

Rural bioeconomies in Europe: Socio-ecological conflicts, marginalized people and practices

Bioeconomy policies claim to contribute to socio-ecological transformations and decreasing rural-urban inequalities.

Based on examples of four bioeconomies in rural Europe, we argue that contrary to these claims, such policies to date have not de-escalated existing social conflicts but instead have often further contributed to polarization tendencies. To live up to those proclaimed goals, bioeconomy research and policy need to deprioritize economic growth and turn to more comprehensive considerations of socio-ecological contexts and the integration of the local population and alternative practices.

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Many governments have issued policy and strategy papers promoting the bioeconomy as a promising approach to achieve both socio-ecological change in the direction of sustainability and economic growth, thereby contributing to multiple *Sustainable Development Goals (SDGs)*. However, the actual sustainability effects of bioeconomic developments remain uncertain and contested (Stark et al. 2022). Bioeconomy policies promise the large-scale substitution of fossil inputs by bio-based inputs, greater efficiency through principles of circularity and cascading use, and growth potentials resulting from the adoption of biotechnology in various sectors. Since rural regions produce the main share of biological resources, one of the associated claims is that bioeconomic transitions alleviate rural-urban inequalities, foster a “rural renaissance” (EC 2018, p. 23) of additional employment, innovation, and investments and increase competitiveness and welfare for rural regions.

As bioeconomy policies and strategies have been devised and discussed by a variety of actors from supranational bodies (European Union, Organisation for Economic Co-operation and Development) through governments and local authorities to economic and civic stakeholders, the notion itself is highly contested (Hausknost et al. 2017, Lühmann 2020). Concerning the boosting of primary production in rural areas, contestation revolves

around fundamental trade-offs, such as land-use conflicts or land grabbing (e.g., Ashukem 2020), biodiversity dilemmas (Otero et al. 2020), or increasing social inequalities (Backhouse et al. 2021).

In this article, we deploy a social science-based understanding of societal conflicts and socio-political contestation surrounding bioeconomy policies and their manifestations (see also Eversberg and Fritz 2022, Holmgren et al. 2020). We argue that pre-existing conflicts influence bioeconomic transitions and vice versa: inequalities and divergences surrounding the rural-urban divide, represented, for example, in the uneven geographical distribution of political participation (Haffert 2021), the perceived domination of rural populations by urban elites and feelings of “being left behind” (e.g., Deppisch et al. 2021, Plüschke-Altfo 2017), may well be exacerbated if not adequately addressed in the context of bioeconomy research and governance. We show that the socio-cultural and geographic complexity of these tensions, as well as their deep rootedness in mentalities and everyday practices, are thus far underestimated in the science-policy nexus of bioeconomic transformation processes.

For this purpose, it makes sense to distinguish between the *bioeconomy* (singular) as a policy concept on the one hand and specific local or regional *bioeconomies* (plural) on the other hand. The former is an abstract notion based on scientific categoriza-

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tions and used to discursively promote ideal models of a bio-based economic system derived from those to reach political and economic goals. The latter refers to the diversity of concrete, locally and regionally specific, historically constituted and socially embedded practices that precede such abstract concepts and that these concepts aim to influence and reorganize.

We base our argument on four examples of bioeconomies in rural Europe (Germany, Estonia, Spain, and Finland) that are changing under the influence of current bioeconomy policies. In all four, the politically prescribed pathways most closely resemble the type “boosting primary production” (Dietz et al. 2018). We show that this not only entails the risk of perpetuating or increasing environmental degradation (e. g., biodiversity, ground water) but also crowds out competing bioeconomic imaginations and creates discursive lock-ins. Rather than solving conflicts, the examples demonstrate that bioeconomic transitions and the accompanying changes in societal structures and social practices often aggravate existing disparities and tensions, sometimes creating entirely new ones. From these observations, we derive three mutually complementary arguments on how to enhance bioeconomy research and policy. In this way, we hope to both critically and productively contribute to the debate on different notions of the bioeconomy (Barben et al. 2021).

As long as bioeconomy research and policy adhere to the imaginaries of infinite growth and promise that it can be delivered on a “green” basis, they perpetuate an expansionary capitalist economic model, which can only exacerbate the current crises.

Dimensions of socio-ecological conflicts – empirical cases of bioeconomic change in rural Europe

Our examples comprise diverse agricultural bioeconomies in Germany, Estonia, and Spain, and a forest bioeconomy in Finland. Generally, these examples cover a range of complementary aspects that are illustrative of the diversity of bioeconomies (Hausknost et al. 2017) and their concrete varieties in rural Europe. At the same time, they describe two different types of relations between bioeconomy policies and bioeconomies. In Germany and Finland, bioeconomic practices are already strongly imbued with the growth logic of bioeconomy policies. This has led to protests in Germany and policies that aim to mediate between industry interests and sustainability objectives. In Finland, emerging protests against the alignment of bioeconomy policy with forest industry interests is currently marginalized. In contrast, bioeconomies in Estonia and Spain present examples in which local bioeconomies conflict with policies of growth. In Spain, bioeconomy growth policies conflict with local and bio-based traditions of olive cultivation, and in Estonia, local, bio-based, semi-subsistence practices are neglected and thus deval-

ued by bioeconomy policies, thereby peripheralizing local traditions and minorities.

In general, the schemes, strategies and technological changes promoted by bioeconomy policies, normally strongly imbued with a capitalist and expansionist logic, a reliance on technology-centered innovation paradigms, and an image of the bioeconomy as a motor of green growth (e. g., Giampietro 2019), collide with the local traditions and socio-ecological arrangements characteristic of these four bioeconomies. This results in new environmental issues and social conflicts, favors socio-ecological problem shifting, and marginalizes long-established sustainable bio-based practices. In this section, we briefly sketch how these socio-ecological conflicts play out in our four examples.

Germany: Perpetuation of unsustainable practices and telecoupling of socio-ecological conflicts

Manure-based bioeconomic innovations are an example of the German bioeconomic transition, which focuses on substituting fossil fuels with renewables and waste recycling. Manure-based innovations (e. g., cultivation of insects, bioenergy, and fertilizer production) are cited as a response to issues in regions with intensive livestock farming and high manure surpluses (Friedrich et al. 2021, Friedrich et al. 2022 b). These surpluses have

resulted in a range of socio-ecological conflicts: the eutrophication of water bodies and the consequent loss of biodiversity; the restricted use of bathing water; or emissions from fields that affect locals through odor. Our empirical research on this topic shows that current innovations follow profit- and competition-oriented motives (Friedrich et al. 2022 b). This results in the marginalization of alternative ideas and approaches to manure surplus that go beyond a mere technological fix. This bioeconomic example shows a shift in conflicts as 1. bioeconomic imaginations of green growth are at odds with agricultural actors arguing for the preservation of the status quo and non-governmental organizations actors calling for systemic change (for details see Friedrich et al. 2022 a). 2. While innovations may contribute to solving conflicts locally by reducing manure surplus, there is a global dependency that could perpetuate socio-ecological conflicts in telecoupled regions (e. g., South America), where agricultural inputs (e. g., soy) are produced (Friedrich et al. 2021).

Estonia: Marginalization of small-scale bioeconomic practices and practitioners

Eastern Estonia provides a prime example for the peripheralization of bio-based practices that follow the principles of sufficien-

cy and agroecology by dominant growth- and efficiency-centered policies. Semi-subsistence agriculture (or food self-provisioning) is a widespread and vivid practice (Pungas 2019), particularly among the ethnic Russian minority living on the Eastern border in a deindustrialized rural area suffering from rural drain. Our case reveals that food self-provisioning practices (and gardeners themselves) experience manifold peripheralization as they are pushed outward along both the urban-rural and east-west divides (Pungas et al. 2022). Therefore, food self-provisioning is perceived or labeled as an inefficient and backward form of agriculture or as a mere niche practice and is devalued through this narrative. At the same time, the planned phasing out of the local oil shale industry turns the region ever more into an economic backwater, creating feelings of loss and fueling political distrust (Michelson et al. 2020). Although the local food self-provisioning bioeconomy could be a positive role model for participatory bottom-up bioeconomic transformations, it is “invisibilized” and denied any mention in bioeconomy strategy papers, as it does not comply with the dominant ideas and interests of respective (national) stakeholders (Pungas 2023). This contributes to a further symbolic devaluation of this culturally meaningful agricultural phenomenon, adding to socioeconomic and ethnic polarization.

Spain: Creation and aggravation of socio-ecological conflicts

The olive sector is the dominant industry in the Spanish province of Jaén, Andalucía. Beyond olives, the industry produces vast amounts of biomass that have been used mostly in a circular way as fertilizer for existing groves or to generate heat and electricity for olive oil production (Koch 2021). Much of the cultivation takes place in so-called traditional groves with low tree density and little irrigation. The *Andalusian Bioeconomy Strategy* aims at intensifying refinement and increasing the production of biomass for industrial use¹ and accords the olive sector, the region's largest biomass producer, with a key role in this. The increase in output envisioned by the strategy, however, by implication requires further intensification of olive cultivation. As the region is already suffering from water scarcity exacerbated by the drilling of illegal wells that continuously drain the aquifer, the prospect of aggravating socio-ecological conflicts surrounding the use of water is looming (e.g., Contreras 2019). More intensive cultivation requires increasing mechanization, which may lead to habitat fragmentation for birds and other wildlife². A bioeconomy focused on the industrial refinement of biomass, thus demanding a steady increase in productivity, not only entails ecological damage but also breaks mentalities and livelihoods by integrating them into a system of perpetual economic growth, which would greatly disrupt social structures of local, circular olive production that in one form or another have existed for centuries.

Finland: Forest-based green growth promises endanger the socio-ecological foundation

The Finnish forest-based bioeconomy demonstrates how currently dominant bioeconomy policies are trapped in a (green) growth narrative, which counteracts any transformative potential and constitutes a textbook example of this current model, its dilemmas, and hidden conflicts (Eversberg et al. 2023). Finland is the most densely forested country in Europe, and its forest industry is a major economic actor with significant political influence (Kröger and Raitio 2017), high investments in technological innovations (Velasco-Fernández et al. 2018), and a deep rootedness within the population (Mustalahti 2018). In this bioeconomy, dominant practices, habits, and mentalities are based on an instrumental economic relationship with nature. Viewing forests as “natural capital” – an abstract resource to calculate with and sell for profit – is rarely challenged, as forest ownership is widely distributed and most of the population profits from it. At the same time, emotional attachment to forests as a “natural heritage” is a widespread phenomenon (Eversberg et al. 2022). Due to this widespread tacit agreement, socio-ecological conflicts primarily revolve around road safety and pollution from increased truck traffic, investments in infrastructure projects, which prioritize business interests over the needs of the local population, and increasingly blatant clear-cutting in proximity to rural settlements. In the practice prevailing here, forests are treated mainly as a mere economic resource, threatening biodiversity and keeping rural development trapped in unsustainable path dependency.

Socio-ecological conflicts in rural bioeconomies: Three aspects of future research and policy

From these four example bioeconomies and the conflicts observed around them, we deduce three conclusions in the form of recommendations for what actors at the science-policy nexus must address. We argue that bioeconomy policies tend to 1. spark new or escalate existing socio-ecological conflicts and 2. marginalize rural people, their practices and civil society actors. Therefore, we see 3. the need for science and policy to focus on the intersections of already existing and newly emerging conflicts through an empirical focus on existing socio-ecological conflict lines and transdisciplinary projects.

Current bioeconomy policies create, escalate, or realign conflicts in rural Europe

The examples given above show that bioeconomy policies and interventions often create new socio-ecological conflicts or exacerbate existing socio-ecological conflicts in rural Europe. This may be due to pressure for the further intensification of agricul-

1 www.juntadeandalucia.es/organismos/agriculturapescaaguaydesarrollorural/areas/politica-agraria-comun/desarrollo-rural/paginas/estrategia-andaluza-bioeconomia.html
2 www.diariocordoba.com/agricultura-medio-ambiente/2022/05/20/estudio-demuestra-olivar-intensivo-afecta-66321340.html

tural and forestry production (Finland and Spain), the perpetuation of unsustainable production systems by bioeconomic innovations (Germany), or a lack of appreciation for existing, sustainable small-scale alternative bioeconomies (Estonia). In the Finnish example, the growth constraints of the industry lead to intensified industrial clear-cutting, endangering the material basis of sustainable forest management and use. In Andalucía, increasing biomass production is bound to aggravate water scarcity, further threaten biodiversity, and destroy relatively sustainable existing practices. The German example demonstrates the externalization of socio-ecological conflicts: the supposed solutions for local manure problems are purely technological and limited to the regional problem level, lack a systemic perspective and, as a result, ignore the negative impacts of industrial agriculture in peripheral world regions (Backhouse et al. 2021). Our examples therefore support Lühmann's (2020) observations on the EU policy level: even though strategy papers' rhetoric has moved toward a greater emphasis on sustainability, actual practices and political interventions are often trapped in "business as usual"³. Increasing the use of bio-based resources without changing modes of living, consumption patterns and diets will most likely increase land use and further industrialize agriculture through extractivist practices (Tittor 2021). As a consequence, existing socio-ecological conflicts may intensify or be transferred to other geographies, economies, and communities.

2 Bioeconomy policies marginalize rural people and their practices

In their current form, bioeconomy policies continue to prefer and prioritize the so-called innovative modernization (and thus perpetuation) of unsustainable production systems, such as those of German intensive livestock farming and Finnish forestry, while sidelining small-scale, non-monetized and sufficiency-oriented alternatives, such as FSP, making mere rhetorical concessions to approaches and voices from civil society that demand a more fundamental shift toward greater socio-ecological sustainability. This can overlap with and exacerbate already existing conflicts, for instance, between small and large landowners, low- and high-tech approaches, rural and urban actors, non-governmental organizations and techno-managerialist ideas. Dominant bioeconomy models are thus an example of existing discursive lock-ins and a neoliberal understanding of nature, which regards the non-human as a mere resource to which access can be restricted, whose output can be scaled, and whose value can be increased (Birch 2019). Simultaneously, the bioeconomy is a textbook example of the power asymmetries that prioritize capitalist growth strategies over (ecological) sustainability objectives and lead to structurally insufficient "transition" policies. The marginalization of rural people and alternative practices may result in frustration and

lead to the further polarization of already existing divisions. One result of these developments can be seen in election results that demonstrate persisting ethnic, sociocultural, and/or urban-rural divides, as in Estonia (Plüschke-Altorf 2017) and Germany (Depisch et al. 2021). Since rural areas provide most of the land required for bio-based production, the concerns of rural communities⁴ should be at the center of sustainability-oriented bioeconomic transformation processes. Despite resistance by rural actors against sustainability transitions in rural areas (e.g., in the context of energy or agricultural transitions), without their integration, further discursive lock-ins are likely to emerge, leading to further delays in urgent transformations.

3 Bioeconomy research and policy need to focus on existing socio-ecological conflict lines and alternative, pluralistic innovation approaches that integrate the perspectives of marginalized actors and enable small-scale circular bioeconomic practices

We argue that 1. the creation, aggravation or shifting of socio-ecological conflicts and 2. the marginalization of alternative perspectives within prevailing bioeconomy policies overlap with existing divisions within rural and between rural and urban communities. In an attempt to reconsider these conflicts as potential enablers rather than barriers to genuine change, we call for an empirically grounded research program with two foci: on the one hand, empirical social science research on socio-ecological mentalities and practices that investigates the social impact of bioeconomy policies in rural bioeconomies and the broader contexts in which they are embedded (see Eversberg et al. 2022). On the other hand, there is transdisciplinary, sustainability-oriented innovation design in the bioeconomy. Currently, bioeconomic innovations are prevalently driven by established actors following classical innovation paradigms. These bioeconomic innovations often lead to incremental rather than transformative change. Thus, new innovation approaches are needed that prioritize ecological sustainability and the common good of rural areas. In this context, we see great possibilities and opportunities for transdisciplinary but also transformative processes, for example, in the form of real-world labs to be addressed by bioeconomy research and policy. Only by placing these two empirical approaches at the center of bioeconomy research, policy development and implementation can conflicts – as drivers of change – be used productively. Accordingly, this would further a better understanding of how the differences and divergences of "social relationships with nature" (Eversberg et al. 2022) as evidenced by conflicts around bioeconomic transitions are indicative of deeper socio-structural conflicts and open up possibilities for rethinking these as part of a critical and constructive discourse on socio-ecological transformations (see also Barben et al. 2021).

3 This is also demonstrated in the German *National Bioeconomy Strategy*, which only includes already existing innovation policies and does not imply any new policies for innovation management (see Bogner and Dahlke 2022).

4 In this respect, we want to note that an integration does not imply to not continuously question fossil mentalities that are no less present among rural populations as they are elsewhere (see Eversberg and Fritz 2022).

Conclusion

In this article, we have shown that current bioeconomy developments in rural Europe do not necessarily bring the promised beneficial development opportunities but can also create new or exacerbate existing socio-ecological conflicts. We have argued that genuinely sustainable and inclusive transformations to a post-fossil economy require a much stronger role for currently marginalized practices that are at odds with the dominant growth-focused policy models; moreover, this requires a shift in the focus of bioeconomy research to transdisciplinary and empirical investigations of conflicts at the level of socio-ecological mentalities and practices. In neither bioeconomic transition management nor most bioeconomy scholarship have these aspects played a central role thus far. Most research, such as the funding policies it depends on, remains trapped in a path dependency set by the promises of ecological modernization and green growth. This trap blocks the necessary shift in attention and political support toward existing practices and ideas that can actually contribute to solutions but that conflict with the practices, logics and structures imposed and expected within the dominant visions. As long as bioeconomy research and policy adhere to the imaginaries of infinite growth and promise that it can be delivered on a “green” basis, they perpetuate an expansionary capitalist economic model, which can only exacerbate the current crises. Any concept of bioeconomy that could offer actual alternatives needs to start out from the realities of actually existing sustainable and socially embedded bioeconomies and put front and center open, inclusive deliberation processes for how these could become part of the basis of just and non-destructive, globally generalizable modes of production and living.

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Nachhaltigkeit

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