



TRansition paths to sUustainable
legume-based systems in EEurope

Pietro (Pete) Iannetta, TRUE-Project Coordinator

pete.iannetta@hutton.ac.uk

**The James Hutton Institute,
Scotland, UK**

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The James Hutton Institute



The institute is named James Hutton, who established links between geology, soil qualities, crop growth, nutritional provision and health.



James Hutton (1726-1797)
Geologist - Naturalist - Farmer



The James Hutton Institute



Craigiebuckler, Aberdeen
Laboratories



Mylnefield Farm, Dundee
Laboratories, glasshouses and arable land (270 ha)



Balruddery Farm, Angus
Arable farm (350 ha)



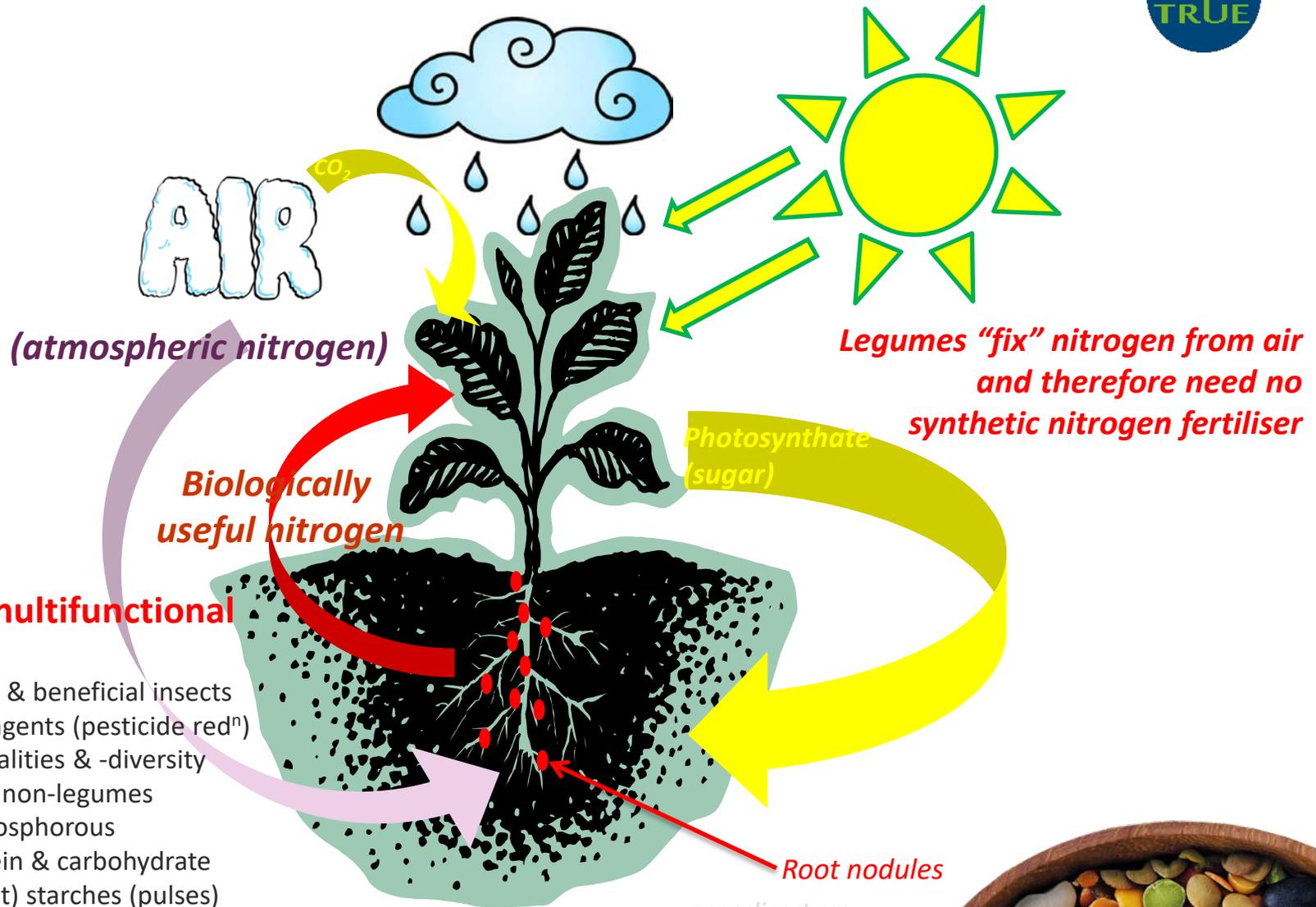
Glensaugh, Kincardineshire
Rotational grassland, permanent pasture, heather moor and peat (865 ha)

www.hutton.ac.uk

- ★ Four main sites, approximately 600 staff
- ★ Two laboratory sites: Dundee & Aberdeen
- ★ Two farm sites: arable and upland
- ★ Biomathematics & Statistics Scotland (BioSS, Edinburgh)



Many do not appreciate what legumes offer?



- Help pollinators & beneficial insects
- Are biocontrol agents (pesticide redⁿ)
- Improve soil-qualities & -diversity
- Gift nitrogen to non-legumes
- Liberate soil phosphorous
- Offer high protein & carbohydrate
- Low GI (resistant) starches (pulses)
- High in essential minerals & other “non-nutritionals”

openclipart.org



Legumes:

- offer a diverse range of types
- **‘cornerstone species’ for the generation of sustainable agri-food systems**

Grain legumes (pulses and oleaginous types)



Forage legumes



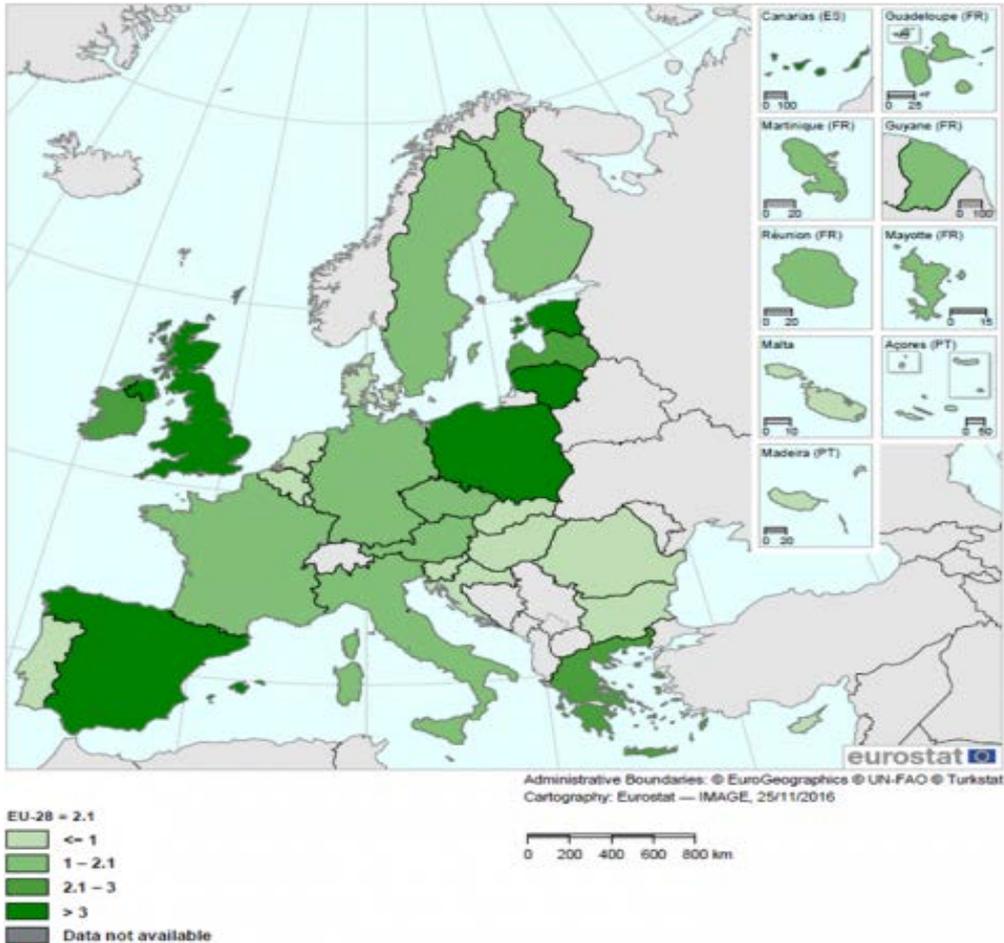
Legumes feed people and animals
Increasingly, forage legumes are being **biorefined**



Legume cultivation: scale across EU countries



% share of land area cultivated for dry legume grains is around 1-4 %



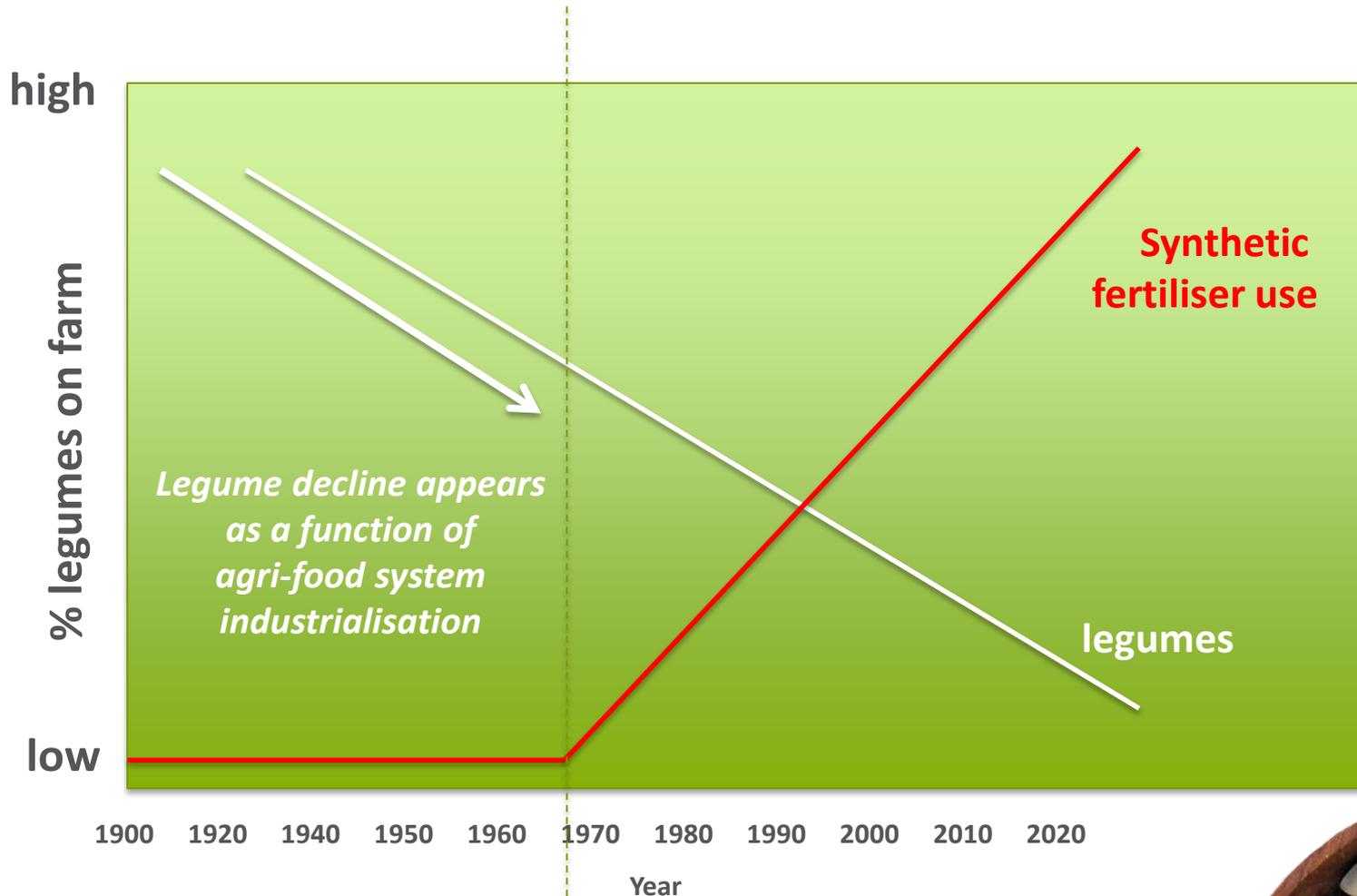
Why is the % of legume cultivation so low in Europe?



Source: Eurostat (online data code: apro_acs_a)



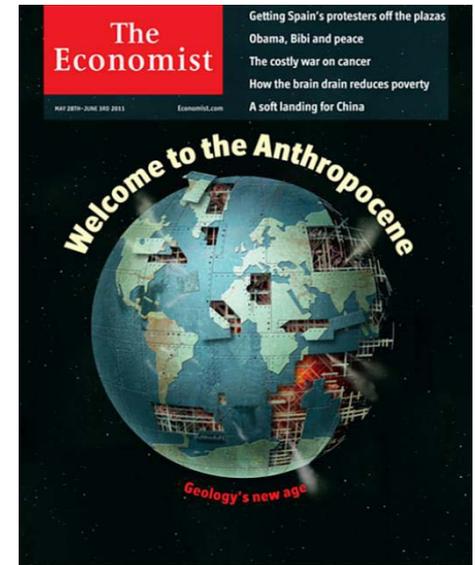
Legume decline is not a simple function of synthetic nitrogen fertiliser use



The ANTHROPCENE



- An epoch proposed by Prof. Paul Jozef Crutzen
- Atmospheric chemist, Nobel Prize Winner
- **Based on INDICATORS of humans impact on the Earth systems**, including
 - biodiversity loss and species extinction
 - biogeography (species distributions/evolution)
 - climate change
 - geomorphology (drainage patterns)
 - stratigraphy (sedimentological record)
 - fossil record (techno-fossils)
 - trace elements
- Suggested periods for initiation include
 - **the industrial revolution / Haber-Bosch 1909**
 - **neolithic times and rise of agriculture**



Waters *et al.*, (2016) *Science* 351.



First some context and questions



Planetary Boundaries

after Johan Rockstrom, Stockholm Resilience Centre et al. 2009.

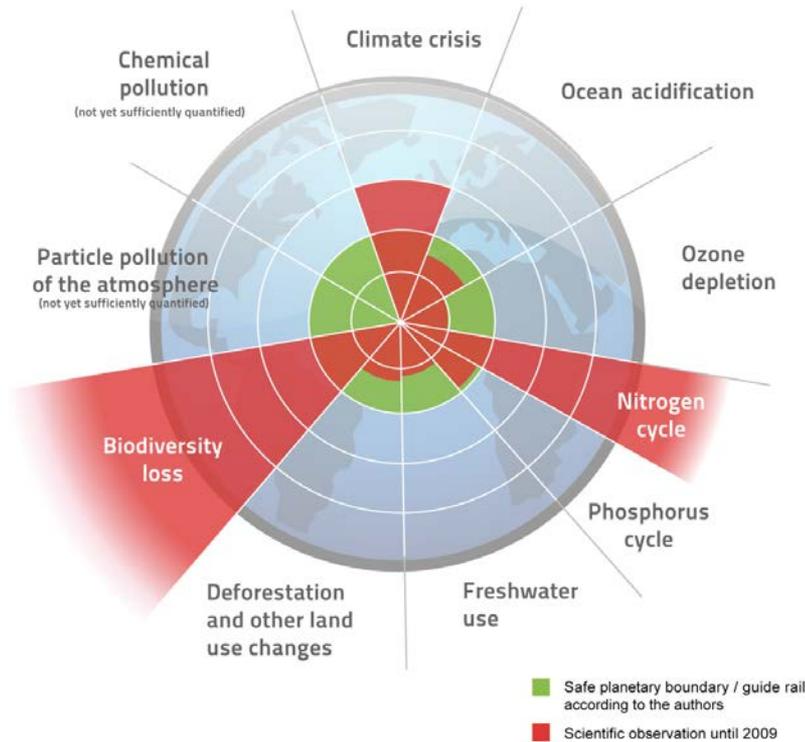
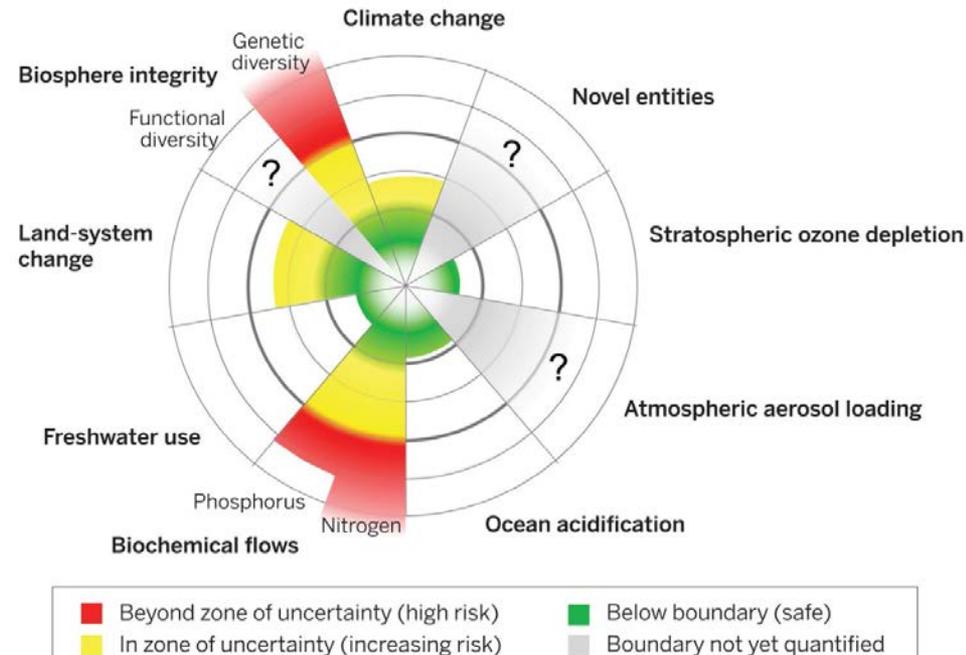


Illustration: Felix Müller (www.zukunft-selbermachen.de) Licence: CC-BY-SA 4.0



[Steffen et al., \(2015\) Planetary boundaries: guiding human development on a changing planet. *Science* 347, 6223.](#)

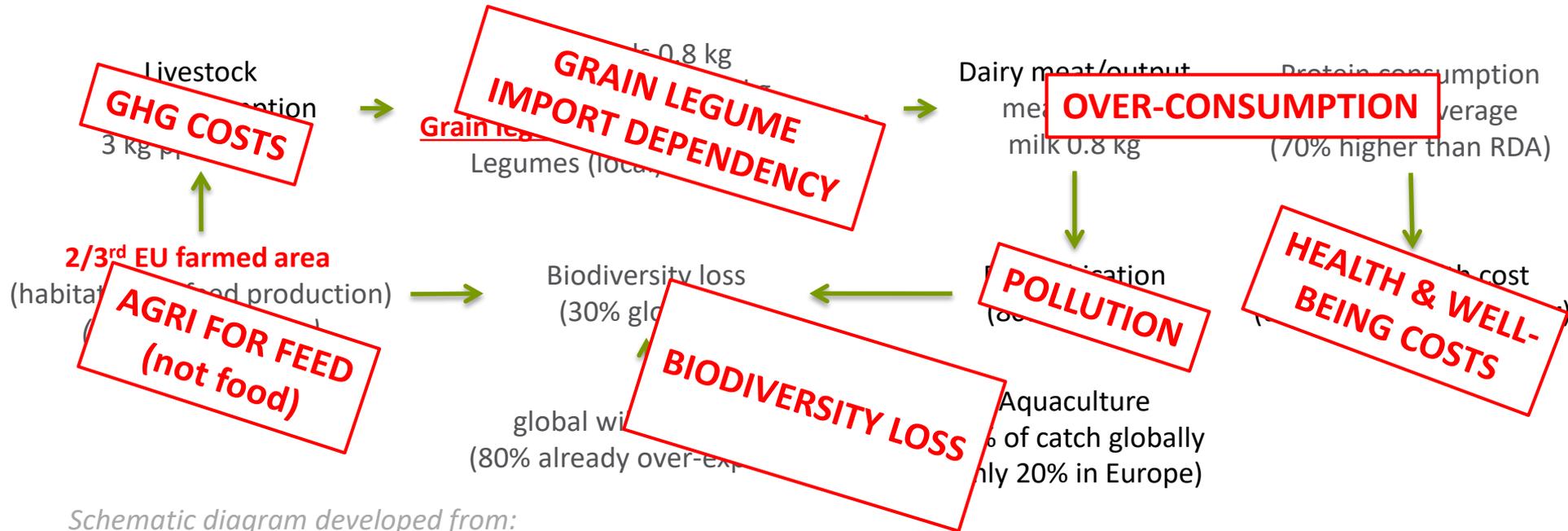
[Rockström et al., \(2009\). A safe operating space for humanity. *Nature* 461, 472.](#)

Q: Why is there a lack of (human) reaction to reactive-nitrogen & -phosphorous?



Society has a complex puzzle to solve

Q: Might domestic legume-based value-chains help resolve this puzzle? If so, how?



Schematic diagram developed from:

[Westhoek et al., 2011. The Protein Puzzle. Euro J Food Res Rev 1, 123.](#)



'Three Pillars of Sustainability'



A concept first developed by René Passet.

Passet, R. (1979). L'économique et le vivant [The economic and the living] 23, Payot.





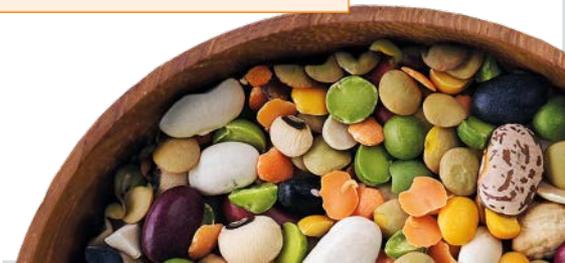
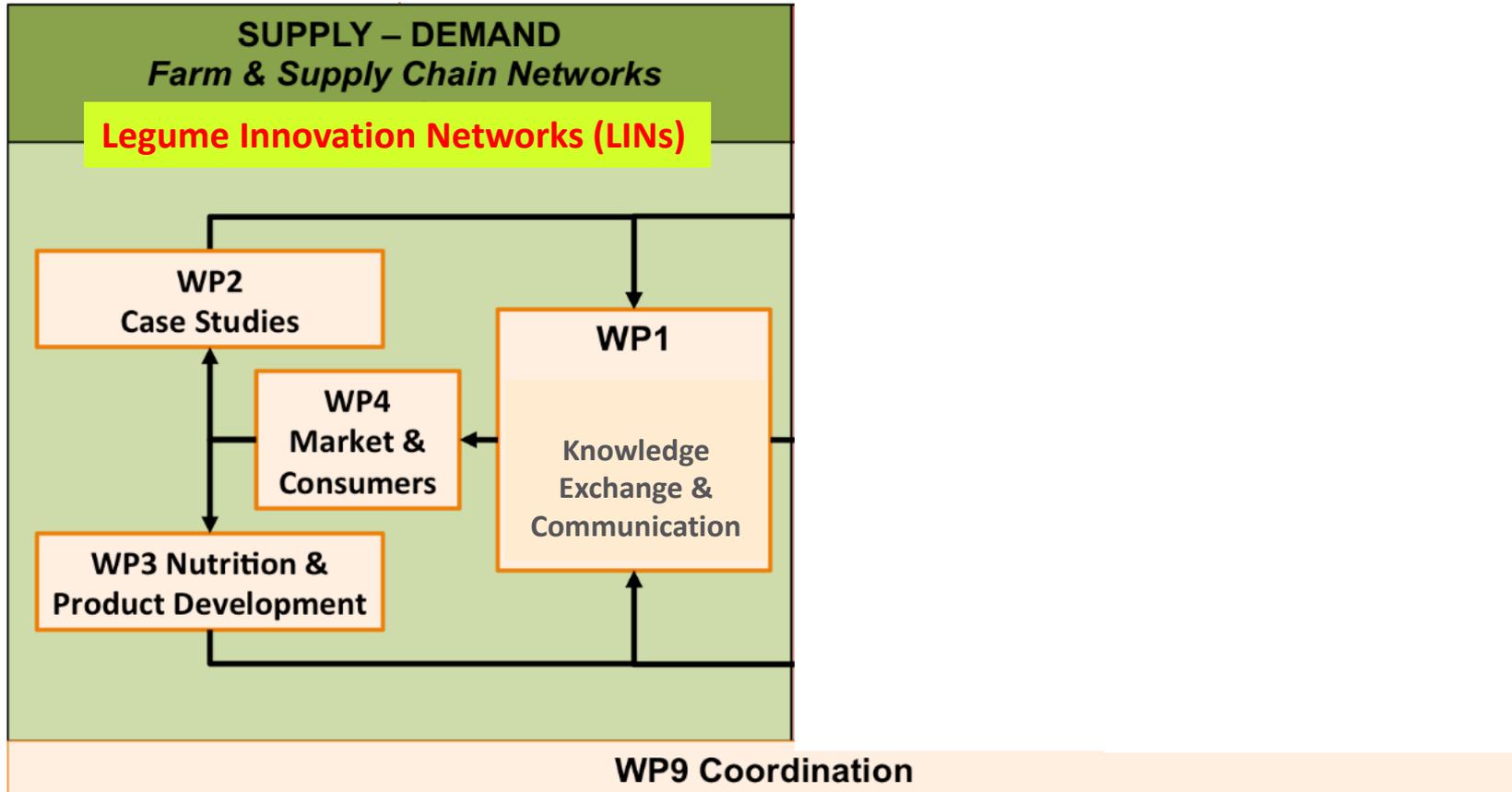
Indicating the state of the three pillars:

The Sustainable Development Goals & Indicators

- There are 17 Sustainable Development Goals, and
- 167 Sustainable Development Indicators
 - **Not specifically targeted to manage agri-food and -feed value-chains**
 - **Tend to operate at national level or higher (not regional or local)**
 - **Need to identify food-system indicators that lie within and between each pillar**



TRUE-Project Work Packages





WP1 – Knowledge Exchange and Communication

To facilitate knowledge exchange between project partners, participants, and production and food chain actors.

- Extensive Knowledge Exchange activities
- European Legume Innovation Networks (LINs), established in 3 regions
- **Website, Blog, Newsletters, Open Access Project Reports & Science-journal articles**
- *Establish TRUEs multiactor- & transdisciplinary-culture*
 - *Publication of the ‘**Transdisciplinary Toolbox**’ –freely available on-line*



WP3 – Nutrition & Product Development



To develop novel food and non-food uses for legumes by screening and processing a range of ingredients and formulations appropriate for regional production systems and historical culture

- **Novel foods and feeds - product development**
 - *Human and aquaculture food- & feed-trials*
 - *Nutritional screening of grains & products*
 - *Food, uptake & health impact (meat substitute)*
 - *Feeds, lupin & faba for aquaculture*
- **It's not all about protein !**
 - *starch, oils, fibre, essential minerals, “non-nutritionals” (not “anti-nutritionals”)*





WP4 – Markets & Consumers

To investigate international markets and trade for legumes and legume-based products (including Case Studies 9-12)

- **More-effective ‘green’ procurement policies**
 - *especially for processed products*
 - *large processor/chain-restaurants collaborations are key*
 - *education of procurement specialists*
- Importance of **‘citizen consumer’** driving demand
- **Retail Price Database** - for legumes/legume-based foods





WP5 - Environment

To produce new inventory data on the environmental intensity of different legume production systems.

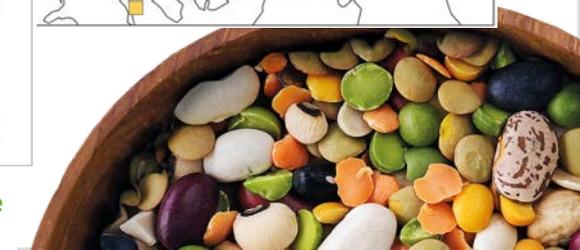
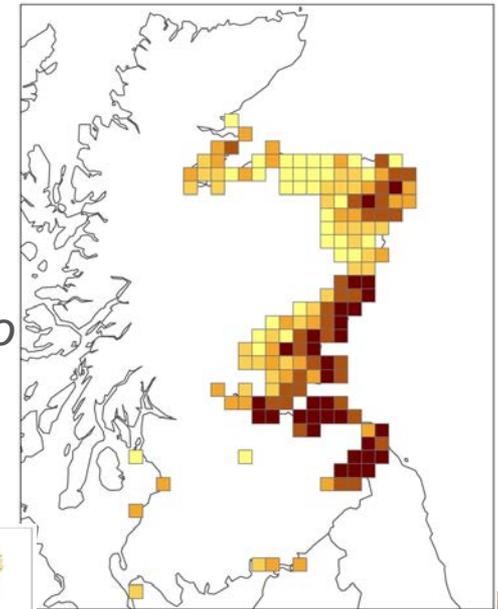
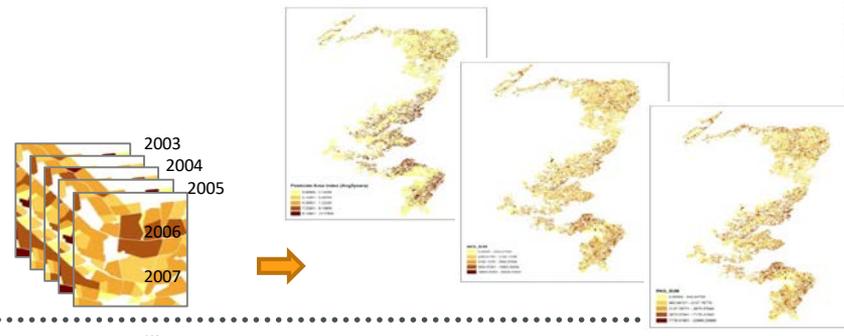
- **New metrics developed to classify foods & feeds**
 - [Environmental impact x Nutrient density] Index
 - Life Cycle (impact) Analysis (LCA)
- **Developing ‘framework European diets’**
 - from FAO food-availability data
- **Very-close collaboration with other WPs/Case Studies**
 - 3, *Novel Products & Nutrition*; 6, *Economics*; and, 8, *Transition Design*
 - *Key Case Studies (WP2) help develop supply-chain maps*



WP6 - Economics

To determine the economic performance of legumes at the Farm-, Farm Network (regional), and EU levels in conventional and organic production systems.

- Case Study data **identifies trade indicators** (farm- and regional-level)
- **Spatial Distribution Maps** generated
- **Science Literature Survey**
- **Survey data**
 - *on farmer's motivation to uptake legumes*
 - *consumer's willingness purchase legume-based food*
 - *impacts of fluctuating supply/demand*



WP7 – Policy and Governance

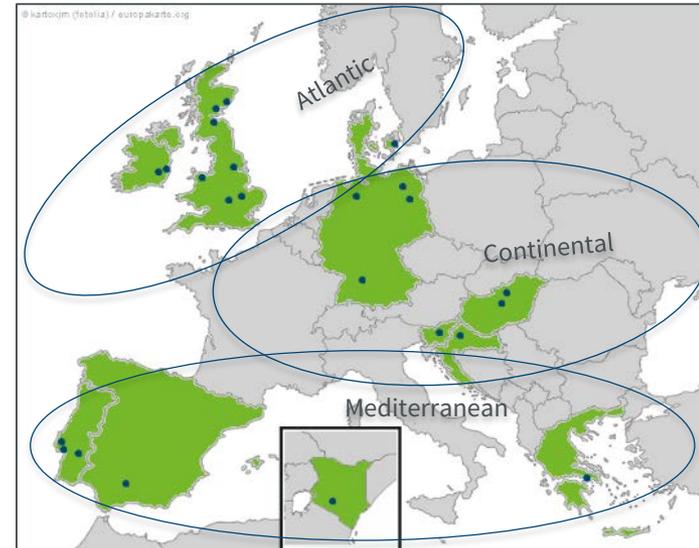


To analyse and enable policies, legislation and regulatory systems for the promotion of legumes.

- ‘Co-design’ & Co-production of policy’ reports are available on-line
 - **Improve policies and their coherence**
 - **Develop the ‘society-science-policy interface’**
- **Stakeholder survey on legume-policies**
 - Lead role in ELINs, with WP’s 1 & 4
- **‘Policy briefs’**
 - e.g.’s *FAO Report ‘legume-policy mapping’, Scottish Government, Regional Development (Croatia)*



Legume Innovation Networks & Case Studies (WP2)



A main objective of TRUE is to establish:

- a single **European Legume Innovation Network**
- to be established in partnership with www.legvalue.eu (in 2020)
- led and directed largely by **non-academic partners**
- **first meeting in 2021**

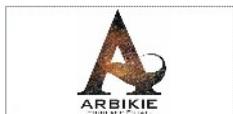


General contact information

Website: www.true-project.eu

Email: info@true-project.eu

Facebook/Twitter: [@TrueLegumes](https://www.facebook.com/TrueLegumes)



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