Exploring relationships among different sustainability aspects in innovative livestock systems in Europe

RATIONALE

The European livestock sector encompasses a variety of innovative systems. This study, conducted within the **Pathways project**, aimed at providing sustainability assessments of such systems, including grazing-based ones, exploring relationships among sustainability dimensions.

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APPROACH

- Through the **PG tool**[1], quantitative and categorical data was collected on **106 farms** from nine European **countries**.
- Farms differed per animal species and management system, from **extensive grazing ruminants** to intensive monogastrics production.
- Each farm received scores for **12 sustainability indicators** (**spurs**).
- Statistical analysis (R studio[2]):
  - **heatmap cluster** analysis→ identification of patterns in the sustainability performances
  - **correlation** analysis → measurement of strength and direction of the associations between the different spurs.

RESULTS

- **Five clusters** were identified (heatmap analysis) → clusters **n. 3, 4,** and **5** presented extensive farming systems (main findings below).
- Environmental-related spurs had high scores, and negative correlated with economic spurs → **economic gains Vs environmental sustainability**
- **Environmental spurs positively correlated among each other** → integrate diverse land-use practices support biodiversity, carbon sequestration, and cultural landscape preservation

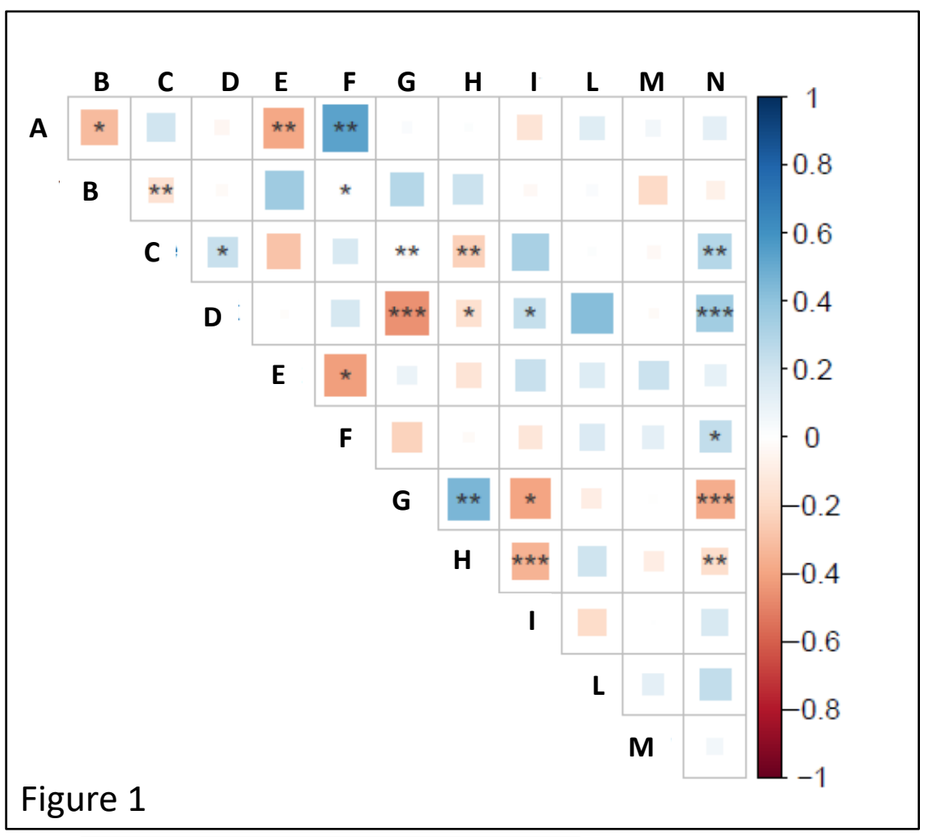

Figure 1

Figure 1. *Correlations between categories of the Public Goods Tool, results from* ***cluster 3****. Positive correlations are blue, negative correlations are red; colour darkness illustrates the correlation strength. Non-significant correlations are white.*

Figure 2. *Public Goods Tool average scores results of all clusters.*

Legend: ***A****, System security & diversity;* ***B****, Agri–environmental management;* ***C****, Landscape & heritage;* ***D****, Soil management;* ***E****, Water management;* ***F****, Manure & fertiliser;* ***G****, NPK budget;* ***H****, Energy & carbon;* ***I****, Animal welfare;* ***L****, Social wellbeing;* ***M****, Profitability;* ***N****, Farm business resilience.*

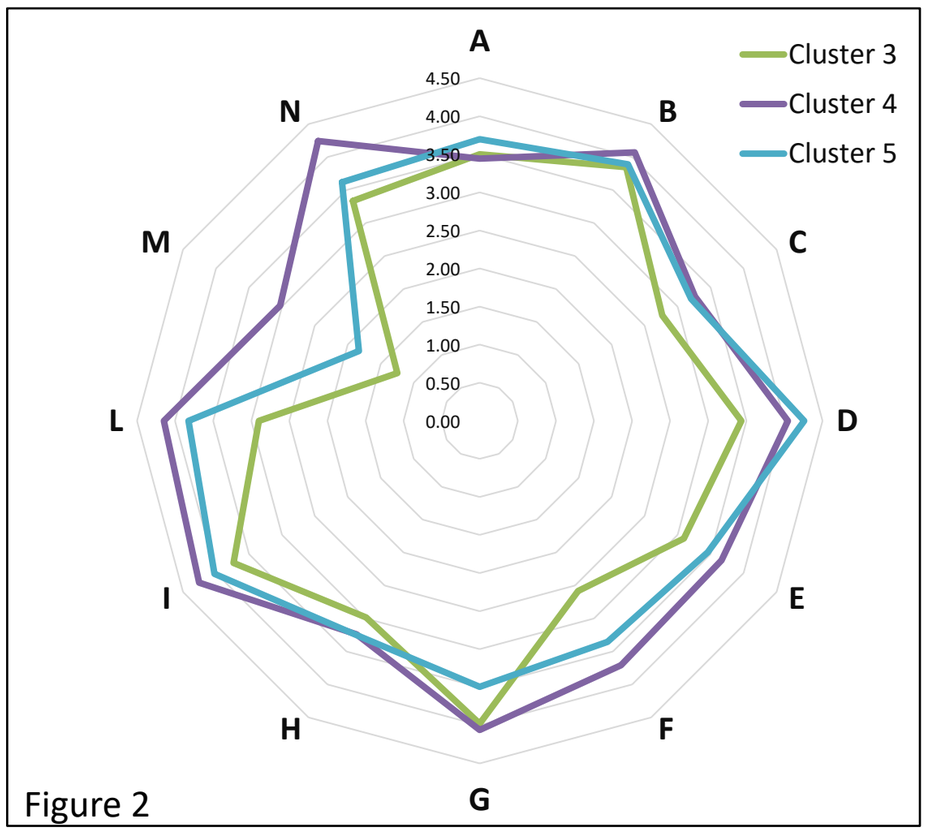

Figure 2

CONCLUSION

Livestock sustainability depends on three main factors: the farm's **management**, **size**, and **geographic location.** Larger and more specialized extensive systems appeared better positioned to achieve both environmental and economic sustainability at scale. Long-term viability of extensive systems will require tailored policy incentives, and market mechanisms that recognize their broad ecosystem services beyond meat production alone.

FURTHER INFORMATION

Key references to find out more:

1. Paraskevopoulou et al (2020). https://doi.org/10.3390/su12083099
2. R Core Team (2023). https://www.R-project.org/

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