How effective are the sustainability criteria accompanying the European Union 2020 biofuel targets?

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Introduction

Renewable Energy Directive (RED)

- In 2020, 20% of the energy consumption and 10% of the total transport fuel demand has to be supplied from renewable sources.

Biofuels offer the potential to reduce GHG emissions

- BUT increasing biofuel demand can lead to an array of negative environmental impacts e.g. higher GHG emissions through iLUC or biodiversity losses through direct or indirect displacement of natural habit.

In order to avoid negative impacts on the environment, sustainability criteria guiding biofuel production have been included in the RED.

We apply a global partial equilibrium model to quantify environmental impacts of the RED on GHG emissions and biodiversity conservation and assess the effectiveness of European biofuel sustainability criteria in ensuring the latter.

Methodology

Our approach relies on two main steps:

1. **Environmental impact :**
   - Scenario analysis in GLOBIOM: Baseline scenario (EU27 biofuel targets) compared with Counterfactual scenario (no EU27 biofuel increase above 2010 level).

2. **Effectiveness of sustainability criteria:**
   - Identifying the share of production in the Baseline scenario in 2020 complying with RED sustainability criteria.
   - Excluding non compliant agricultural production from “sustainable” production potential
     - Biofuel feedstocks from deforested areas (Art. 17.4)
     - Biofuel feedstocks from highly biodiverse areas (Art. 17.3)
     - Biofuel feedstocks not reaching the 50% GHG emission saving target (Art. 17.2)
   - Is the global “sustainable” production potential big enough to satisfy EU biofuel demand in 2020?

Computing the “sustainable” production potential complying with sustainability criteria relies on an ex-post calculation respecting the rationale of the RED.

GLOBIOM*

- Global partial equilibrium model integrating the agricultural, bioenergy and forestry sectors.
- Demand and international trade are represented at the level of 27 EU member states and 23 aggregated world regions outside Europe.
- Detailed disaggregation of land into Simulation Units.
- Represents 18 major crops and 4 different management systems simulated with EPIC model. Forestry parameters from G4M model.
- In the model six land use types are represented. Land use change is driven endogenously by demand as well as profitability of the different land based activities.
- GLOBIOM covers first and second generation biofuels, traditional biomass use and production of heat, electricity and gas from woody biomass.
- Objective function: Maximize consumer and producer surplus.

*Havlík et al. (2011) Global land-use implications of first and second generation biofuel targets. Energy Policy, 39, 5690-5702.

Scenarios

Baseline scenario:

- European biofuel demand in 2020: 881 PJ of biodiesel , 286 PJ of bioethanol and 31 PJ of 2nd generation biofuels (as specified in the NREAPs)
- No sustainability criteria

Counterfactual scenario:

- No biofuel increase in Europe above 2010 level
- No sustainability criteria

Results

Environmental impact

- **Total emissions increase by 95 Mt CO_2 eq (+1.3% additional emissions) in 2020** in the Baseline compared to the Counterfactual.
- Rising emissions from deforestation and from change in cropland management cannot be compensated for by an increasing carbon sink due to additional establishment of short rotation tree plantations and emission savings due to the replacement of fossil fuel with biofuels.
- **Biofuel expansion is responsible for about 2.2 Mha losses of highly biodiverse areas (+12.4% additional biodiversity loss).**
- Total deforestation rises by 2.4 Mha (+4.2%).

Effectiveness of sustainability criteria

- **Overall the majority of corn (50%), sugar cane (84%), wheat (55%), palm oil (97%), soybean (90%) and rapeseed (78%) production can be classified “sustainable” in the sense of RED.**
- The 50% mitigation target is responsible for the major share of production excluded from the “sustainable” production potential in the ex-post calculation. A small share of total production is excluded due to violation of sustainability criteria on direct land use change and conservation of high biodiversity areas.
- **Globally, “sustainable” production in the sense of the RED can produce more than 10 times the 2020 EU biofuel demand.**
- Crops for bioethanol production like sugar cane and corn have large “sustainable” production potentials (US, Brazil and South and South East Asia) to satisfy the European biofuel demand.
- About 75% of EU biofuel demand is expected to come from biodiesel, which offers limited “sustainable” feedstock production potential inside the EU (rapeseed can at most supply 33% of the biofuel mandate). Consequently, a substantial share of biodiesel feedstocks will have to be imported to Europe.

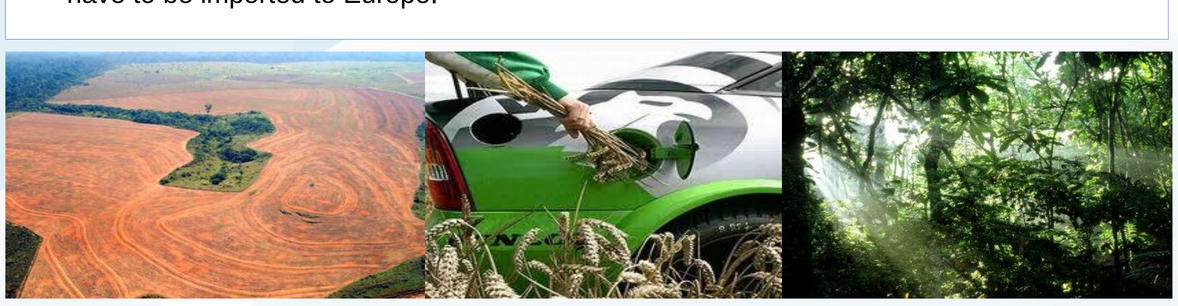

Table 1: Share of total European biofuel demand in 2020 which can be supplied by the “sustainable” production potential per feedstock in a region.

	Corn	Wheat	Sugar cane	Rapeseed	Soybean	Palm oil	Total
EU27	33%	63%	0%	25%	0%	0%	120%
Middle East and North Africa	15%	15%	0%	0%	1%	0%	31%
Sub-Saharan Africa	6%	3%	10%	0%	0%	4%	23%
Pacific	0%	9%	10%	9%	0%	0%	28%
Former USSR	0%	62%	0%	1%	0%	0%	63%
China	0%	2%	9%	25%	13%	0%	49%
South and South East Asia	2%	55%	111%	5%	0%	77%	250%
Latin America	29%	10%	80%	0%	39%	3%	162%
USA & Canada	251%	54%	7%	26%	45%	0%	383%
World	**337%**	**274%**	**228%**	**91%**	**98%**	**84%**	**1111%**

Conclusion

- **European biofuel targets have a negative impact on GHG emissions and biodiversity.**
- More than 10 times the total European biofuel demand in 2020 can be supplied “sustainably” according to RED.
- **Biofuel sustainability criteria are ineffective in preventing negative effects on the environment** due to leakage effects in sectors not covered by sustainability criteria (e.g. food, animal feed sector, biofuel sector outside EU).
- Policy failure of applying sustainability regulation to a single sector in a single region.

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