Valorising legume benefits within the cropping system: from field scale to European scale

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Why do we need to assess impacts of scaling out legumes based cropping systems?

- There are MANY ways of growing legumes (cash crops, covercrops, feed, food) that can lead to various performance, services and impacts.
- BUT not all of them are suitable within a particular socio-economic context (e.g. cheap mineral fertilizers does not promote legumes as a way to decrease the amount spread).
- When facing uncertain future it is interesting to explore multiple alternatives using the same framework.

Method overview

Collective work:

France
Germany
Latvia
Lithuania
The Netherlands
Switzerland

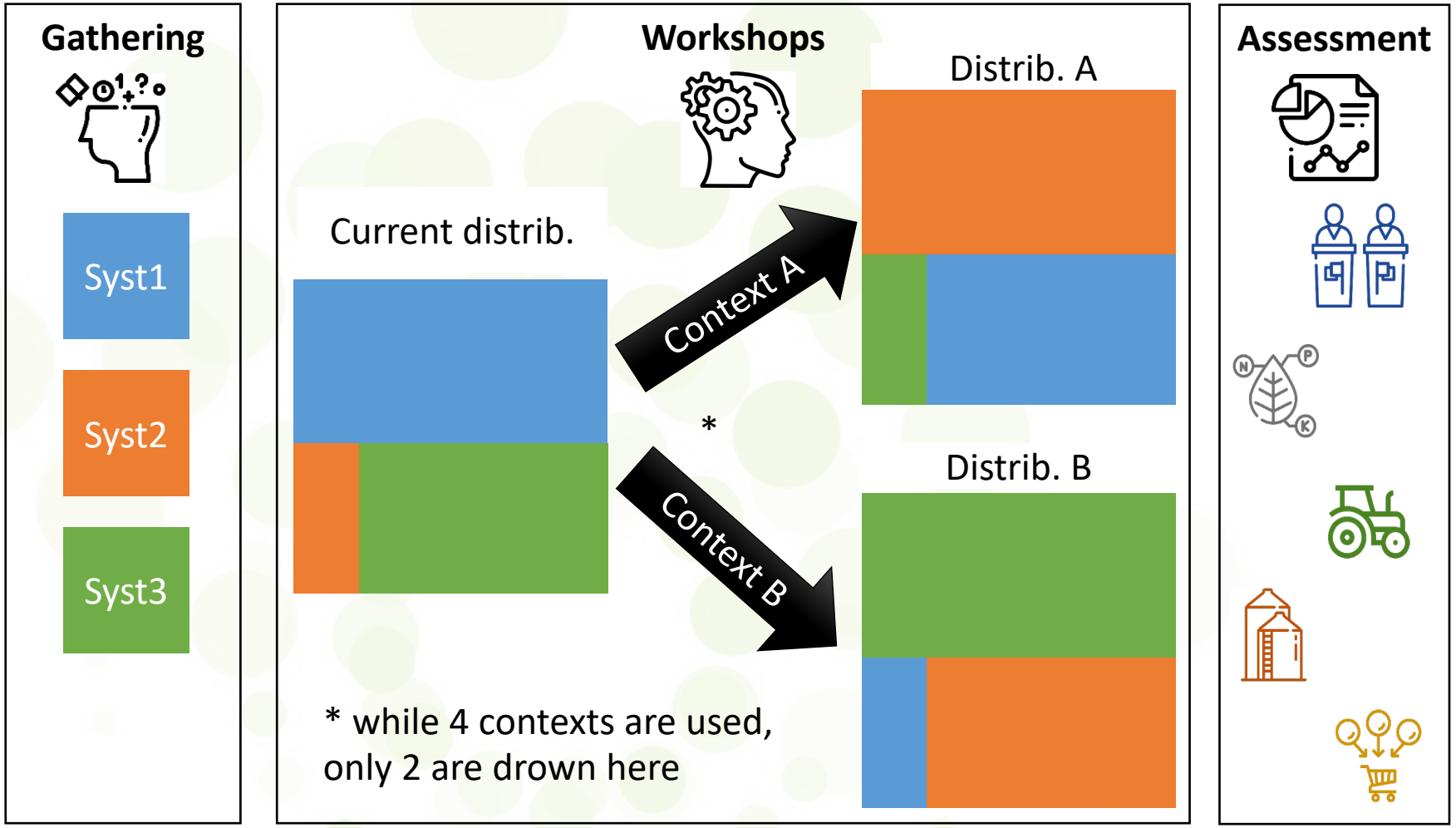

Figure 1: schematic overview of the method

Focus on describing cropping system clusters within each country

Up to 13 clusters representing current dominant and innovative cropping systems based on national statistics and expert knowledge

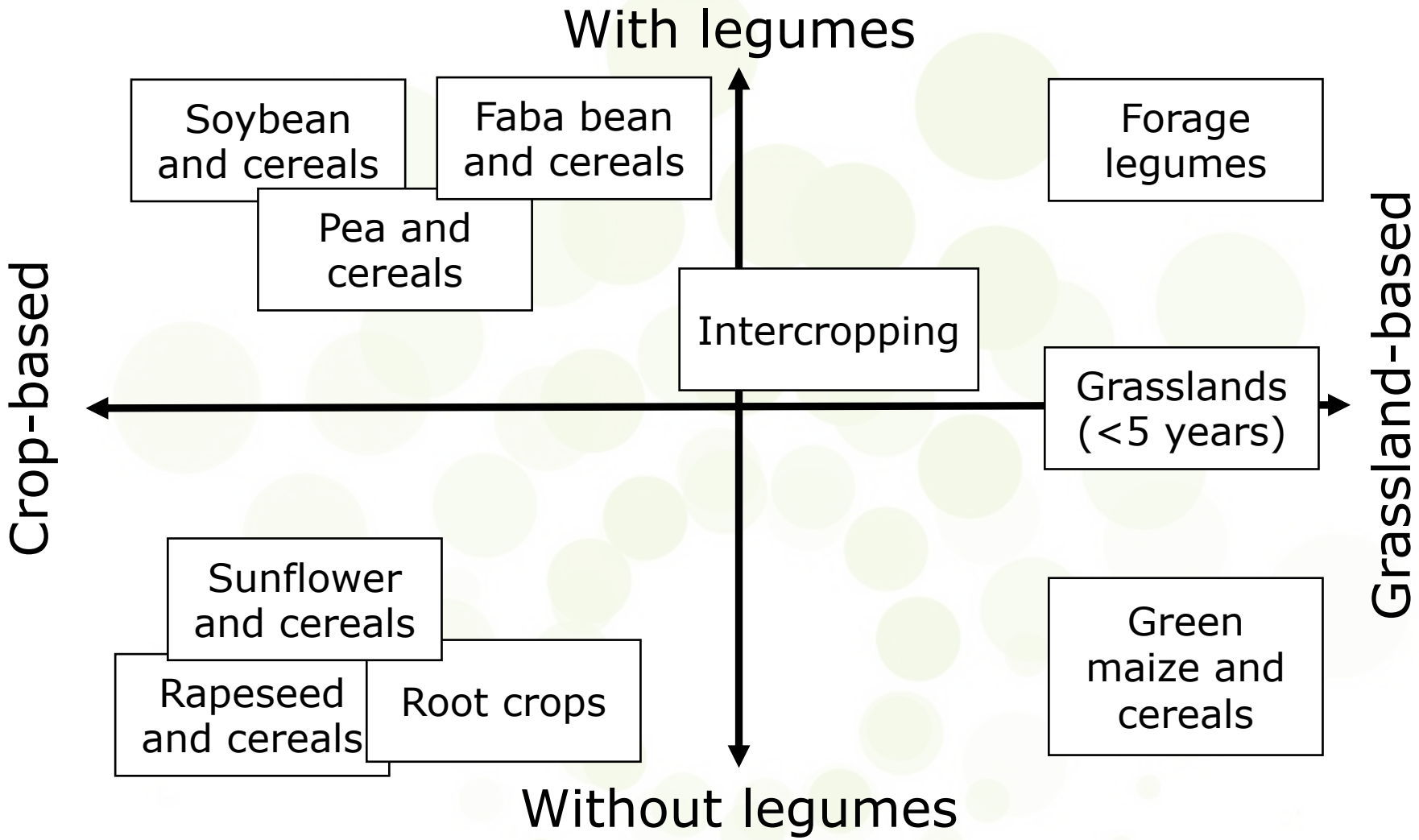

Figure 2: examples of cropping system clusters

4 contrasted prospective contexts

[Kootstra et al. 2017](), LEGVALUE deliverable 5.2

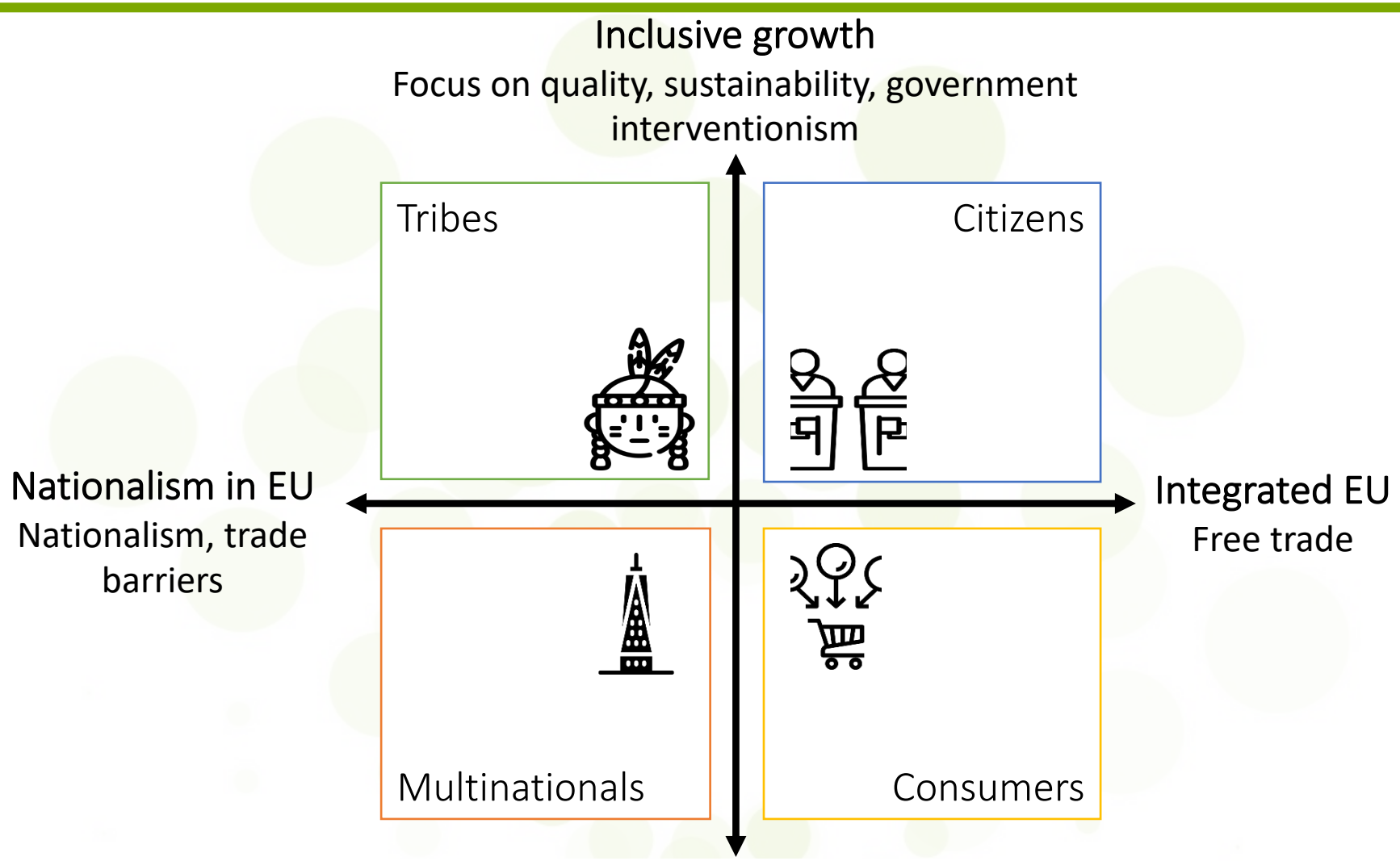

Figure 3: schematic view of the contrasted prospective socio-economic contexts

Performance assessment of designed scenarios

Table 1: sample of indicators used to asses impact of scaling out legumes-based cropping systems

Themes	Indicators
Nitrogen (kg/ha/year)	- **Crude protein harvested** - **Nitrogen fertilizer use**
Energy (GJ/ha/year)	- Calorific valueharvested - Energy used to make the nitrogen fertilizer
Value (€/ha/year)	- Gross revenues at current selling prices - Nitrogen fertilizer costs

Efficiencies

Balances

Indicators are defined at crop level within a cropping system cluster.
They are then **aggregated at territory scale using an area-weighted average based on land area devoted to each cropping system cluster** (participants design scenarios by changing land area devoted to cropping system clusters).

Increases in legumes production area is higher under inclusive growth scenarios

Results aggregated at the scale of the 6 countries involved

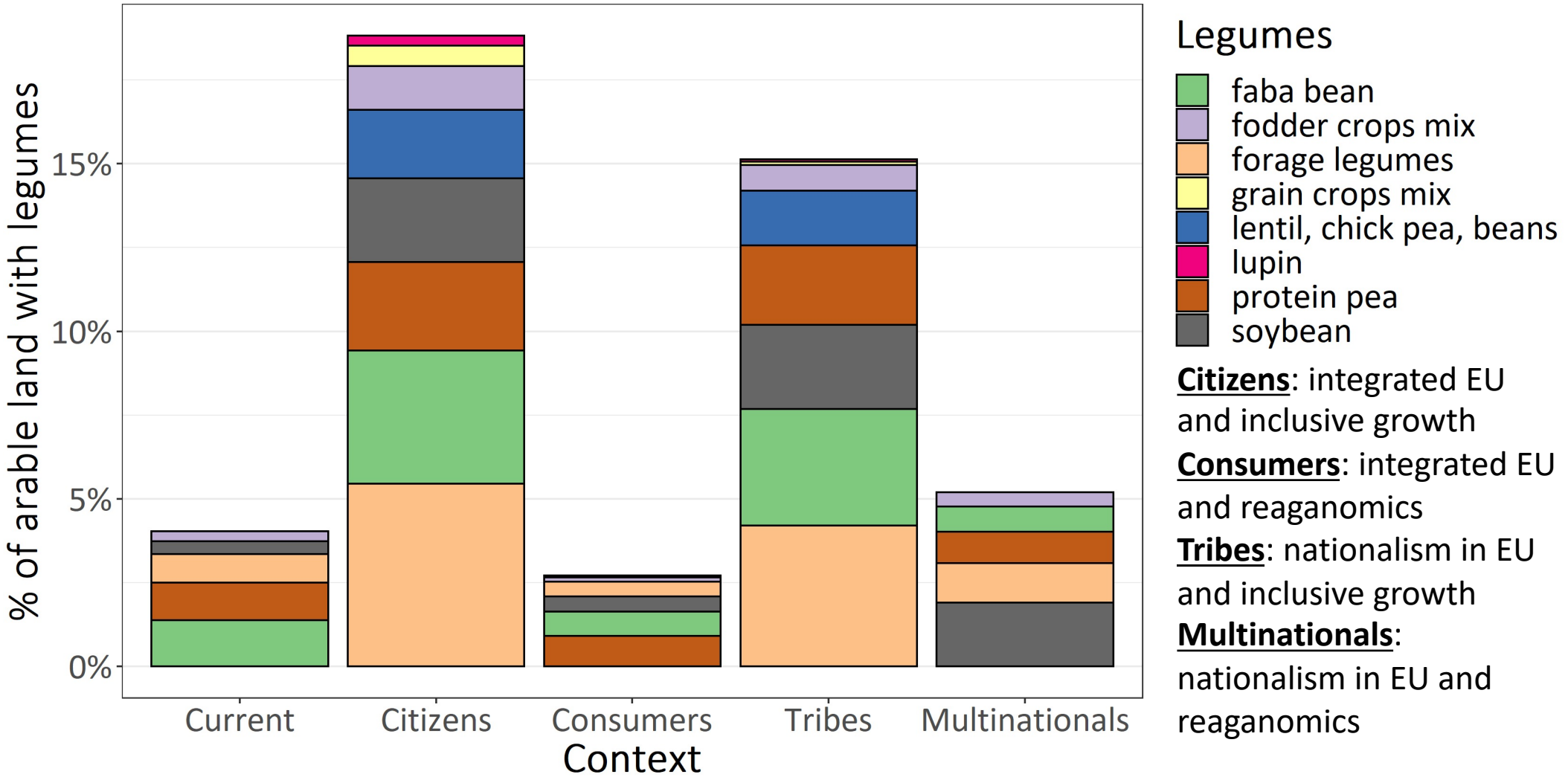

Figure 4: share of arable land dedicated to legumes for each context

Inclusive growth scenarios lead to improved N fertilizer efficiency with small reduction in total protein production

Citizens: integrated EU and inclusive growth
Consumers: integrated EU and reaganomics
Tribes: nationalism in EU and inclusive growth
Multinationals: nationalism in EU and reaganomics

Table 2: changes in nitrogen fertilizer use and protein production relative to current situation

Indicator	Current	Citizens	Consumers	Tribes	Multinationals
Protein harvested (kg/ha/year)	147	-7%	-1%	-9%	-3%
Nitrogen fertilizer spread (kg/ha/year)	127	-31%	4%	-26%	5%
Nitrogen fertilizer efficiency*		**++**	**=**	**+**	**-**

*Nitrogen fertilizer efficiency = protein production / Nitrogen fertilizer use

Opportunities to improve protein self-sufficiency

Citizens: integrated EU and inclusive growth

Consumers: integrated EU and reaganomics

Tribes: nationalism in EU and inclusive growth

Multinationals: nationalism in EU and reaganomics

Table 3: distribution of crude protein production across contexts

Crops categories	Current	Citizens	Consumers	Tribes	Multinationals
cereals and oilseeds	78%	71%	81%	76%	85%
forage legumes, grasslands and fodder mixes	9%	16%	6%	11%	3%
green maize	8%	5%	10%	6%	7%
dry pulses (including soybean) for feed/food	1%	5%	1%	4%	2%
dry pulses for food only	0,0%	0,1%	0,0%	0,1%	0,0%
others	3%	3%	3%	2%	3%

Conclusion

1. **Protein production remains almost unchanged** in these four scenarios despite contrasted legumes development schemes

2. BUT **inclusive-growth** scenarios **lower nitrogen fertilizer use** and **could improve nitrogen efficiency** and **protein self-sufficiency**

3. This results could **promote discussion between stakeholders** of legume development at various scales

Acknowledgement

- Ina Stute (FH-SWF)
- Alice Dind (FiBL)
- Nathaniel Schmid (FiBL)
- Zydre Kadziuliene (LAM)
- Lina Sarunaite (LAM)
- Oskars Balodis (LLK)
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Thank you for listening

Do you have questions?