Yields and sustainable intensification, outlook of agriculture – some observations

BIOEAST AS A DRIVING FORCE IN THE CONTEXT OF THE EUROPEAN GREEN DEAL

TWG: AGROECOLOGY AND SUSTAINABLE YIELDS

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Outline

- EU yield gap today and outlook for tomorrow
- Some reasons for the yield gap
- Agroecology and sustainable intensification is a global issue
- Potential for biomass production and use in BioEAST
  - Alternative farming practices, new technologies, advisory services etc. (not further looked at)
  - Land abandonment
  - Current use of biomass and

The starting point

Major policy developments have occurred around the frameworks of the low-carbon economy, the circular economy and the bioeconomy.

- European policy aims to develop the bioeconomy but while new uses for biomass and increasing food and fodder consumption require increasing agricultural output, land for agricultural use has decreased. This leads to growing pressures on the available agricultural land and soil resources which are exacerbated by the impacts of climate change.

TABLE ES.1 Summary of past trends, outlooks and prospects of meeting policy objectives/targets

Theme	Past trends and outlook: Past trends (10-15 years)	Past trends and outlook: Outlook to 2030	Prospects of meeting policy objectives/targets: 2020	2030	2050
Protecting, conserving and enhancing natural capital					
Terrestrial protected areas	■	■	☑		
Marine protected areas	■	■	☑		
EU protected species and habitats	■	■	⊡		
Common species (birds and butterflies)	■	■	⊡		
Ecosystem condition and services	■	■	⊡		
Water ecosystems and wetlands	■	■	⊡		
Hydromorphological pressures	■	■	⊡		
State of marine ecosystems and biodiversity	■	■	⊡		
Pressures and impacts on marine ecosystems	■	■	⊡		
Urbanisation and land use by agriculture and forestry	■	■			⊡
Soil condition	■	■	⊡		
Air pollution and impacts on ecosystems	■	■	□	□	
Chemical pollution and impacts on ecosystems	■	■	⊡		
Climate change and impacts on ecosystems	■	■	⊡		
Resource-efficient, circular and low-carbon economy					
Material resource efficiency	■	■	☑		
Circular use of materials	■	■		□	
Waste generation	■	■	□		
Waste management	■	■	□		
Greenhouse gas emissions and mitigation efforts	■	■	☑	⊡	⊡
Energy efficiency	■	■	□	⊡	⊡
Renewable energy sources	■	■	☑	⊡	⊡
Emissions of air pollutants	■	■	☑	□	
Pollutant emissions from industry	■	■	□		
Clean industrial technologies and processes	■	■	□		
Emissions of chemicals	■	■	⊡		
Water abstraction and its pressures on surface and groundwater	■	■	⊡		
Sustainable use of the seas	■	■	□		
Safeguarding from environmental risks to health and well-being					
Concentrations of air pollutants	■	■	⊡	☑	
Air pollution impacts on human health and well-being	■	■		☑	
Population exposure to environmental noise and impacts on human health	■	■	⊡		
Preservation of quiet areas	■	■	⊡		
Pollution pressures on water and links to human health	■	■	⊡		
Chemical pollution and risks to human health and well-being	■	■	⊡		
Climate change risks to society	■	■	□		
Climate change adaptation strategies and plans	■	■	□		

Indicative assessment of past trends (10-15 years) and outlook to 2030		Indicative assessment of prospects of meeting selected policy objectives/targets	
■	Improving trends/developments dominate	Year ☑	Largely on track
■	Trends/developments show a mixed picture	Year □	Partially on track
■	Deteriorating trends/developments dominate	Year ⊡	Largely not on track

Note: The year for the objectives/targets does not indicate the exact target year but the time frame of the objectives/targets.

The starting point

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Terrestrial protected areas			☑		
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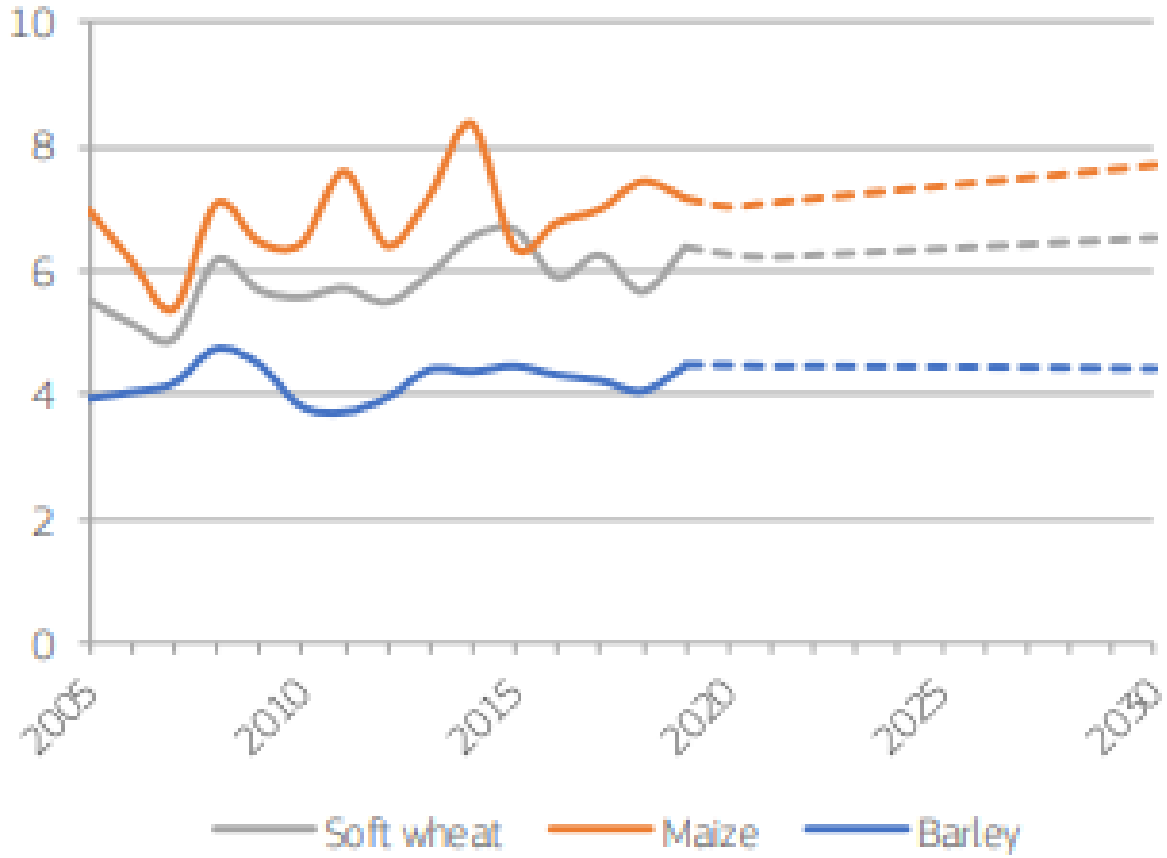
EU protected species and habitats			☒		
Common species (birds and butterflies)			☒		
Ecosystem condition and services			☒		
Water ecosystems and wetlands			☒		
Hydromorphological pressures			☒		
State of marine ecosystems and biodiversity			☒		
Pressures and impacts on marine ecosystems			☒		
Urbanisation and land use by agriculture and forestry					☒
Soil condition			☒		
Air pollution and impacts on ecosystems			☐	☐	
Chemical pollution and impacts on ecosystems			☒		
Climate change and impacts on ecosystems			☒		

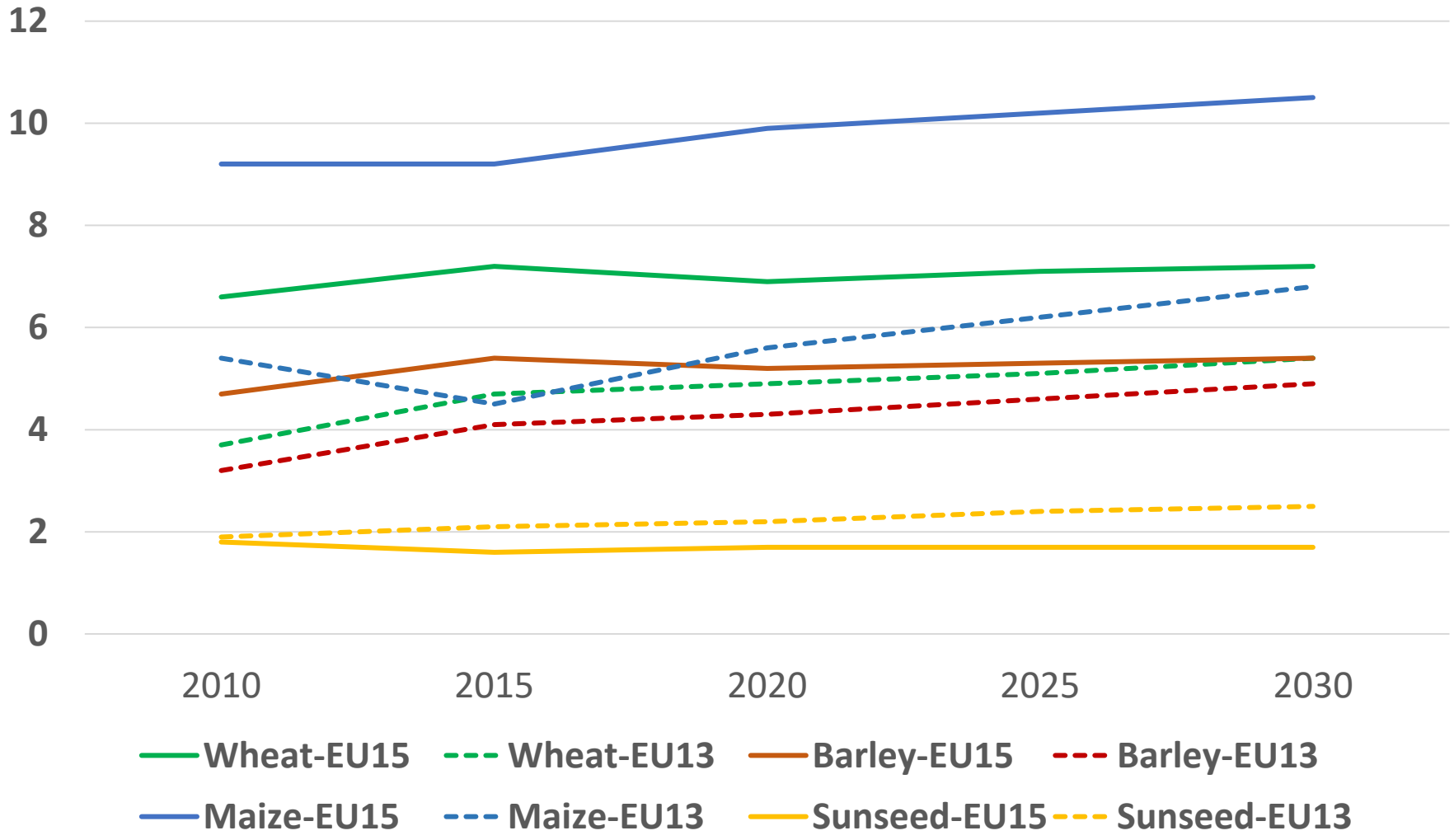
Outlook for EU yield

EU yield for main cereals (t/ha)



Source: EC (2019), EU agricultural outlook for markets and income, 2019-2030. DG Agriculture and Rural Development.

Yield gaps towards 2030 (T/ha)



Source: AGMEMOD Outlook for Agricultural and Food Markets in EU Member States 2018-2030; Salamon, P. et al. (2018), Thünen Working Paper 114.

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Observations on EU yield gaps

- EU yield gaps are due to further close in the outlook period.
- Yields are impacted by factors linked to
  - public policy, such as a more restricted use of chemicals and technological progress in plant breeding, as well as
  - by the increased number of extreme weather events.

Yield uncertainty in 2030 (Coefficient of variation,%)

Commodities	EU-15	EU-N13
Barley	4.0	7.0
Common wheat	4.0	12.0
Durum wheat	5.0	6.0
Maize	5.0	19.0
Milk	-	-
Oats	7.0	7.0
Other coarse grains	-	-
Other oilseeds	3.0	10.0
Palm oil	-	-
Rapeseed	3.0	6.0
Rice	4.0	0.6
Rye	8.0	11.0
Soya beans	7.0	15.0
Sugar beet	9.0	8.0
Sugar cane	-	-
Sunflower seeds	5.0	16.0

Source: EC (2019), EU agricultural outlook for markets and income, 2019-2030. DG Agriculture and Rural Development.

Agroecology and sustainable intensification as a global issue (non-representative quotes)

- Communication (COM(2019) 352) on 'Stepping up EU Action against Deforestation & Forest Degradation':
  - "Expansion of land used for agriculture is estimated to be the driver of around 80% of tropical deforestation"

- "65% embodied cropland (18.3 Mha) associated with the international trade with non-food products in 2010 was imported from outside the EU-28"
  [Quantifying the global cropland footprint of the European Union's nonfood bioeconomy. Bruckner et al 2019 Environ. Res. Lett. 14 045011]

http://www.foeeurope.org/land-footprint-infographic

- Potential for biomass production and use in BioEAST
  - Alternative farming practices, new technologies, advisory services etc. (not further looked at)
  - Land abandonment
  - Current use of biomass

Sustainable intensification – Agricultural land abandonment

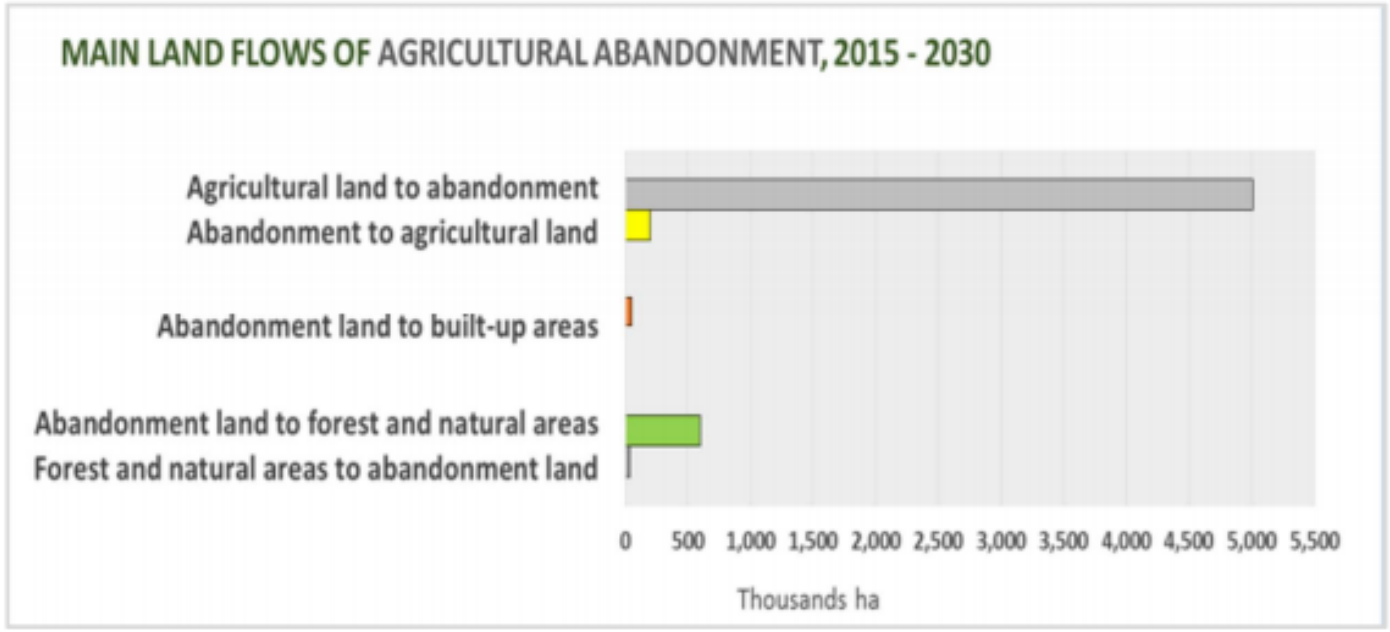


Figure 7: Conversion dynamics of agricultural land abandonment in the EU within 2015-2030

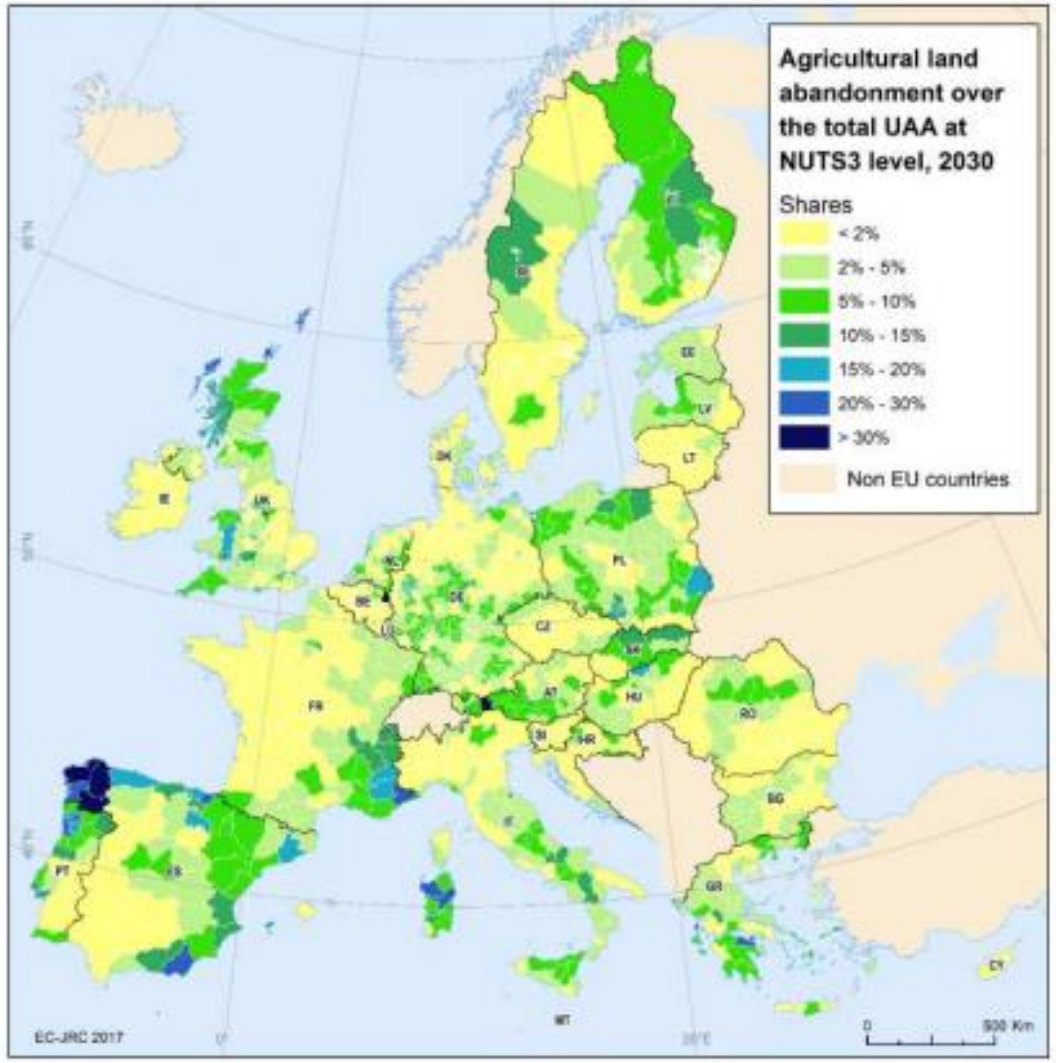
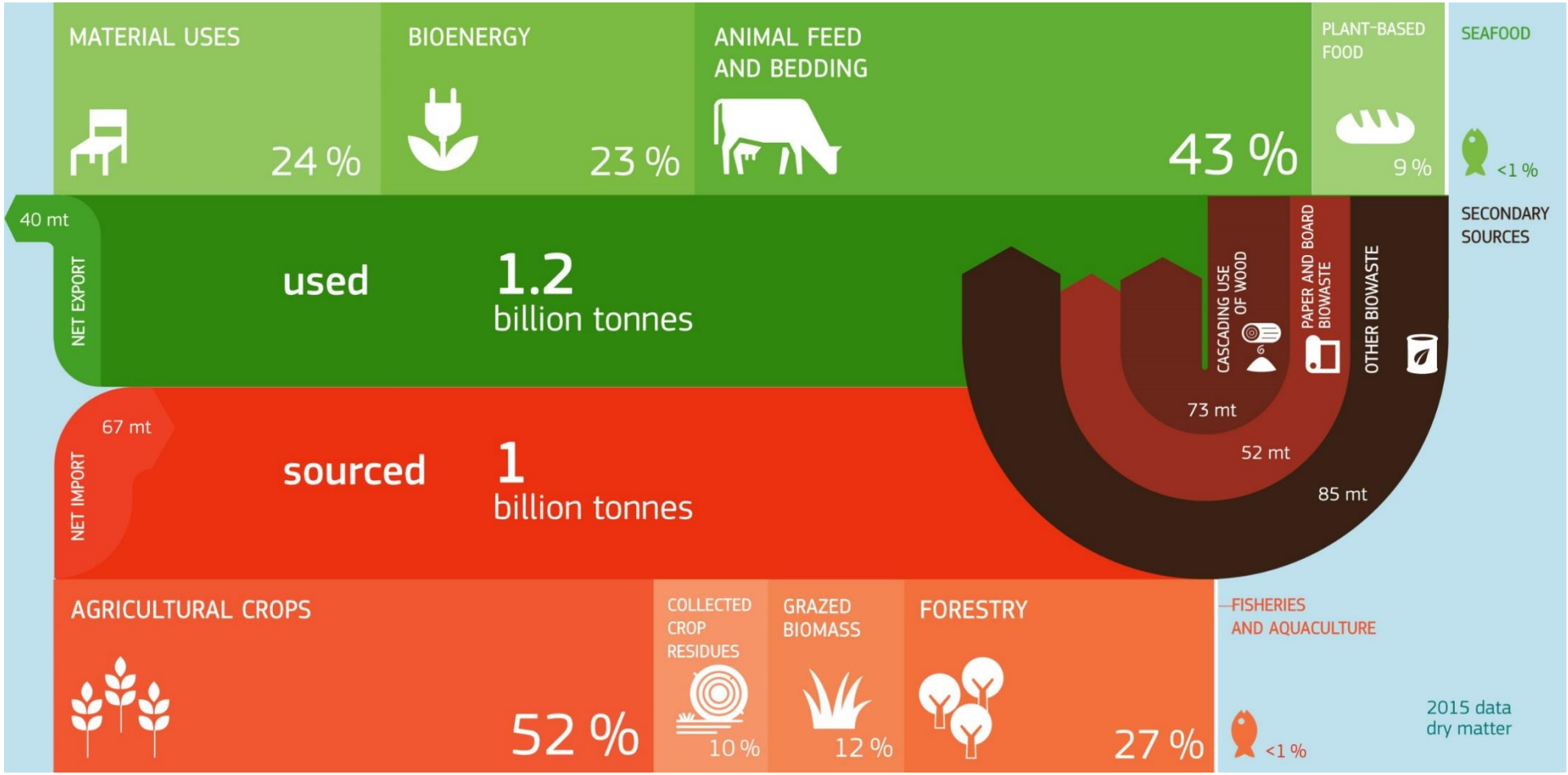


Figure 6: Shares of agricultural land abandonment with regard to the total agricultural land aggregated at NUTS 3 level in 2030

Source: Agricultural land abandonment in the EU within 2015-2030; JRC Policy Insights, Oct. 2018.

Potential for biomass production and use – biomass flow diagrams



Source: JRC study on biomass supply and demand

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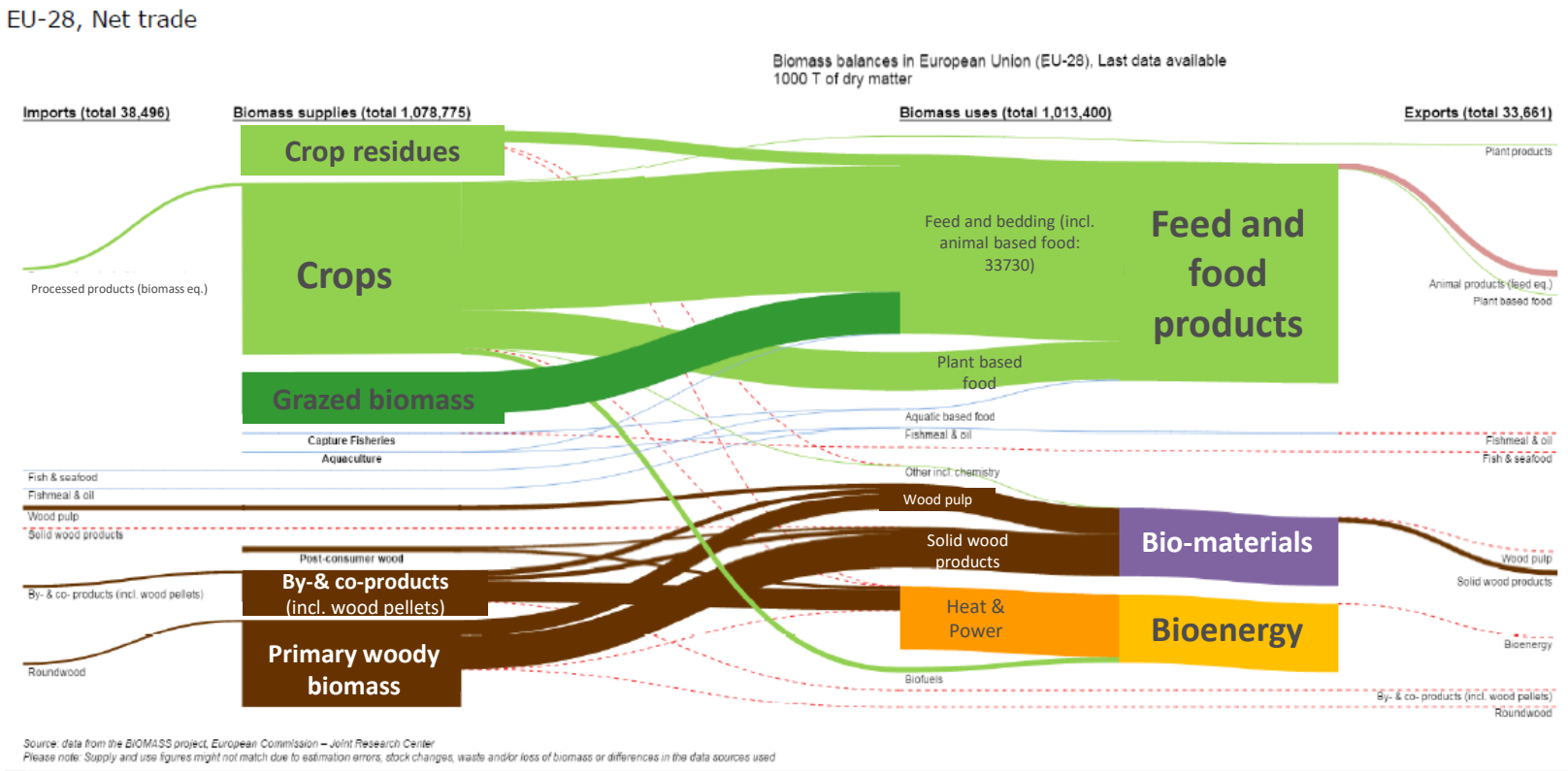
Biomass used in the Bioeconomy

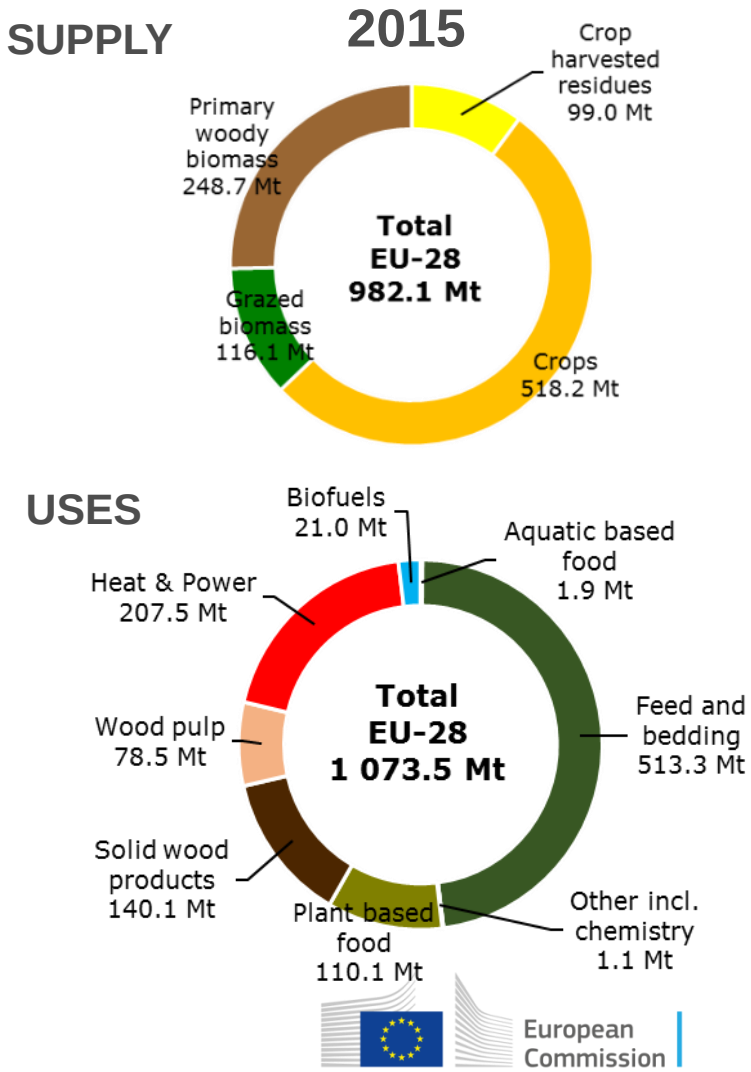
Biomass flows in the European Union – Cross sectorial

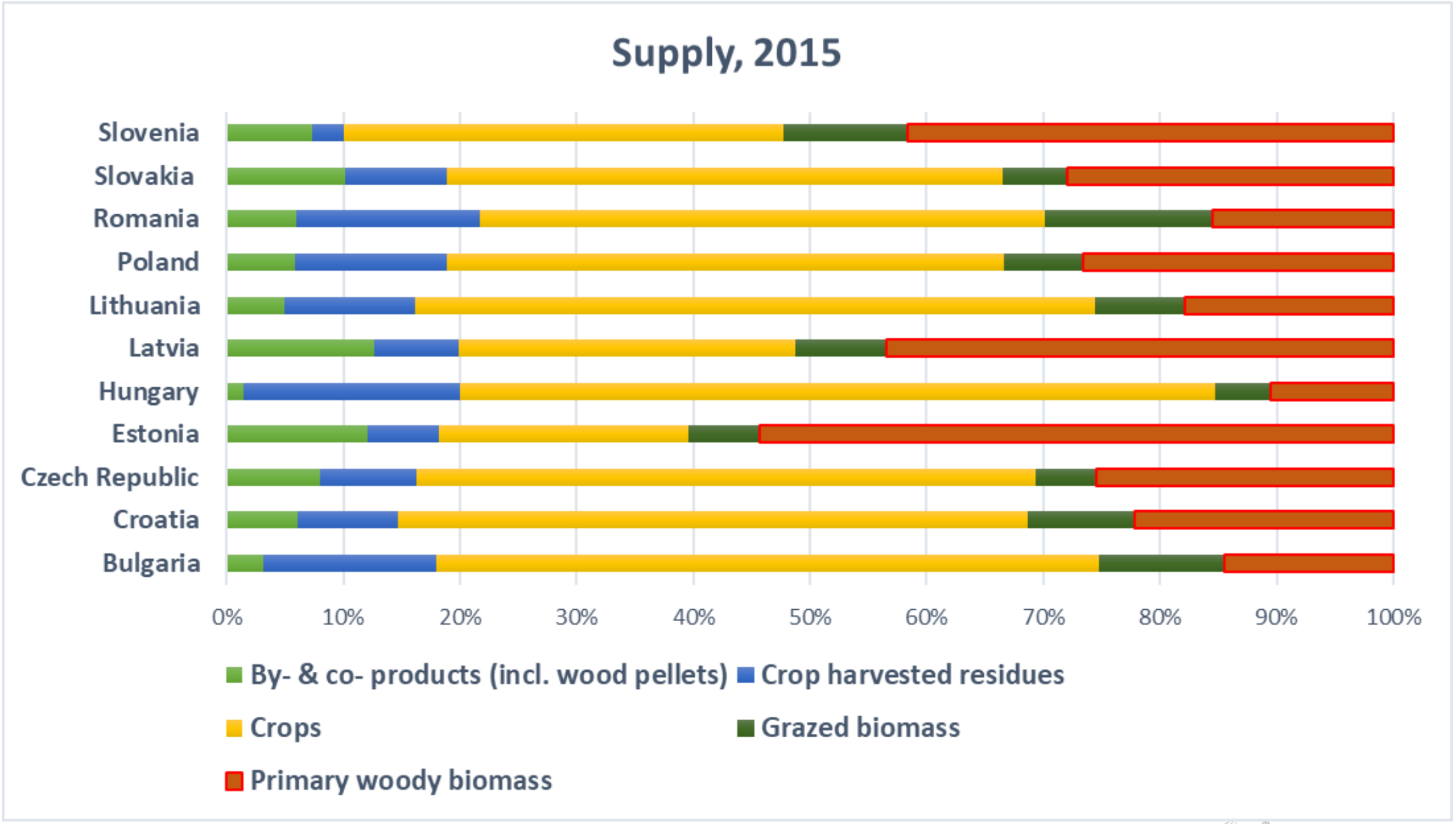


Source: Biomass flows in the European Union, EUR 28565 EN

Please note: Supply and use figures might not match due to estimation errors, stock changes, waste and/or loss of biomass or differences in the data sources used

https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS/index.html





Source: JRC study on biomass supply and demand;
https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS/index.html

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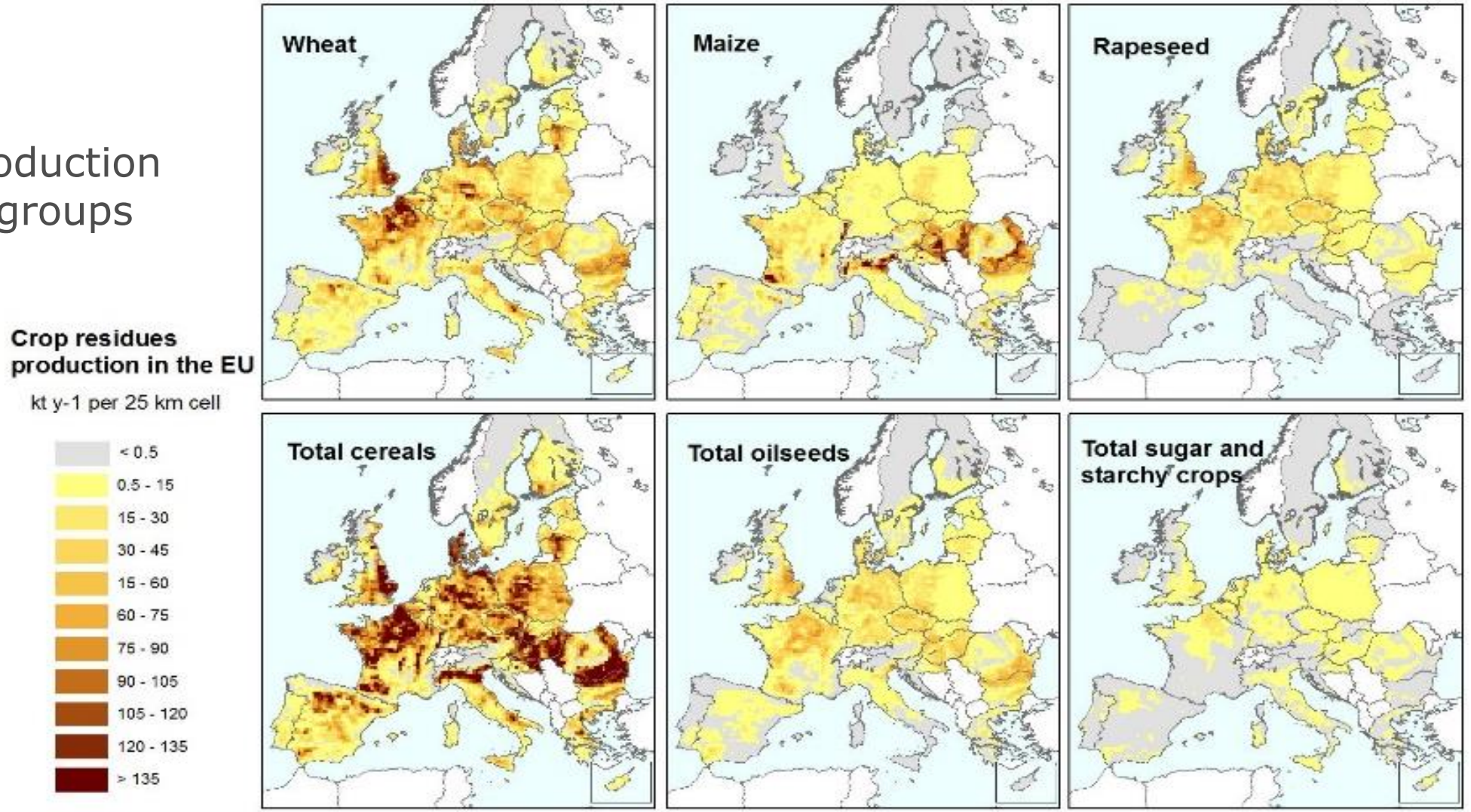
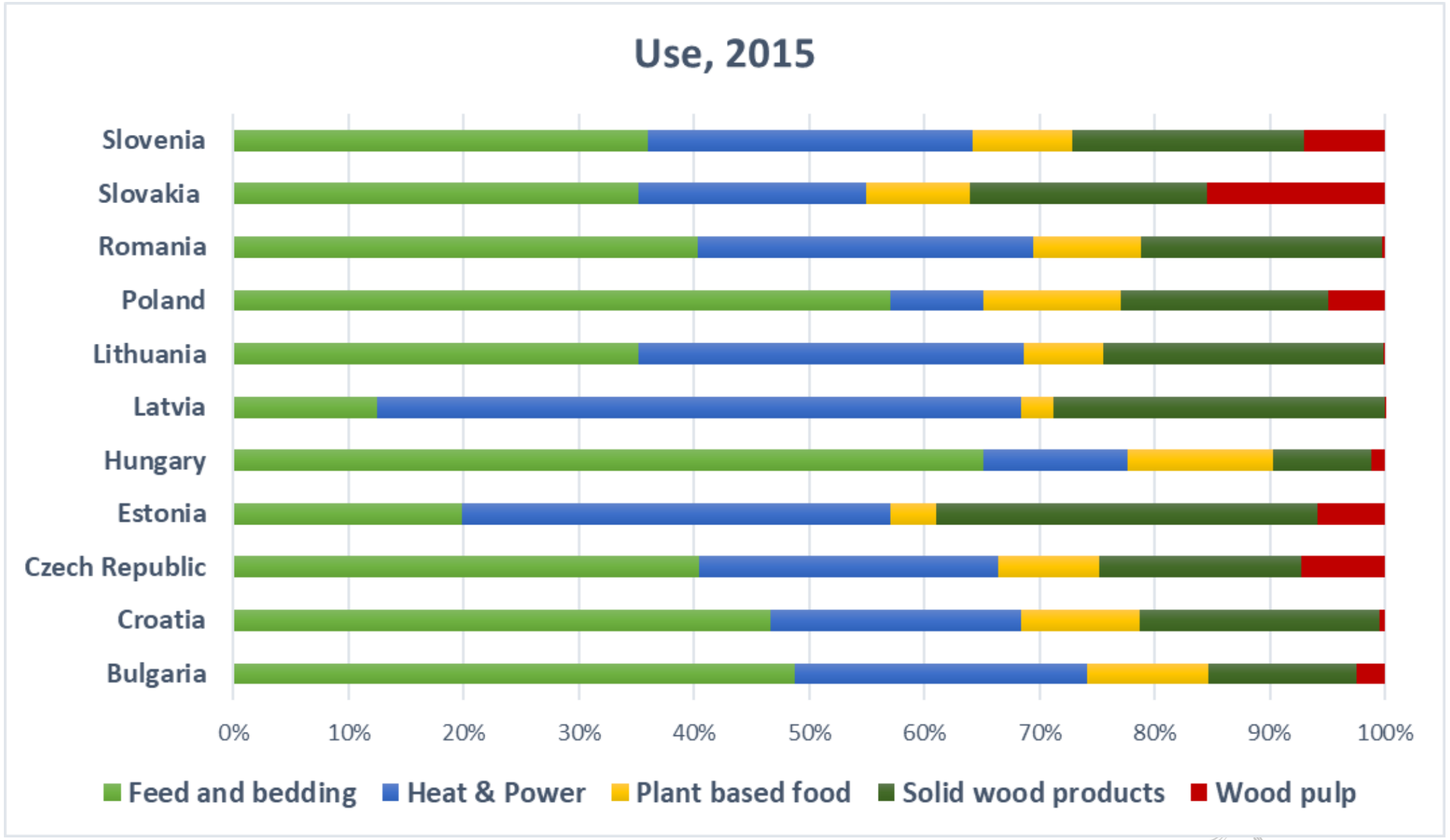
Potential for biomass production and use in BioEAST – Mapping crop residues production

Spatially explicit

- Total residue production
- Crops and crop groups



Source: JRC study on biomass supply and demand



Source: JRC study on biomass supply and demand;
https://datam.jrc.ec.europa.eu/datam/mashup/BIOMASS_FLOWS/index.html

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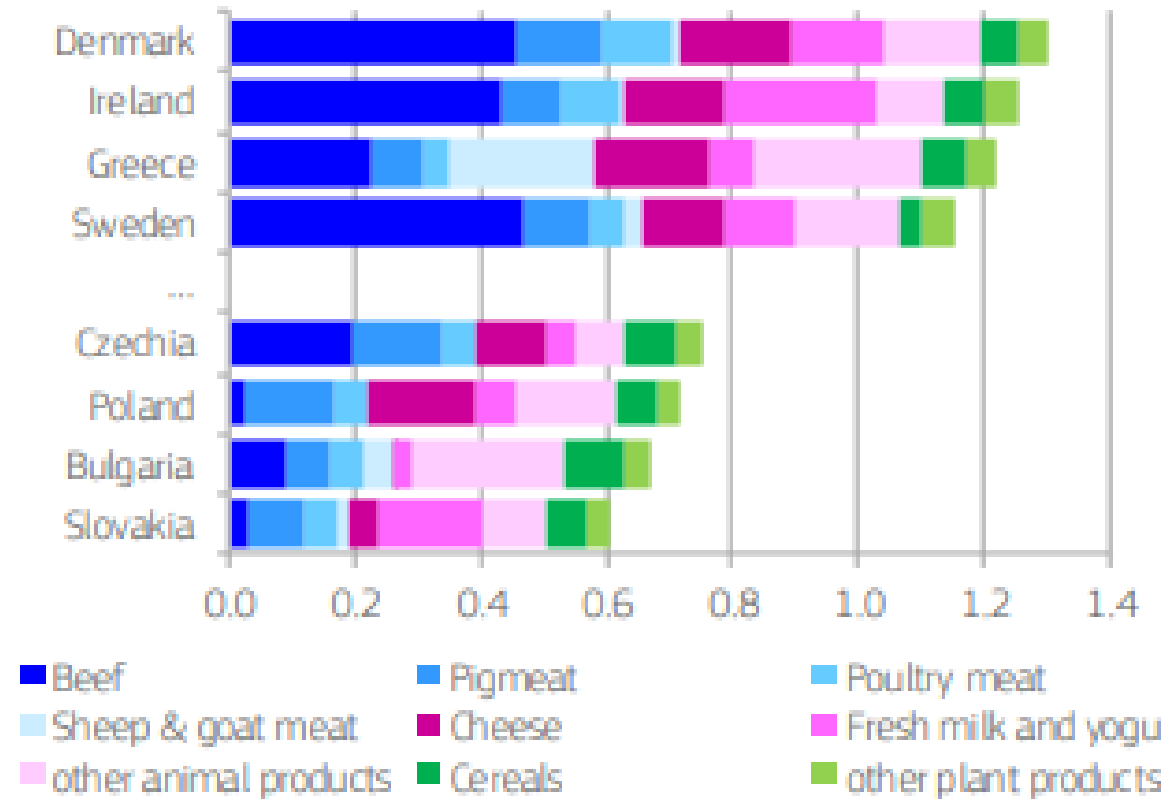
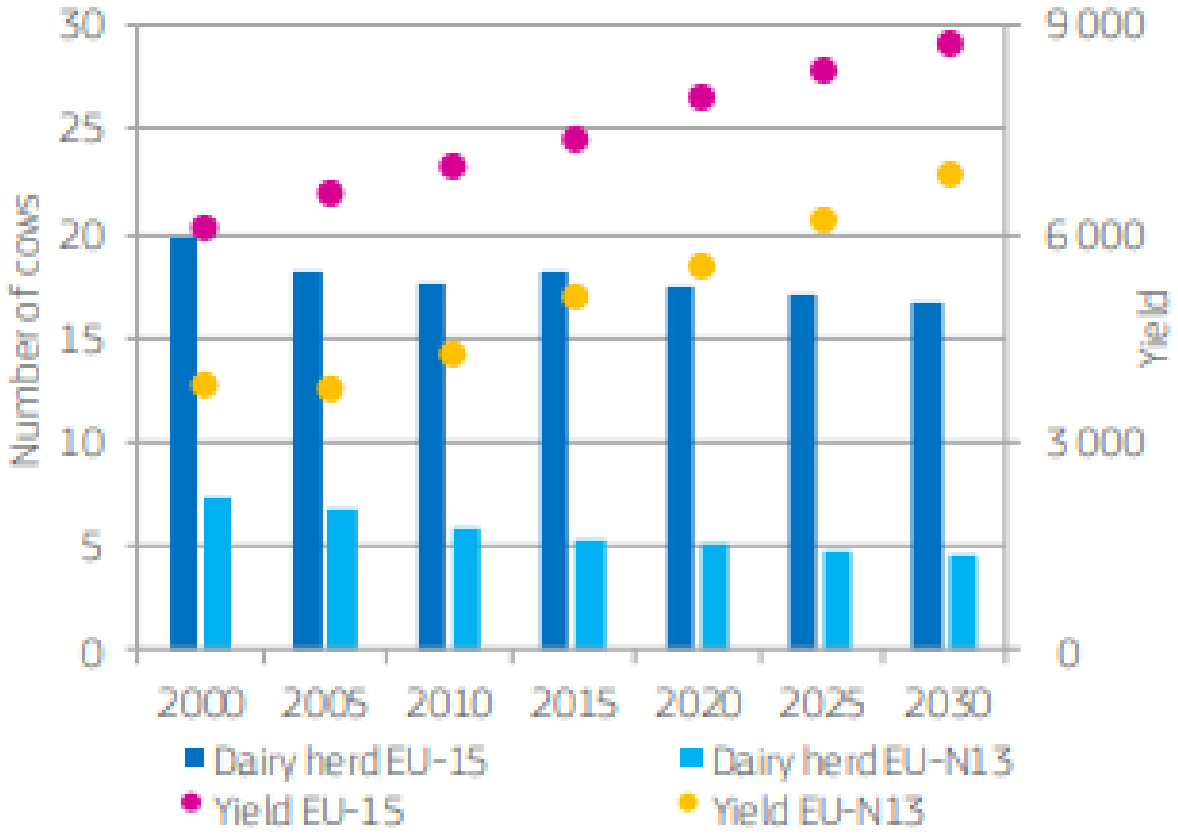
Implications with animal production

GRAPH 8.3 Farm gate GHG footprints of food consumed in selected Member States, 2030 (t CO_2 eq per capita)



Source: DG JRC, based on the 2019 CAPRI baseline.

GRAPH 4.2 Number of cows (million heads) and yield (kg/cow) in the EU



Source: EC (2019), EU agricultural outlook for markets and income, 2019-2030. DG Agriculture and Rural Development.

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Concluding remarks

- EU yield gaps are due to further close over the next decade
- Global dimension of biomass (trade) important
- Alternative farming practices, new technologies, advisory services etc. are key for agroecology and sustainable intensification
- Potential sources for biomass production and use are related to land abandonment, residues, and in general to the current use of biomass

Thank you

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Figure 28. Evolution of first and advanced biofuels in the EU; REF; Mtoe

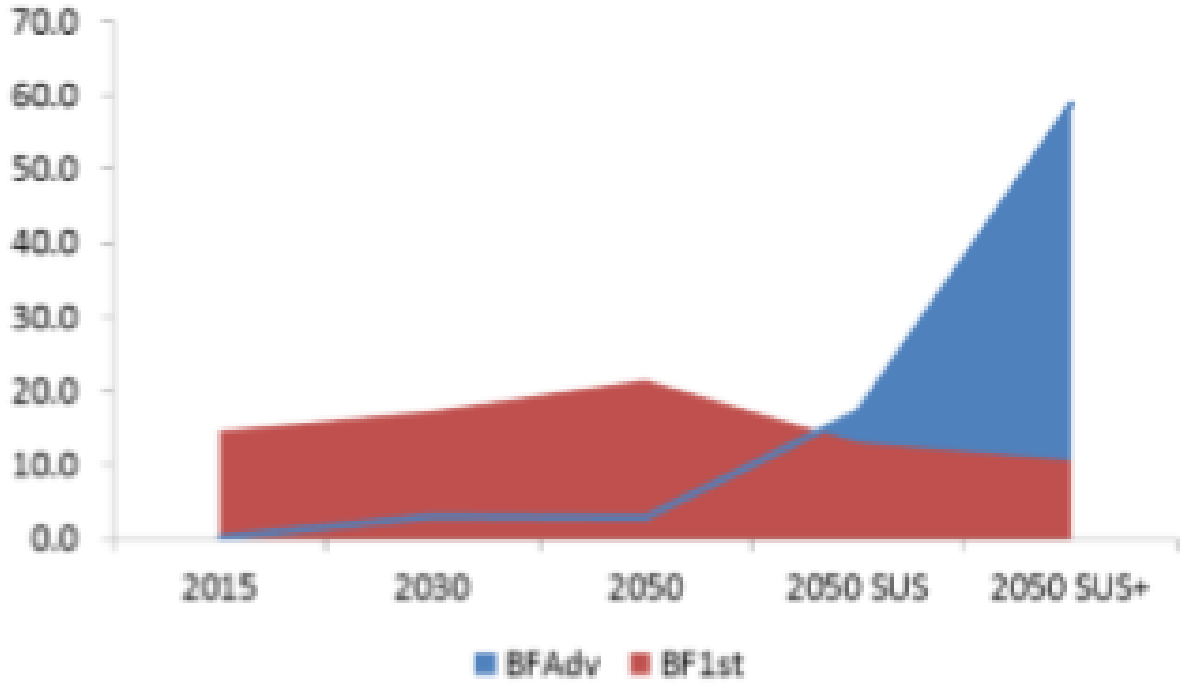

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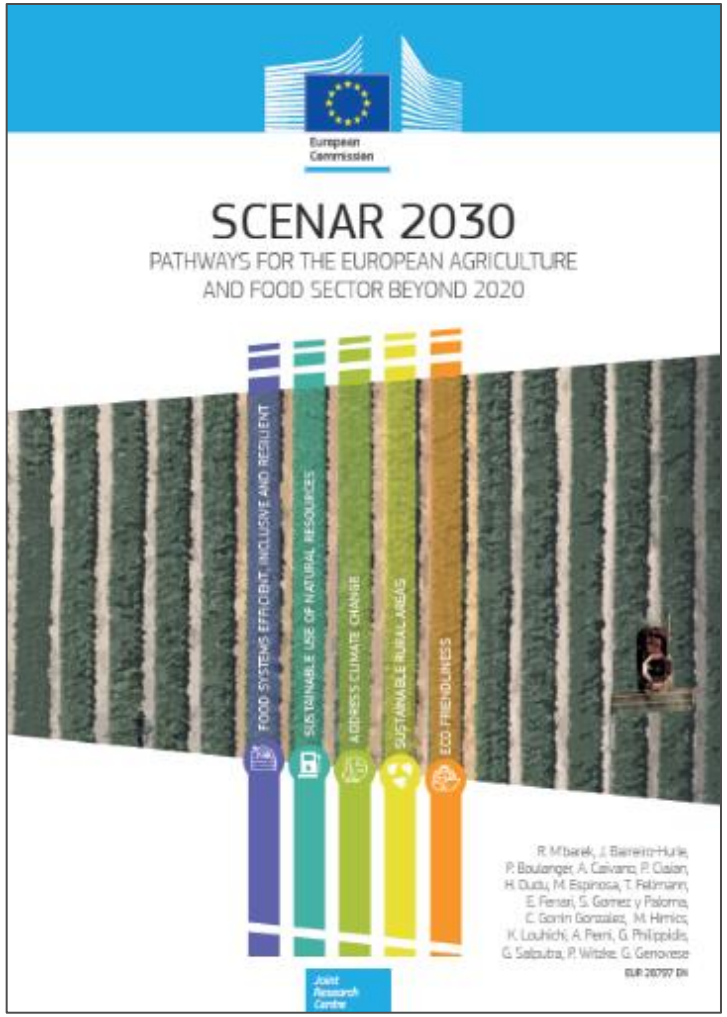
Figure 38. Key results in the context of the bioeconomy objectives and SDGs for the EU, 2015, 2030, 2050

			EU						
Bioeconomy objectives	**SDGs**	**Description of indicator**	REF 2015	REF 2030 vs 2015	REF 2050 vs 2015	SUS vs REF 2030	SUS+ vs REF 2030	SUS vs REF 2050	SUS+ vs REF 2050
1 Food Security	2.1	Food prices index (2011=100)	99.0	-0.2	0.8	0.5	1.2	-0.5	1.7
1 Food Security	2.2	Calories per capita per day	3424.2	1.5	2.6	0.1	-0.2	0.2	-0.1
1 Food Security	2	Food production (million metric tons)	1185.2	8.2	14.6	0.6	0.0	1.3	1.2
1 Food Security	2	Food production per ha	6.7	8.4	15.2	0.6	0.0	1.3	1.6
2 Sust Resources	15.2	Brazil crop land (ha)	818107.0	3.1	-1.2	1.9	3.0	2.3	7.9
2 Sust Resources	15.2	Land use (million ha)	178.1	-0.2	-0.5	0.1	0.0	0.0	-0.3
2 Sust Resources	6.4	Abstracted irrigated water use (billion m^3)	56.0	-0.2	-0.2	0.1	0.0	-0.3	0.0
3 Renewable Energy	8.4	Advanced biofuels (Mtoe)	0.2	1661.0	1484.9	255.3	315.7	506.3	1957.4
3 Renewable Energy	8.4	Conventional biofuels (Mtoe)	14.7	18.4	46.8	-5.0	-5.4	-39.2	-50.3
3 Renewable Energy	7.2	Share renewable energy (change in %)	22.1	149.3	279.5	13.7	11.7	6.7	5.2
4 Climate Change	13.2	Climate emissions reductions (Mtoe)	4672.0	-15.6	-17.6			-60.1	-78.9
4 Climate Change	13.2	tCO_2e per million € of economic activity	250.9	-32.1	-52.7	-20.0	-24.4	-49.3	-78.5
5 Jobs&growth	8.1	Per capita growth (€/person/year)	23167.3	18.6	54.1	0.0	-0.2	-1.0	-1.0
5 Jobs&growth	8.5	Employment agriculture (million persons)	12.9	-1.8	-13.6	-0.3	-2.2	10.8	-0.8
5 Jobs&growth	9.2	Industry's share of employment (change in%)	24.3	-7.6	-20.4	0.9	-11.0	-1.4	-3.8
5 Jobs&growth	17.1	Food import quantity index (change in%)	102.0	10.8	22.5	0.0	-0.9	0.8	0.8

Link EU with global agrifood sector

- SEE also Scenar 2030: scenario with more intensive production;



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