LegumeGap: Increasing productivity and sustainability of European plant protein production

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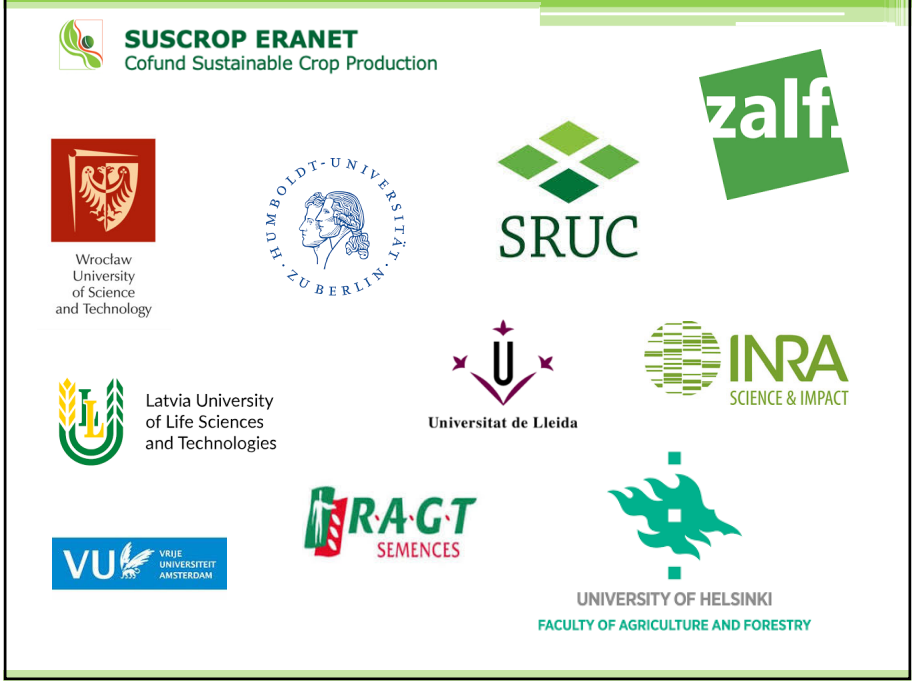

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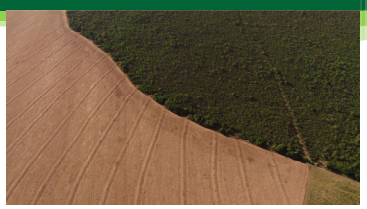
Rationale

- Protein self-sufficiency
- Diversification
- Reduction in fertilizer and pesticide use
- Reduction in GHG emissions
- Sustainable diets
- Prevention of land degradation and biodiversity loss



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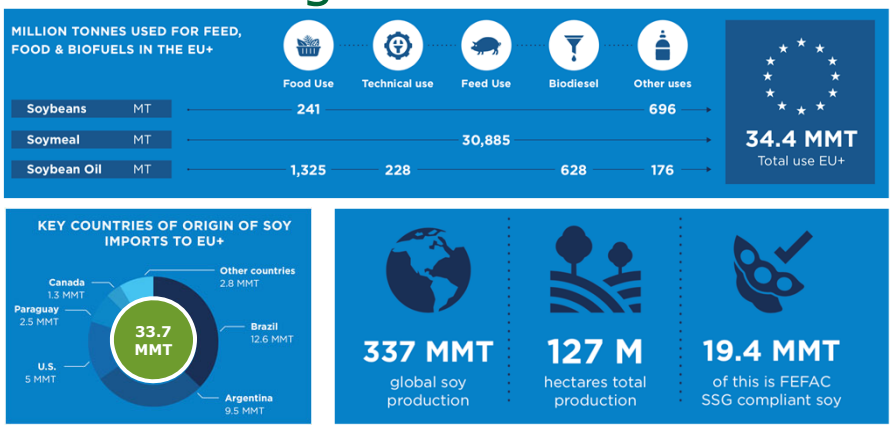
EU and legumes



https://www.idhsustainabletrade.com/uploaded/2019/04/European-Soy-Monitor.pdf

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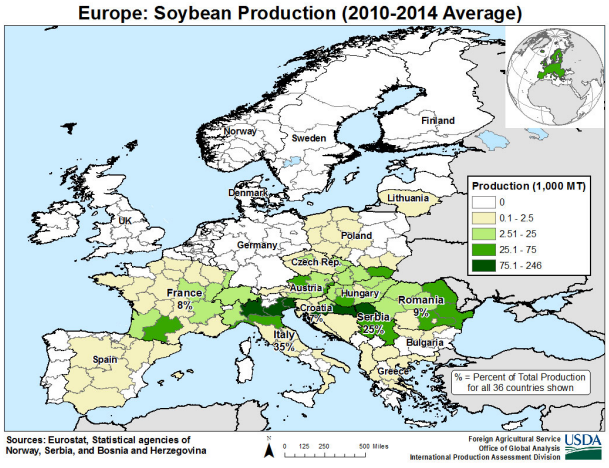
EU and legumes



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Knowledge gaps

- Inadequate investment in breeding
- Sub-optimal management practices
- Gaps in farmers' knowledge

- Variable yields

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LegumeGAP objectives

1. Quantify and characterize yield gaps
2. Identify optimal cultivars
3. Develop optimal management practices
4. Analyse the components and underlying factors of the legume yield gap
5. Evaluate potential and trade-offs of legume production at field and EU scales



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WP2: Cultivars

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What's available? Cultivars

- Characterization of germplasm:
  - Phenology, N fixation, stress response
- Field experiments:
  - 10 soy bean cultivars
  - 3 faba bean cultivars
  - Spain – Germany – Poland
- Derive possible cropping range

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WP2: Cultivars

WP3: Optimal management

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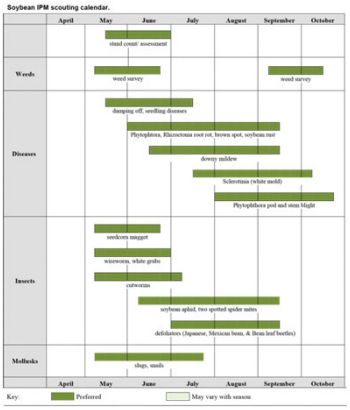
What's available? Practices

- Review of management practices:
  - Crop/cultivar choice
  - Inoculation of seed with Rhizobia
  - Pest-disease-weed management
  - Reduced tillage, use of cover crops, intercropping
  - irrigation
- Analysis of long-term experiments:
  - Germany, Finland, UK, France
- Testing novel practices
  - Based on review
  - Germany, Spain, Poland, Latvia
- Overview of optimal management strategies per region
- Synthesis of factors influencing yield instability



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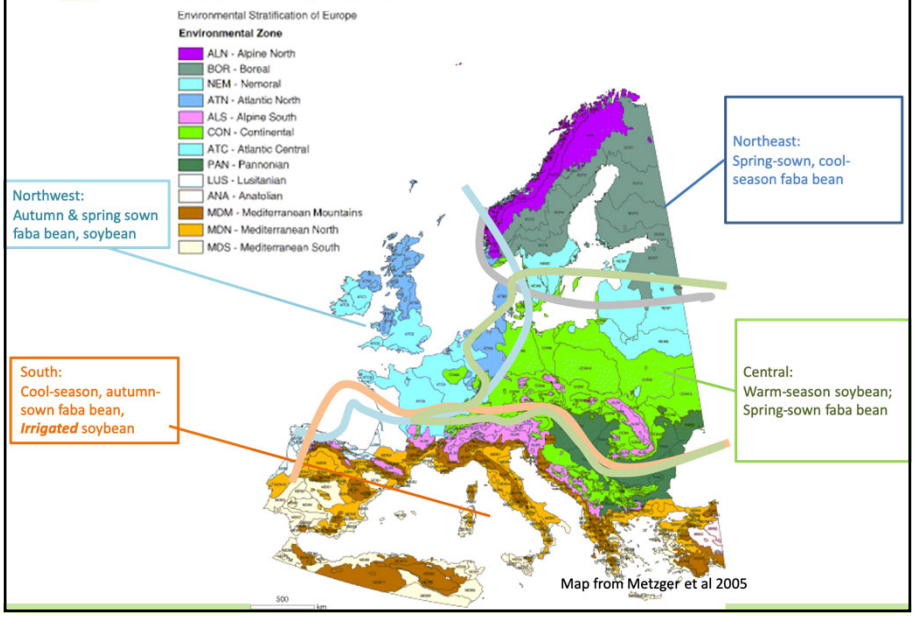

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WP1: Modelling production potential

WP2: Cultivars

WP3: Optimal management

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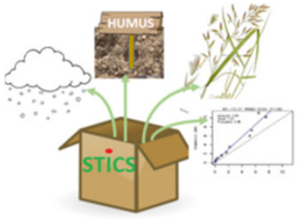
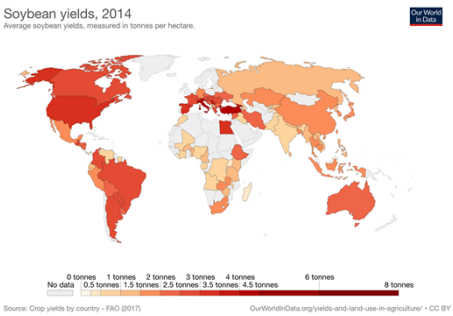
Potential yields

- STICS model
- Potential and exploitable yields
- Quantifying potential of cultivars (WP2) and management practices (WP3)
- Field and EU scale





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WP1: Modelling production potential

WP2: Cultivars

WP3: Optimal management

WP4: Yield gap factors

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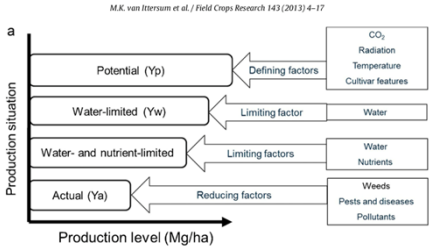
Yield gap factors

- Test cases: disentanglement of yield gap factors
- Modelling: Manageable vs unmanageable
- Survey: Knowledge yield gap



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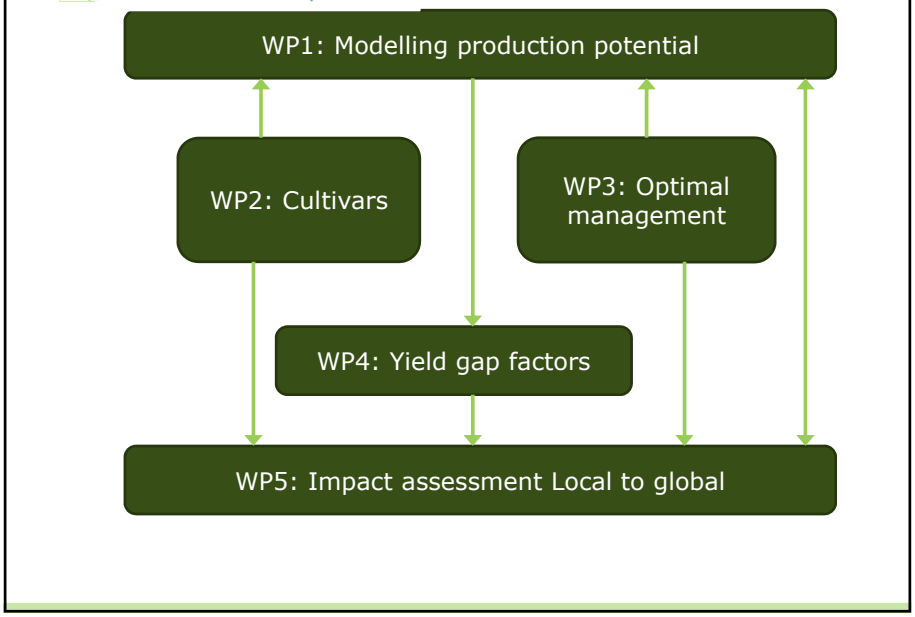

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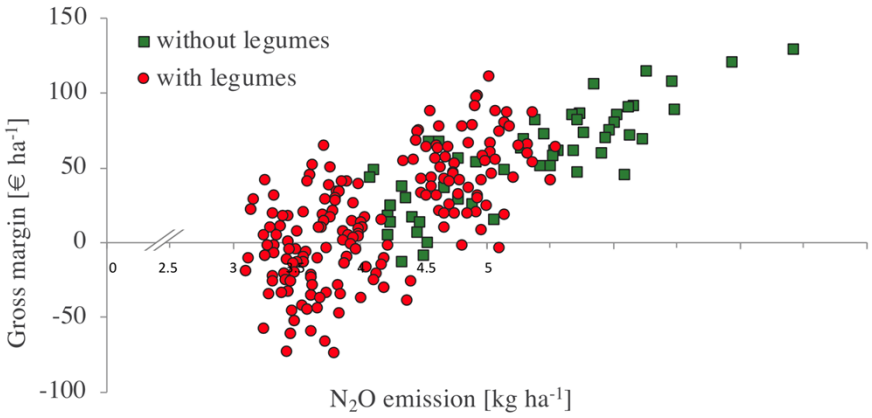
Local impacts: Rotation modelling



Doi: 10.1016/j.eja.2015.11.005

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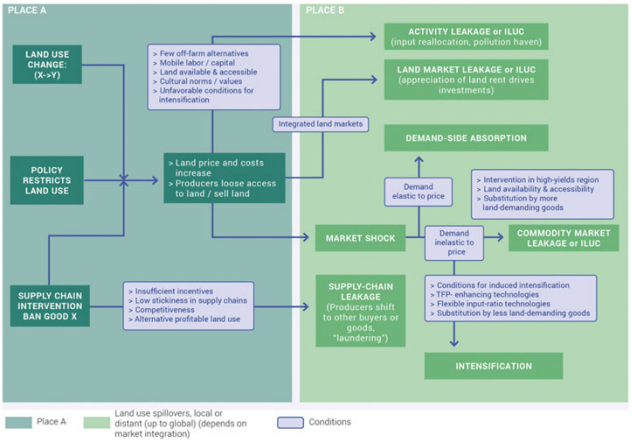
Displaced impacts



Doi: 10.1016/j.gloenvcha.2018.08.006

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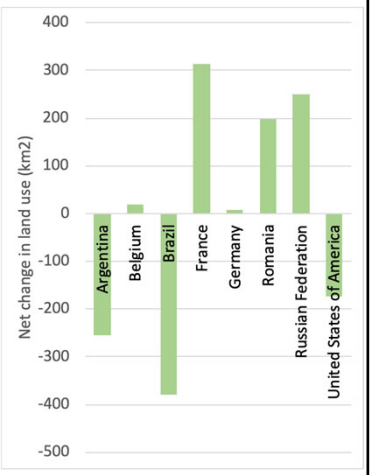
Displaced impacts: example

- Introduce soy in Dutch arable rotations:
  - Maize, Wheat, Sugar beets, Grass, Potatoes
  - Once in 3 years
- 87038 ha / year, 305 kton
- At the cost of:
  - 63 kton sugar beets
  - 707 kton maize
  - 197 kton wheat
- Unchanged consumption: shift in import
  - Key trade partners
  - Total: 21 km^2 land use saving



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4. Analyse the components and underlying factors of the legume yield gap
5. Evaluate potential and trade-offs of legume production at field and EU scales
6. Propose appropriate legume production strategies for Europe
   - Cultivars
   - Field and knowledge management
   - Location



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Thank you

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