



The Role of Legumes in Organic and Low Input Agriculture: Present and in the Future

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Benefits of Legumes

- Nitrogen
 - Self-sufficient via biological nitrogen fixation
 - Fertilisation effect for following crop
- Energy
 - Use of solar energy *in situ*
 - Save on fossil energy resources
 - Chemical nitrogen fertilisers: 1 litre oil for 1 kg nitrogen
 - No energy for transportation and broadcasting
 - Biogas production via fermentation

Benefits of Legumes

- Nitrogen
- Energy
- Forage and feed quality
 - Forage intake is higher with legume-based forage
 - followed by higher production
 - Reduced dependence on non-forage feeds
 - Local / home grown protein-rich feed
 - Europe imports about 70% of its plant-derived protein
 - Legumes including condensed tannins (Lotus, sainfoin, sulla) prevent bloating, increase nitrogen utilisation, decrease parasite problems
 - Beneficial mineral content

Benefits of Legumes

- Nitrogen
- Energy
- Forage and feed quality
- **Food quality and health benefit**
 - Legumes effect the chemical, functional and sensorial properties of milk and meat (more conjugated linoleic acid, polyunsaturated acids)
 - Animal products from legume-based systems are thought to be more natural by consumers
 - Grain legumes help to prevent cardiovascular disease, type 2 diabetes, obesity

Benefits of Legumes

- Nitrogen
- Energy
- Forage and feed quality
- Food quality and health benefit
- **Environmental benefits**
 - Higher Nitrogen use efficiency
 - On field level
 - On system level
 - By ruminants
 - Less transient high soil mineral nitrogen concentrations
 - GHG emissions
 - Nitrogen leaching

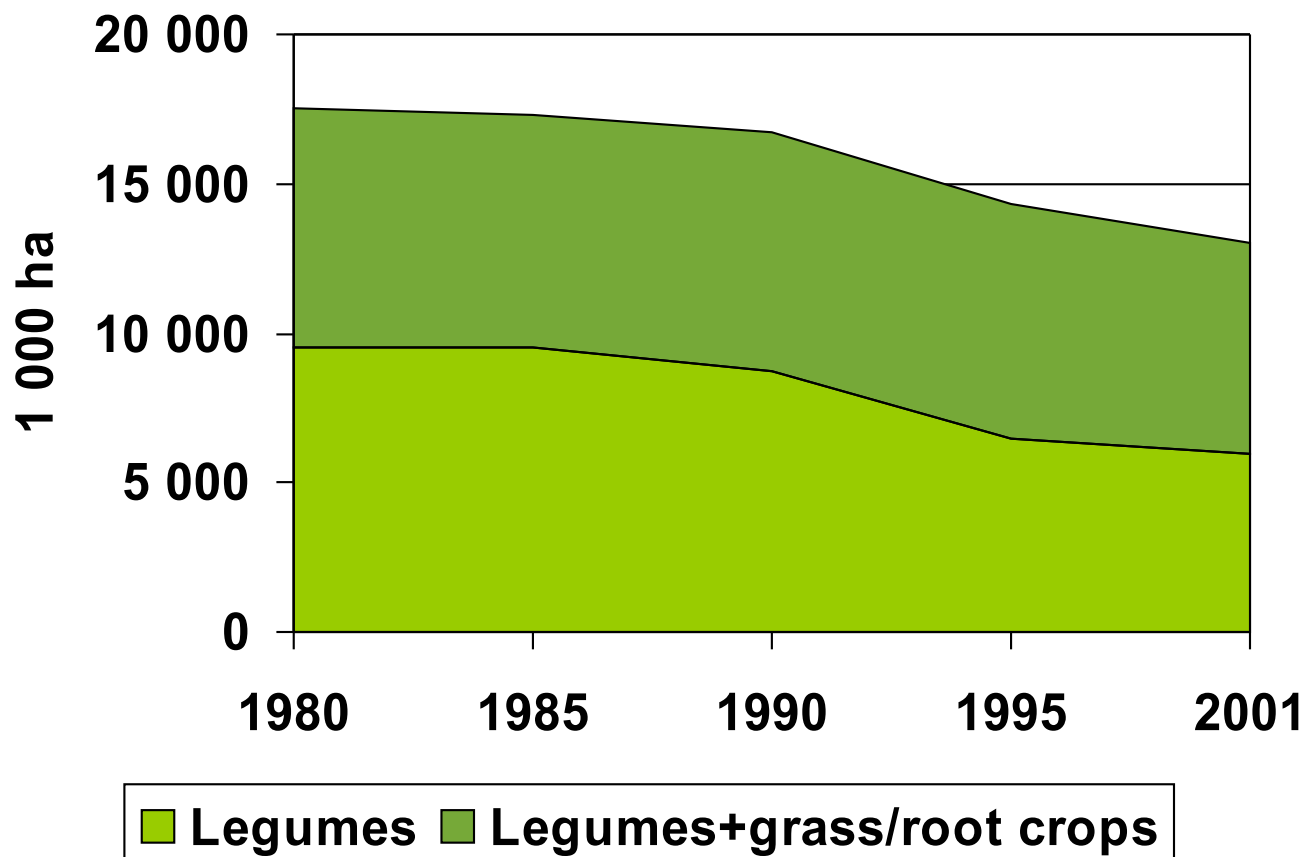
Benefits of Legumes

- Nitrogen
- Energy
- Forage and feed quality
- Food quality and health benefits
- Environmental benefits
- **Ecosystem services**
 - Higher biodiversity
 - Root exudates enhance the growth of beneficial soil organisms
 - Break soil-borne cereal disease cycles
 - Deep rooting legumes improve the soil structure
 - Increase soil organic matter content

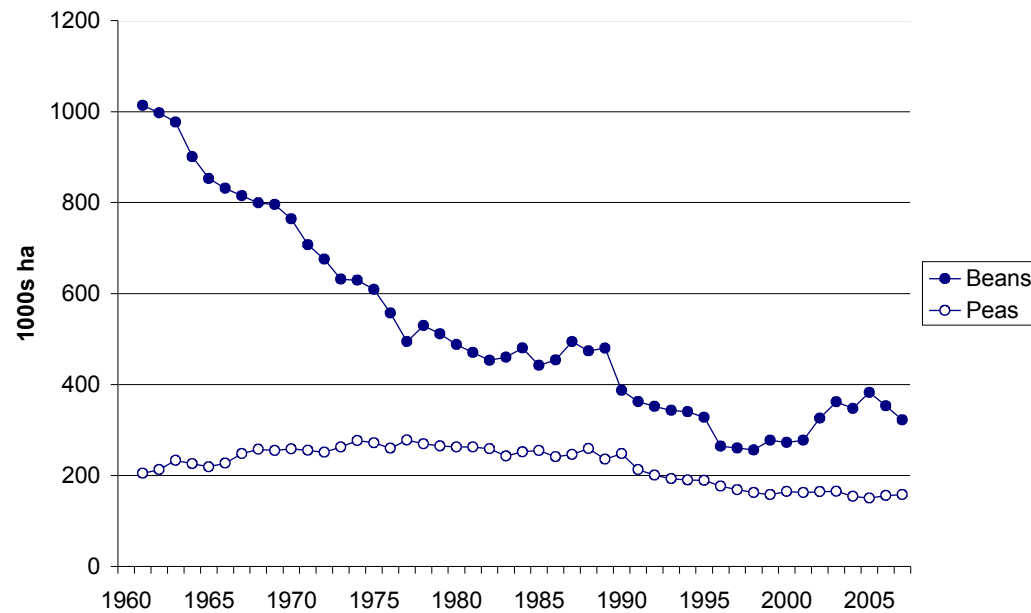
Benefits of Legumes

- Nitrogen
- Energy
- Forage and feed quality
- Food quality and health benefits
- Environmental benefits
- Ecosystem services
- **Economic gain**
 - High yields without inorganic fertilisers
 - Global warming – increased legume yields relative to grasses
 - Including extra 10% legumes in grasslands would result
 - + 137 € ha⁻¹ for farmers
 - + 1 300 Million € for the European livestock farming sector (Doyle & Topp 2002)

Forage area under legumes in 12 European countries 1980-2001



Areas planted with bean and pea crops in the EU between 1961-2007



Difficulties with Legumes



- Less stable and predictable yields compared to cereals and grasses with inorganic nitrogen fertilisers
- Establishment, management and maintenance of perennial legume-based swards
- Plant diseases of legumes
- Annual weeds increase in wide row space cultivation
- Bloat, oestrogen problems
- Environmental risks
 - Timing of nitrogen mineralisation and leaching risk?
 - Greenhouse gas emissions?

EU-funded Legume-projects

- *COST 852: Quality Legume-Based Forage Systems for Contrasting Environments, FP6*
- *GLIP Grain Legumes Integrated Project, FP6*
- *GL-TTP Grain Legumes Technology Transfer Platform, FP6*
- *EUROCROP Agricultural research for improving arable crop competitiveness, FP6*
- *LEGSIL Legumes for silage in low input animal production systems, FP5*
- *GL-Pro European extension network for the development of grain legume production in the EU, FP5*
- *EU-Faba Faba bean breeding for sustainable agriculture, FP5*
- *LINK Legume Interactive Network, FP4*

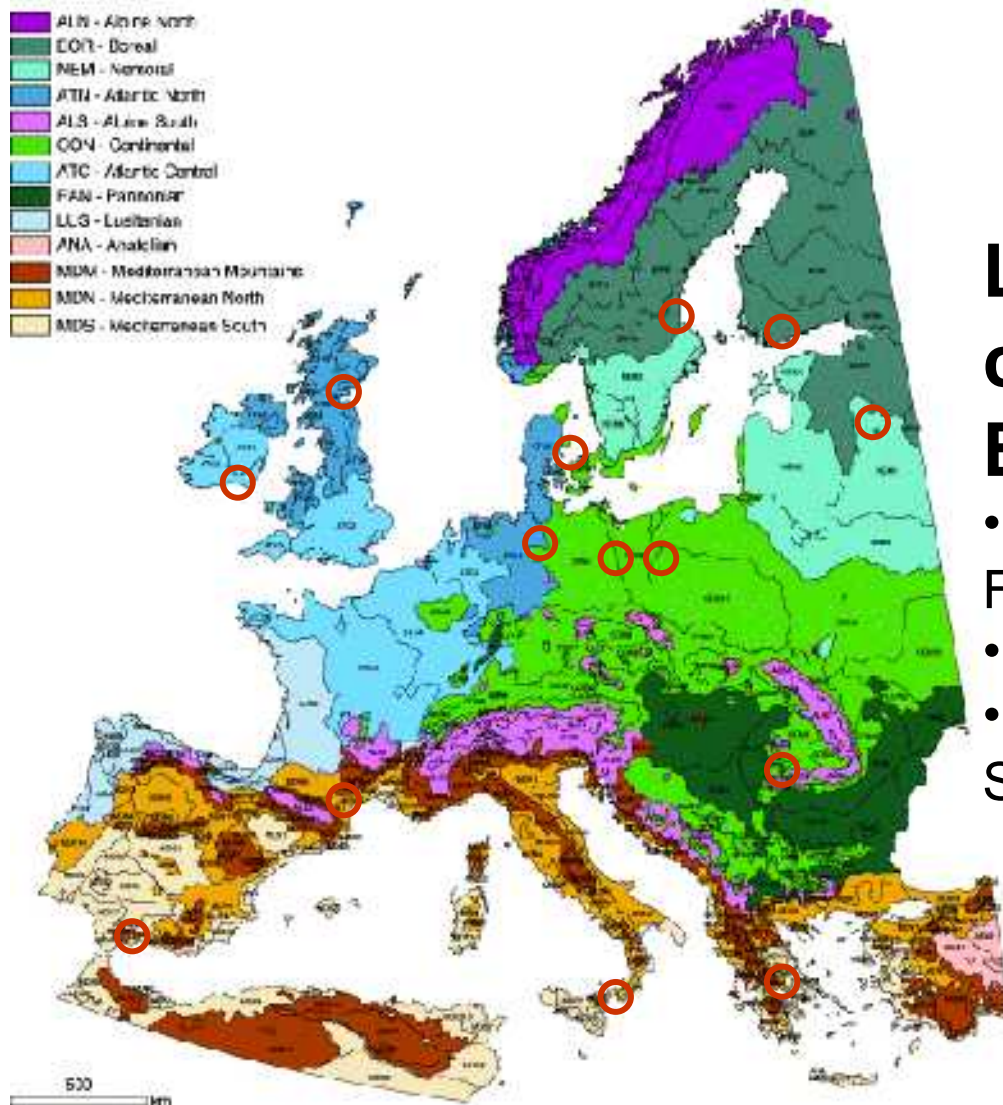
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Environmental Stratification of Europe

Environmental Zone

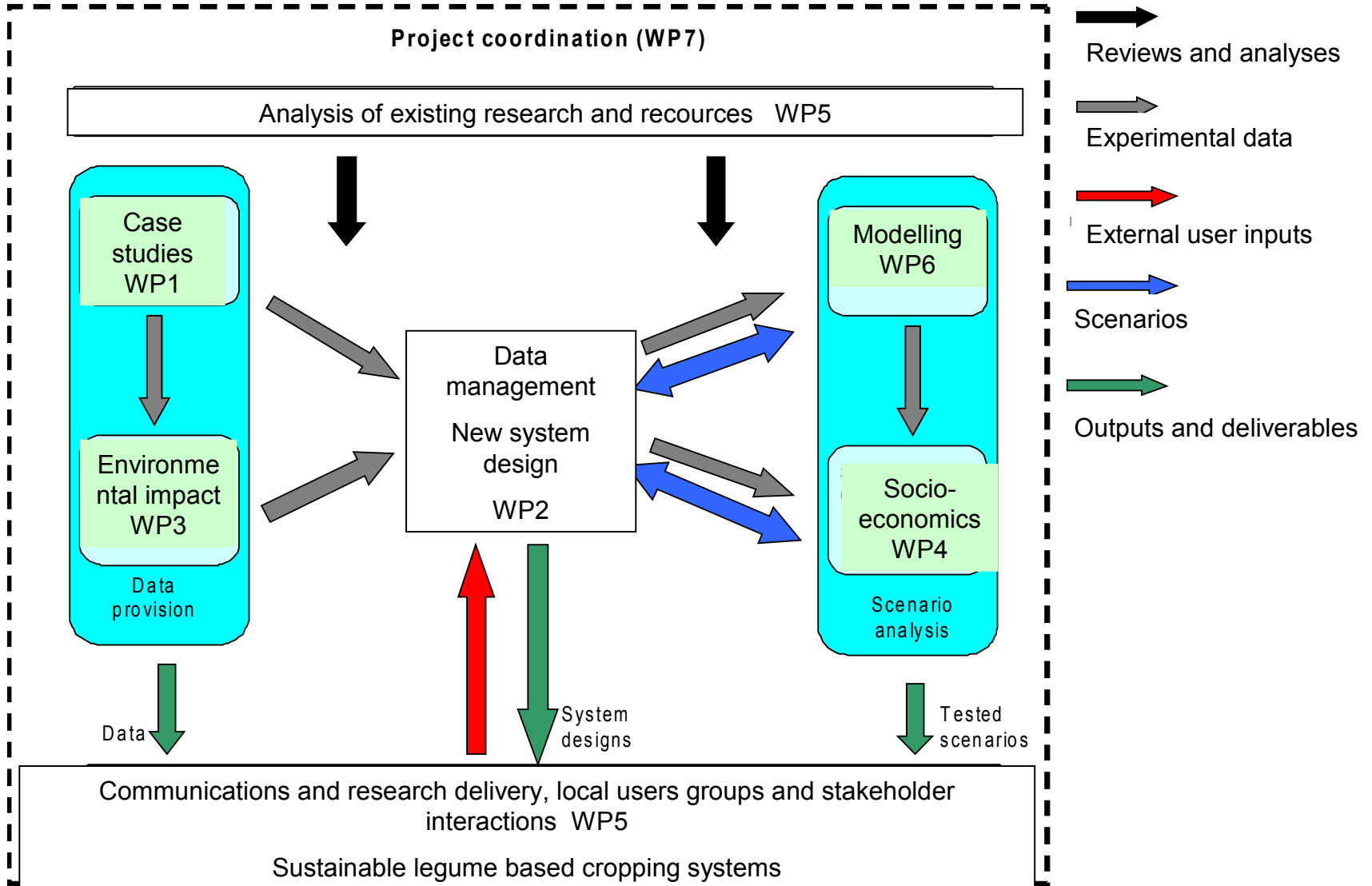
- ALN - Alpine North
- EON - Boreal
- NEM - Northern
- ATN - Arctic North
- ALS - Alpine South
- CON - Continental
- ATC - Arctic Central
- PAN - Pannonic
- LUS - Lusitanian
- ANA - Anatolian
- MDM - Mediterranean Mountains
- MNM - Mediterranean North
- MDS - Mediterranean South



Legume-supported cropping systems for Europe

- EU FP7 funded project to start in February 2010.
- 17 partners in 13 countries
- coordinated by Bob Rees, Scottish Agricultural University

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Conclusions

- Legumes have the basis for higher profits per hectare, but it is more difficult to gain
- Tools for farmers
 - Decision making
 - Production practices
- Multidisciplinary system research
 - Micro-organisms – soil – plant – animal – consumer – markets – economics – politics – sociology
- Consumer aspect
 - Health benefits
 - Processing legume-based foodstuffs

Thank you for your attention!

