BIOMASS FUTURES

The role of biomass in meeting a diversified demand – Sharing final results from the Biomass Futures project

Global results

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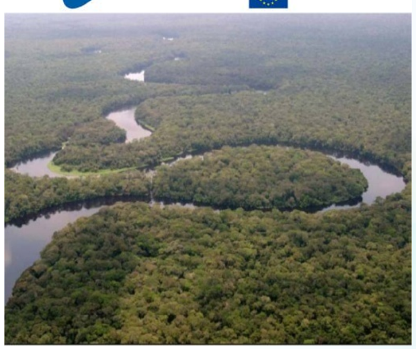
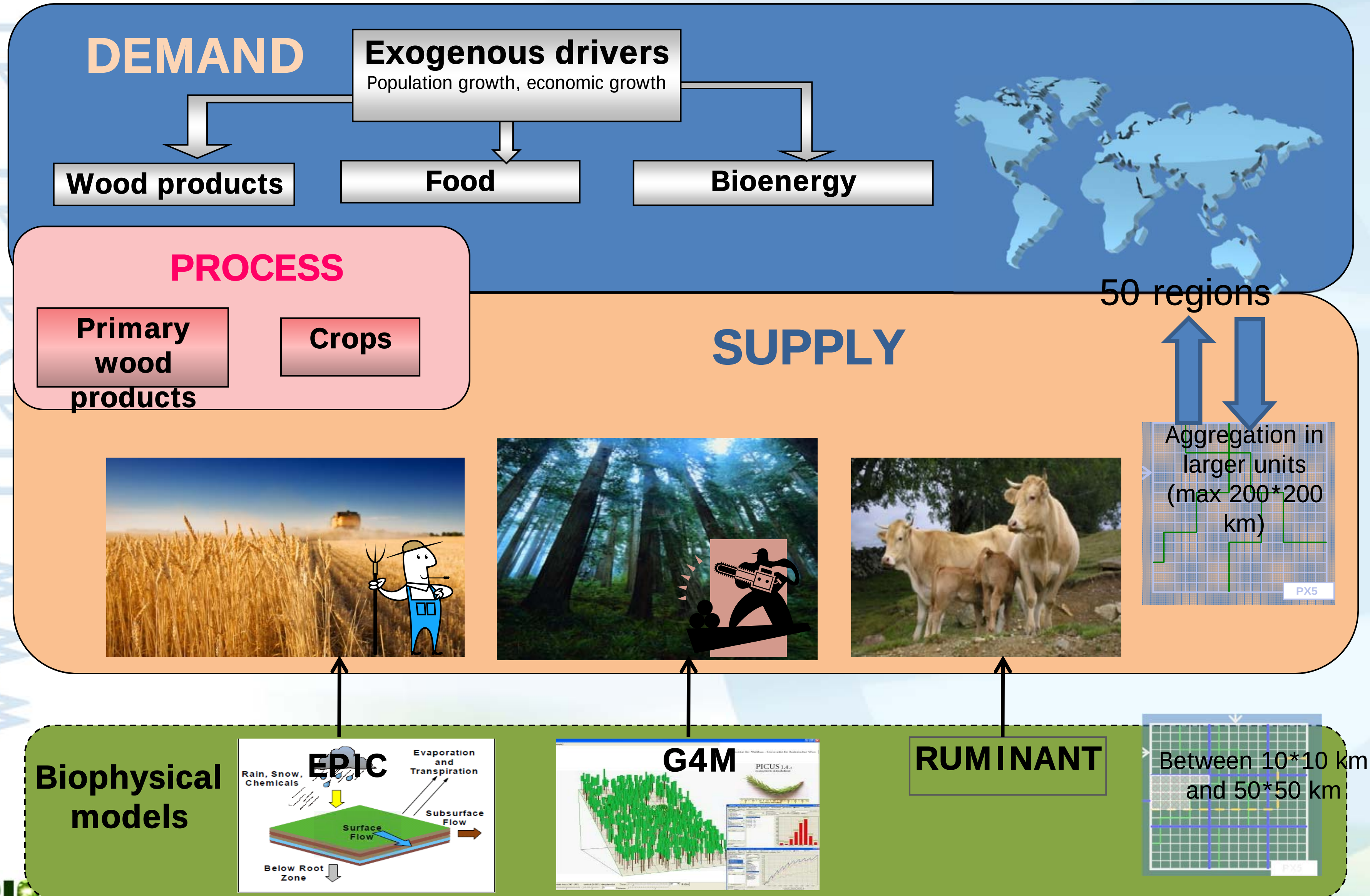
INTELLIGENT ENERGY EUROPE
FOR A SUSTAINABLE FUTURE



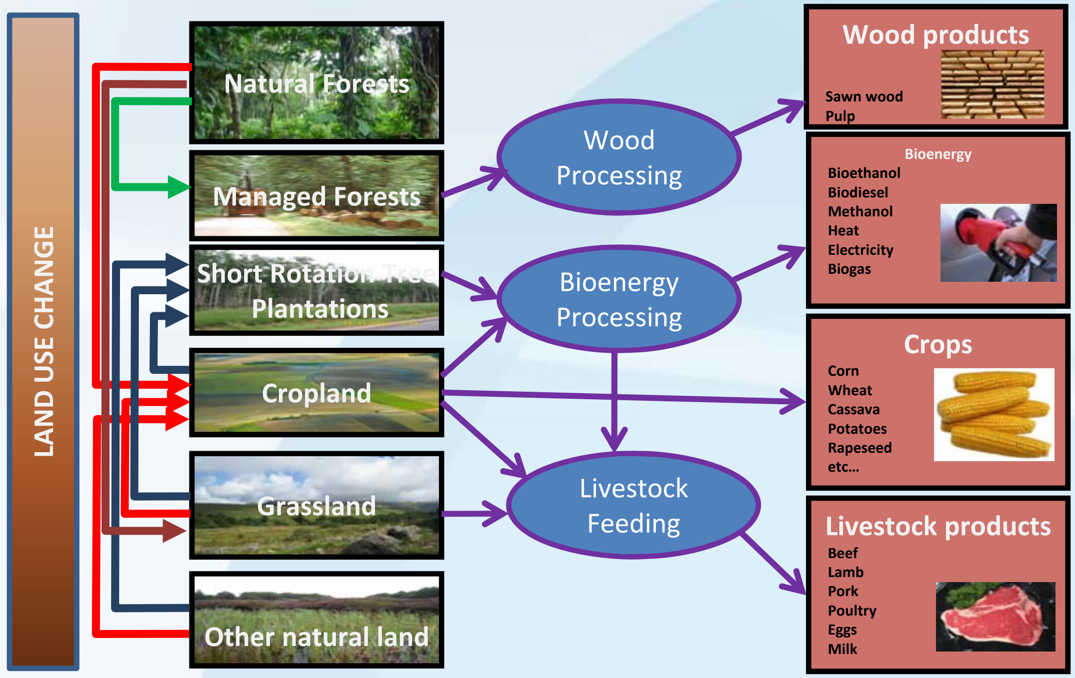
Aims and scope

- Focus: assessment of impacts outside EU
- Comparison of scenarios
  - Reference (RED policy)
  - Sustainability (more stringent criteria)
  - Assessment of imports: sensitivity runs of trade and deforestation assumptions
- Accounting for a wider scope of sustainability issues, addressing
  - (direct and indirect) land use change
  - environmental variables (water, nitrogen, GHG emissions)
  - economic effects (e.g. food prices)

GLOBIOM model structure

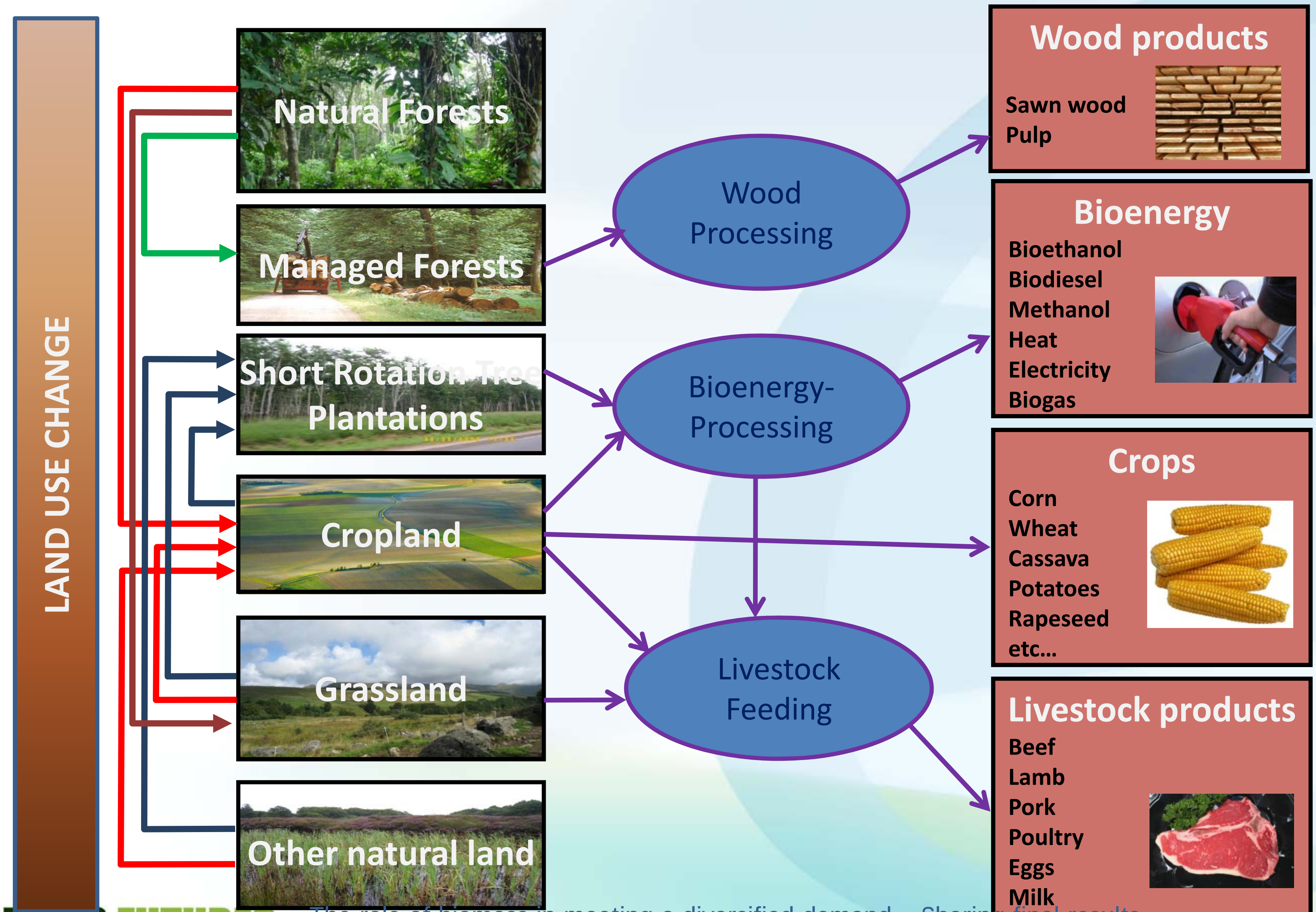


Global assessment assumptions



- GLOBIOM developed by IIASA
- Recursively dynamic partial equilibrium model of the agricultural, bioenergy, forestry and livestock sector
- Covering 28 world regions (plus EU27)
- Demand for rest of the world: POLES Reference scenario
- Deliverables for Biomass Futures:
  - Imports for demand models
  - Impacts of imports and scenarios of biomass use (water and Nitrogen use, GHG emissions, deforestation)

GLOBIOM - Supply chain



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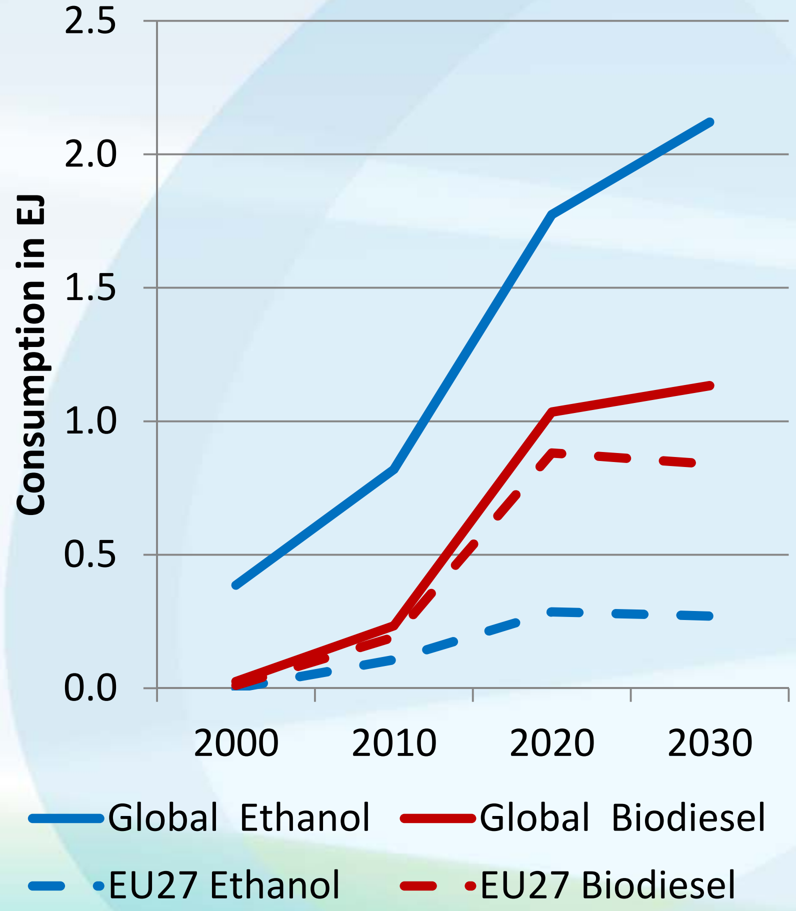
Global versus EU biofuel consumption

- Share of European biodiesel of global demand increases from 42% in 2000 to 74% in 2030
- EU ethanol share is also rising to 13% of global demand in 2030
- Other countries such as Brazil and the US continue expansion of production



Description of scenarios

- Reference
  - EU domestic bioenergy demand: PRIMES Reference; NREAPs (2020)
  - Sustainability criteria: RED
  - Rest of the world bioenergy demand: POLES Reference scenario
- Sustainability (difference to Reference)
  - More stringent GHG efficiency targets
  - Exclusion of high biodiverse areas (WCMC maps)

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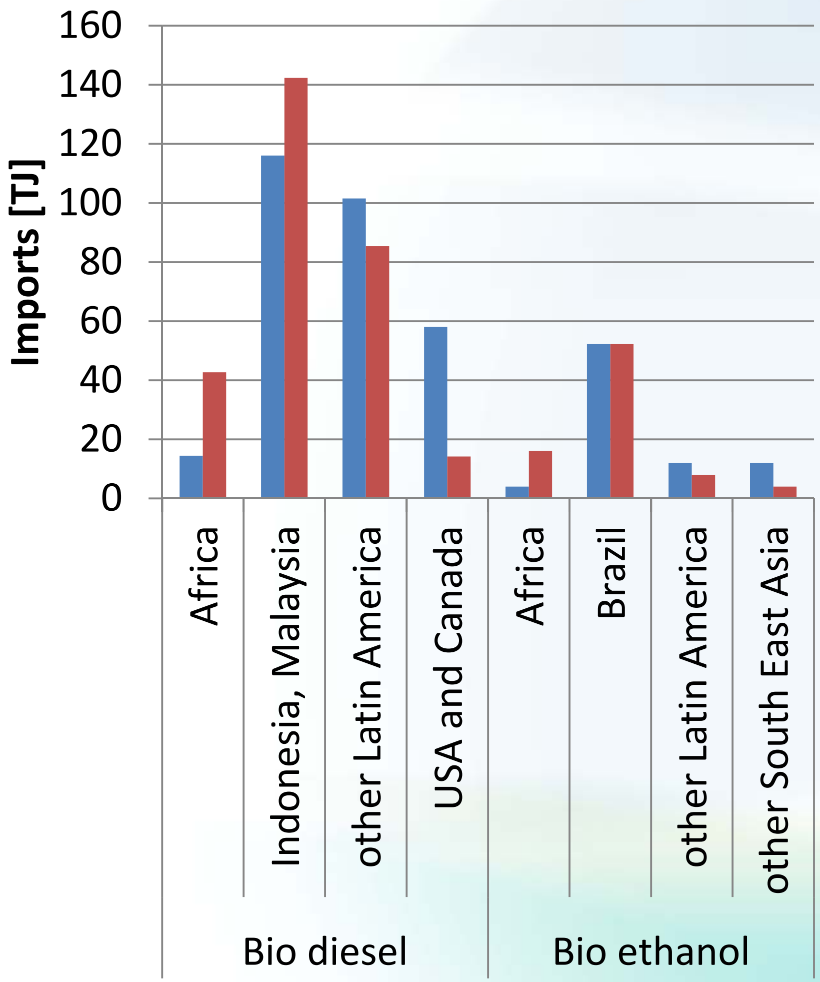
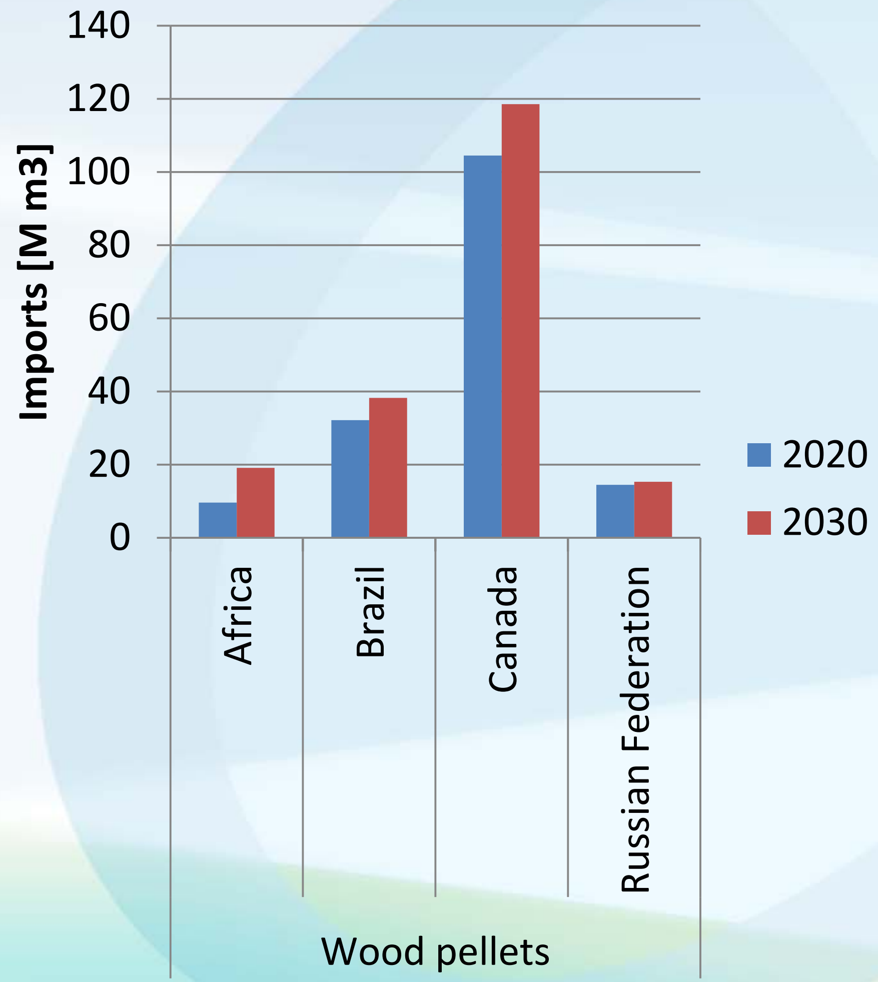
Results: Import quantities and origin

Excluding sustainability criteria, to be added ex post before entering demand





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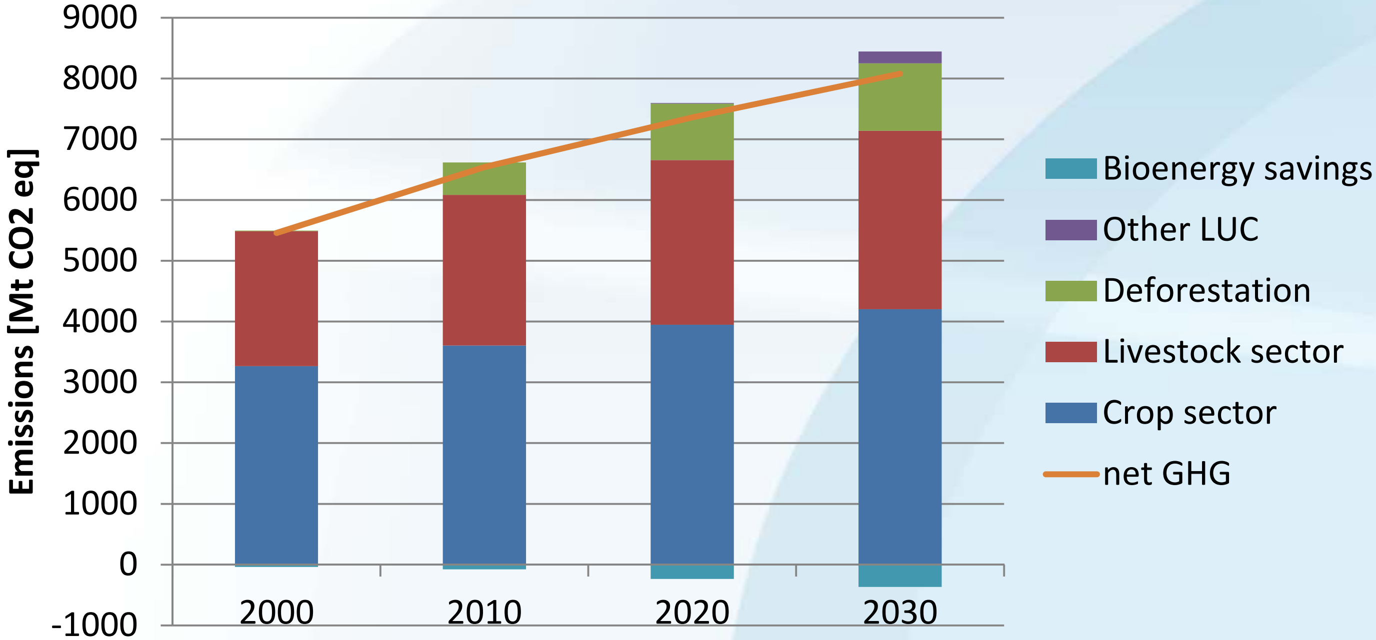
Biofuel production Reference scenario [PJ]

Region	Product	2010	2020	2030
Global	Corn ethanol	453	1,325	1,464
	Sugar cane ethanol	259	418	627
	Wheat ethanol	107	31	30
	Cellulosic ethanol	101	798	2,473
	Total ethanol	**920**	**2,573**	**4,594**
	Palm oil biodiesel	0	78	109
	Rapeseed biodiesel	165	734	751
	Soybean biodiesel	40	223	273
	Sunflower biodiesel	29	0	0
	Total biodiesel	**234**	**1,034**	**1,134**
EU27	Corn ethanol	0	178	162
	Wheat ethanol	107	27	27
	Cellulosic ethanol	0	31	31
	Total ethanol	**107**	**236**	**220**
	Rapeseed biodiesel	162	591	555
	Sunflower biodiesel	29	0	0
	Total biodiesel	**191**	**591**	**555**

Impacts: Global GHG emissions



Global GHG emissions in Reference scenario in Mt CO2 eq

- Globally increasing GHG emissions in Reference scenario
- Population and GDP are largest drivers
- Main source for additional emissions of biofuels is due to deforestation and other land use change

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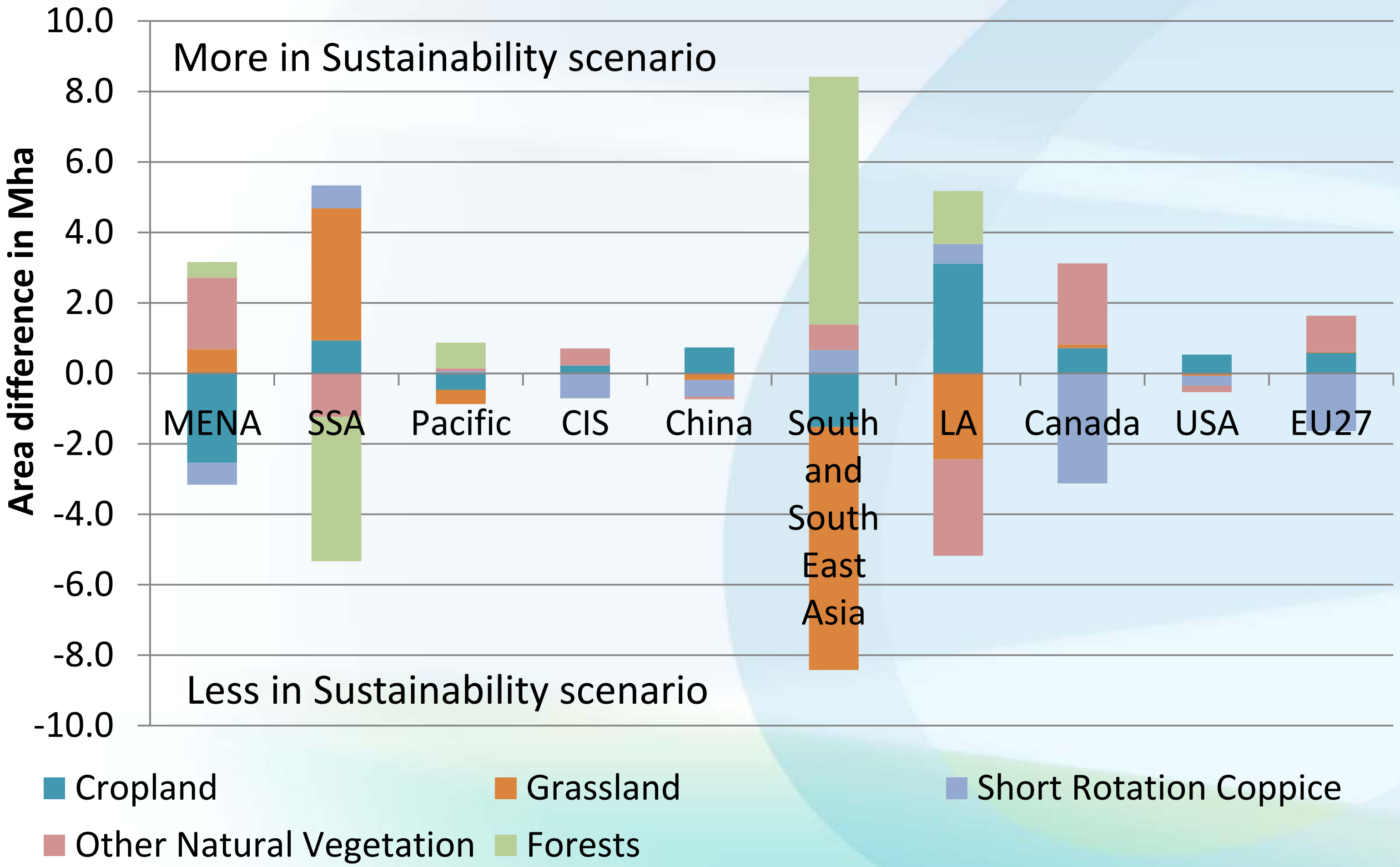
How to assess direct and indirect impacts?

- Biomass Futures scenarios
  - Reference (RED policy)
  - Sustainability (more stringent criteria)
- Commodities in model considered to be homogenous, i.e. products from all regions are identical and substitutable
- Similar to real situation of leakage: sustainable feedstocks potentially used for EU biofuels, remaining sources supply to other sectors and regions
- Model exercises to assess effects:
  - run with artificial assumption of frozen EU27 biofuel demand in 2020 at 2010 levels (theoretical scenario of constant biofuels for analytical purposes not as a policy scenario)
  - no trade of biofuels between EU and RoW (but allowing food trade)
  - effectively avoided deforestation (of all kind)

Impacts: Global land use change

Land use change in Sustainability compared to Reference in 2030



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Impacts: Global land use change effects

Sustainability vs. Reference scenario

- Smaller grassland area due to restricted grassland expansion (- 5.4 Mha)
- Slightly larger cropland area due to change of biofuel feedstock mix and reallocation of production outside Europe (+2.3 Mha)
- Less deforestation (- 5.6 Mha) and conversion of other natural vegetation (- 2.4 Mha) due to sustainability criteria
- However, slight increase in Sub-Saharan Africa
- Increasing EU imports trigger competition between cropland for biofuel production and grasslands for animal feeding, additional grasslands to expand into forests as cropland for biofuel production expands into highly productive grasslands

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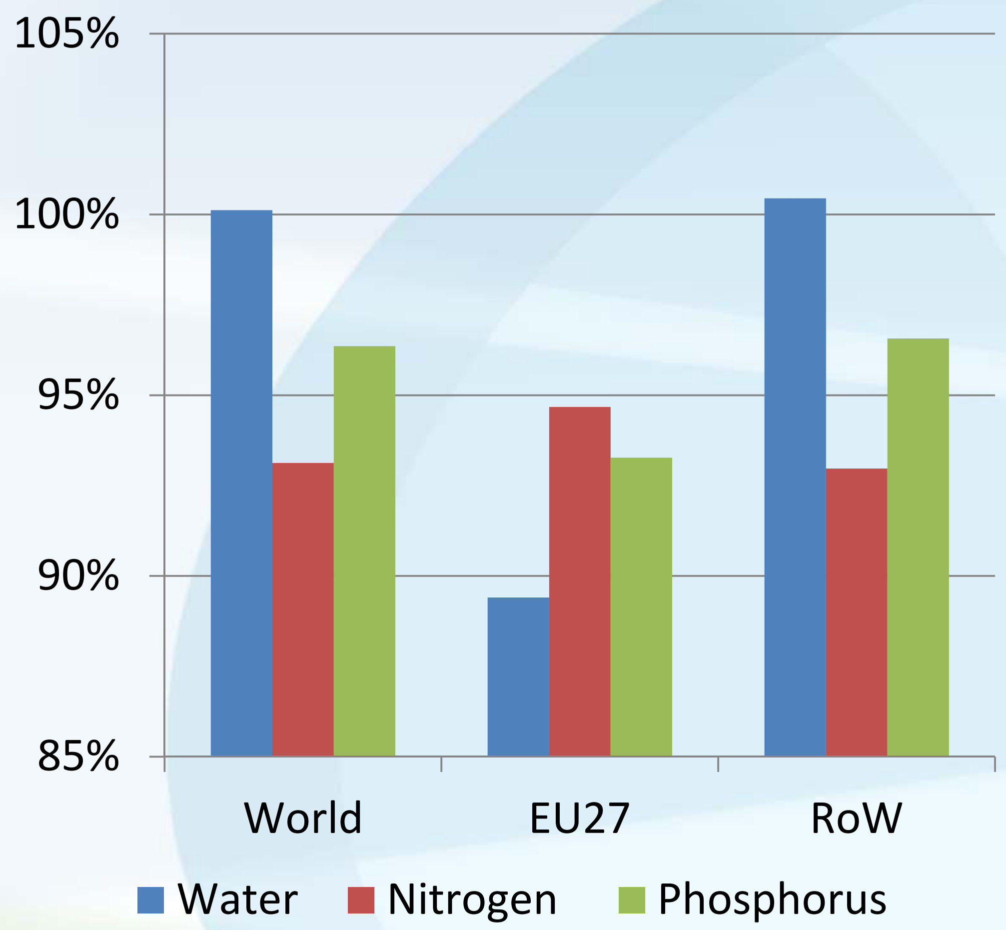
Impacts: Management intensity

Reference Scenario

- Globally increasing Nitrogen use and intensity in Reference Scenario until 2030
- In EU only minor intensification takes place



Nitrogen intensity in Sustainability compared to Reference in 2030

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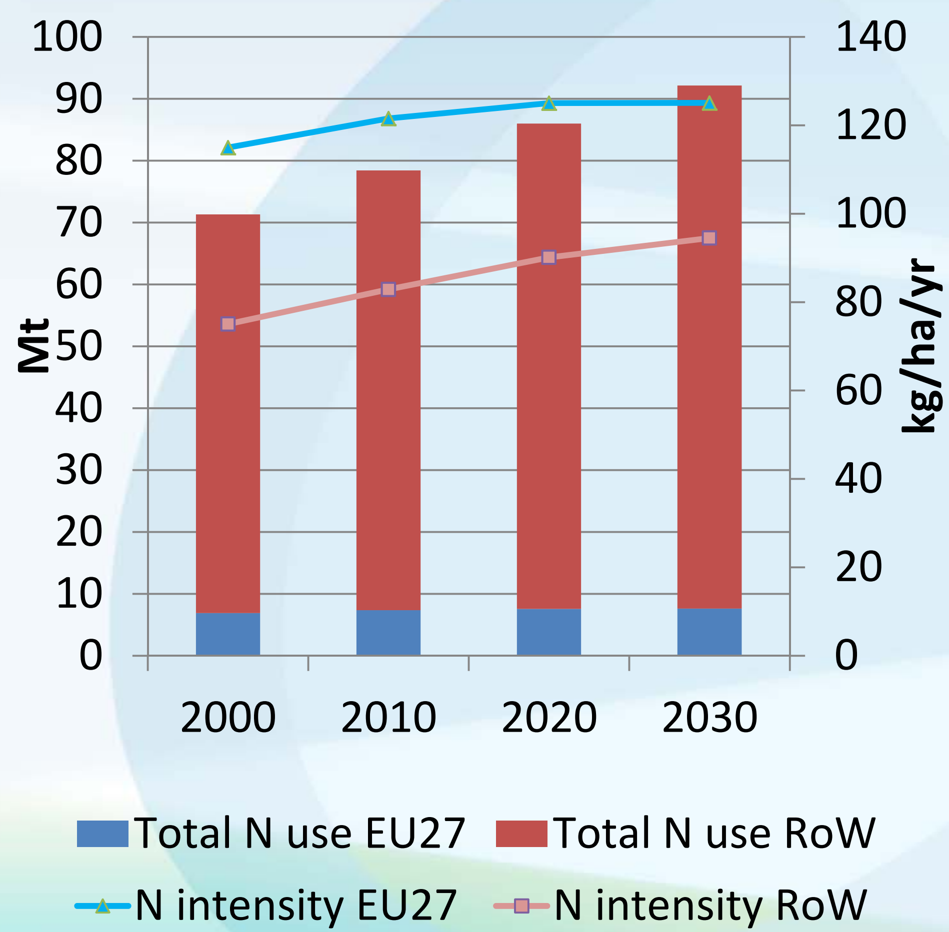
Impacts: Management intensity

<u>Sustainability vs. Reference</u>

Management intensity decreases:

- Shift in management systems
- Change in biofuel feedstock mix (i.e. less rapeseed and corn)
- Reallocation of production

Nitrogen use and intensity in Reference until 2030



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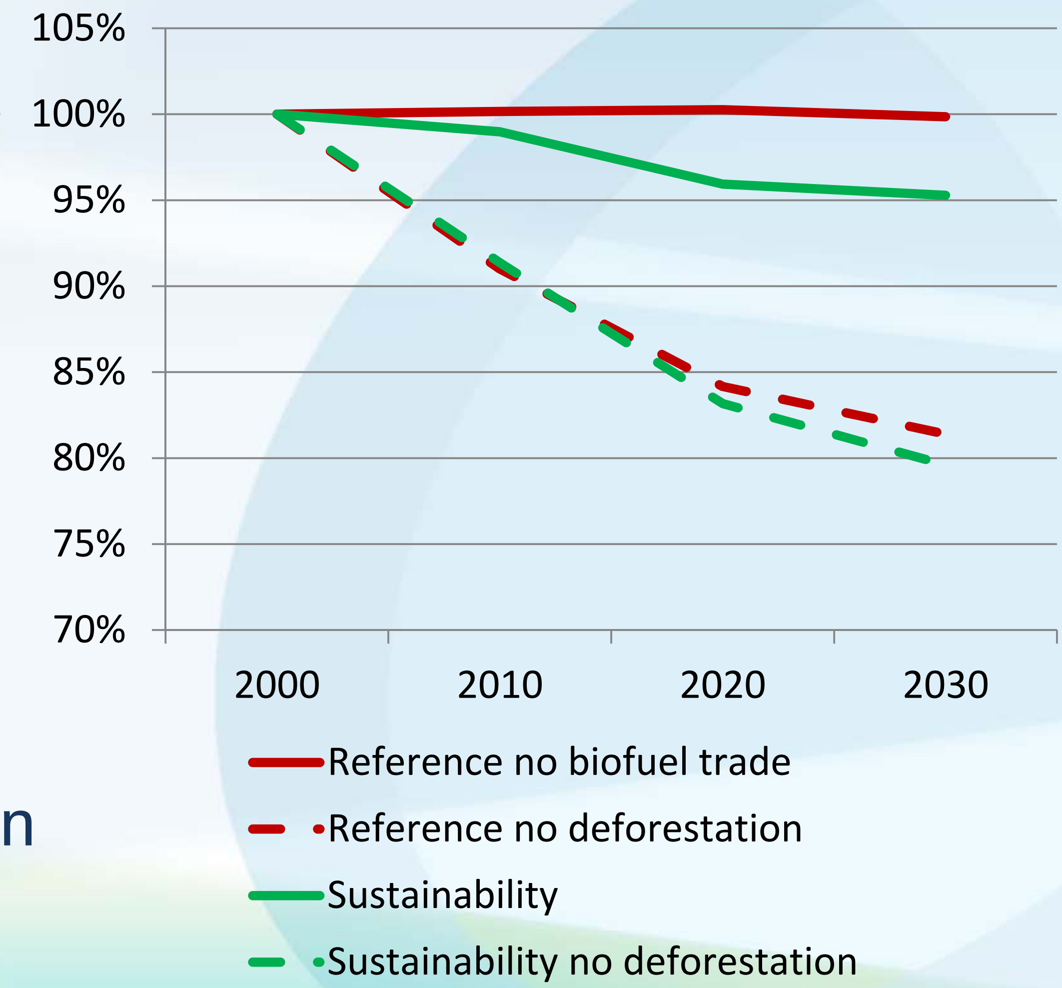
Effects of increased bioenergy in 2020

- Artificial assumption: EU27 biofuel demand frozen at 2010 levels in 2020
- Observed land use change
  - Loss of highly biodiverse areas of 2.2 Mha globally, especially primary forests and grasslands
  - Deforestation of 2.4 Mha
- Total GHG emissions of 95 Mt CO2 eq (1.3%)
- NB: no feedbacks considered from other sectors in case of stagnating biofuel demand

Total GHG emissions in sensitivity runs

- Development of total global GHG emissions relative to Reference scenario
- Not allowing biofuel trade has no mitigation effect
- Additional sustainability constraints have limited effects
- Most effective: targeting deforestation directly (e.g. through REDD policies)



Main observations

- Satisfying European bioenergy targets in 2020 and 2030 requires a substantial increase in imports from the rest of the world
- EU biofuel mandates do have an effect on global land use and emissions (indirect effects)
- Effects most effectively mitigated through direct land use policies e.g. targeting emissions from deforestation and biodiversity loss (e.g. REDD)
- Such policies need to target total agricultural production
- Risk of undesirable social effects (food prices)