



TRansition paths to sUustainable
legume-based systems in EEurope

Legume processing: opportunities and barriers

Pietro (Pete) Iannetta,
Agroecologist/TRUE Coordinator
James Hutton Institute, Dundee, Scotland UK

Nyborg, Denmark, Tues. 7th May 2019



*TRUE 2nd General Assembly 2018
Agricultural University of Athens, Greece*



The banner features the TRUE logo at the top left, with the text 'Transition paths to sustainable legume-based systems in Europe'. Below this, a 'Project consortium' section lists various partner logos including CABI, ESSRG, CAVI, EUREST, IGIV, and SRUC. A large image of a bowl filled with diverse legumes is positioned at the bottom of the banner. Social media icons for Facebook, Twitter, and YouTube are visible in the bottom right corner, along with the website address 'www.true-project.eu'.



www.true-project.eu
pete.ianetta@hutton.ac.uk



TRansition paths to sUstainable legume-based systems in Europe



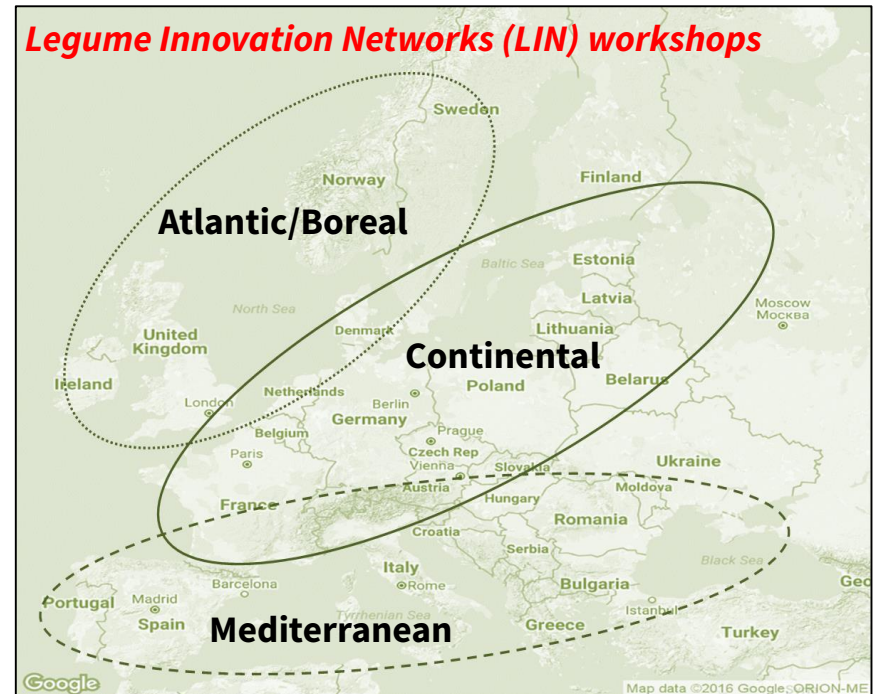
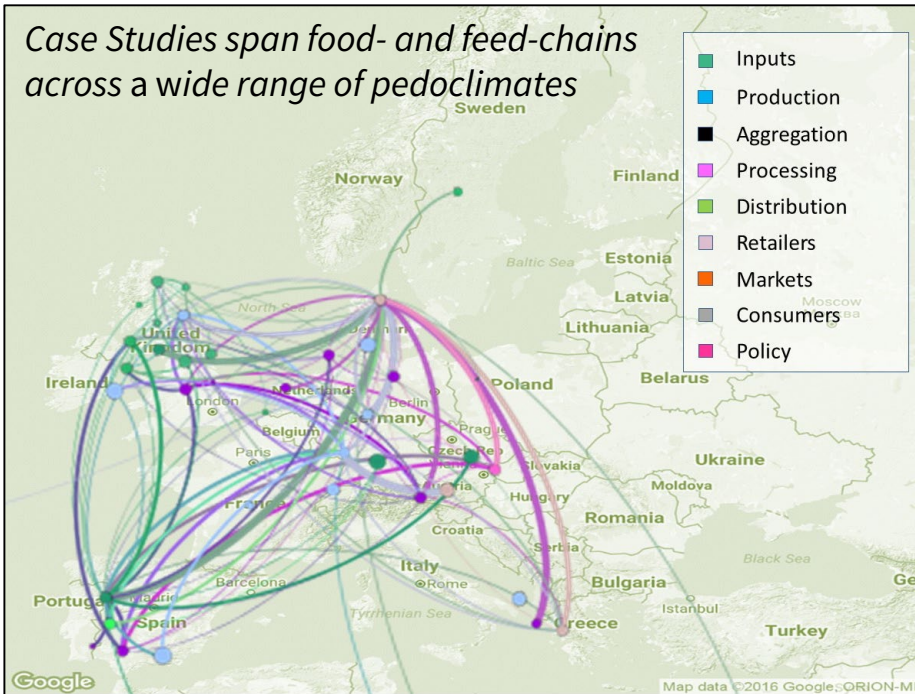
24 Partners: equal-balance of industry and non-industry



Legume Innovation Network (LIN) workshops



24 Case Studies: activities span the supply chain



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 by **industry and civil-society groups**
- **first meeting in 2021**



The rational of TRUE: I



- **We know what legume-supported farmed-systems look like.**
 - o However, such systems are not adopted – why is this?
- **Consequently: The 3 Pillars of Sustainability are not in harmony.**
 - o Can legume-focused **sustainability development indicators** help monitor and harmonise The 3 Pillars?



The Three Pillars of Sustainability, René Passet.

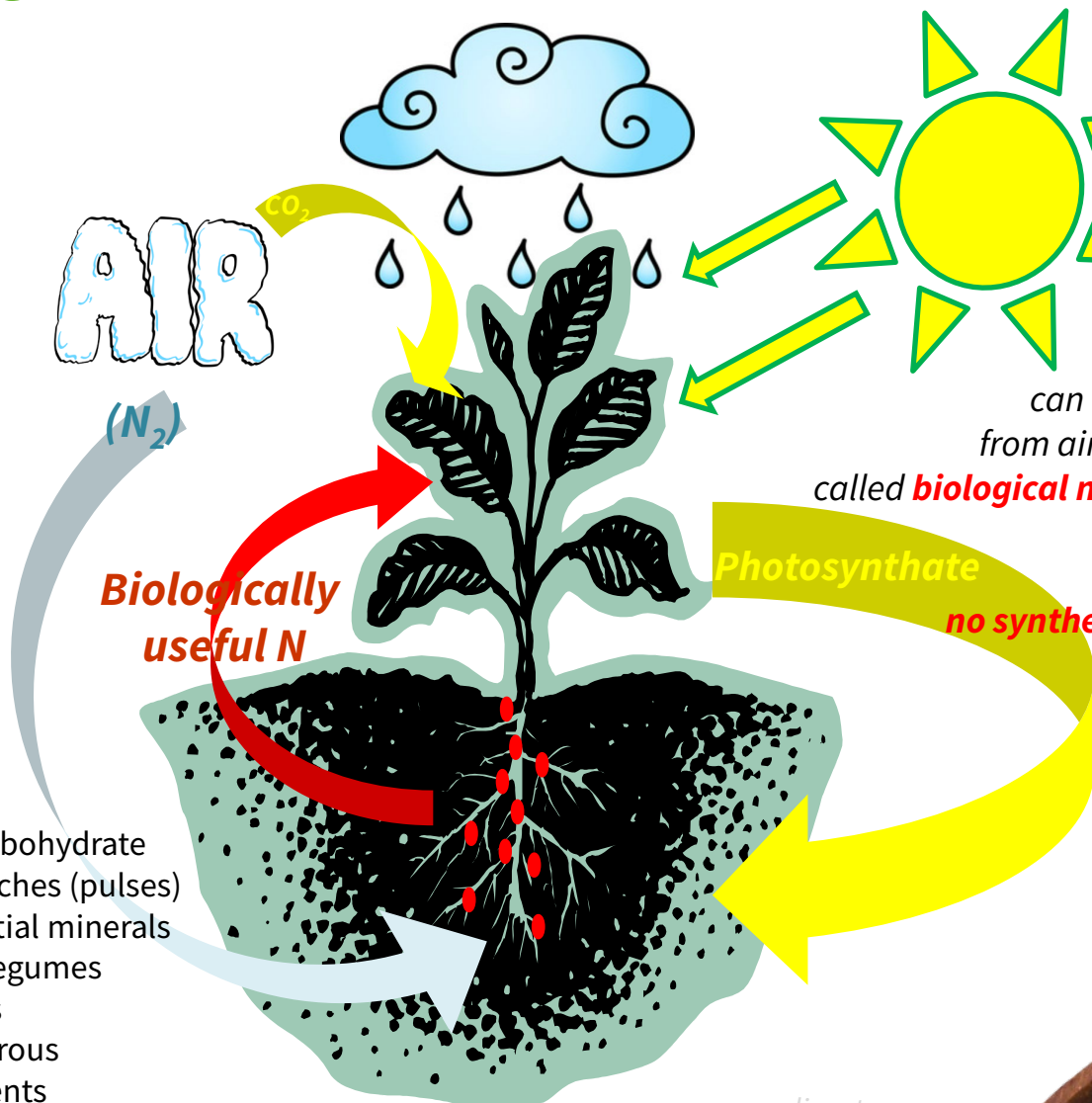
Passet, R. (1979). *L'économie et le vivant* [The economic and the living] **23**, Payot.



What is a legume?



A simple
Schematic - legume



So, legumes:

can acquire their nitrogen
from air via a natural process
called **biological nitrogen fixation**; and

therefore need
no synthetic nitrogen fertiliser

Legumes can also:

- high protein, high carbohydrate
- low GI (resistant) starches (pulses)
- good source of essential minerals
- gift nitrogen to non-legumes
- improve soil qualities
- liberate soil phosphorous
- can be biocontrol agents
- support pollinators / beneficial insects

openclipart.org



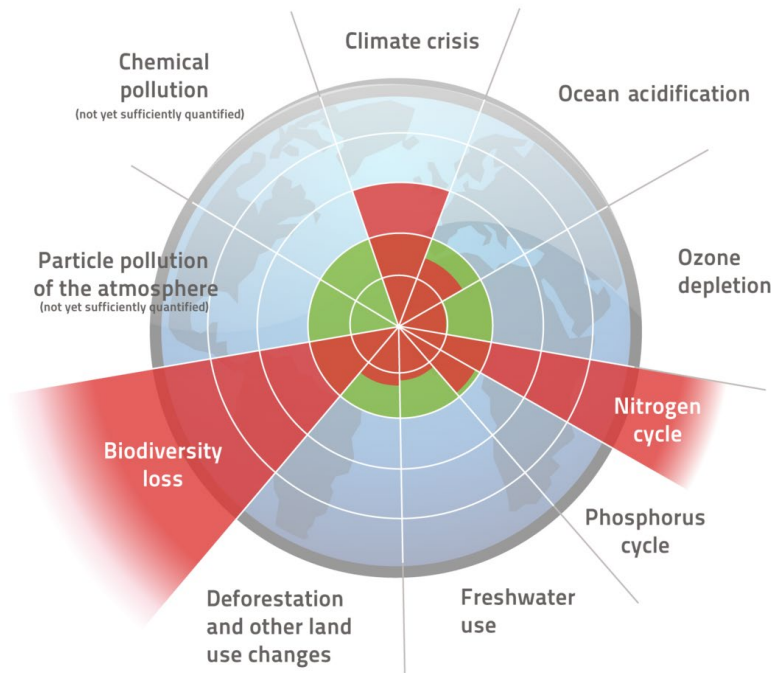
Why is biological nitrogen fixation by legumes important?



Legumes help encourage 'natural nitrogen cycling'

Planetary Boundaries

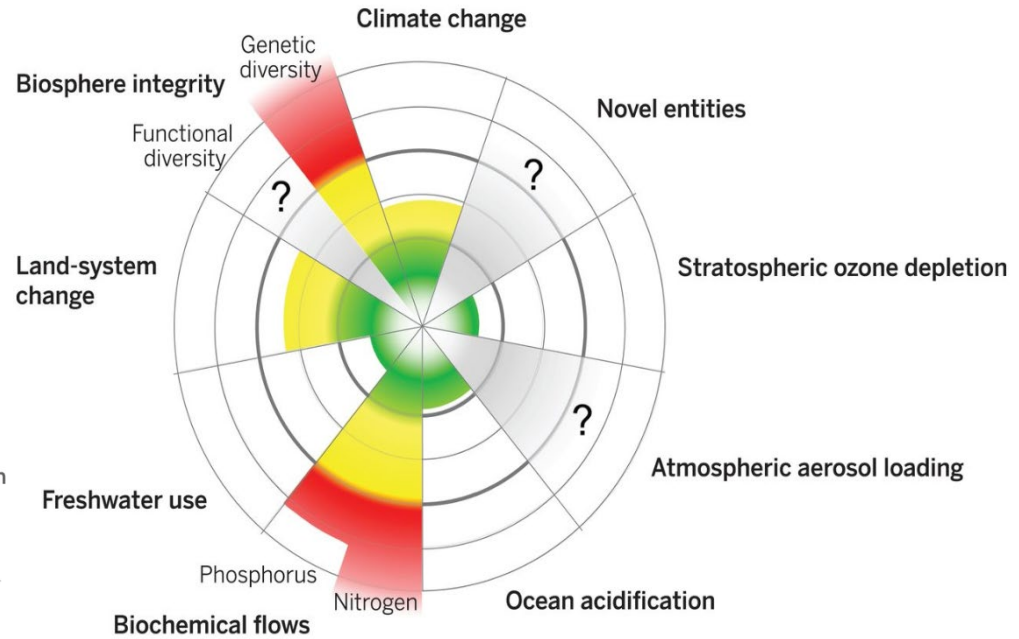
after Johan Rockström, Stockholm Resilience Centre et al. 2009



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

- Safe planetary boundary / guide rail according to the authors
- Scientific observation until 2009

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

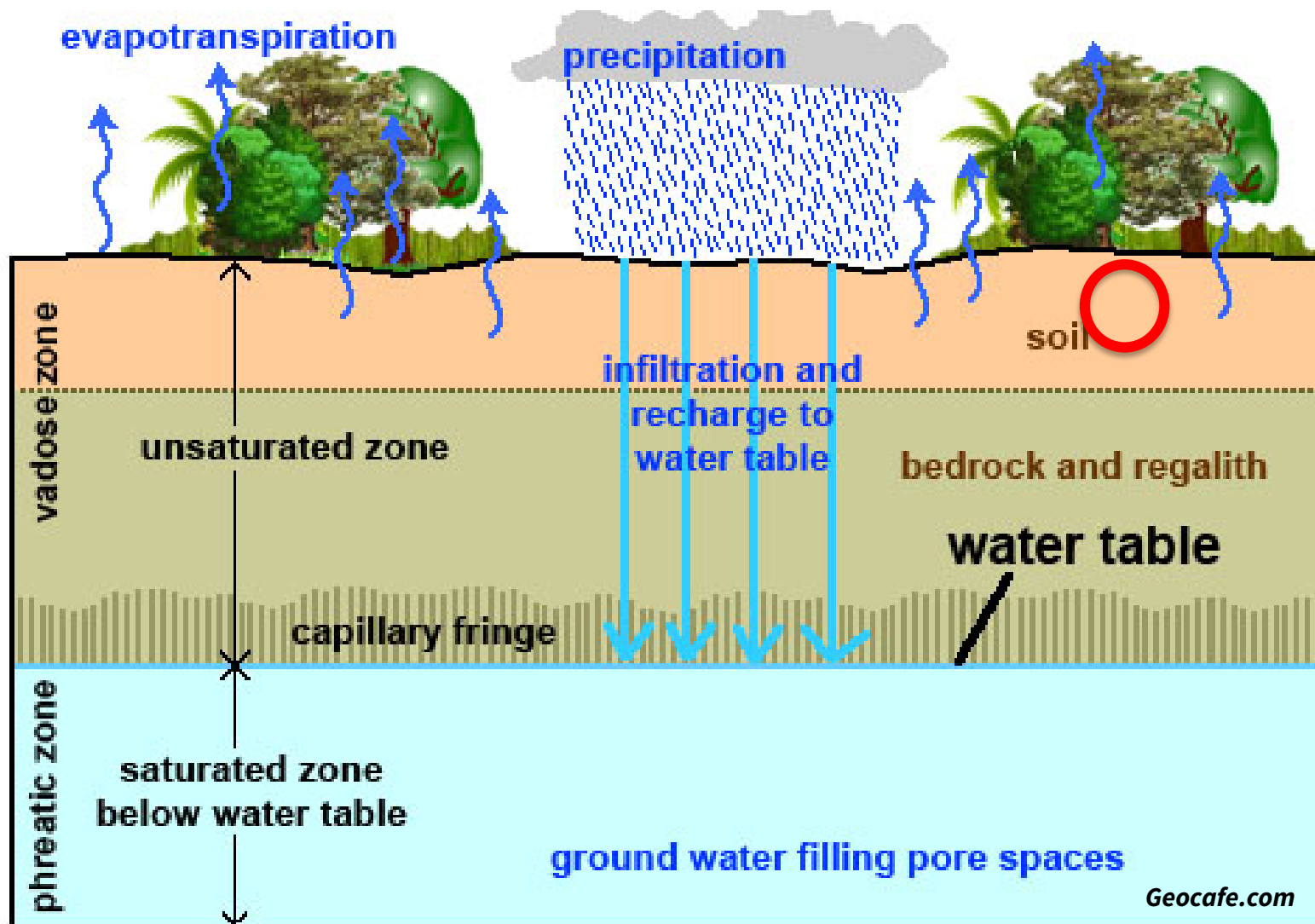


- Beyond zone of uncertainty (high risk)
- In zone of uncertainty (increasing risk)
- Below boundary (safe)
- Boundary not yet quantified

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



“The nitrate time-bomb”





Why not aspire to natural-nitrogen farming?

NEWS AGRICULTURE, CLIMATE, POLLUTION

Fertilizer produces far more greenhouse gas than expected

Farmers' overuse of nitrogenous additives may explain puzzling emissions

BY BETH MOLE 5:31PM, JUNE 9, 2014

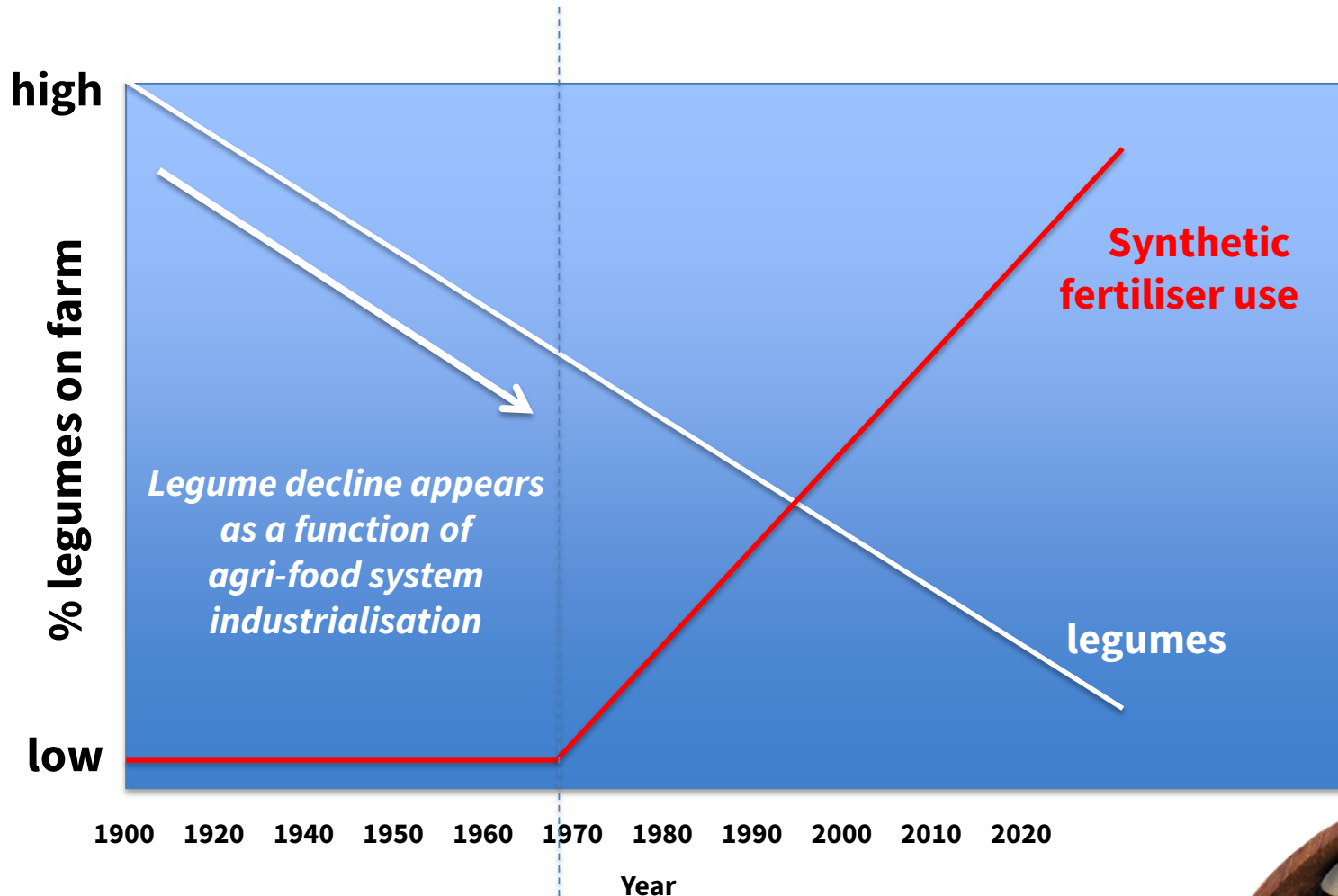
Excess fertiliser can exponentially boost the emissions of microbes

[Shcherbak et al., \(2014\). Global meta-analysis of the nonlinear response of soil nitrous oxide \(N₂O\) emissions to fertilizer nitrogen. Proceedings National Academy Sciences 111, 9199.](#)

Yet, legumes occupy only 1-4 % of European arable farmed-land



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

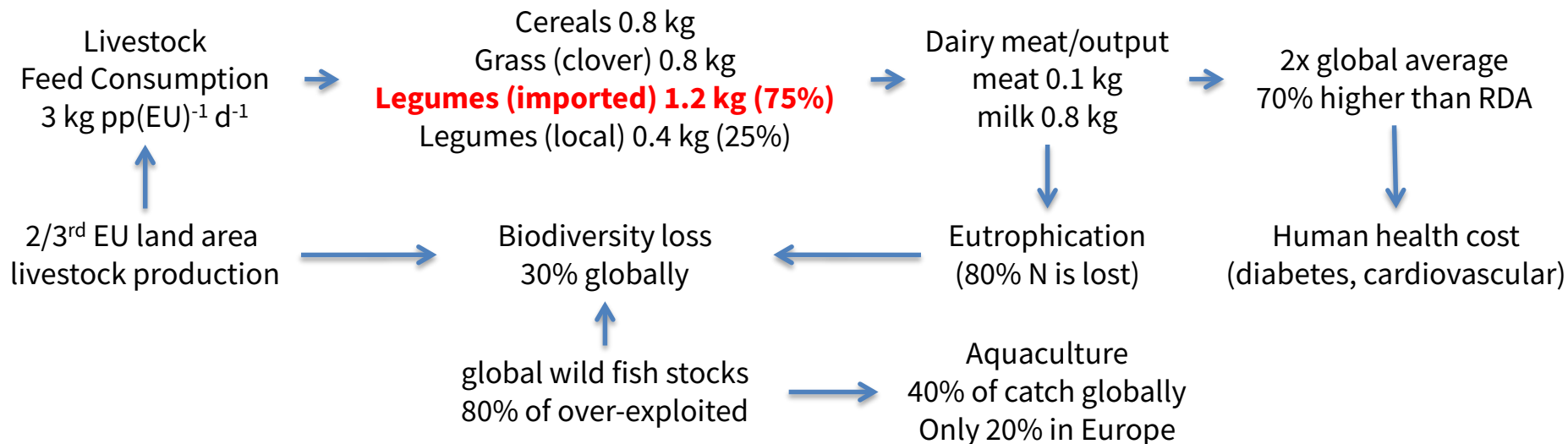


The rational of TRUE II: the legume- puzzle & -paradox



In conclusion:

- Europe already has legumes supported agri-food systems,
- but forfeit legume benefits (**paradox**), as the legumes we use are imported.
- Unsustainable consumption (feed and food) presents a **puzzle** of negative impacts to resolve.



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



Legumes: agents to help resolve human-health crises too



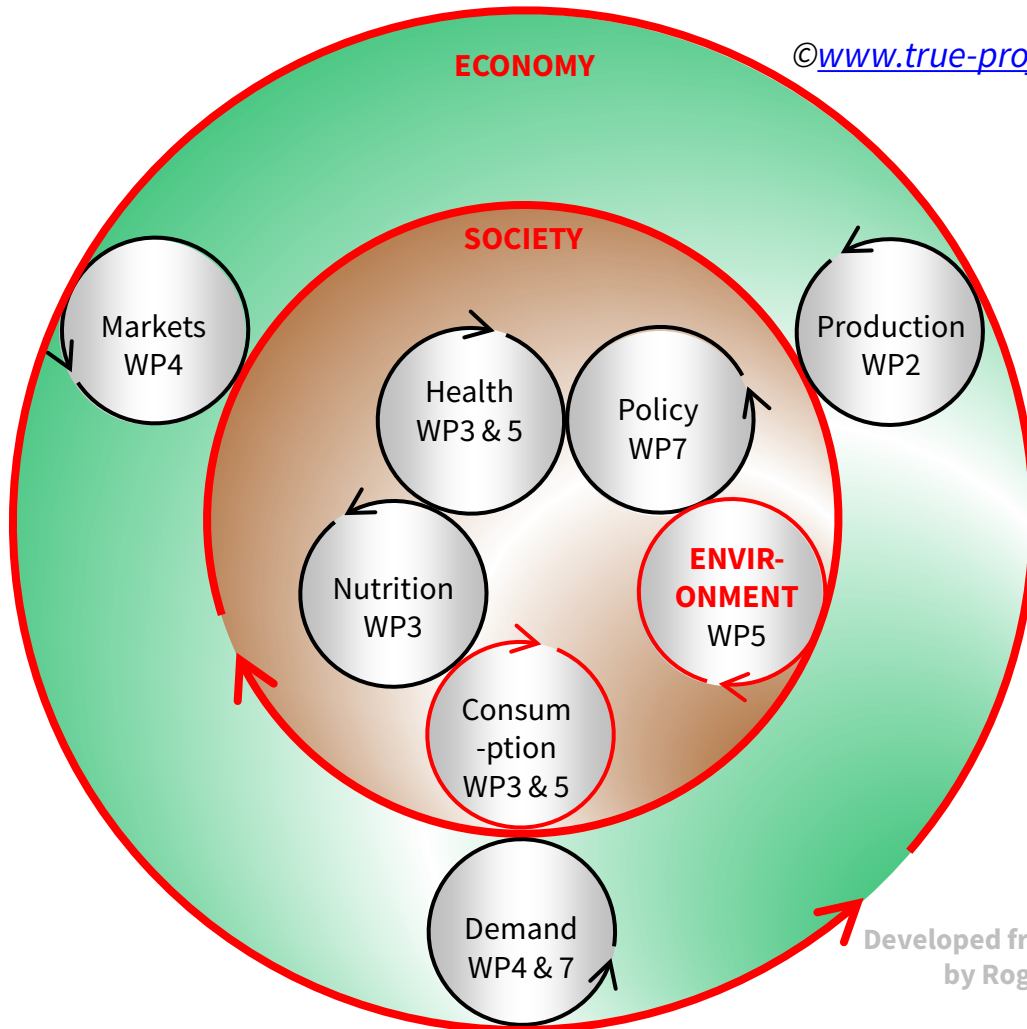
- Major global health issues prevalent:
 - 1980-2017 obesity doubled (30% of global population)
 - heart disease / diabetes
 - 11% of total health care costs (2014) due to diabetes
([Rocha et al., 2014](#))
 - 30% of global population suffer nutrient deficiencies (≠ same 30% obese)
- [5th IPCC Assessment](#): sustainable-consumption to combat climate change



TRUE Perspectives on 'The 3 Pillars'



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- **Environment and consumption** better harmonised with **production, demand** and **market**
- This will help ensure that the Society and Economy pillars are harmonised.
- Economy pillar is only sustainable if the integrity of the internal core elements are optimised.

Developed from an original sketch by Roger Vickers CEO, PGRO

WP8, will identify indicators to help harmonise The 3-Pillars



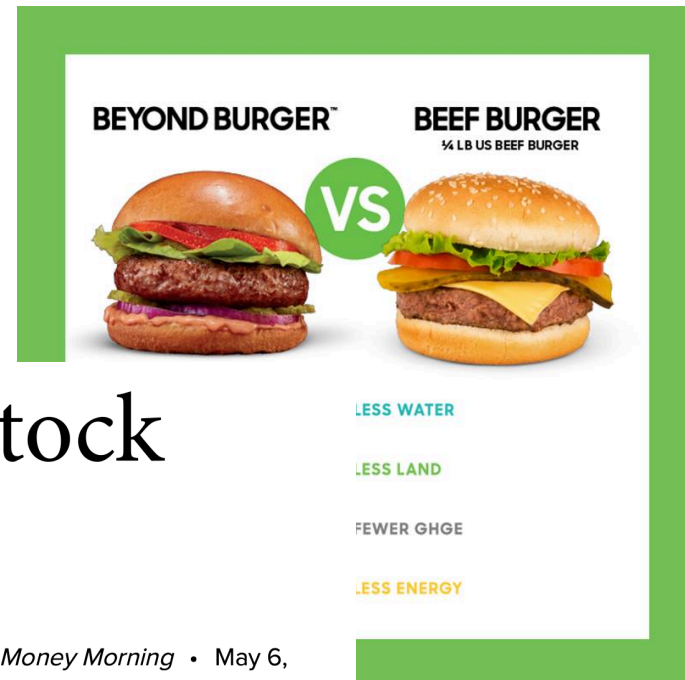


Beyond Meat™ (www.beyondmeat.com/)

The utility of Life Cycle Assessment in the ready meal food industry

Calderón et al., 2010

- Beyond Meat – Life Cycle Assessment [report](#)
- Stock market flotation (last week)



US vegan food maker Beyond Meat eyes \$4bn valuation

What Is the Beyond Meat Stock Price – and Is It a Buy?

By [DANIEL SMOOT \(HTTPS://MONEYMORNING.COM/AUTHOR/DSMOOT/\)](https://money Morning.com/author/dsmoot/), Associate Editor, *Money Morning* • May 6, 2019

Following its debut on Thursday (May 2), the **Beyond Meat stock price** skyrocketed 34% above its open price of \$46.

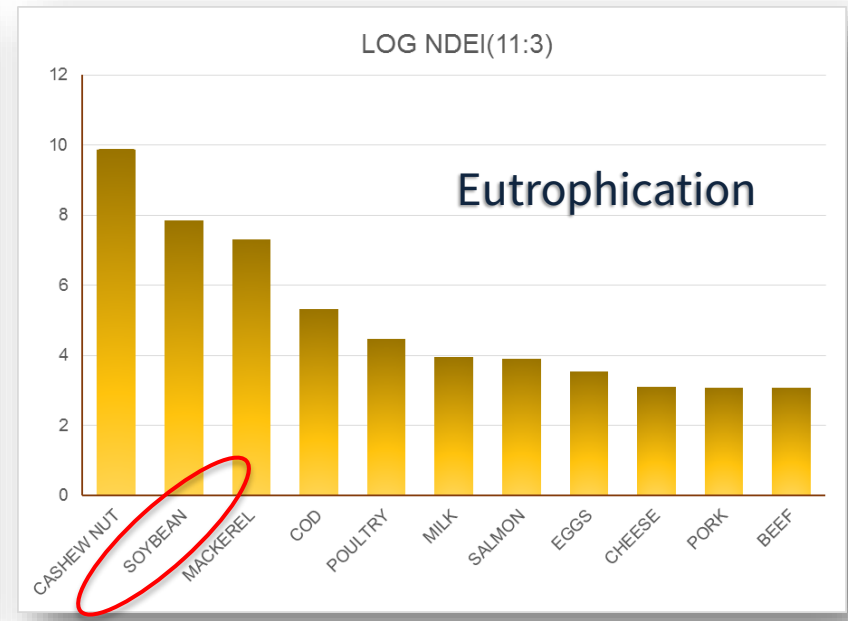
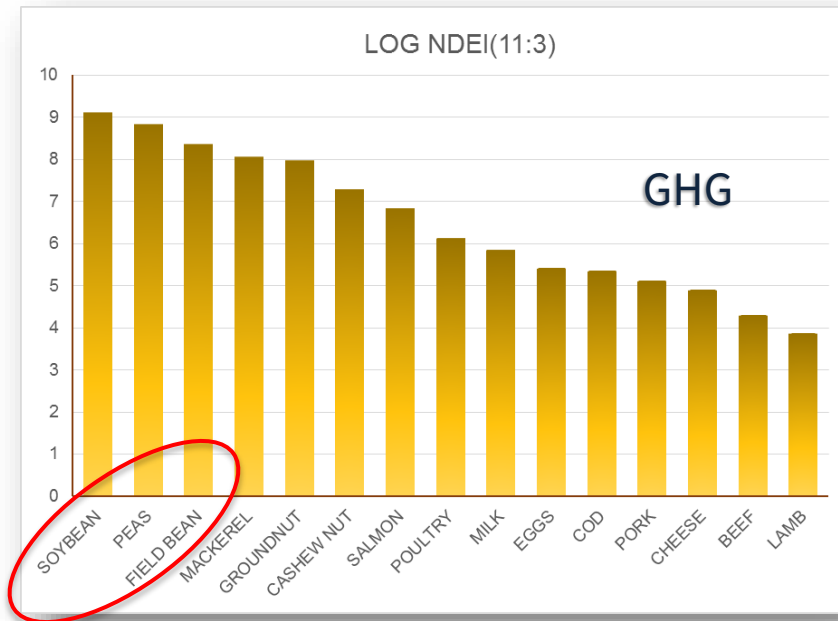
Will local agri-food systems feature benefit?



TRUE-LCA (Life Cycle Assessment) Tools



[Nutrient Density / Environmental Impact] (NDEI) indices



Nutrient Density/Environmental Impact Ratio

Mike Williams & Sadhbh Sheeran



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin





Recent project outputs

Peer-reviewed papers published by TRUE partners

- Santos *et al.*, (2018) [Relationship between seed traits and pasting and cooking behaviour in a pulse germplasm collection](#). ***Crop and Pasture Science***, 69, 892-903.
- Leinonen *et al.*, (2019) [Lysine supply is a critical factor in achieving sustainable global protein economy](#). ***Frontiers in Plant Science***, doi.org/10.3389/fsufs.2019.00027.
- Squire *et al.*, (2019) [Transitions to greater legume inclusion in cropland: defining opportunities and estimating benefits for the nitrogen economy](#). ***Food and Energy Security***, *In Press*.
- Black *et al.*, (2019) Assessing the influence of the inclusion of [field bean \(*Vicia faba* L.\)](#) on the [taste and overall impression of beer](#). ***Journal of Brewing and Distilling***, *In Press*.
- Leinhardt *et al.*, (2019) Just the tonic! [Legume biorefining for alcohol](#) has the potential to reduce Europe's protein deficit and mitigate climate change. ***Environment International***, (*accepted*).





Recent project outputs

Open access deliverables available on-line

- [Transdisciplinary Toolbox](#)
- [Co-design of policy](#)
- [LCA methodology report](#)
- [Public and private procurement](#)
- [Outline business plans](#)
- [Data for LCA proof of concept](#)
- [Co-production of policy assessment](#)
- [Practice Abstracts](#)

For more publicly available outputs click [here](#)

For the TRUE-Blog 'notes from the field' click [here](#)

For the Newsletter click [here](#)



Implementing home-grown legume-based agri-food systems in Europe

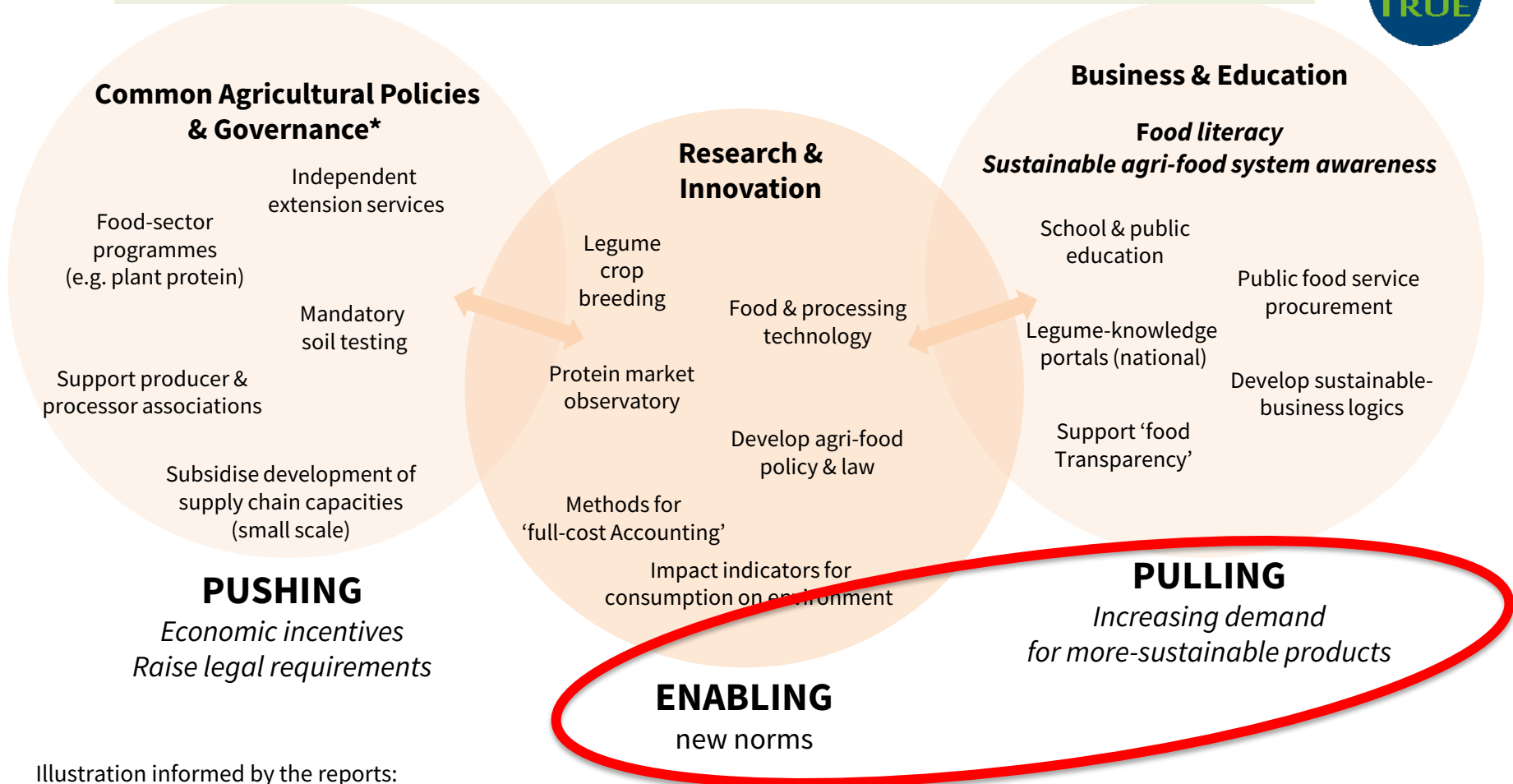


Illustration informed by the reports:

- Market developments and policy evaluation aspects of the plant protein sector in the EU
- Eyhorn et al., (2019). Sustainability in global agriculture driven by organic farming. *Nature Sustainability*, 253
- On the development of plant proteins in the European Union.

**Good-governance should ensure the creation, protection and distribution of wealth.*





European “Crop Diversification” Conference

European Conference on Crop Diversification

September 18 -21, 2019
Budapest, Hungary

ABOUT

IMPORTANT DATES

VENUE

PROGRAMME

COMMITTEES

Cropdiversification 2019 >> About

About

The European Conference on Crop Diversification will take place from the 18th to 21st of September 2019 in Budapest, Hungary. The conference will explore how we can achieve the full potential of cropping system diversification for improved productivity, delivery of ecosystem services and resource-efficient and sustainable value chains. Take part in the discussion – we look forward to your contribution! The call for papers will come out in November 2018.

www.cropdiversification2019.net/



General contact information

Website: www.true-project.eu

Email: info@true-project.eu

Facebook/Twitter: [@TrueLegumes](#)



The TRUE project is coordinated by

The James Hutton Institute

The James Hutton Institute is supported by

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a division of the Scottish Government*



Scottish Government
Riaghaltas na h-Alba
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