Carbon footprint of peat use and destruction in Switzerland in connection to agriculture

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Goal and Scope

This poster investigates the environmental impact of peat degradation on the Swiss food production and consumption. It includes emissions from the use of imported peat as substrate or as soil around seedlings and emissions from drained organic soils (under agricultural land). So far, these aspects were neither fully covered in the ESU database for food production and consumption [1] nor in the ecoinvent database for different agricultural products [2].

Importance of peat and application in this study

Organic soils are important reservoirs in the carbon cycle. Their drainage and subsequent use and degradation releases relevant amounts of greenhouse gases (mainly CO_2 and N_2O) [3]. Additionally, the use of imported peat as substrate also leads to CO_2 emissions, on production site and on the place of use.

The degradation of drained organic soils is responsible for around 2 % of the Swiss direct greenhouse gas emissions (0.74 million tons CO_2–eq per year), with only taking up 0.67 % of Switzerland's area [a] .For the calculation, the IPCC emission factors (EF) for different kinds of land uses on drained organic soils are used [4], as well as the area on which they are applied for this study.

The emission factors are calculated and implemented in the ESU database to analyse their influence on the average food consumption.

[a] https://www.nzz.ch/wissenschaft/klima/klimaforschung-wie-der-moor-verlust-das-klima-anheizt-ld.153022

Emissions from drained organic soils

For different kinds of land uses, different EF are calculated (in kg GHG/m^2(soil)a). The calculated total emissions from peat degradation per year are distributed over the area used for vegetable cultivation, the remaining cropland and grassland. The following formula was applied to calculate the distinct CO_2 and N_2O emissions factors for areas used for vegetable cultivation and the remaining cropland:

$$EF\left(\frac{kgCO_2}{ha_{land\ use\ x}}\right) = \frac{EF_{land\ use\ x,peat} * ha_{land\ use\ x,peat}}{ha_{land\ use\ x}}$$

According to IPCC, the CH_4 emissions are only relevant for grassland. The next table shows the resulting EF for the different kind of land uses [4].

	Unit	vegetable cultivation	remainig cropland	grassland
emissions on peat land (IPCC, 2014)	t CO2/ha/a	32	32	20
	kg N2O/ha/a	43	43	15
	kg CH4/ha/a			19
area organic soil (Paul S., 2013)	ha	3523	8077	6700
total emissions in Switzerland	tCO2/a	111'327	255'233	134'000
	kgN2O/a	150'482	345'003	103'467
	kgCH4/a			126'853
total area in CH (agrarbericht.ch, 2018)	ha	12'127	386'057	609'042
emission factors for LCI	kg CO2/m2a	**9.2E-01**	**6.6E-02**	**2.2E-02**
	kg N2O/m2a	**1.2E-03**	**8.9E-05**	**1.7E-05**
	kg CH4/m2a			**2.1E-05**

Emissions from imported peat

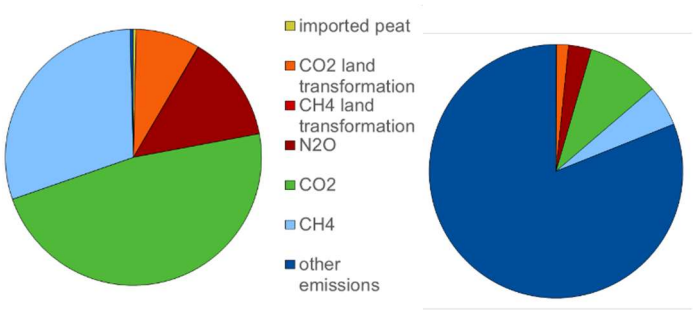
Peat extraction is forbidden in Switzerland. However, imported peat might still be used. A relevant amount of peat is imported as substrate and with seedlings for vegetable and fruit cultivation. The trade statistics show that 524'000 m^3 peat were imported in 2014, 66'000 m^3 as substrate for vegetable and fruit cultivation, 82'000 m^3 for seedlings.

The peat imported with the seedlings is included in the balance of vegetables and fruits. The peat used as substrates is distributed over the area of greenhouses in Switzerland, this leads to an amount of 1.1 kg peat/m^2a. For every kind of vegetable and fruit, this amount was multiplied with the area of greenhouse used for its production in Switzerland.

If the carbon is degraded, one kg of peat emits 0.87 kg of CO_2. This results in emissions of 91'000 t CO_2 for the reference year 2014. When the emissions from the peat for vegetable cultivation is distributed over the area of greenhouses, this results in 0.96 kg CO_2 emissions per m^2a greenhouse.

Influence of peat emissions on the average food consumption

The graph on the left analyses the carbon footprint of the average Swiss food consumption over one year in kg CO_2-eq, the graph on the right in UBP according to the ecological scarcity method. For the CO_2 and CH_4 emissions, it was possible to distinct emissions caused by land transformation and other sources. For N_2O, no distinction was possible in the inventory. About 55% of the CO_2 emissions from land transformation are due to products from Switzerland and the rest is due to imported products. The added emissions make up about 21% and 4% (including the whole N_2O emissions). The real fraction caused by peat degradation is assumed to be lower, because the major part of the N_2O is due to emissions from fertilizer production and application (around 90 % of the N_2O emissions aren't due to peat degradation). The obtained results suggest, that these emissions are of some relevance for Switzerland and should be included in LCI for agricultural products.



This calculation only considers the impact of the direct emissions from peat degradation. Other aspects like for example the importance of wetlands for the biodiversity aren't included.

[b] https://www.nabu.de/natur-und-landschaft/moore/lebensraum-moor/11777.html

References

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