Sustainable supply potential of herbaceous energy crops as a result of pastureland Productivity developments in Europe

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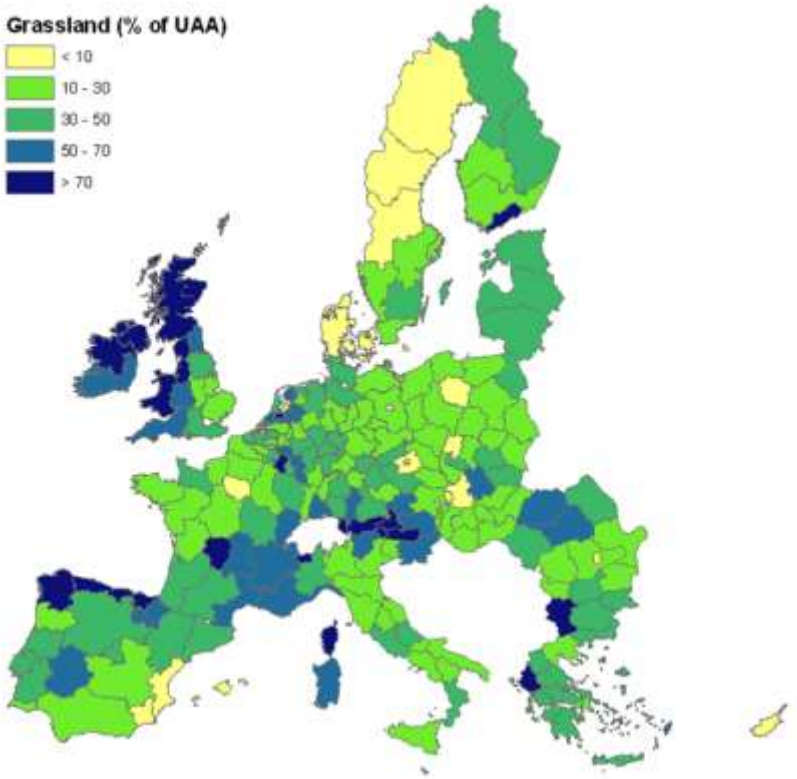
Introduction

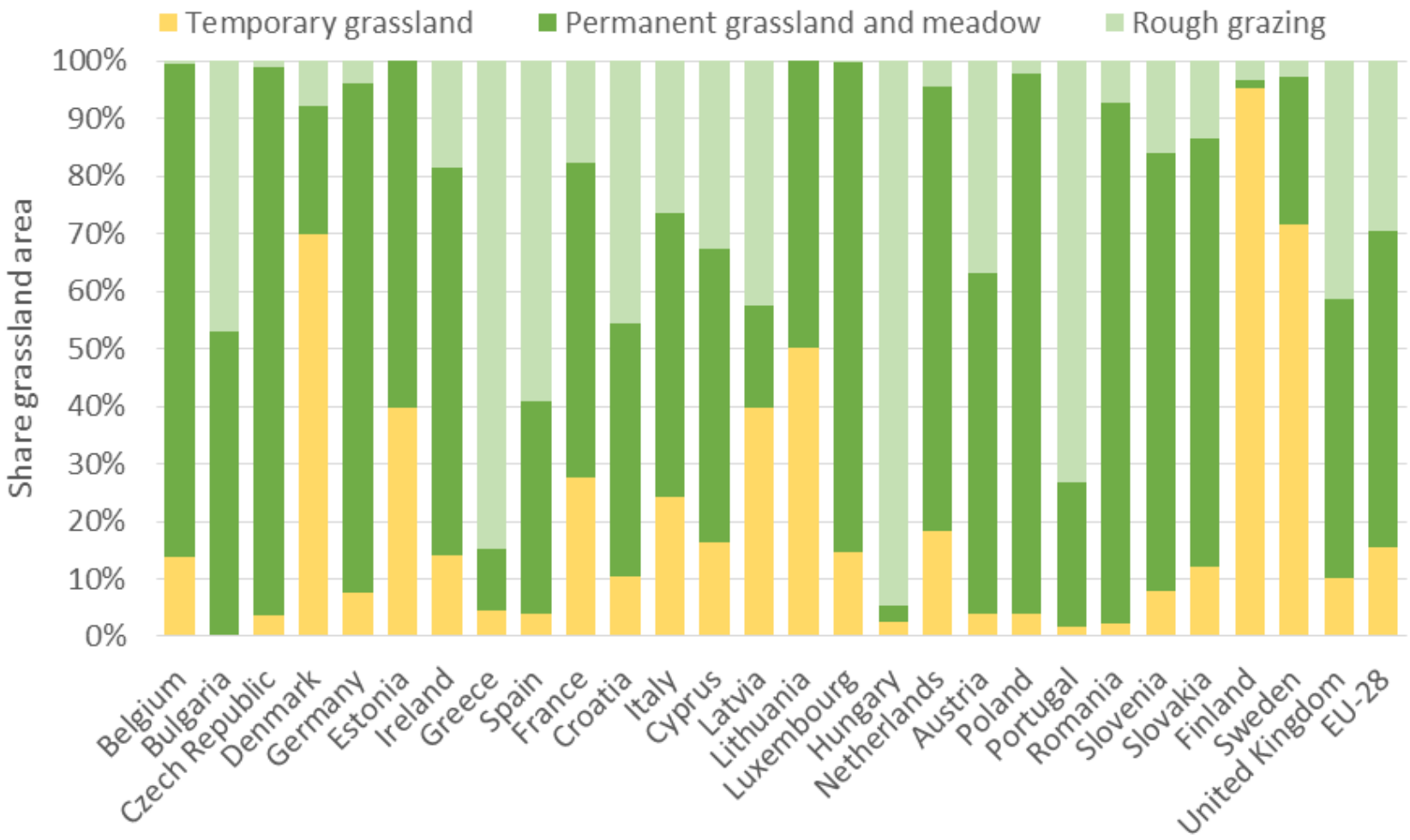
- Expected increase in demand for biomass for energy, material and food production requires increase in agricultural productivity
- No studies assessed yet the potential of pastureland for increased biomass production
- Objective: Assess the sustainable supply potential of herbaceous energy crops resulting from the intensification of European pastureland
- Part of Climate KIC project: Fuel Supply Chain Development and Flight Operations (RENEWABLE JET)

Potential for pasture intensification

- Grassland is the main land use in EU
  - 60 million ha permanent pasture
  - 11 million ha temporary pasture
- In large parts of EU pasture land is used extensively
- However, nature value of grassland can be high



Distribution of grasslands



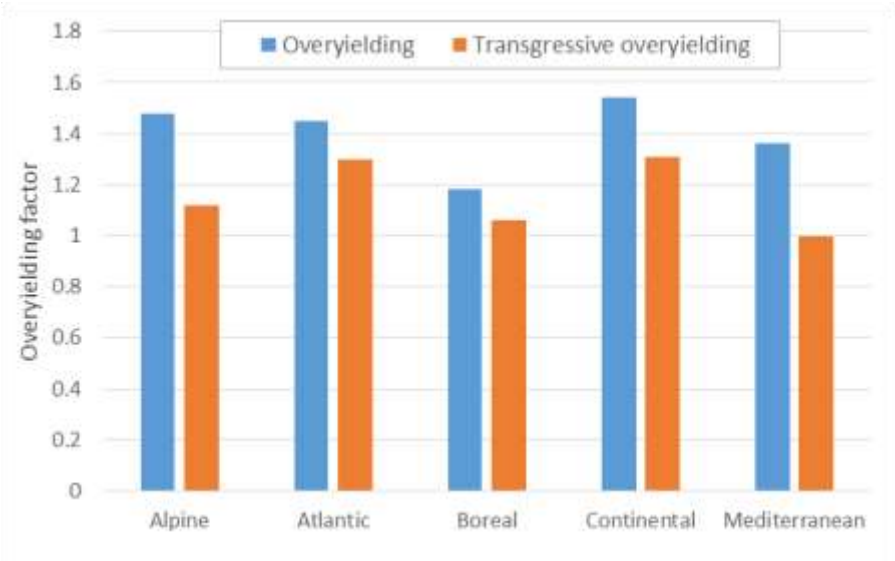
Options to increase sustainable biomass potential in grassland

- Increase permanent grassland productivity
  - Improved fertilizer and manure management
  - (Improved) irrigation
  - Optimized grazing management

- Increase temporary grasslands productivity
  - Use grass legume mixtures
  - Use for freed land for energy crops

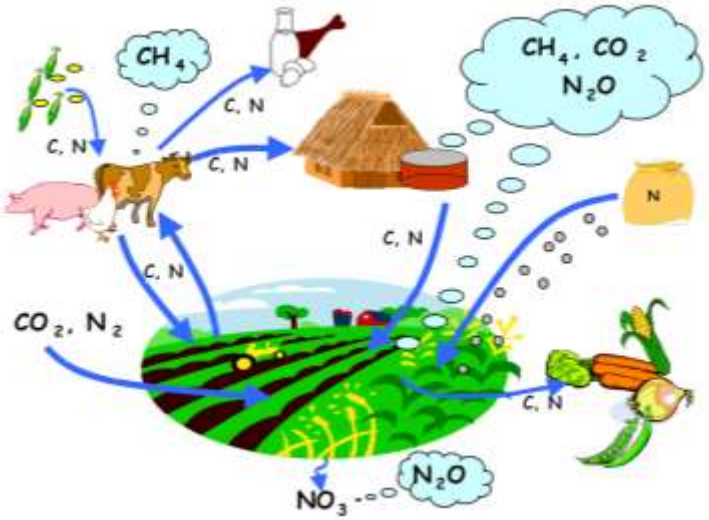
Grass legume mixtures

- Grass legume mixtures have higher yields compared to monocultures
- Legume proportion decreases over time, therefore more relevant for temporary grassland
- Introducing legumes can reduce nitrogen fertilization
- Data derived from large scale experiment at 33 sites (Kirwan et al., 2014)
- Current use of mixtures is not well known, set at 50%

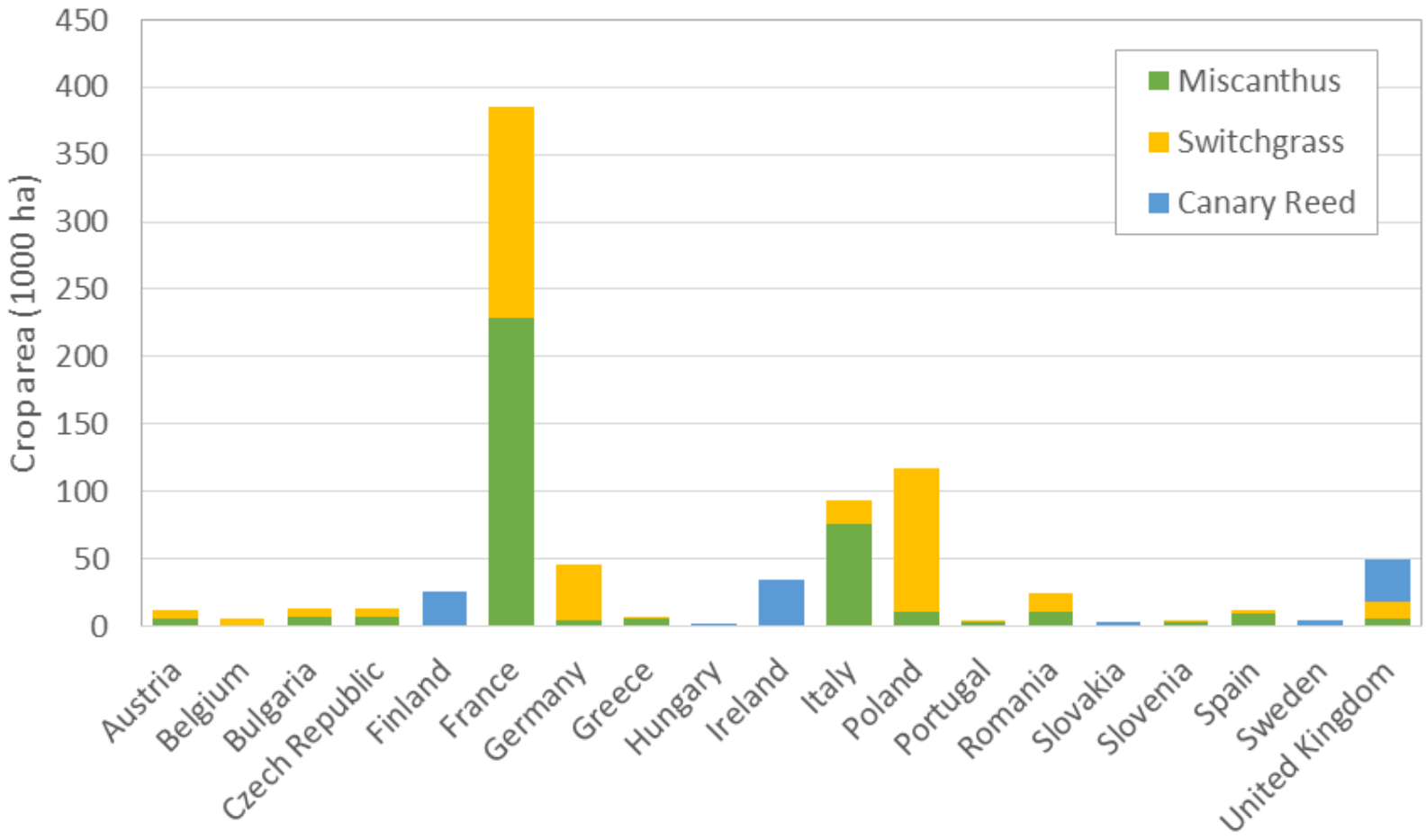


Modelling option grass legume mixtures

- MITERRA-Europe
  - Environmental impact assessment model for agriculture
  - NUTS2 level for EU
  - All agricultural GHG emissions
- Simulation for 2030 based on CAPRI crop area projections
- Data for N reduction fertilizer from Suter et al. (2015), based on 16 experimental sites, on average 35% increase in N yield

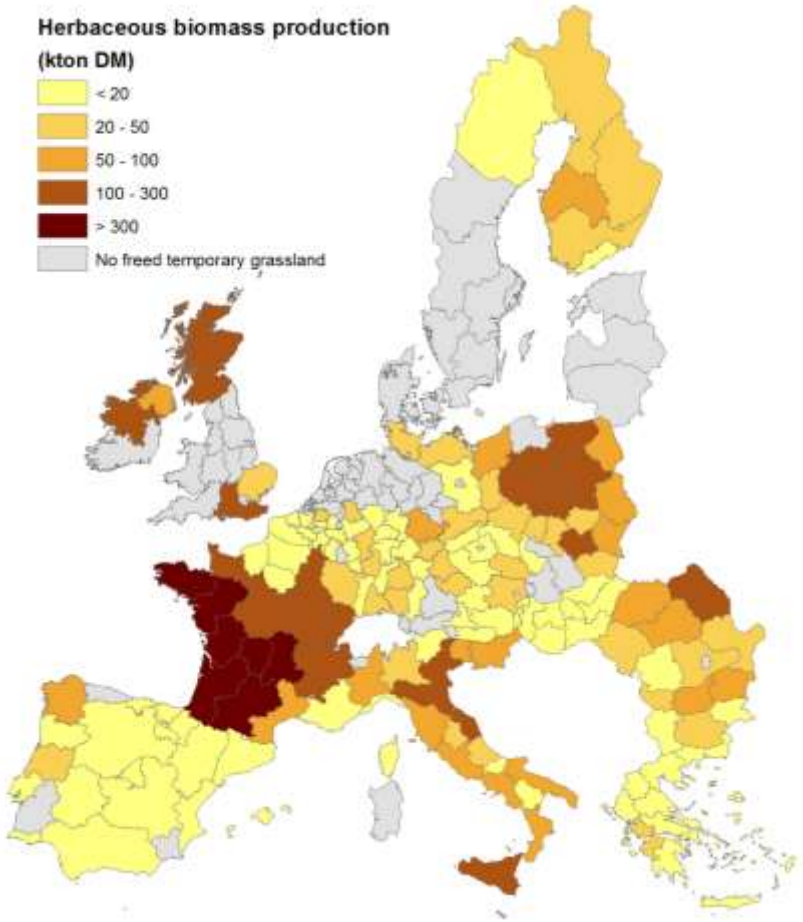


Results – Herbaceous energy crop areas



Results

- Herbaceous energy crop area of 0.85 million ha
- Herbaceous energy crop production of 11 Mton DM, which is ~200 PJ
- 1.6% less N_2O emissions (3.5 Mton CO_2-eq)
- Additional 1.3 Mton CO_2 sequestration per year



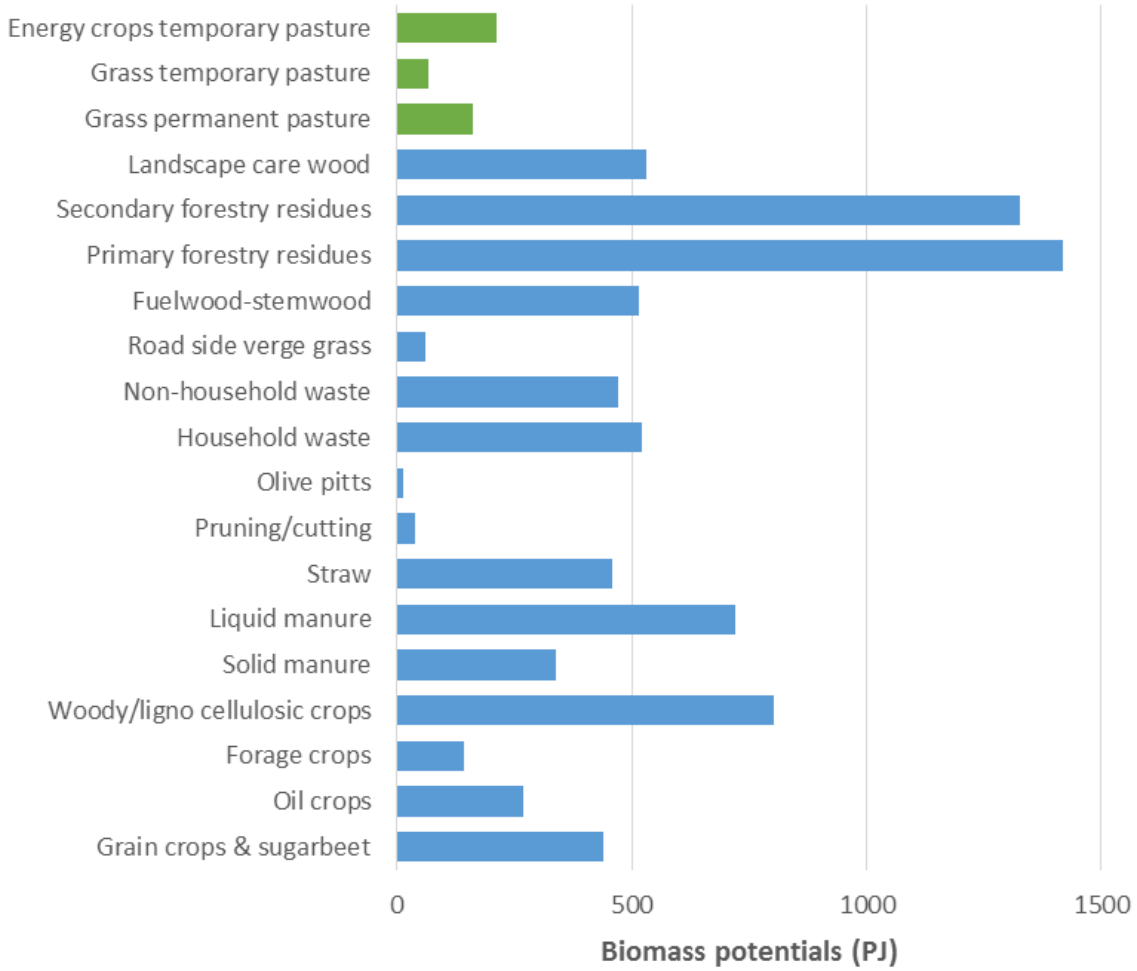
Alternative options

- Use grass from temporary pastures
  - 3.7 Mton DM additional grass
  - 2.8 Mton CO_2-eq less N_2O emission
  - 1 Mton CO_2 SOC sequestration

- Increase yield on permanent pastures
  - Assumed 5% increase in yield
  - 9 Mton DM grass production
  - 1.3 Mton CO_2-eq more N_2O emission
  - 4 Mton CO_2 SOC sequestration

Comparison with other biomass potentials

- Recent biomass potentials from Biomass Policies
- Total 8066 PJ for 2030
- Temporary pastures can add about 2.5%



Alternative options

- Use surplus grass for biogas
- Use specific grass species for biorefinery
  - *Festuca arundinacea*
  - Yield 16-20 ton DM/ha in NL
  - In rotation with arable crops
  - Improves soil quality
  - Biorefinery into animal feed and biogas by HarvestaGG

Discussion / Conclusion

- Biomass production from pasture land can add a sustainable contribution to biomass demand
- Highest potential for temporary grasslands
  - More options for management
  - No risk on biodiversity loss or carbon loss
  - About 1 million ha available for energy crops
- Data availability on grassland yield and management is poor → uncertain results
- Possible potential for increased grass production on permanent pastures

Thank you

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