



Sustainable Land-Based Bioeconomy Development – Recent Scientific Insights and Research Gaps

European Bioeconomy Scientific Forum 2023 – Moving Towards the Transformation

Session 2: Identifying synergies for a holistic bioeconomy approach





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Sustainable Land - Based Bioeconomy Development

Guest Editors

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Special Issue

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Manuscript submission was open until end of March 2023 for the following thematic categories:



- Development of a bioeconomy concept;
- Economic perspectives of a land-based bioeconomy;
- Environmental concerns in a sustainable land-based bioeconomy;
- Socio-cultural aspects in sustainable land-based bioeconomy development;
- Transformational pathways for a knowledge-based sustainable bioeconomy development;
- Monitoring, assessment and reporting approaches for a land-based bioeconomy.

Some Stats

- 14 manuscripts submitted
- 11 papers published
- 3 rejections
- Open access
- Papers viewed by ~25 000
- Already 26 citations
- Regional focus on:
 - Europe
 - Romania
 - Germany
 - Slovakia
 - Brazil
 - Central & South America

Review

Bioeconomy—A Systematic Literature Review on Spatial Aspects and a Call for a New Research Agenda

Franz Grossauer ^{1,*} and Gernot Stoeglehner 


Review

Forest Bioeconomy in Brazil: Potential Innovative Products from the Forest Sector

Yasmin Imparato Maximo ^{1,*}, Mariana Hassegawa ¹, Pieter Johannes Verkerk ¹ and André Luiz Missio ^{2,3}



Article

The Role of the Social Licence to Operate in the Emerging Bioeconomy—A Case Study of Short-Rotation Coppice Poplar in Slovakia

Christine Pichler ¹, Daniela Fürtner ^{2,*}, Franziska Hesser ¹, Peter Schwarzbauer ² and Lea Maria Ranacher ¹





Article

Unlocking Romania's Forest-Based Bioeconomy Potential: Knowledge-Action-Gaps and the Way Forward

Alexandru Giurca ^{1,*}, Liviu Nichiforel ², Petru Tudor Stăncioiu ³, Marian Drăgoi ² and Daniel-Paul Dima ⁴




Article

A Collaborative, Systems Approach for the Development of Biomass-Based Value Webs: The Case of the Acrocomia Palm

Ricardo Vargas-Carpintero ¹, Thomas Hilger ^{2,*}, Karen Tiede ³, Carolin Callenius ³, Johannes Mössinger ⁴, Roney Fraga Souza ⁵, Juan Carlos Barroso Armas ², Frank Rasche ² and Iris Lewandowski ¹

Article

Navigating the Biocosmos: Cornerstones of a Bioeconomic Utopia

Wolfgang Onyeali ^{1,*}, Michael P. Schlaile ^{2,3,4,5,6,*} and Bastian Winkler ⁷



Background of the authors

- Forest Sciences (22)
- Economic Sciences (10)
- Agricultural Sciences (3)
- Spatial Planning (2)
- Environmental System Sciences (2)
- Political Sciences (1)

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→24 male



Article

Embracing the Non-Wood Forest Products Potential for Bioeconomy—Analysis of Innovation Cases across Europe

Gerhard Weiss ^{1,2}, Alice Ludvig ^{1,2,3} and Ivana Živojinović ^{1,2,3,*}

Article

Implementing Circular-Bioeconomy Principles across Two Value Chains of the Wood-Based Sector: A Conceptual Approach

Filip Aggestam ^{1,*} and Alexandru Giurca ²

Article

Ex-Ante Eco-Efficiency Assessment of Dendromass Production: Conception and Experiences of an Innovation Project

Franziska Hesser ^{1,*}, Daniela Groß-Fürtner ², Leona Woitsch ¹ and Claudia Mair-Bauernfeind ³

Article

Wood-Based Products in the Circular Bioeconomy: Status and Opportunities towards Environmental Sustainability

Mariana Hassegawa ^{*}, Jo Van Brusselen , Mathias Cramm and Pieter Johannes Verkerk

Article

Bioeconomy Innovation Networks in Urban Regions: The Case of Stuttgart

Lea F. Stöber ^{1,*}, Marius Boesino ², Andreas Pyka ¹ and Franziska Schuenemann ²

Development of a bioeconomy concept

- *Pichler et al.* contributed to the need for a measurement framework for the **Social License to Operate** - which is the relationship between industries, their communities, and other stakeholders - by adapting a quantitative model originating from the mining industry to **short-rotation coppice** operations.
- *Vargas et al.* developed an integral palm (*Acrocomia*) **biomass-based value web concept** which is an **extension of the value chain concept** and promotes the understanding of complexity. They stress that there are **no 'one-size-fits-all' solutions** for the development of value webs.
- The analysis of *Aggestam & Giurca* showed that the implementation of circularity is complex and requires **tailored approaches** across wood-based value chains and that a concise and universally adopted conceptualisation of the circular bioeconomy for value chains of the wood-based sector is still missing.
- *Onyeali et al.* introduce the **cornerstones of a bioeconomic utopia** and propose a bioeconomy based on human needs with the household as the basic unit.

Economic perspectives of a land-based bioeconomy

- *Hesser et al.* stressed that the **eco-efficiency approach** to assess dendromass production is useful to support R&D in identifying optimized use of a resource to obtain **high economic output with low environmental impact**.
- *Stöber et al.* explored that seeing the participation in a bioeconomic research project as a form of innovation activity, the **bioeconomy is economically relevant** for a surprisingly wide range of regional industries.
- Analysing two value chains of the wood-based sector, the results of *Aggestam & Giurca* confirm that **circularity does not guarantee economic viability** for the wood-based sector.

Economic perspectives of a land-based bioeconomy cont.

- By analyzing existing innovation activities, *Weiss et al.* found that the **economic contribution of NWFPs' to the bioeconomy was unrecognised** by both policymakers and forestry practitioners and their production was rarely considered a forest management objective.
- *Maximo et al.* depict that the **bioplastic sector** which manufactures derivatives from cellulosic sugar, **shows significant economic potential**.
- To unlock Romania's forest-based bioeconomy potential *Giurca et al.* highlight that a **stronger emphasis on economic instruments** is needed **as an alternative** to the command-and-control instruments. This involves setting clear **compensation schemes** for biodiversity conservation, setting payments for ecosystem services.

Environmental concerns in a sustainable land-based bioeconomy



- *Grossauer & Stoeglehner* mention a **loss of landscape mosaics** and of **biodiversity** through intensification of crop production.
- In a systematic review of LCA literature on bio-based materials *Hassegawa et al.* found that bio-based products generally require **less energy**, but the production of bio-based materials might result in **higher environmental impacts** compared to their fossil- or mineral-based counterparts in the categories of **eutrophication and stratospheric ozone depletion. Biodiversity is still overlooked in LCA studies.**
- *Maximo et al.* mention that **engineered wood products** are responsible for climate change impacts in the production stage due to the production of lumber and energy consumption during wood drying, especially when fossil fuels are used. However, the use of engineered wood elements for long periods can **offset the GHG emissions** due to carbon storage.
- *Aggestam & Giurca* stress that circularity and material efficiency **can only go as far as** wood and the natural systems' **regenerative capacity** allows. SFM may be important to safeguard ecosystem services and ensure the long-term provision of wood sustainably.
- Both *Hesser et al.* and *Pichler et al.* present that forestry on its own cannot sustainably satisfy the demand for woody biomass. Short-rotation coppice represents a possible alternative production system where fast-growing tree species are cultivated on agricultural land and gained relevance **to ease the pressure of demand for wood from forests.**

Socio-cultural aspects in sustainable land-based bioeconomy development

- *Weiss et al.* found that innovative processes for marketing non-wood forest products **support the sustainable regional development of cultural landscapes** (e.g. “Nature Park Specialties”).
- Society does not consider wood unconditionally sustainable anymore. With the Social License to Operate (SLO) *Pichler et al.* describes the dynamic relationship between bioeconomic industries, their communities, and other stakeholders. The study adapted a quantitative SLO model based on integrative socio-psychological relationship modelling and for the first time applied it to short-rotation coppice-based value chains. **The SLO model revealed the perception of individual benefits as the strongest predictor for social acceptance of bioeconomic development.**
- *Vargas-Carpintero et al.* recommend that institutional arrangements should be implemented to foster the **inclusion of local farmers and smallholders** in biomass-based value chains and webs and promote their economic viability. Examples provided are the ‘Minimum Price Guarantee Policy for Sociobiodiversity Products’, the ‘Social Fuel Stamp’, and the National Program for Smallholders Strengthening in Brazil.

Transformational pathways for a knowledge-based sustainable bioeconomy development



- Stöber et al. stressed that for a successful transformation towards a sustainable bioeconomy, **cooperative knowledge creation leading to innovations through research** at the company and academic level are important. Urban regions are the centre of economic and research activities. They applied social network analysis in an urban region to shed light on the dynamics of innovation networks of regional universities, research institutes and firms to **enable the translation of new knowledge into innovation and business opportunities to support the transformation of the urban region.**
- By providing an overview of concrete examples of selected NWFP-related innovations in Europe that may have an opportunity **to scale up in future alongside a wider transformation process**, *Weiss et al.* illustrate in which way NWFPs can contribute to the European bioeconomy.
- *Giurca et al.* found that Romania's forest sector can be **at the heart of a sustainable circular-bioeconomy transition.** To enable a successful circular-bioeconomy transition, several **top-down and bottom-up** initiatives are needed next to financial support.

Monitoring, assessment and reporting approaches for a land-based bioeconomy

- Several authors mentioned that there is a need to **initiate and improve data collection** on bioeconomy related aspects to face the lack of data and information **for evidence-based decision-making**.

Research Gaps

- *Aggestam & Giurca* found that **circular principles are not yet understood** nor applied equally across the wood-based sector. To analyse circularity, more work is needed to develop applicable conceptual frameworks to measure circularity at both the policy (macro) and enterprise (micro) levels to serve information needs of the scientific community, policymakers, and industry.
- *Weiss et al.* resulted that there is a pronounced neglect of the institutional system towards non-wood forest products, resulting in a **lack of statistics**.
- *Stöber et al.* recommend to perform similar social network analysis across different urban regions **to uncover differences in terms of bioeconomy innovation networks** due to regional prerequisites.
- *Hasegawa et al.* found that while there are benefits associated with the substitution of non-renewable materials by wood-based products, there is still **limited understanding of the substitution effects** at market-, country- and global level. Other **environmental impacts are not well understood**, future research could contribute here.

Future research agenda

Grossauer & Stoeglehner investigated that spatial aspects are rarely discussed in scientific publications on the implementation of a bioeconomy. Therefore a future research agenda should focus on:

- Land use conflicts and approaches to reduce land take.
- A toolbox offering different methods for the protection of fertile land.
- Options for controlling intensification in agriculture by using spatial planning as well as landscape and nature conservation instruments.
- Impacts of the transition to a bioeconomy on biodiversity and ecosystem services.
- The use of strategic environmental assessment and environmental impact assessment to integrate policies to reduce and adapt to climate change, biodiversity losses or the degradation of biologically productive land.
- How centralised or decentralised should a bioeconomy be?
- How to integrate regional effects and the socioeconomic impacts of BE implementation, in planning and governance processes including the development of new planning models and instruments.

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Thank you for your attention!

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