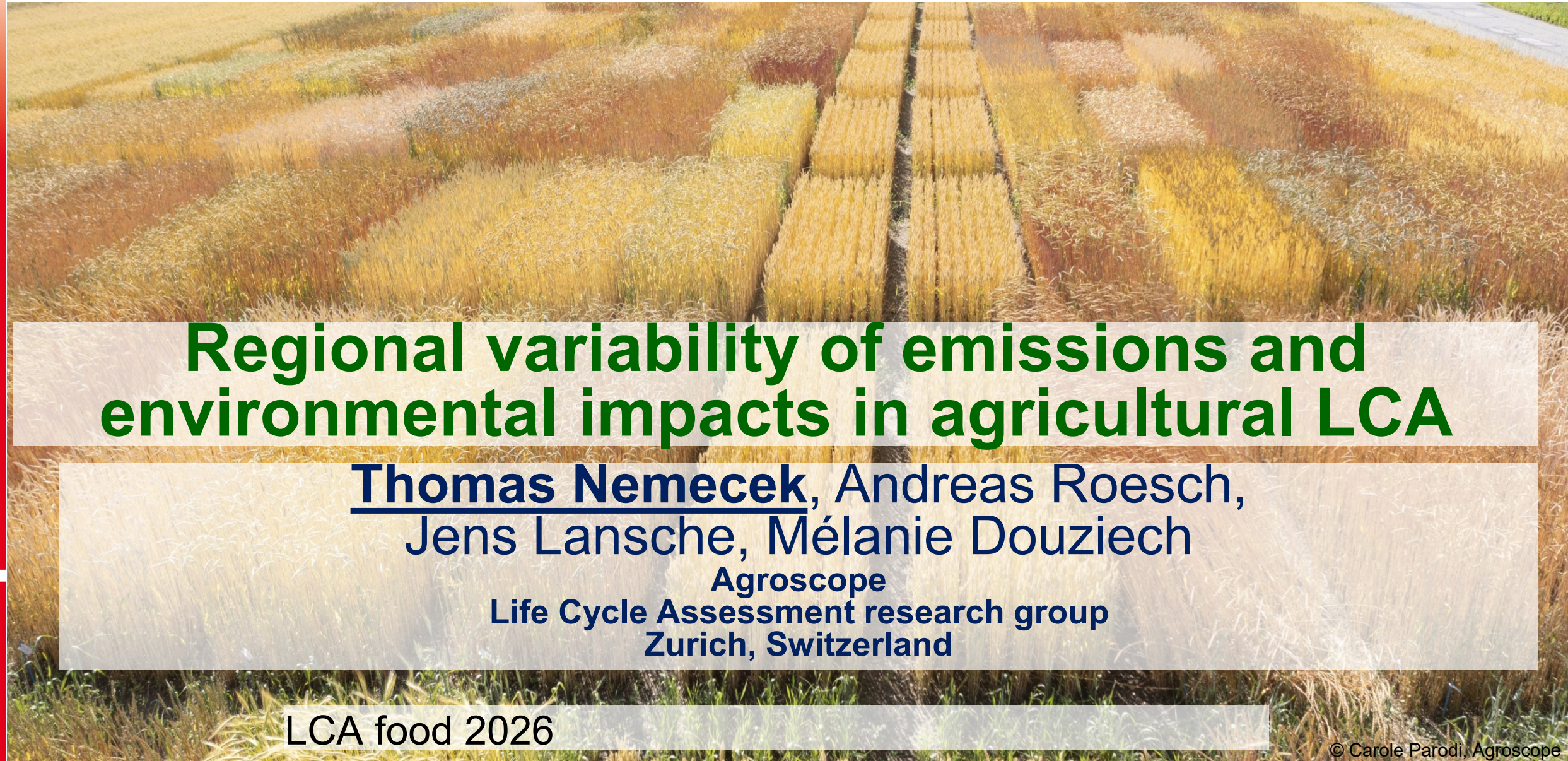
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Regional variability of emissions and environmental impacts in agricultural LCA

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LCA food 2026

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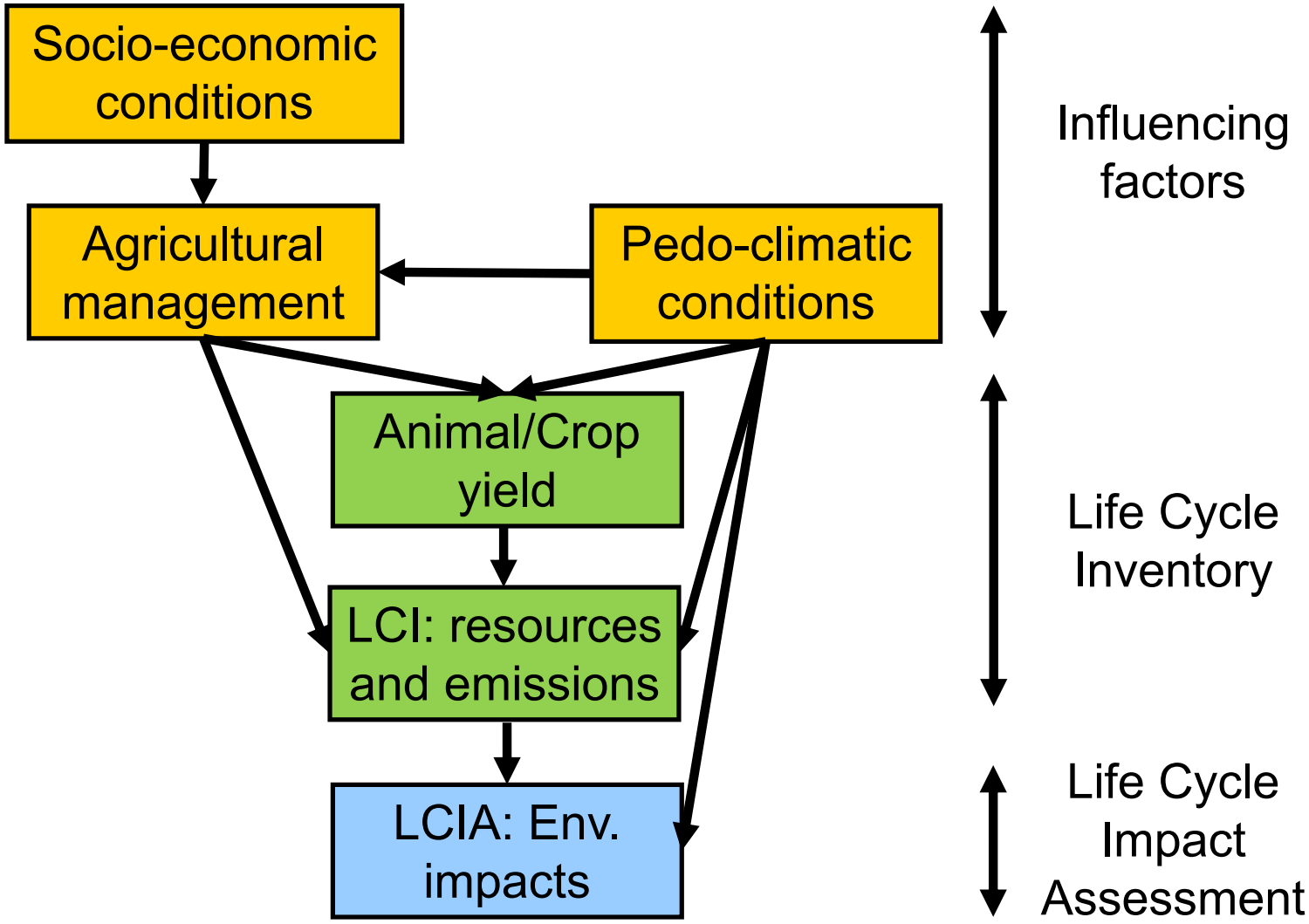
Today's menu

Objective: Explore the drivers for the variability of impacts of agricultural systems

Outline:

- Methods
- Analyse the contributions of variability of emissions and characterisation factors to impact variability
- Effects of yield resp. land occupation on impact variability
- Relevance to include spatial differentiation
- Take-aways

Factors influencing variability of impacts



Roesch *et al*. (2026) https://doi.org/10.1007/s11367-026-02722-0

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Analysing variability

- LCI databases analysed: ecoinvent, AGRIBALYSE, WFLDB, Agri-footprint
- Minimum 10 countries for the same product needed
- Agri-footprint retained for the analysis
- Impact categories with regionalised CFs at country level analysed (SALCA LCIA method)
- Quantification of variability:
  Coefficient of variance (CV) = standard deviation SD/mean

The International Journal of Life Cycle Assessment (2026) 31:148
https://doi.org/10.1007/s11367-026-02722-0

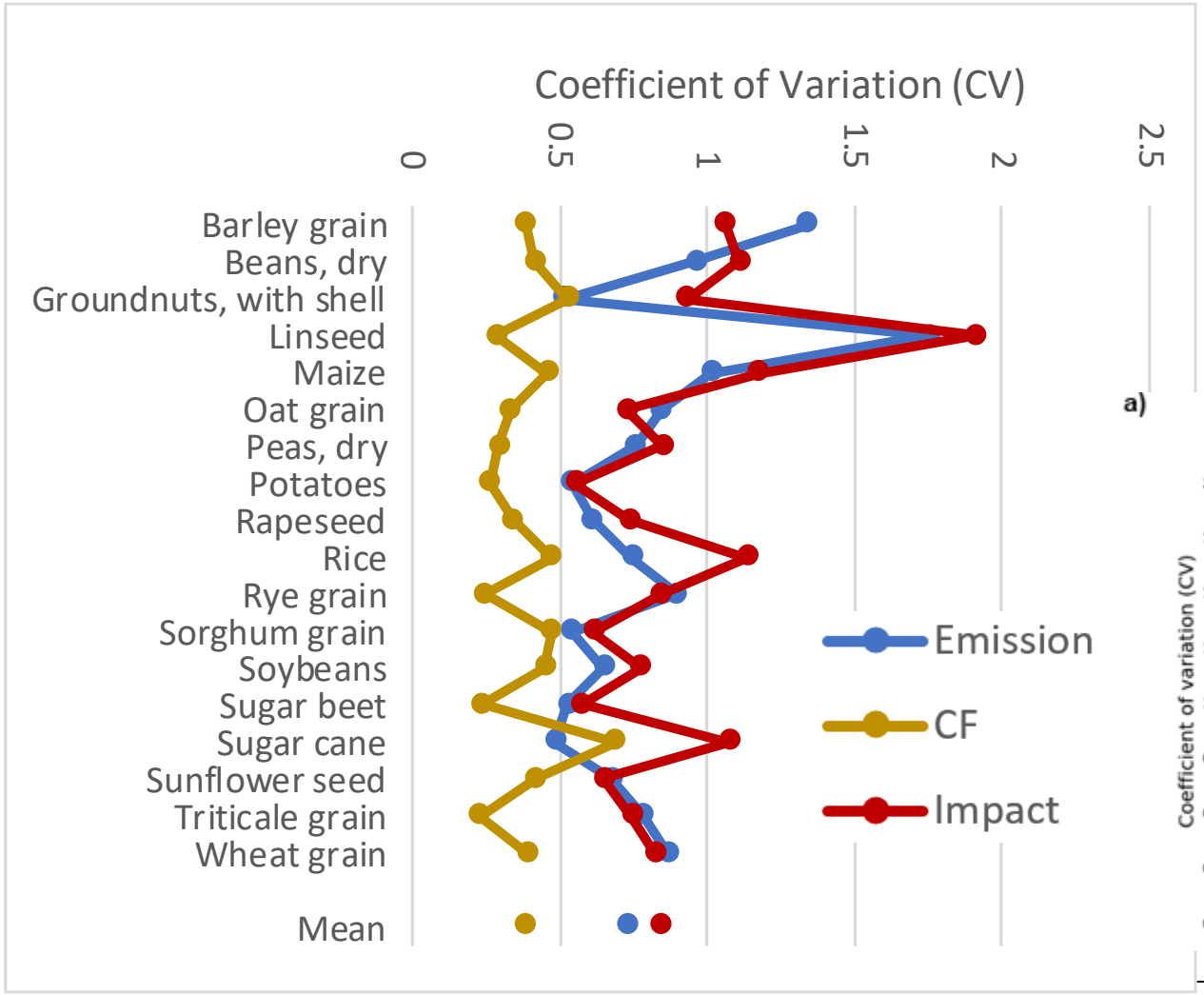
LCA FOR AGRICULTURE

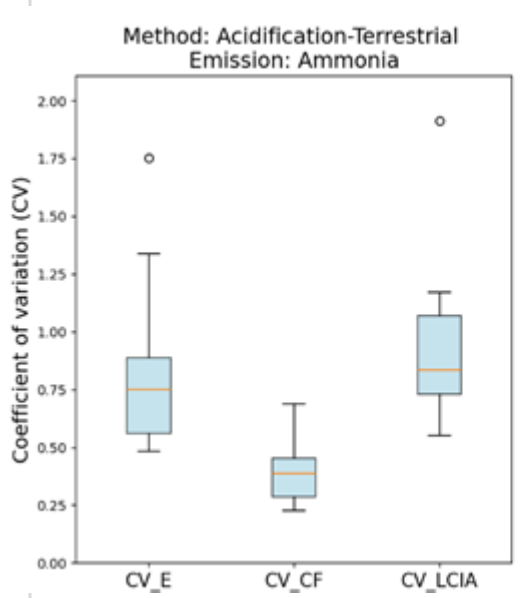
Regional variability of emissions and environmental impacts in agricultural LCA: a product-level analysis

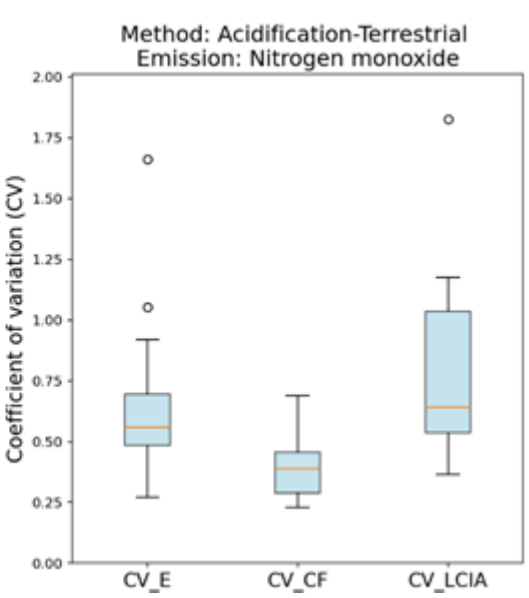
Andreas Roesch[1] · Jens Lansche[1] · Mélanie Douziech[1] · Thomas Nemecek[1]

Received: 26 March 2026 / Accepted: 16 July 2026
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Variability of emissions, CFs and impacts: Terrestrial acidification → emission as driver





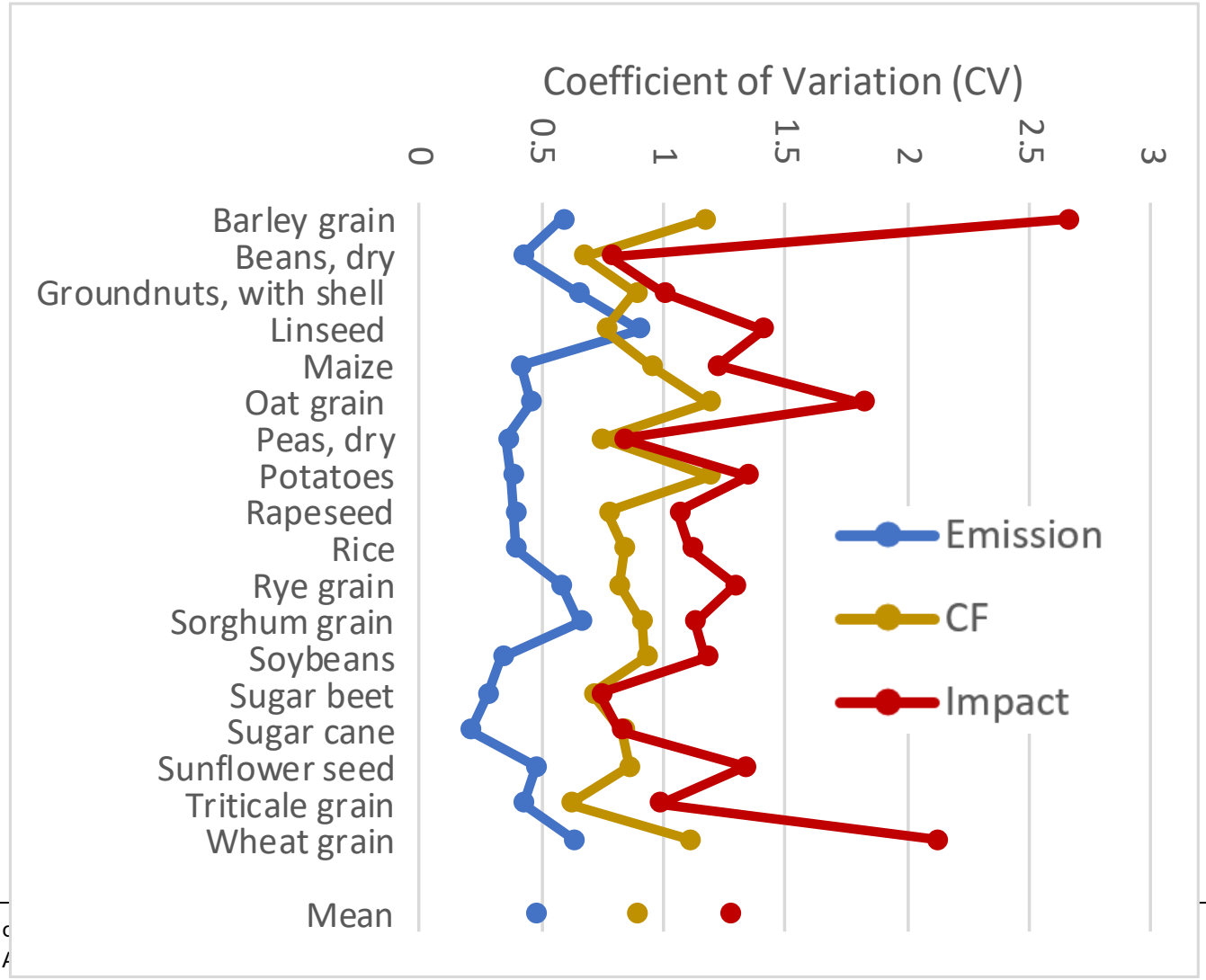


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Roesch *et al*. (2026) https://doi.org/10.1007/s11367-026-02722-0

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Variability of emissions, CFs and impacts: Biodiversity → CFs as driver

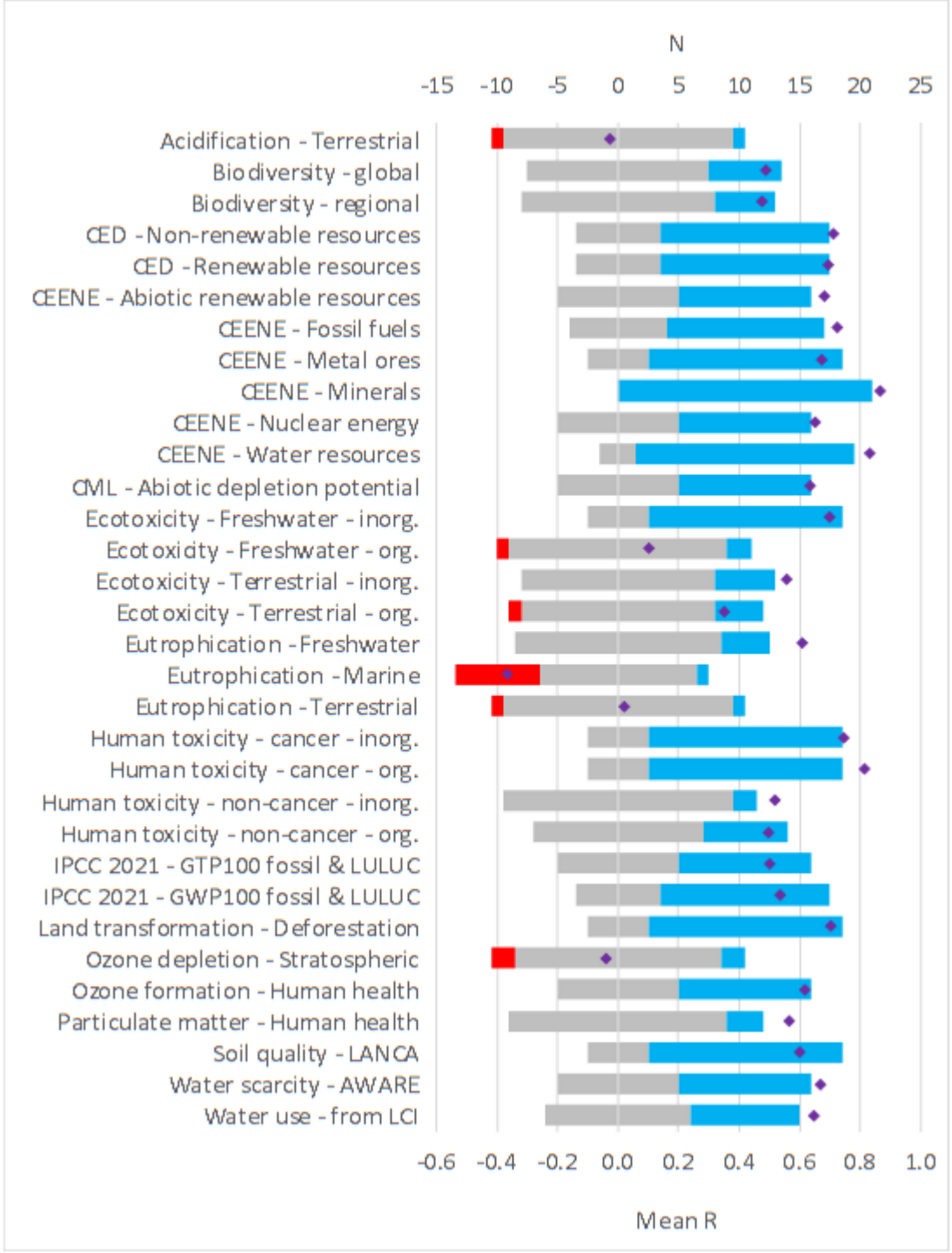


Roesch *et al*. (2026) https://doi.org/10.1007/s11367-026-02722-0

Analysis of yield effects

- Same dataset analysed
- All impact categories, except those directly related to land occupation
- Agricultural land occupation (ALO) used as a proxy for the inverse of the yield (relationship between yield and impact is non-linear)
- Sperman rank correlation between ALO and midpoint impacts, significance at 5% level

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Strong yield effect:

Spearman rank correlation coefficients between agricultural land occupation and midpoint environmental impacts.

Correlations:

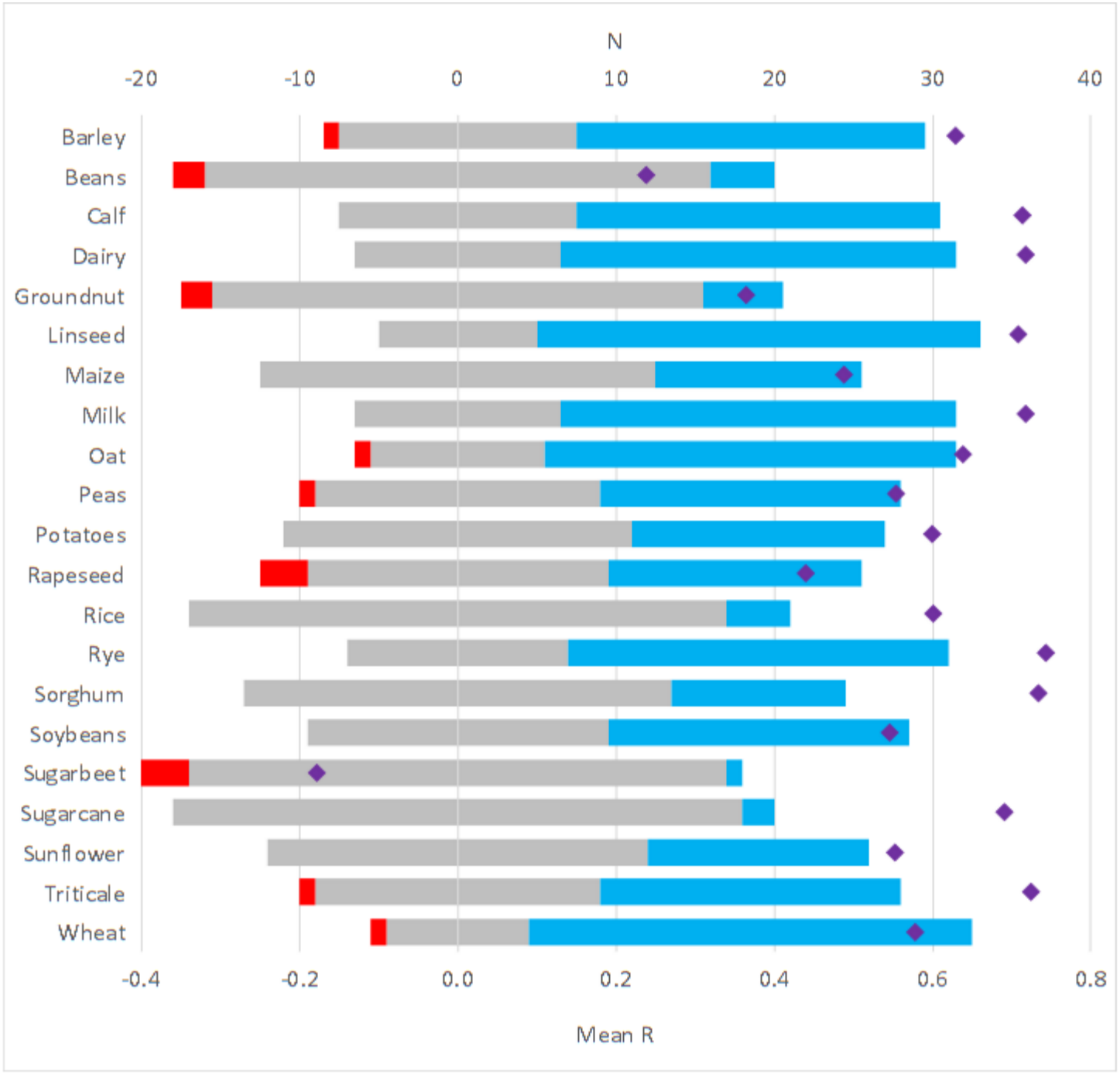
43% positive

2% negative

55% non-significant

Roesch *et al*. (2026)
https://doi.org/10.1007/s11367-026-02722-0

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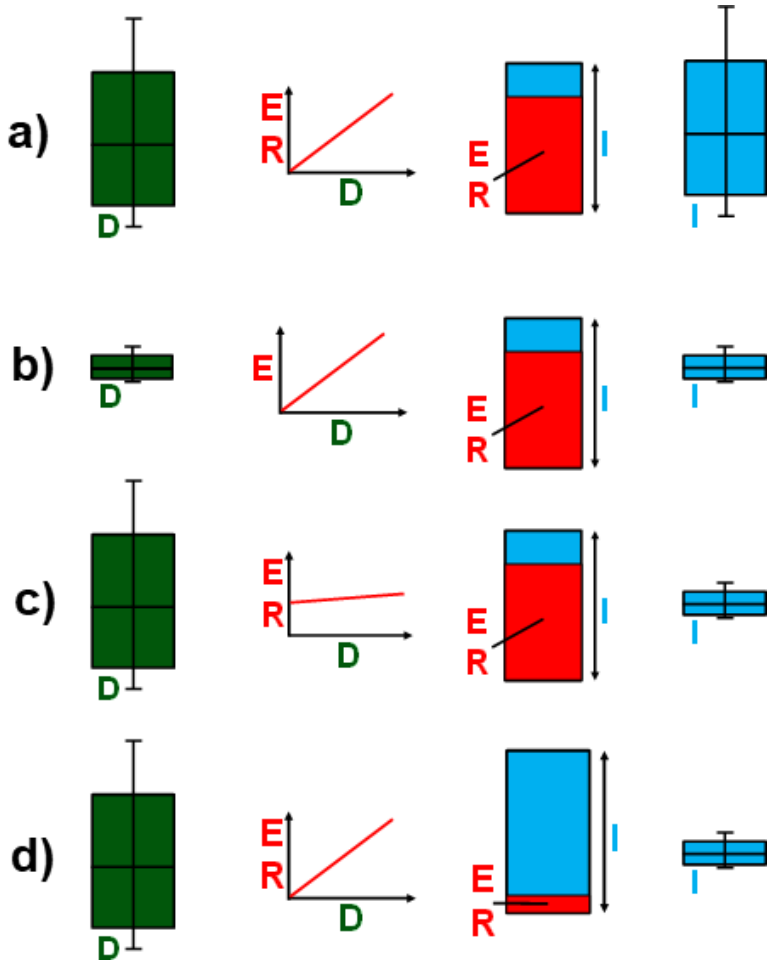
Yield effects:

- No clear patterns regarding impacts or crops
- Majority of correlation coefficients between 0.4 and 0.8.

Roesch *et al*. (2026)
https://doi.org/10.1007/s11367-026-02722-0

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Influence of driving force (D) → resource (R)/emission (E) → impact (I)



The relevance of spatial differentiation depends on the goal and scope.

Roesch *et al*. (2026)
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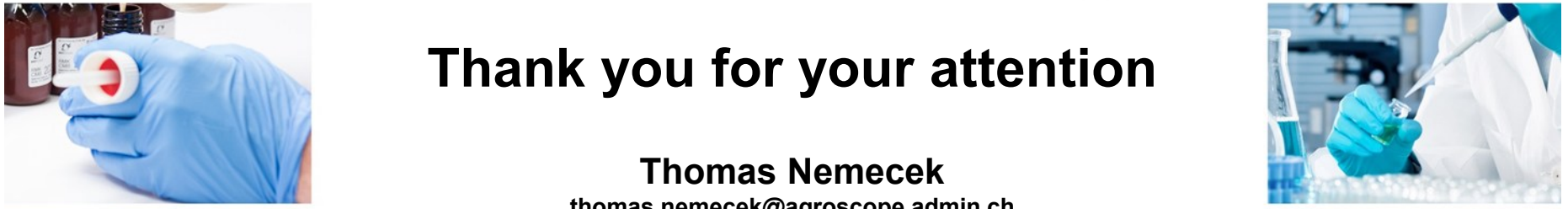
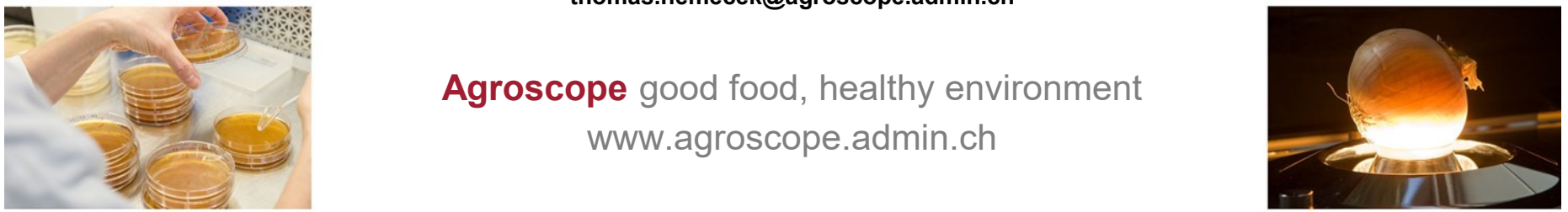
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Take-aways

- Variability of emissions dominates variability of nutrient-related impacts like eutrophication and acidification
- Variability of CFs dominates variability for land use-related impact categories like biodiversity
- Higher agricultural land occupation (and therefore lower yields) increase most impacts
- Relevant for stakeholders:
  - Farmers → agricultural management
  - Policymakers → targeted subsidies
  - Food manufacturers/retailers → sourcing low-impact ingredients or products
  - Retailers/consumers → eco-labelling

Roesch *et al*. (2026) https://doi.org/10.1007/s11367-026-02722-0





Thank you for your attention

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