

Diverse Decision Space of Sourcing Agricultural Bioenergy without Land Use

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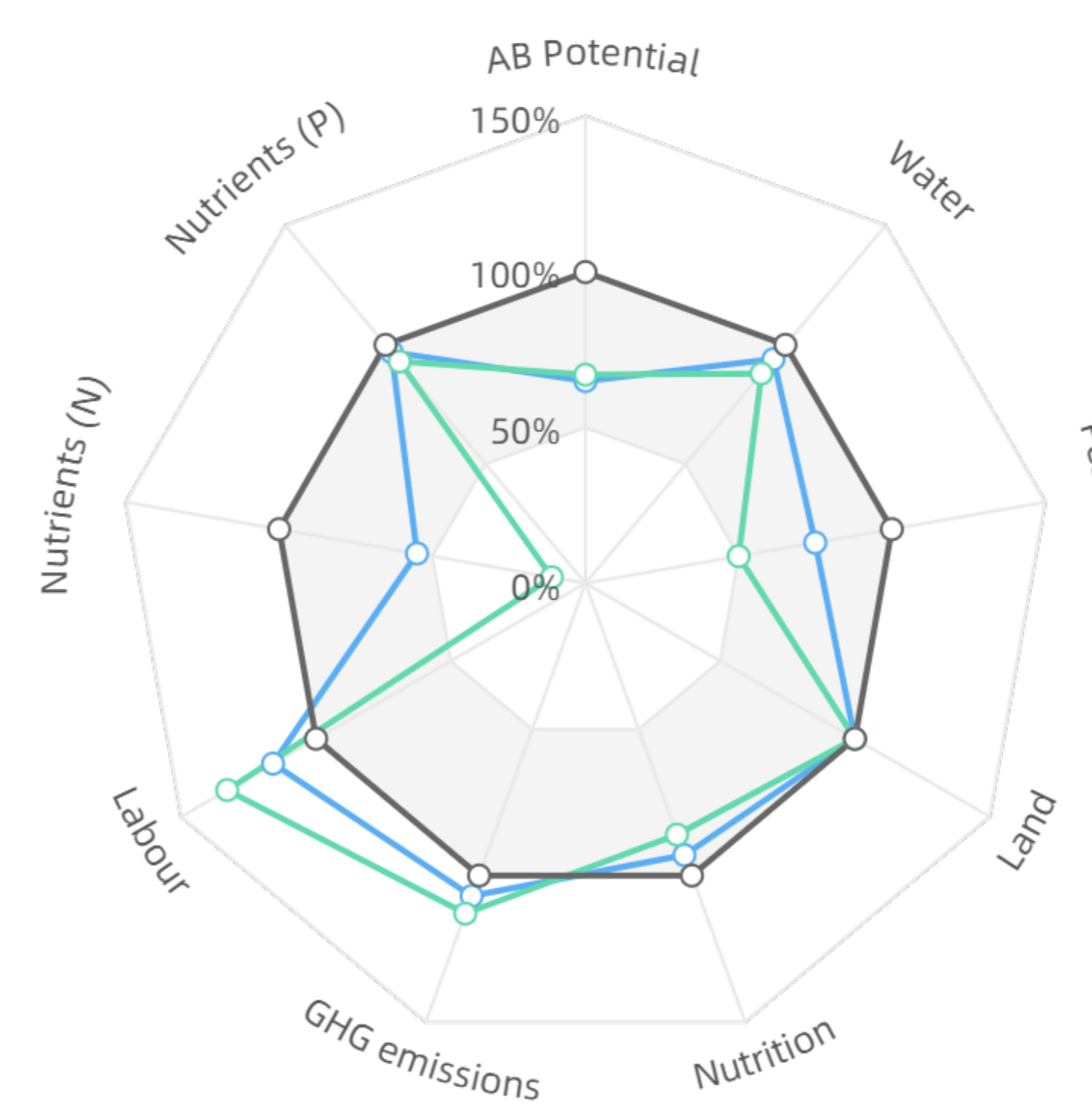
1 Introduction

What is Land-Free Ancillary Bioenergy (AB)?
 Energy from non-dedicated biomass, i.e., residues and by/coproducts of little or no value, **without land-use conflicts or food competition!**¹



Fig. Definition of ancillary biomass compared to the current sustainable biomass

2.3 Similar biomass potential can cause very different environmental impacts³ (Decision space 2)



Major difference:

- Nutrients insufficiency
- Pesticide
- Labour

Fig. Comparing the environmental impacts of scenarios providing the similar potential of ancillary bioenergy

2 Results

2.1 Future Potential of Ancillary Bioenergy in Europe and Its Spatial Pattern² (Open datasets available⁴)

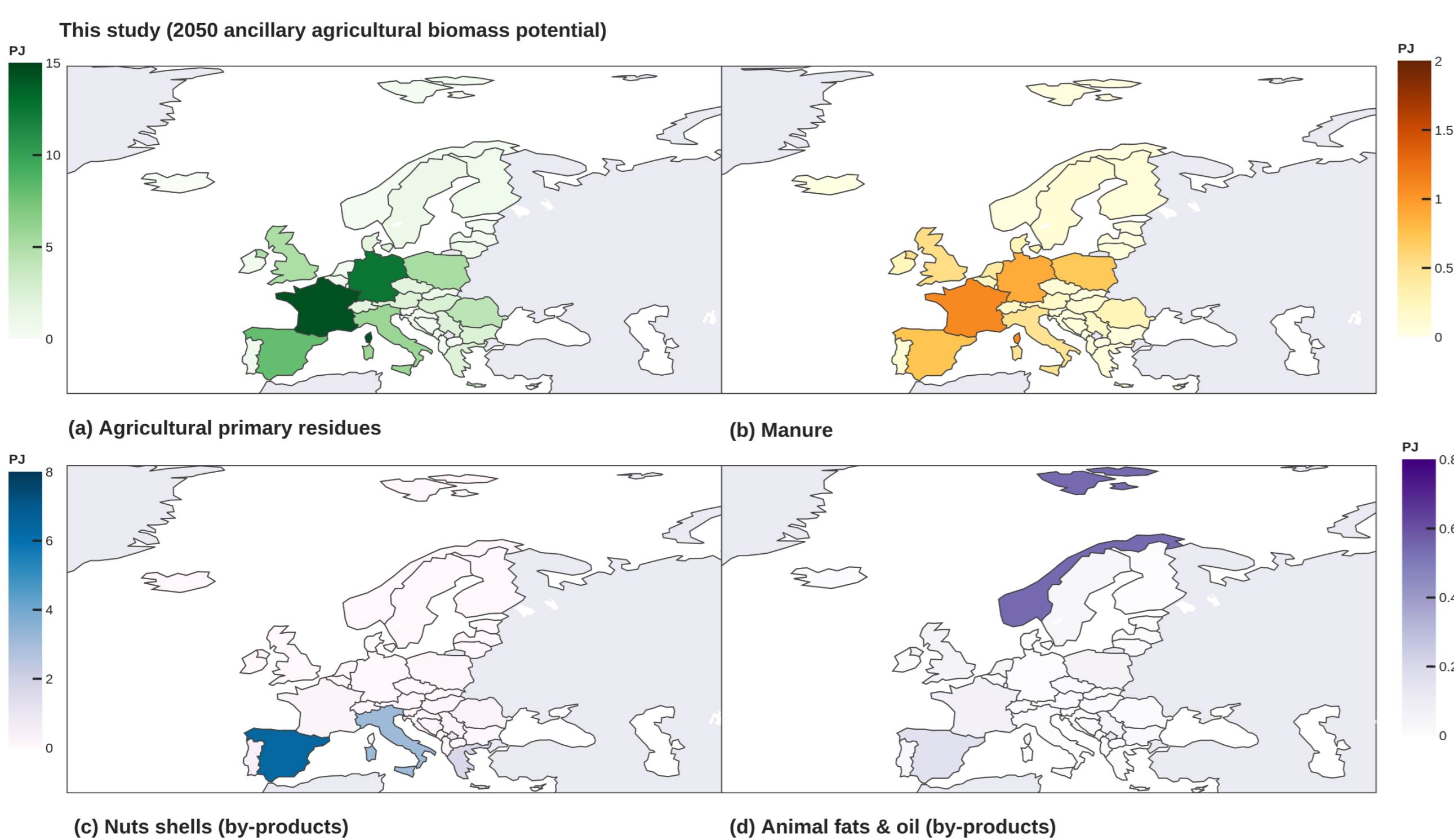


Fig. Spatial distribution of the 2050 potential of ancillary biomass in Europe, which is 3-6 times lower than other modelling estimates including dedicated biomass

5 Take-home Messages

- There is a **limited future potential for land-free ancillary bioenergy** in Europe (2394-10,342 PJ, which is 3-6 times lower than other estimates including dedicated biomass)
- We explore a decision space of sourcing the **similar potential** of land-free ancillary bioenergy under **different policies, thus different environmental impacts**
- Insufficient nutrients can be one major constraint of utilizing land-free bioenergy

2.2 Varied mixes of agricultural practices can lead to the similar ancillary biomass potential³ (Decision space 1)

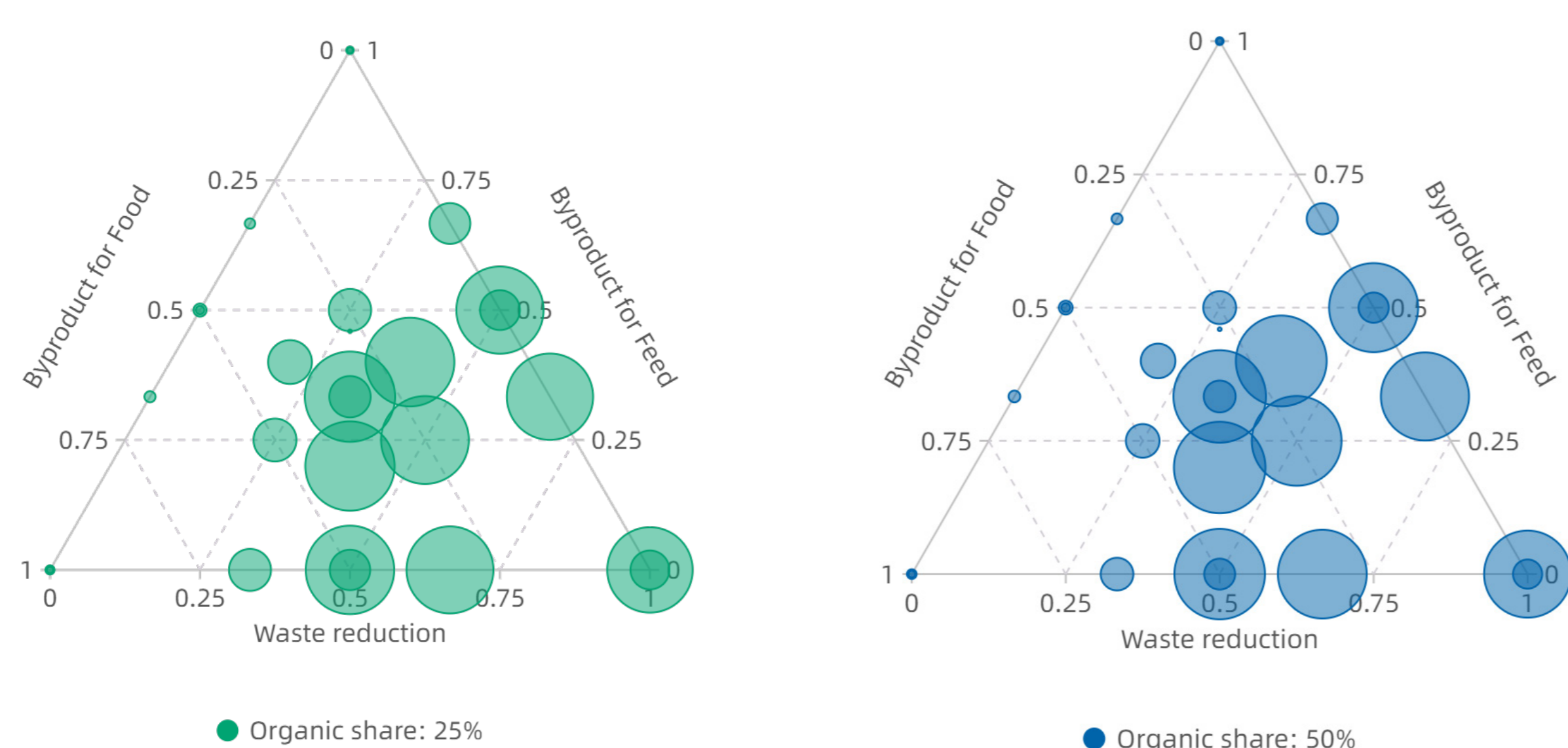


Fig. Similar ranges of biomass potential (the size of bubbles) from 25% and 50% organic agricultural scenarios when changing agricultural practices (i.e., waste reduction, byproducts for food/feed)

References (All open-access & open-source)

1. Wu et al. (2022). Challenges and Opportunities for Bioenergy in Europe: National Deployment, Policy Support, and Possible Future Roles. *Biomass and Bioenergy* (Under Review)
2. Wu et al. (2022). Strategic uses for ancillary bioenergy in a carbon-neutral and fossil-free 2050 European energy system. *Environmental Research Letters* (Under Review)
3. Wu et al. (2023) Diverse decision space of sourcing agricultural bioenergy without Land Use (In Preparation)
4. <https://github.com/wwwuFei/AB-Euro-Calliope>

