of the Organization's Strategies and relevant Action Plans on Mainstreaming Biodiversity across Agricultural Sectors,[43] Climate Change,[44] Science and Innovation,[45] as well as Corporate Environmental Responsibility.[46]

38. Programme Priority Area BE2 calls for a bioeconomy that balances economic value and social welfare with environmental sustainability promoted through formulation and implementation of integrated evidence-based policies and practices in micro- and macroenvironments, using technological, organizational and social innovations.

39. FAO provides inputs on the bioeconomy to key multilateral environmental agreements, including the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement;[47] the Convention on Biological Diversity (CBD) and the Kunming-Montreal Global

[40] Wolfslehner, B et al. 2016. *Forest bioeconomy – a new scope for sustainability indicators*. European Forest Institute. Joensuu, Finland. https://doi.org/10.36333/fs04
[41] ECE/TIM/2023/8−FAO:EFC/2023/8
[42] Winkel, G., ed. 2017. *Towards a sustainable European forest-based bioeconomy – Assessment and the way forward*. What Science Can Tell Us 8. https://efi.int/sites/default/files/files/publication-bank/2018/efi_wsctu8_2017.pdf
[43] FAO. 2020. *FAO Strategy on Mainstreaming Biodiversity across Agricultural Sectors*. Rome. https://doi.org/10.4060/ca7722en
[44] FAO. 2022. *FAO Strategy on Climate Change 2022–2031*. Rome. https://www.fao.org/3/cc2274en/cc2274en.pdf
[45] FAO. 2022. *FAO Science and Innovation Strategy*. Rome. https://www.fao.org/3/cc2273en/cc2273en.pdf
[46] FAO. 2021. *FAO Corporate Environmental Responsibility Strategy 2020–2030*. Rome. https://doi.org/10.4060/cb4218en
[47] Gomez San Juan, M., Harnett, S. & Albinelli, I. 2022. *Sustainable and circular bioeconomy in the climate agenda: Opportunities to transform agrifood systems*. Rome, FAO. https://doi.org/10.4060/cc2668en

Biodiversity Framework;[48] the United Nations Convention on Combating Desertification (UNCCD), the Global Framework on Chemicals, and the ongoing negotiations on the international legally binding instrument on plastic pollution, including in the marine environment, among others.

40. FAO seeks to promote bioeconomy innovations to support food security, rural livelihoods, Indigenous Peoples' rights, gender and youth empowerment, climate action, and biodiversity and ecosystem restoration. To help achieve this aim, FAO provides technical support to Members on the bioeconomy to guide policymakers in establishing strategies, action plans and programmes. By applying a set of ten aspirational principles and 24 criteria to assess benefits and trade-offs, FAO supports countries in developing a bioeconomy in a sustainable way.[49]

41. As of March 2024, supported both by core activities and by donor contributions, FAO is engaged in about 150 bioeconomy-related projects associated with the PPA BE2 worth almost USD 350 million. The bioeconomy approach across FAO mostly focuses on supporting the transition to a better environment through efficient and knowledge-based natural resources management, pollution reduction, value addition and waste upcycling. FAO's work on the bioeconomy also contributes to socioeconomic benefits, including income addition and diversification, rural development, and inclusion of vulnerable groups.

42. FAO's Forestry Division spearheads a broad range of actions related to the forest-based bioeconomy, namely, policy advisory work, capacity development, partnerships, and knowledge development and exchange.

43. Over the last biennium, FAO concentrated its efforts on enhancing the forest-related bioeconomy through capacity building in Africa, Latin America and the Caribbean, and Asia and the Pacific regions. These efforts aimed to accelerate the adoption of forest-based innovations, strengthen sustainable forest-based value chain development, and foster public–private partnerships. Stakeholder exchanges and policy dialogues were organized to address opportunities and challenges in the forest-based bioeconomy, focusing on sustainable production, utilization of forest products and livelihood improvements. FAO also conducted evidence-based assessments to guide countries, regions and institutions on integrating forests and forestry into sustainable bioeconomy transformations and promoting innovations for resource efficiency and value addition in forest products.

44. FAO facilitated partnerships with the private sector, for example through the FAO Advisory Committee on Sustainable Forest-based Industries (ACSFI), to promote a forest-based bioeconomy and the restoration of productive ecosystems. The ACSFI strategic framework 2020–2030 aims to position the forest sector in the bioeconomy by "identifying and disseminating good practices as well as related capacity building to support the development of innovative forest product value chains in the forest bioeconomy", and thus promote the SDGs.[50,51,52]

45. The Collaborative Partnerships on Forests (CPF) Joint Initiative, Sustainable Wood for a Sustainable World (SW4SW),[53] led by FAO and involving five other international organizations, aims to promote sustainable wood in the wider context of developing low-carbon bioeconomies. It focuses on generating evidence, supporting capacity building, sharing tangible experiences and fostering consensus among policymakers and stakeholders through knowledge exchange. The initiative worked with other FAO programmes such as the Forest and Landscape Restoration Mechanism and the Forest

[48] Gomez San Juan, M., Harnett, S. & Albinelli, I. 2022b. *Sustainable and circular bioeconomy in the biodiversity agenda: Opportunities to conserve and restore biodiversity in agrifood systems through bioeconomy practices*. Rome, FAO. https://doi.org/10.4060/cc3417en
[49] FAO. 2021. *Aspirational principles and criteria for a sustainable bioeconomy*. https://www.fao.org/3/cb3706en/cb3706en.pdf Rome
[50] FAO. 2021. *Advisory Committee on Sustainable Forest-based Industries. Strategic Framework 2020–2030.* Rome. https://openknowledge.fao.org/server/api/core/bitstreams/ad5ec555-0a68-4509-a1fe-c60afec2e8a8/content .
[51] FAO. 2021. *Building a forest-based bioeconomy to halt climate change and achieve multiple Sustainable Development Goals (SDGs): A statement from the ACSFI*. https://openknowledge.fao.org/handle/20.500.14283/cb7013en
[52] https://www.fao.org/forestry/statutory-bodies/advisory-committee-on-sustainable-forest-based-industries/en
[53] https://www.fao.org/collaborative-partnership-on-forests/initiatives/sustainable-wood-for-a-sustainable-world/en

and Farm Facility, as well as with other international organizations such as the Central African Forest Commission (COMIFAC) and UN-Habitat. Through the CPF Forest Communicators Network (FCN), FAO raised global awareness about the role of sustainable wood in green building, climate action and the bioeconomy, supporting innovative uses of sustainable wood in various sectors.

46. Numerous FAO publications focus on the application of the bioeconomy concept in specific forest-based industries, such as the joint publications by the UNECE FAO Forestry and Timber Section,[54] and "Forest products in the global bioeconomy" which provides a comprehensive overview of forest products and the bioeconomy.[55]

V. The way forward

47. From forestry, fisheries and aquaculture[56] to crop and animal production, to waste conversion and technological innovation, bioeconomy is a cross-cutting approach that promotes more efficient, inclusive, resilient and sustainable agrifood systems. With the agricultural subsectors sustainably providing renewable raw materials, bioeconomy solutions have the potential to contribute to sustainability efforts undertaken by other sectors beyond agriculture, including construction, textiles, pharmaceuticals, and many others, with positive benefits for livelihoods, human health, the climate and the environment.

48. FAO Members can unlock the potential of a bioeconomy, including the forest-based bioeconomy, to contribute substantively to achieving the SDGs and the 2030 Agenda. FAO has relevant technical expertise, knowledge products, operational capacities, networks, and access to finance to support Members in their efforts to enhance and scale up the role of forests, forestry and forest-based value chains in agrifood systems transformation and the bioeconomy.

49. However, unlocking the full potential of the bioeconomy will require considerably greater policy emphasis on using data, knowledge, science, technology, innovation, scaled-up capacity building and investments to adapt the sustainable management of forests and related value chains while addressing the need for equitable sharing of the benefits and social costs of forest-based bioeconomy initiatives.

50. During this biennium (2024–2025) of the PPA on "Bioeconomy for sustainable food and agriculture", FAO is building on the following elements that have stood out as success factors during this first biennium of implementation (2022–2023):

a. Strengthening integration of bioeconomy policies into national policies and improving general policy coherence, including for forestry. This includes enhancing the collection of bioeconomy-related data, focusing on biological resources and biomass availability and potential applications that support sustainability principles and criteria. Co-designing bioeconomy strategies, policies and programmes with local communities can support adopting a bottom-up approach to technology selection, and mainstreaming bioeconomy in other sectoral policies, including food systems transformation pathways.

b. Improving the knowledge base, reporting and consolidation of lessons learned. This includes empowering youth, women and Indigenous Peoples and other groups, as this can contribute to overcoming issues related to consumer acceptance and bioeconomy uptake by making bioeconomy value chains, including forest products, more accessible and common.

c. Empowering FAO Decentralized Offices to scale up bioeconomy solutions on the ground through continuous knowledge exchange, capacity building, and advisory, providing technical, policy, monitoring criteria and investment support. This entails increasing the number of projects working on the ground to deploy the bioeconomy, such as scaling up

[54] ECE/TIM/2023/8−FAO:EFC/2023/8

[55] Verkerk, P. H. et al 2022. *The role of forest products in the global bioeconomy – Enabling substitution by wood-based products and contributing to the Sustainable Development Goals*. Rome, FAO. https://doi.org/10.4060/cb7274en .

[56] Cai, J., Lovatelli, A., Aguilar-Manjarrez, J., Cornish, L., Dabbadie, L., Desrochers, A., Diffey, S. *et al.* 2021. *Seaweeds and microalgae: an overview for unlocking their potential in global aquaculture development*. FAO Fisheries and Aquaculture Circular, Vol. 1229. Rome, FAO. https://doi.org/10.4060/cb5670en

innovative ideas “from the lab to the market” by leveraging investments and enhancing coordination and synergy among bioeconomy projects, increasing technology transfer and South–South and triangular cooperation.

d. Within FAO’s portfolio, increasing public–private partnerships and synergies and collaboration across FAO’s Divisions and Offices, with impactful partnerships, relevant programmes and projects, including those submitted to vertical funds, PPAs, and the value-added impact areas (VAIAs).

e. Consolidating FAO’s role as a leading global convening body on the bioeconomy for sustainable food and agriculture through the inclusive consideration of diverse and regionally balanced perspectives in FAO’s normative, policy and scientific work on the bioeconomy. Global, national, and local partnerships dedicated to the bioeconomy are needed to improve cooperation among countries and among these three levels.