

Towards carbon neutrality in Mediterranean landscapes: the role of sustainable land management

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Introduction and objectives

Almost a third of global anthropogenic greenhouse gas emissions come from food systems, mainly from crop and livestock production activities, which also drive biodiversity and soil degradation making agricultural systems more vulnerable to climate change. Agroecological practices that exploit and restore biodiversity can mitigate emissions while improving agroecosystem resilience to a changing climate.

This study i) evaluates the climate-mitigation potential of an agroecological transition in Mediterranean regions (here applied to the Sardinia region) and ii) provides a decision-making framework to implement mitigation actions, monitor carbon footprints, and track climate targets.

Materials and Methods

Cradle-to-gate life cycle assessment (LCA) of agricultural sector and scenario analysis

1 Quantifying the carbon footprint of the agricultural sector (including background processes) – Baseline scenario

Sources: national databases, local sources, International Panel on Climate Change (IPCC) guidelines (2006, 2019); International databases such as ECOINVENT V3.8 Database (2021); Literature

2 Exploring the climate change mitigation of an alternative, agroecology-driven scenario for the agricultural sector

Sources: Land use data; Literature; IPCC guidelines (2006, 2019)

$$\text{Mitigation}_{\text{practice}} (\text{t CO}_2\text{eq/year}) = \text{Surface area (ha)} \times \text{GHG reduction and/or soil/biomass sequestration rate (t CO}_2\text{eq/ha/year)}$$

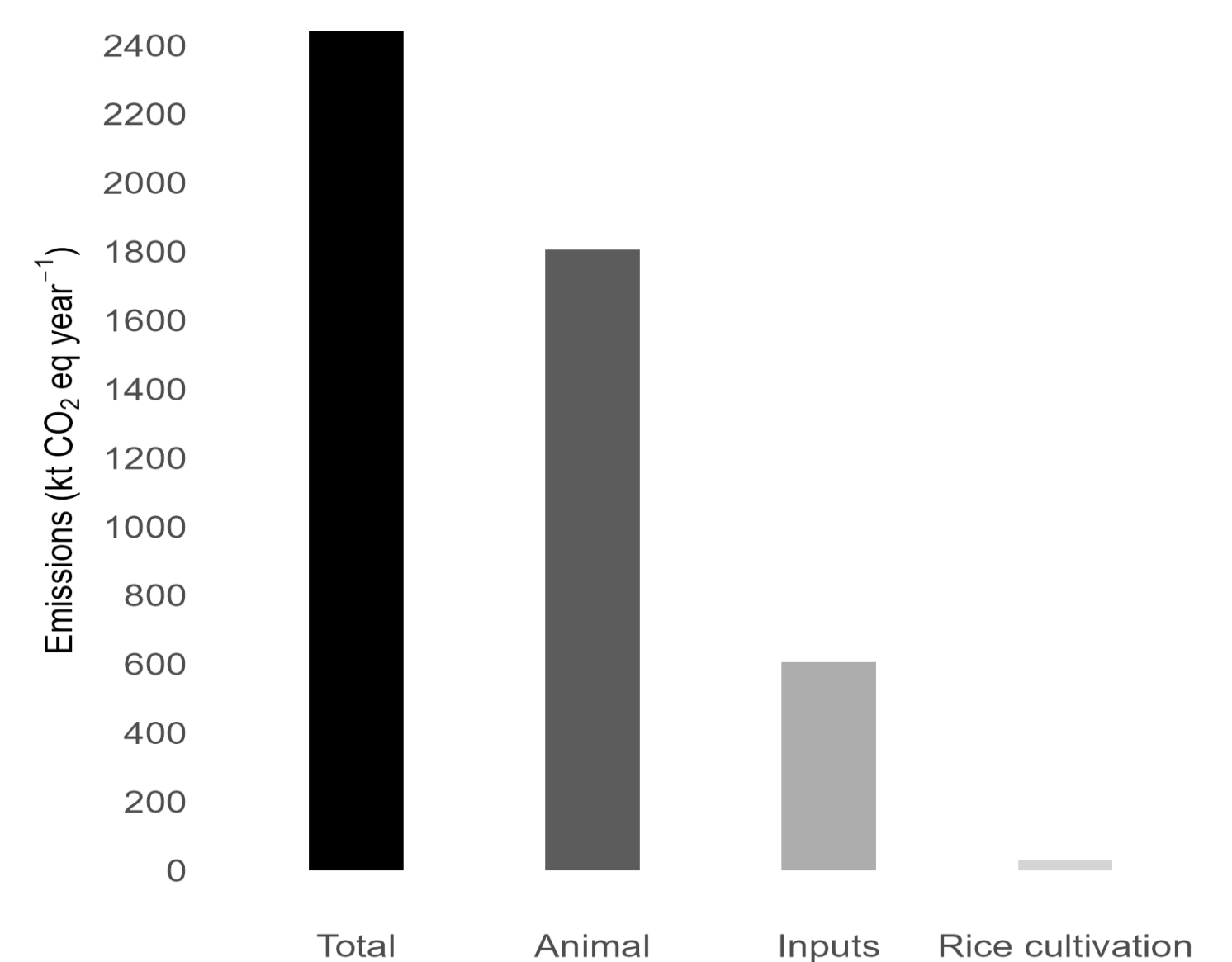
List of mitigation measures used for scenario analysis

Measures targeting animal emissions – diet		Tanniferous forages Oilseeds, oil, and byproducts
Agroecological landscapes	AGR	Cover crops
	AGR	Organic amendments
	AGR	Reduced tillage
	AGR	Legume-rich pastures
	AGR	Alternative water management of rice
	AGR+	No-till
	AGR+	Organic farming
	AGR+	Transition to pastures, agroforestry
	AGR+	Herbaceous strips

AGR+= combined measures, measures that radically transform agricultural systems and farming methods, biodiversity-intensive

Results

Current emissions from Sardinia's agricultural sector – Baseline scenario



Main hotspots: animal emissions (enteric fermentation + manure management) and diesel use for agricultural machinery

How to reduce the carbon footprint - What if?

Expansion of agroecological practices (including meeting EU targets such as 25% of land under organic farming) can offset over a third of annual agricultural emissions, mainly through carbon sequestration.

