Sustainable biomass availability towards 2050 and a deep dive into the biodiversity impact

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Enough sustainable biomass availability?

What is the impact on biodiversity?

Agenda

1. Concawe
2. A look into sustainable biomass availability in the EU towards 2050
3. A deep dive into biodiversity impact
4. Conclusions

01 Concawe

Concawe: Environmental Science for EU Fuel Manufacturing

Concawe Membership

Concawe represents 39 Member Companies ≈ 95% of EU Refining

Open to companies owning refining capacity in the EU

Concawe Mission

Concawe's mission is to **develop scientific research** and technical studies on industry's products and operations, and their impact, often in association with external research institutes, in order to:

Increase the understanding of the impact of our industry and use of our product through advanced scientific developments

Develop with scientific rigour technically feasible and cost-effective pathways to achieve the EU's health, environmental and climate goals

Contribute to an informed legislative decision and facilitate the industry's regulatory compliance

Evaluate, for future scenarios, the potential role and contribution of our industry and its evolution.

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A look into sustainable biomass availability in the EU towards 2050

Imperial College London's study

Concawe commissioned a study with **Imperial College London Consultants:**

Published on 24/8/2021

"Sustainable biomass availability in the EU towards 2050 (RED II Annex IX Part A/B)"
It includes an excel file with granularity per **feedstock** and **country,** by **2030** and **2050.**

Basis for the analysis

1. Focus on biofeedstocks in **RED II Annex IX (Part A and B):**
   Traditional biofuel crops **(1st generation) and wastes & residues beyond Annex IX not included.**
2. **Imports potential** to EU considered (up to 50-60 Mtoe/y in 2030/2050).
3. Allocation of biomass raw materials **to biobased products** (bioplastics, biopharmaceuticals, construction materials, etc.) -> Deducted from the total availability

Agricultural biomass	Energy crops	Primary crop residues (e.g. wheat straw, prunnings, etc.)	Secondary crop residues (processing residues)	Manure
Forest biomass	Low-quality stemwood (fuelwood)	Primary forest residues	Secondary forest residues (processing residues)	
Waste and recycling	Wood waste	Vegetal waste	Animal and mixed food waste	
	Paper and cardboard	Household biowaste	Sewage sludge	

Imperial College's scenarios and assumptions

1. **LOW. Low mobilization:**
   - Farming and forest practices at 2020 levels.
2. **MEDIUM. Improved mobilisation in selected countries in EU:**
   - Improved mobilisation in **countries with high biomass availability**
3. **HIGH. Enhanced availability through R&I and improved mobilisation in all EU countries:**
   - Pushed to a higher technical sustainable potential in **all EU countries.**

Table 2 Main assumptions for the three scenarios examined in the Concawe study

	Scenario 1 (Low)	Scenario 2 (Medium)	Scenario 3 (High)
Agriculture			
Removal rate of field residues	40%	45%	50%
Use of prunings	5%	20%	50%
Moderate yield increases in perennial lignocellulosic crops in unused, degraded and abandoned land	1%	1%	2%
Share of unused, degraded and abandoned land for dedicated crops, excluding biodiversity rich land and on land with high carbon stocks (Current share of unused, degraded and abandoned land for dedicated crops: There are no offical statistics- only at experimental and demonstration scale)	25%	50%	75%
Forestry			
Stem wood used for energy purposes (Current stemwood for energy: 45%) (1)	25%	30%	50%
Primary forestry residues availability for energy production	40%	50%	60%
Secondary forestry residues and post consumer wood availability for energy	55%	60%	65%
Wastes			
Biowaste used for energy production (Current collection for bioenergy: 40-45%)	60% in 2030 (65% in 2050) of biowaste is recycled and 40% in 2030 (35% in 2050) is separately collected and available for bioenergy	50% in 2030 (55% in 2050) of biowaste is recycled and 50% in 2030 (45% in 2050) is separately collected and available for Anaerobic Digestion	40% in 2030 (45% in 2050) of biowaste is recycled and 60% in 2030 (55% in 2050) is separately collected and available for Anaerobic Digestion

(1) This concerns the fuelwood potential from roundwood and unused forest biomass currently unexploited. All material uses of stemwood were subtracted and only the stemwood currently used as fuelwood was incorporated in the potential.

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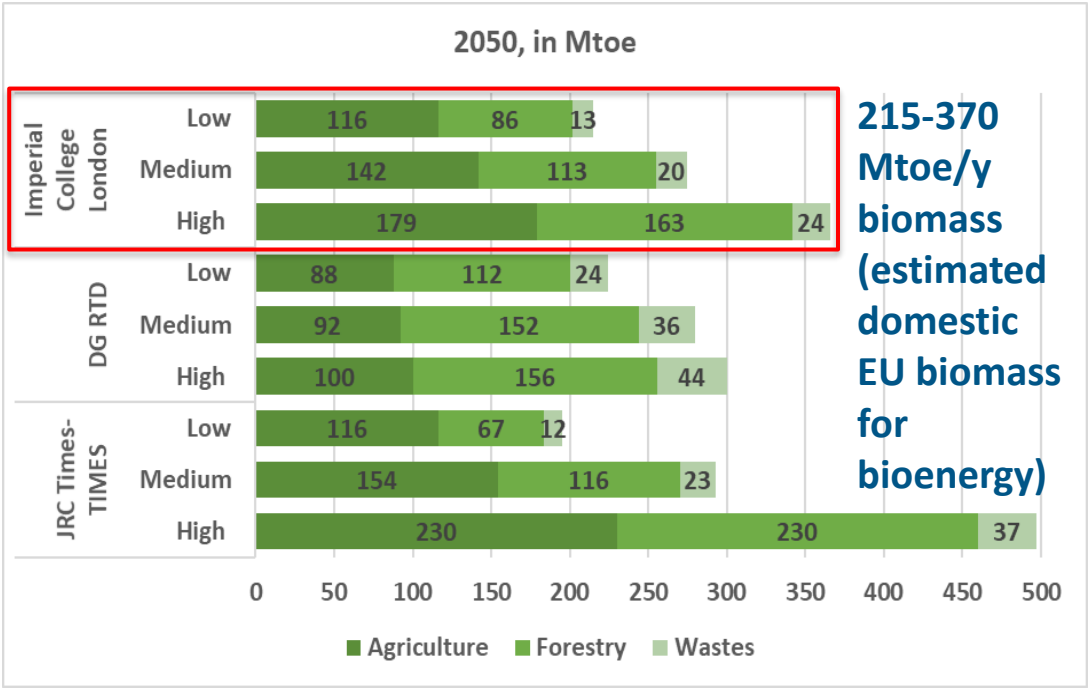
Estimated domestic EU biomass for bioenergy

Comparison with JRC and DGRTD

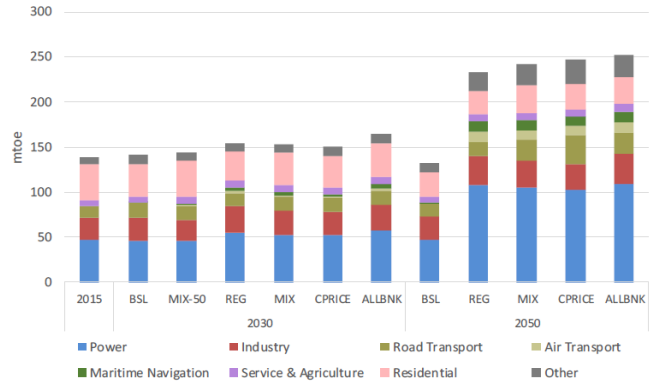


215-370 Mtoe/y biomass (estimated domestic EU biomass for bioenergy)

Competition with other sectors

The EU Commission (ACP4A & IA) allocates ~170 Mtoe/y of biomass to power + industry + residential sectors in 2050 -> Subtracted to estimate the remaining biomass availability for transport sector

Figure 77: Use of bioenergy by sector and by scenario



Source: PRIMES model

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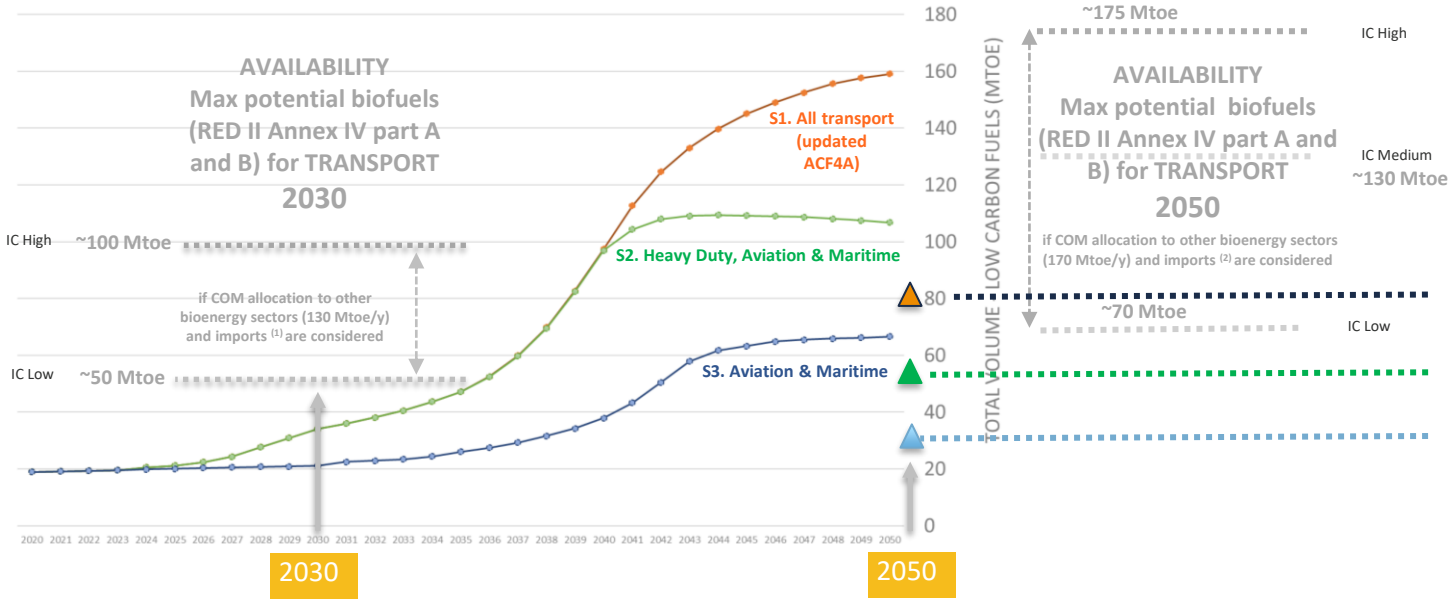
Comparison with Concawe's demand scenarios

Enough technical sustainable biomass potential for transport biofuels(1)

Three 1.5◦C demand scenarios exploring different penetration of LCF into Transport



BIOFUELS
Concawe Scenarios (2050)
Initial estimate / flexible allocation:
¬ ½ efuels / ½ biofuels

(1): Biomass imports potential in 2030: 50 Mtoe/y (~20 Mtoe/y of biofuels)
COM allocation to other bioenergy sectors (130 Mtoe/y) would imply ~50 Mtoe/y of biofuels

(2) Biomass imports potential in 2050: 60 Mtoe/y (~40 Mtoe/y of biofuels)
COM allocation to other bioenergy sectors (170 Mtoe/y) would imply ~120 Mtoe/y of biofuels

(1) In a context of high electrification of road transport (consumption of liquids divided by 3 vs. today), and in a context where approx. 50% of the low-carbon fuels production is addressed by e-fuels

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03

A deep dive into biodiversity impact

Biodiversity impact assessment of future potential biomass availability

Concawe commissioned a study with **Fraunhofer Institute** in collaboration with **Imperial College London Consultants** :

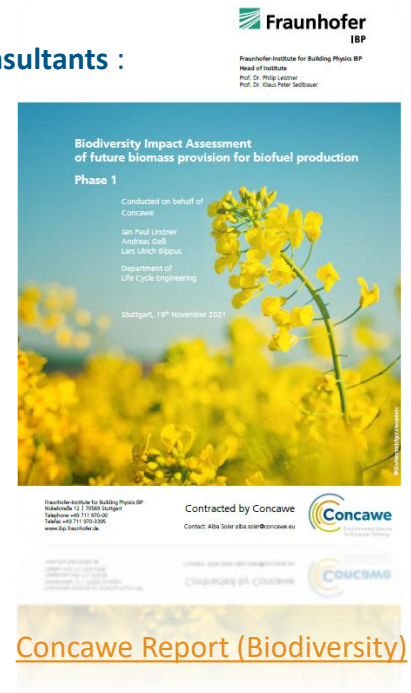
Scope: assess impact on biodiversity of sustainable biomass harvested in **unused, abandoned and degraded lands** (estimated by Imperial College in the previous study) for:

Miscanthus as an example energy crop

Impact assessment in:

1. Germany

2. Bulgaria



Concawe Report (Biodiversity)

Currently there is **not one single accepted scientific methodology** to assess the impact on biodiversity.

More rigorous method; more detailed input data

Fraunhofer has applied 2 methodologies:

1) Their own methodology - **Biodiversity Impact Assessment (B.I.A.) (Lindner et al.)**
2) IIASA's methodology - **Potentially disappeared species (P.D.F.) (Chaudhary & Brooks)**

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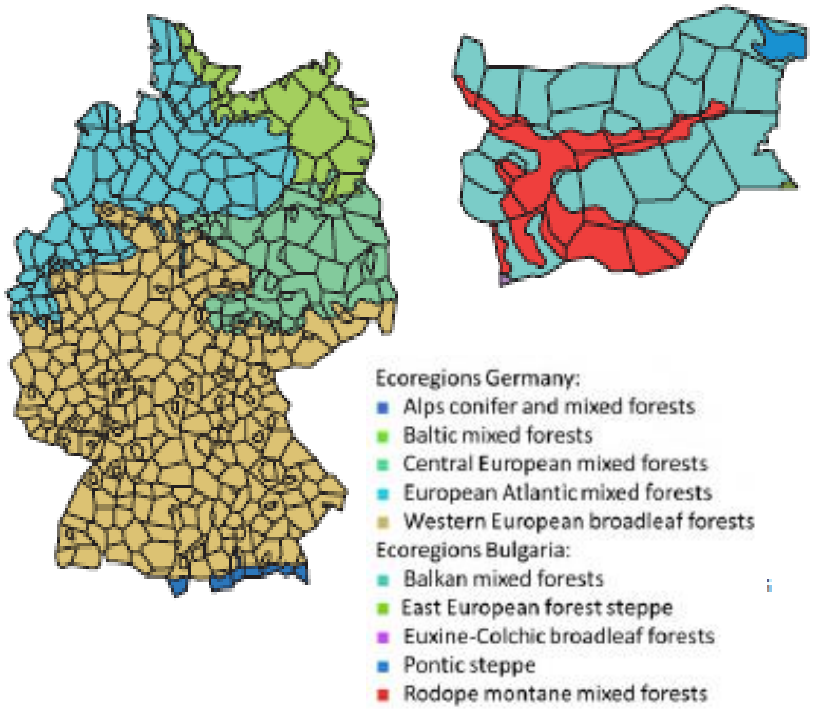
Granularity and Productivity

Granularity per country: NUTS 3

Ecoregions (NUTS 3) in Germany and Bulgaria



Miscanthus yields given by the high scenario of IC (enhanced management practices and increased availability through research and innovation) were used to identify the largest positive or negative impact on biodiversity.

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A deep dive into biodiversity

Fraunhofer's methodology – Biodiversity Impact Assessment (B.I.A) (Lindner et al.)

- **BIA method is used to quantify biodiversity value as a consequence of land use → can be used only to calculate future biodiversity value (in 2050) after their use for biomass production**
- **Hemeroby (degree of anthropogenic interference) classification system was used to quantify the current biodiversity state of marginal lands**

Hemeroby Class	Class name	Different types of land use; indicative examples, to be defined by measurements
I	Natural	Undisturbed ecosystem, pristine forest, no utilization
II	Close-to-nature	Close-to-nature forest management no thinnings
III	Partially close-to-nature	Intermediate forest management (moderate thinnings, natural assemblage of species); Highly diversified agroforestry systems, low input
IV	Semi-natural	Semi-natural forest management (regular thinning, exotic species); close-to-nature agricultural land use, extensive grassland, orchards, highly structured cropland with low input
V	Partially distant-to-nature	Mono-cultural forest; intermediate agricultural land use with moderate intensity, short rotation coppices
VI	Distant-to-nature	Distant-to-nature agricultural land use
VII	Non-natural artificial	Long-term sealed, degraded or devastated area

Base case (classification identified by Fraunhofer as most fitting one)

- Unused land: Hemeroby class II
- Abandoned land: Hemeroby class III
- Degraded land: Hemeroby class V

Sensitivities:

- For unused and abandoned land, the hemeroby level definitions of levels II and III fit quite well - > No sensitivity applied
- Degraded land however showed a **broader spectrum of definition** -> Sensitivities to levels IV and VI

Degraded land definition in RED II

Degraded: "'Severely degraded land' means land that, for a significant period of time, has either been significantly salinated or presented significantly low organic matter content and has been severely eroded."

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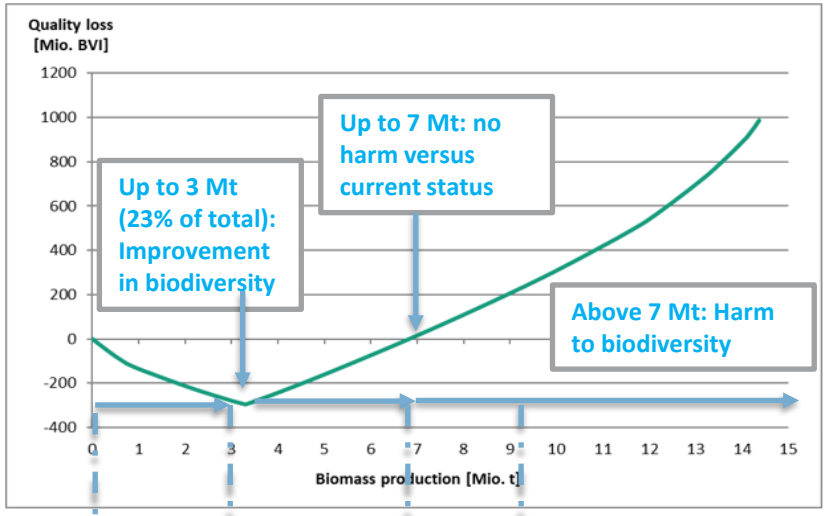
A deep dive into biodiversity

1) Biodiversity Impact Assessment (B.I.A) (Lindner et al.) - Results

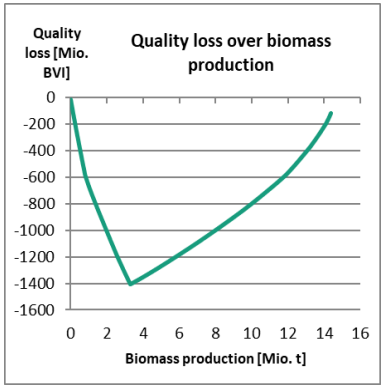
1.1. Results (Base case-> Degraded lands: Hemeroby class V)

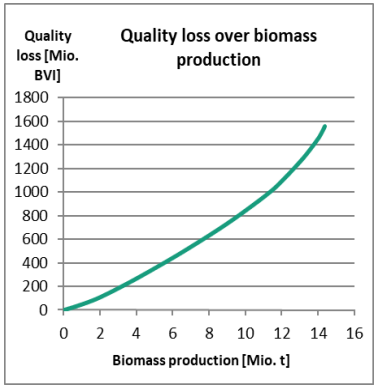


Scenarios of Imperial College London (energy crops potential)

Units of the chart: BVI (Biodiversity Value Icrement): Biodiversity value per produced kg of Miscanthus

1.2. Sensitivities to Hemeroby class VI (left) and VI (right)





Up to 14 Mt: no harm versus current status

Always harm to biodiversity vs current status

Most representative one

04 Conclusions

Conclusions

Enough sustainable biomass availability potential by 2030 and 2050?

- The initial estimate shows that, taking into account the competition for other sectors, **there is enough sustainable biomass potential for biofuel production (RED II Annex IX part A/B)** in the transport sector in Concawe's scenarios.

- **To realise this theoretical potential, additional R&D would be required as well as the implementation of improvement management strategies. Even if the theoretical potential is there, the supply chain would need to be developed to mobilise all these resources.**

What is the potential impact on biodiversity?

- The results show that according to the Fraunhofer's B.I.A methodology (base case) for Miscanthus and the 2 selected countries:
  - The biomass potential given by the **Medium Scenario from Imperial College is not harming biodiversity**
  - The biomass potential **given by the Low Scenario** has a **potential to improve biodiversity**

  while both in line with IC scenarios supplying enough sustainable biomass for transport biofuels in 2050

- Both methods show that different conclusions can be drawn **with different definitions of current state of land** (especially for degraded land). Detailed inventory and definitions of state of land needs to be developed at EU level.

(1) In a context of high electrification of road transport (consumption of liquids divided by 3 vs. today), and in a context where approx. 50% of the low-carbon fuels production is addressed by e-fuels

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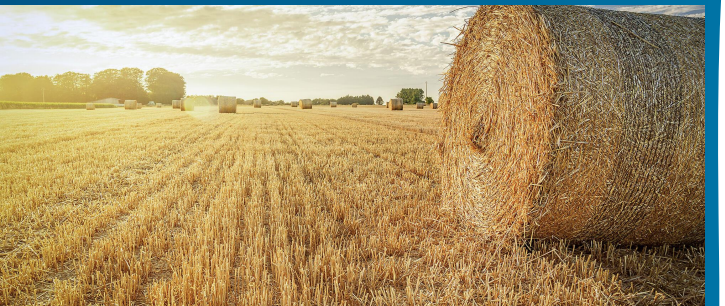

www.concawe.eu

Thank you for your attention

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