RESEARCH PROJECT

GBR-ACT

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Green Biorefineries as Catalysts for Agroecological Transitions and Circular Value Chains

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Summary

Global agriculture faces biodiversity loss, soil degradation, water pollution, and economic instability, driven by input-intensive farming, monocultures, and reliance on chemical and imported inputs [1,2]. The EU Green Deal, Farm to Fork Strategy, and Biodiversity Strategy promote agroecological transitions that support climate neutrality, soil regeneration, and circular bioeconomy models, ensuring food security and economic viability [4,5,6].

Grasslands, covering 35% of EU agricultural land, provide significant ecological benefits, including biodiversity conservation, soil carbon sequestration, and climate mitigation. However, their utilization and expansion has been limited by economic constraints. GBRs address this by enabling cascade utilization of bioresources by converting grass and grass-legume mixtures into protein for feed and food applications, while utilizing side streams for bioenergy, biofertilizers, and bio-composites production, creating market incentives for farmers to integrate grass cultivation to diversify farming systems. The protein from GBRs replace imported soybean meal, which is linked to deforestation in origin countries.

GBRs offer a transformative solution by integrating agroecological principles into value chains, valorizing underutilized grasslands, and creating circular bioeconomy opportunities. By linking agriculture with feed, food, bio-materials, and biogas industries, GBRs optimize biomass utilization, reduce waste, and enhance resource efficiency. Their integration into agricultural value chains enables:

- Economic Viability – Creating new revenue streams, making grass-based systems profitable.
- Agroecological Transformation – Encouraging sustainable farming practices by reducing dependency on synthetic inputs andmonocultures.

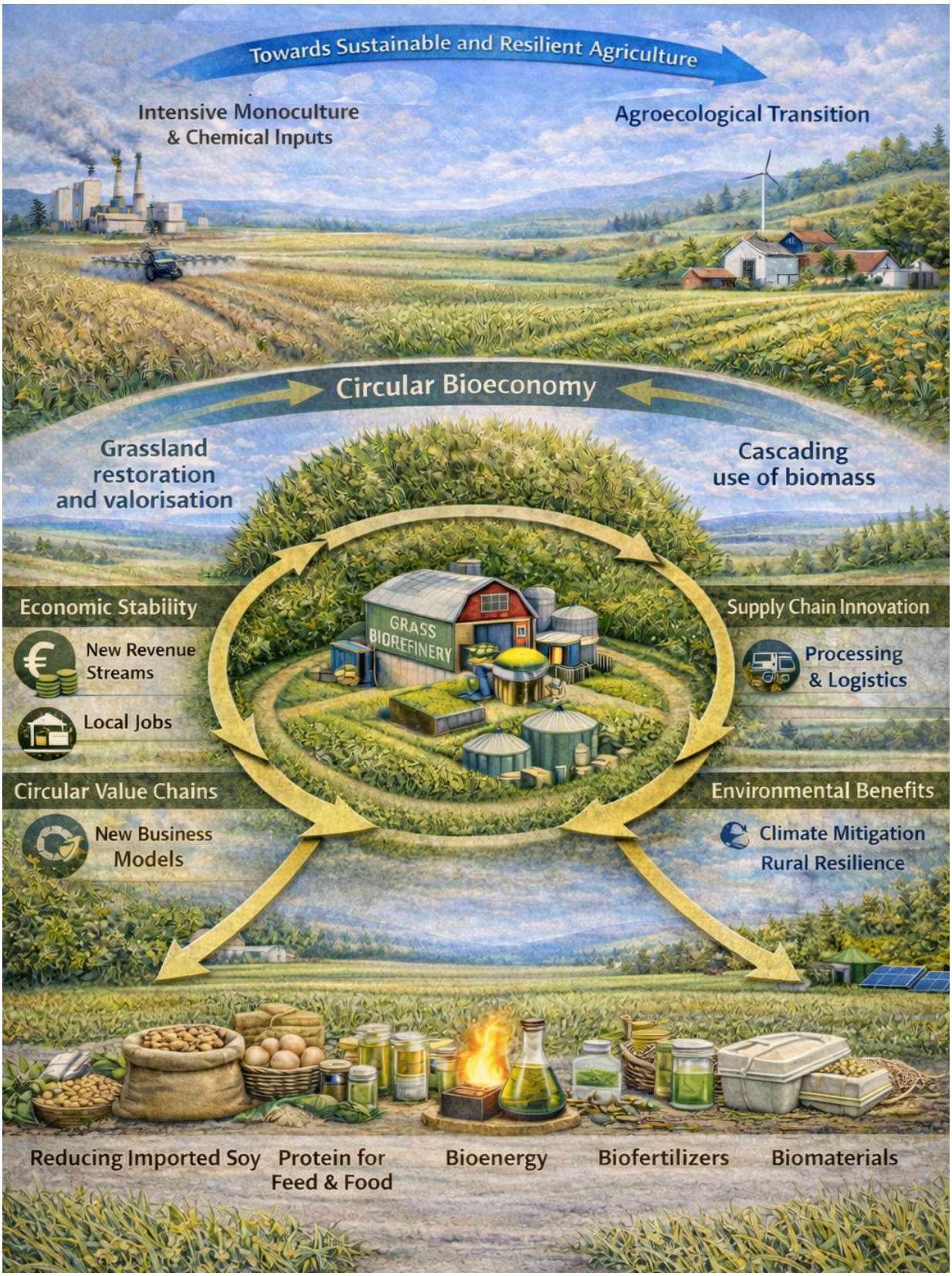
- Supply Chain Innovation – Enhancing logistics, processing, and market integration for grass-based products.
- Multifunctional Benefits – Supporting ecosystem services, circularity, and rural economic resilience.

This project creates a development platform for GBRs to accelerate agroecological

develop sustainable business models, assess feasibility, replicability and environmental impacts of produced solutions, and create deployment strategies for widespread GBR adoption.

Recognizing Europe's diverse agricultural, regulatory, and market conditions, the project follows a transnational collaboration model. Localized assessments and tailored strategies will inform a shared roadmap, ensuring scalability while adapting to national frameworks. By integrating insights from six countries, the project will develop actionable recommendations for optimizing production, improving sustainability, and promoting widespread adoption across the EU.

Building on previous GBR research, this project shifts the focus from lab-scale and pilot demonstrations to deployment strategies. It proactively explores the future role of GBRs in EU agriculture and industrial landscapes, designing tailored business models and market strategies that address uncertainties while leveraging GBRs' potential as a key enabler of agroecological transitions and the circular bioeconomy.



GBR-ACT illustration. Source: Sebnem Yilmaz Balaman

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