



The LifeWatch ERIC Biodiversity
& Ecosystem eScience Conference
PLOVDIV, BULGARIA 7-10 JULY 2026



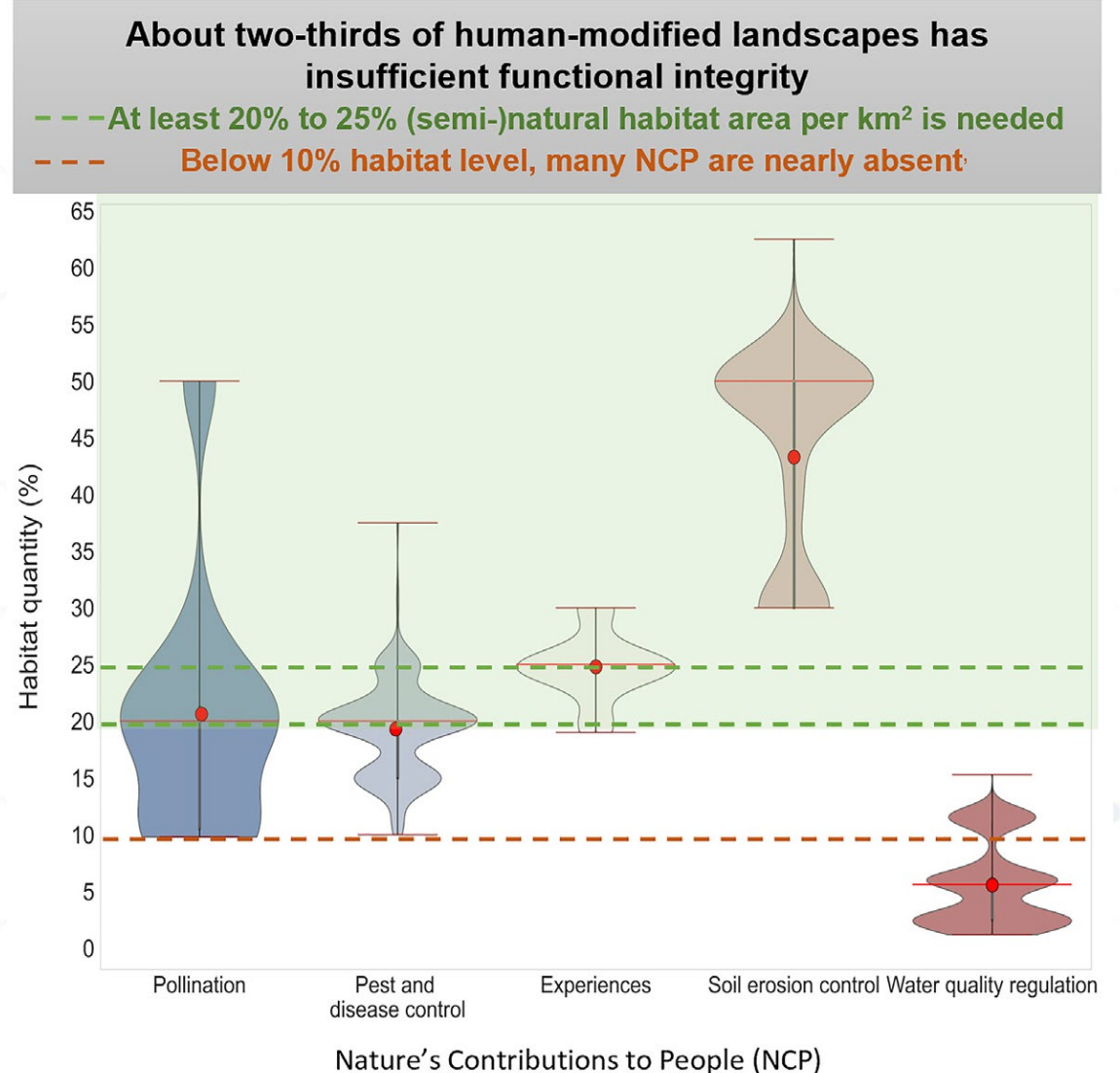
What about the biodiversity into the agroecological landscapes?

*Presenter: **Sergio Salazar-Galán**, Ángel Salazar, Gloria Guzmán-Casado, Manuel González de Molina*

08 July 2026

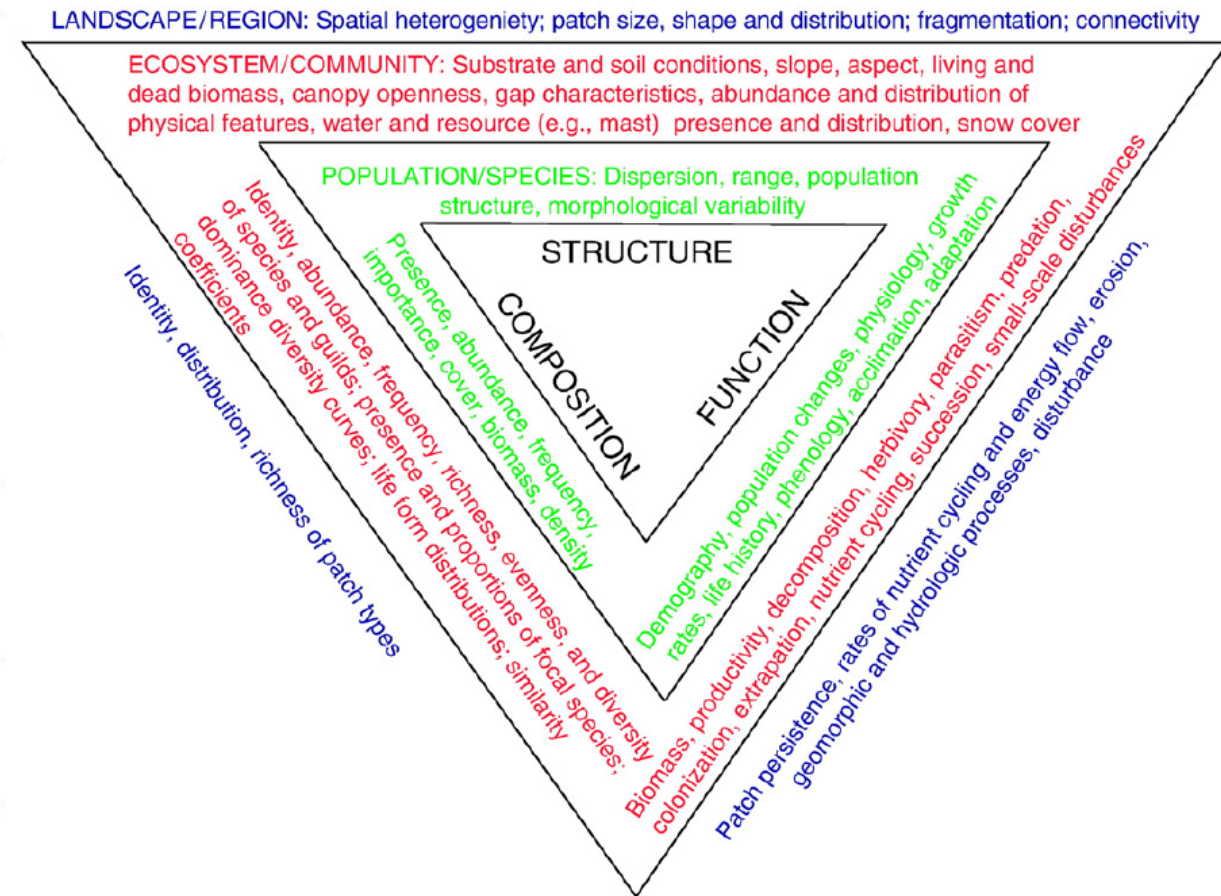


- The greater the landscape heterogeneity the greater the potential to restore and maintain biodiversity in agroecosystems and their services.
 - Achieved through crop diversification and semi-natural/natural habitats
 - A > complexity > sustainability and resilience
 - Contrasting results between conventional (monoculture...) and organic farming (polyculture...) in terms of the provision of ecosystem services



Mohamed, A., DeClerck, F., Verburg, P. H., Obura, D., Abrams, J. F., Zafra-Calvo, N., ... & Stewart-Koster, B. (2024). Securing Nature's Contributions to People requires at least 20%–25%(semi-) natural habitat in human-modified landscapes. *One Earth*, 7(1), 59-71.

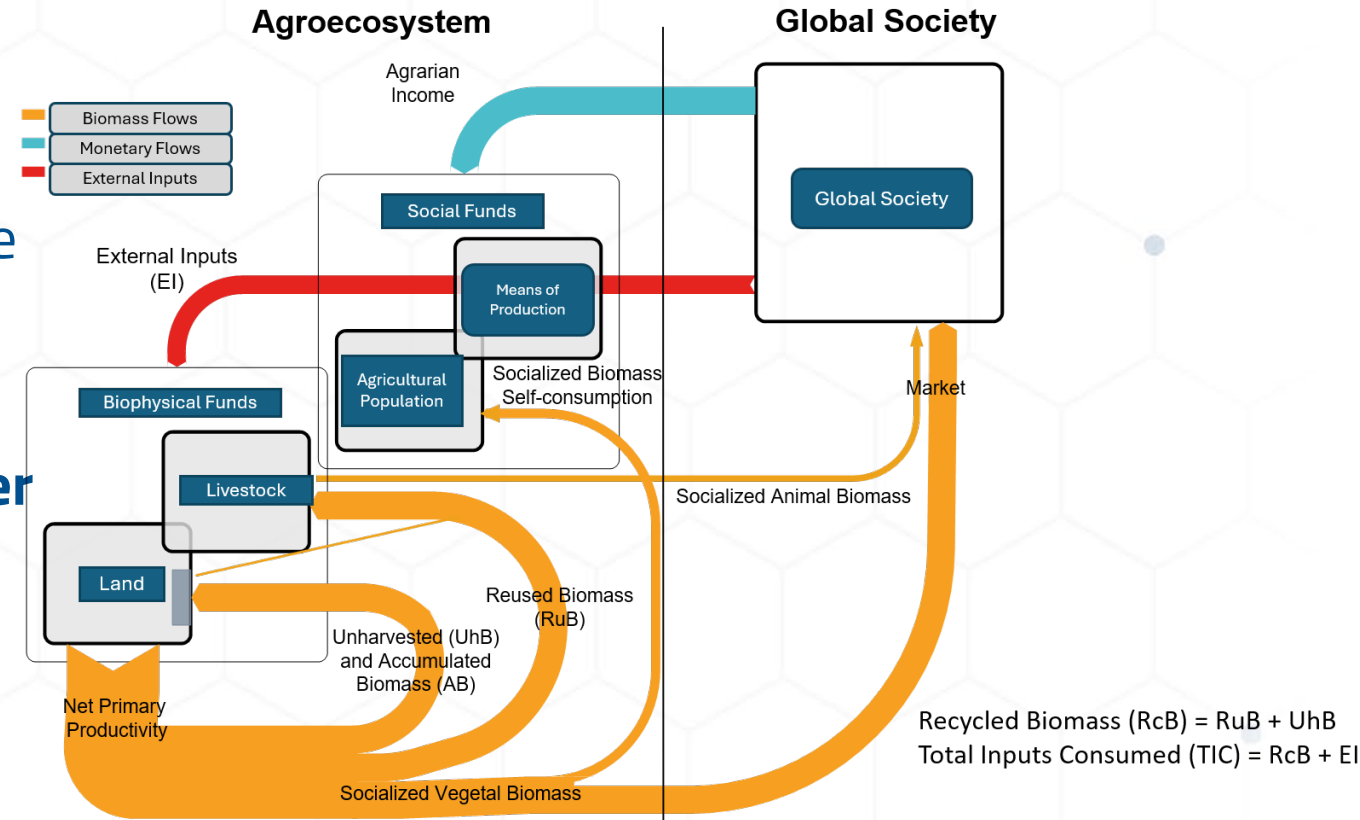
- In the context of **agroecological transitions** (scaling up):
 - How can we **redesign** sustainable and resilient **foodlandscapes**?
 - How can we quantify changes in the EESS of agroecosystems as their structure and agricultural practices change at the landscape level?
- Some approaches:
 - **Ecological indicators** (see Dale & Polasky, 2007):
 - Magnitude, exposure, response to change
 - Structure and composition (provide information on function)
 - Landscape metrics: spatial gradients, networks...
 - **Primary agroecological structure** (see Quintero et al., 2022; Salazar-Rojas et al., 2023)
 - Composition, configuration, heterogeneity
 - **Habitat suitability** (see Altieri et al., 2024):
 - Biocontrol: composition/configuration
 - **Agrarian social metabolism** from an agroecological perspective (see González de Molina et al., 2020)
 - Functional (biophysical and social funds/flows)



Dale, V. H., & Polasky, S. (2007). Measures of the effects of agricultural practices on ecosystem services. *Ecological economics*, 64(2), 286-296.

Hypothesis and framework

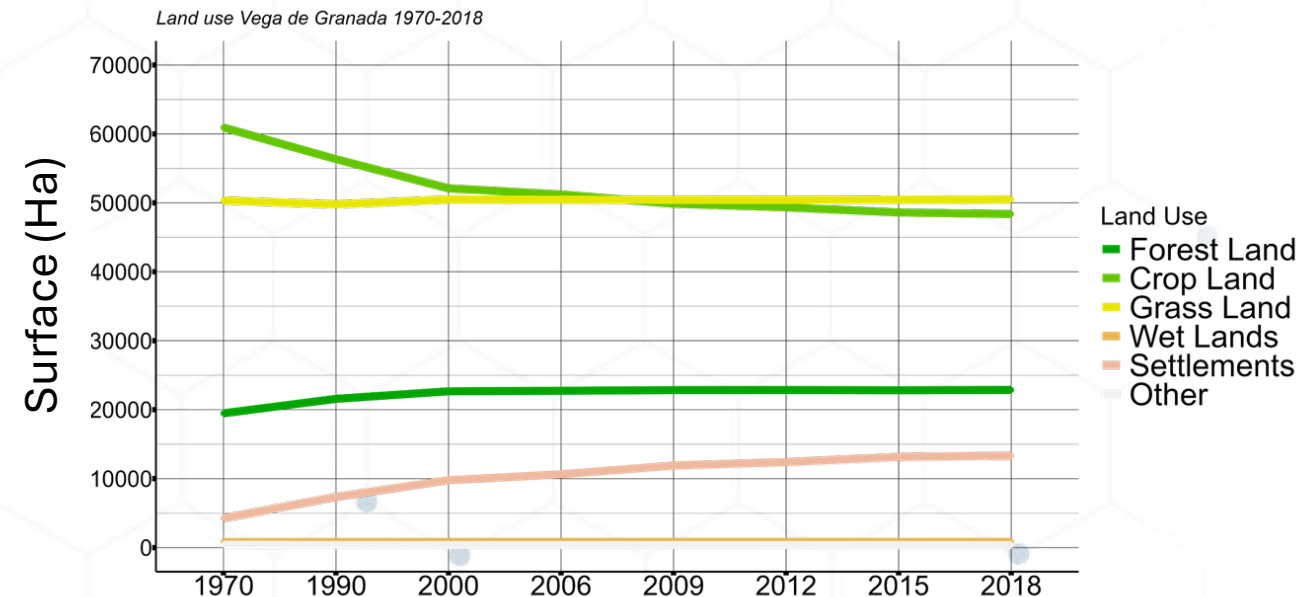
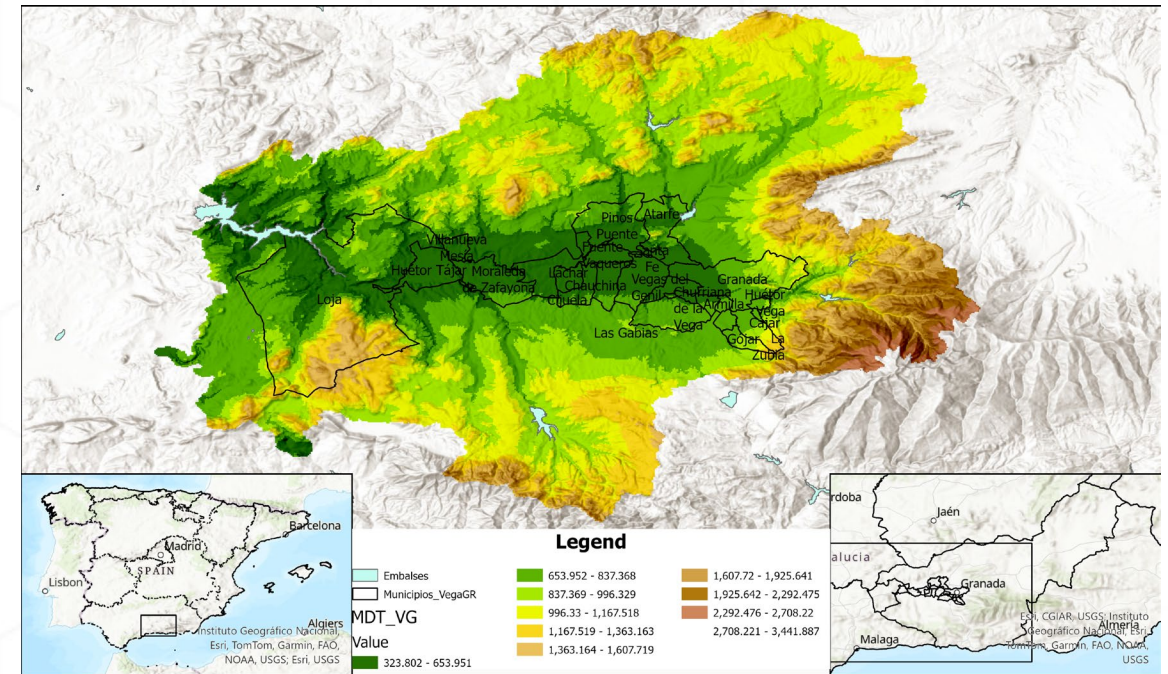
- From the perspective of landscape agroecology, agricultural activity must have:
 - the capacity to generate, within the territory, the biomass flows (NPP) necessary for the reproduction of the **biophysical "fund" elements** (structure) of the agroecosystem (**soil health, biodiversity, soil water retention, seeds, etc.**).
 - the capacity to generate the **biomass flows** necessary to meet the needs of the local community (**socialised biomass**).
 - the capacity to maintain **social funds** within the territory (**decent work and quality of life for workers and their families**)



González de Molina, M.; Soto Fernández, D.; Guzmán Casado, G.; Infante-Amate, J.; Aguilera Fernández, E.; Vila Traver, J.; García Ruiz, R. The Social Metabolism of Spanish Agriculture, 1900–2008: The Mediterranean Way Towards Industrialization. *Springer Open Access*. 2020.

Case study

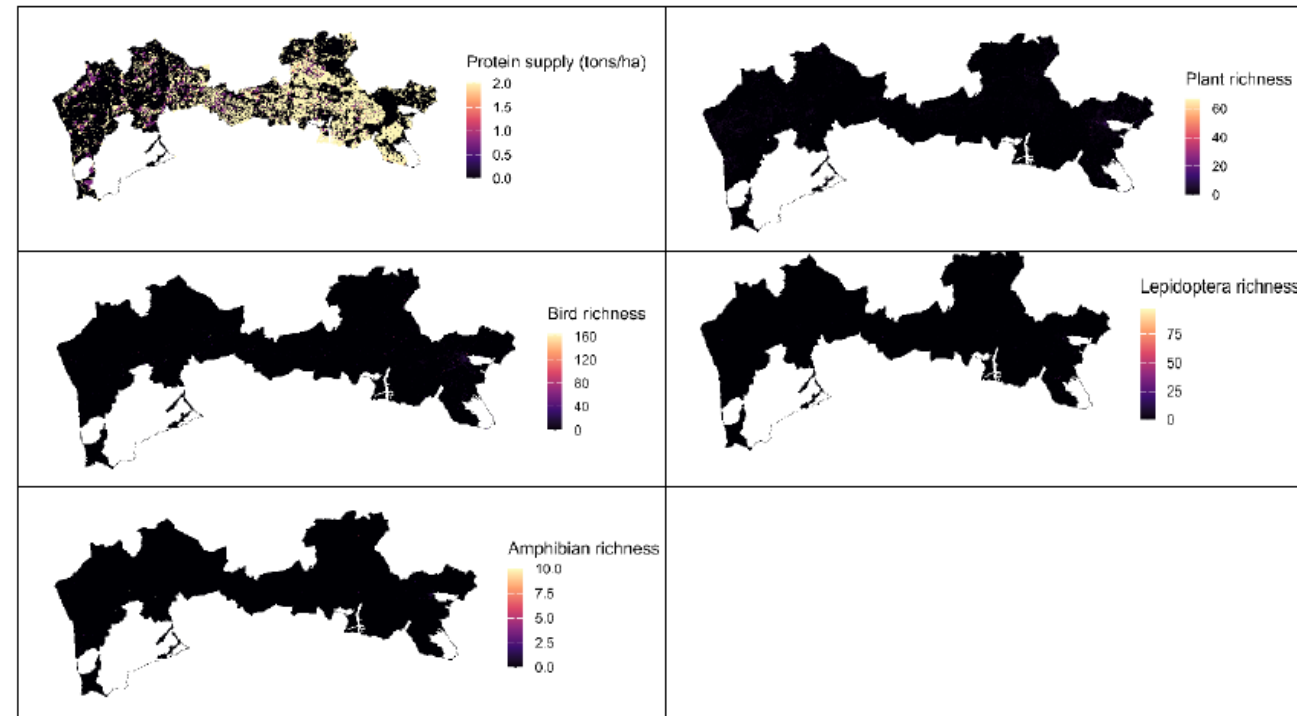
- **Vega de Granada**, in south-eastern Spain:
 - An agricultural county comprising **22 municipalities**.
 - An **alluvial plain** (with fertile soils) which, over the centuries, has provided **food for the local population**.
 - Intensification and specialisation (**olives, some vegetables; traditional crops such as cereals and legumes were drastically reduced**).
 - Olive surface increased by a factor of 1.7 and production by a factor of 21.
 - Yields (1983): rain-fed ($2,509 \text{ kg ha}^{-1}$) and irrigated olive groves ($4,559 \text{ kg ha}^{-1}$)
 - Yields (2016): rain-fed ($2,338 \text{ kg ha}^{-1}$) and irrigated olive groves ($4,614 \text{ kg ha}^{-1}$).



- Calculation of the **territorial feasibility of food supply at present, taking biodiversity into account from a functional point of view:**

- Semi-supervised imputation of land use, annual and permanent crops (1990 and 2015)
- Food protein data matrix
- Spp richness map
- Crop nutrient supply map
- Land use map with solutions to improve protein supply and spatial connectivity at the landscape level

Is it possible to construct a geospatial metabolic profile that includes key biodiversity indicators and allows for the observation of variability?



Spp (bird, lepidoptera and amphibian richness (www.gbif.org))

Scenario analysis

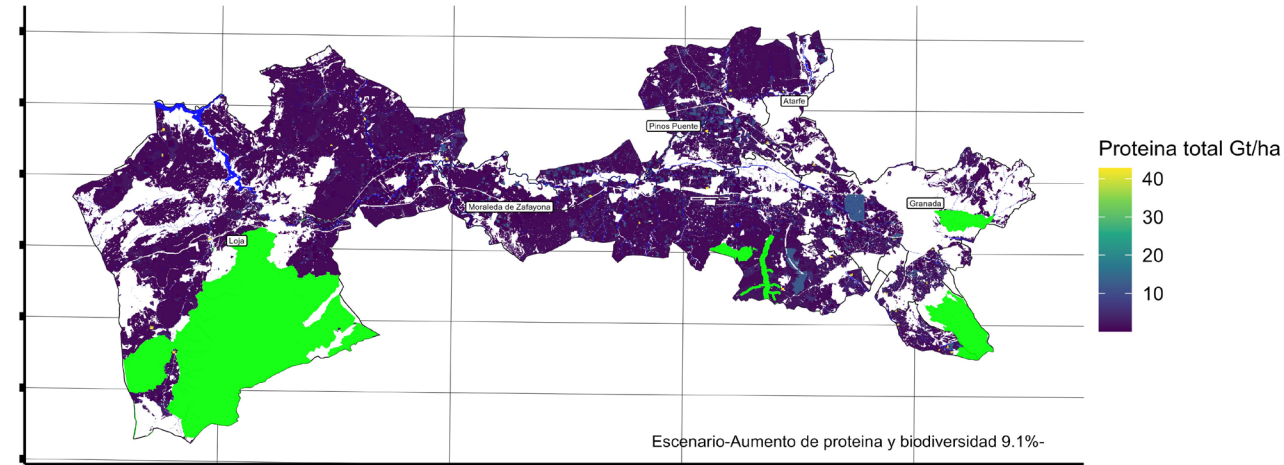
■ Food balance:

	1983		2016	
	min	max	min	max
Vegetables	12,97	-41,78	-106,50	-161,25
Fruits	-26,93	-158,33	-79,01	-210,41
Potatoes	47,09	28,84	-16,14	-34,39
Cereals-bread	0,18	-18,07	-32,11	-50,36
Cereals-pasta	2,84	-4,46	-7,92	-15,22
Cereals-rice	-9,39	-16,69	-9,39	-16,69
Legumes	-7,75	-19,22	-10,36	-21,83
Nuts	-2,15	-9,97	-2,81	-10,63
Oil olive	9,94	9,94	29,20	29,20

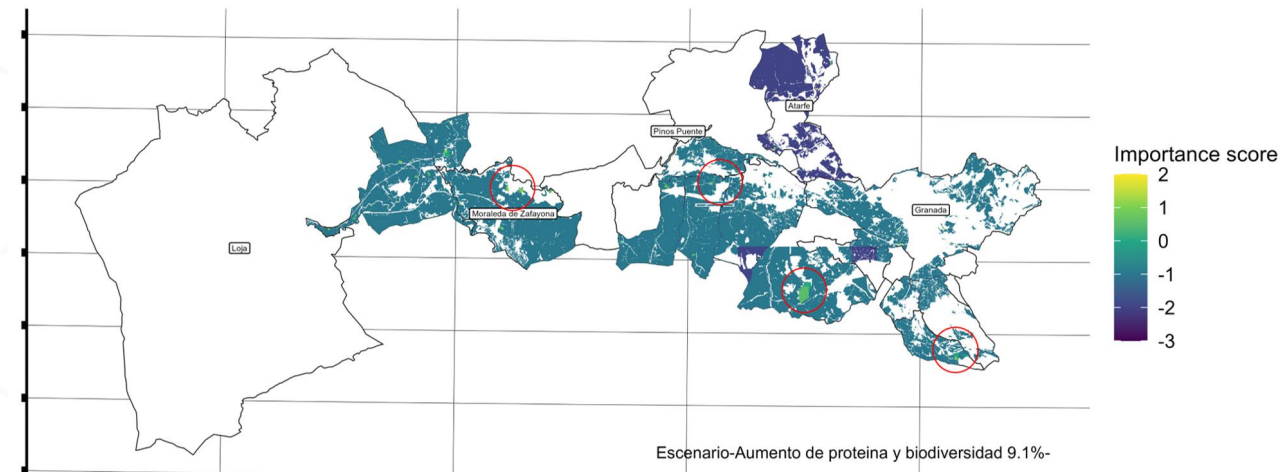
■ What to do?

- Redesign of the county's landscape-scale agroecosystem by:
 - Changing land uses to improve the supply of protein (the main priority for local production) and spatial connectivity at the landscape level (habitat maintenance as a proxy for biodiversity)
 - Prioritisation

Scenario of change (+9.1% protein/biodiversity) – considering watercourses and Natural Parks



Prioritisation



- The results obtained show that systematic land-use planning based on spatial optimisation makes it possible to identify landscape configurations capable of reconciling protein provision with biodiversity representation within complex agricultural landscapes.
- The explicit inclusion of multiple taxa and management scenarios makes it possible to represent part or the ecological complexity of agroecosystems and the trade-offs associated with food production.



More research is needed

- The model is heavily dependent on the resolution and quality of the raster data used, particularly in the spatial representation of biodiversity and land use. Furthermore, the approach used simplifies complex ecological processes, including population dynamics, biotic interactions and temporal responses to changes in management.
- Future research could incorporate **functional metrics, dynamic connectivity, additional ecosystem services and socio-economic scenarios**, enabling progress towards more comprehensive and realistic spatial planning models.



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THANK YOU!

Questions?

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