The Impact on Climate and Deforestation Risk Due to Palm Oil and Main Alternative Oils for the Food Sector

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MOSTA CLIMATE CHANGE WEBINAR
Necessary actions needed to bring crude palm oil to net zero emissions
Online, 13 April 2022

MOSTA
Malaysian Oil Scientists & Technologists Association

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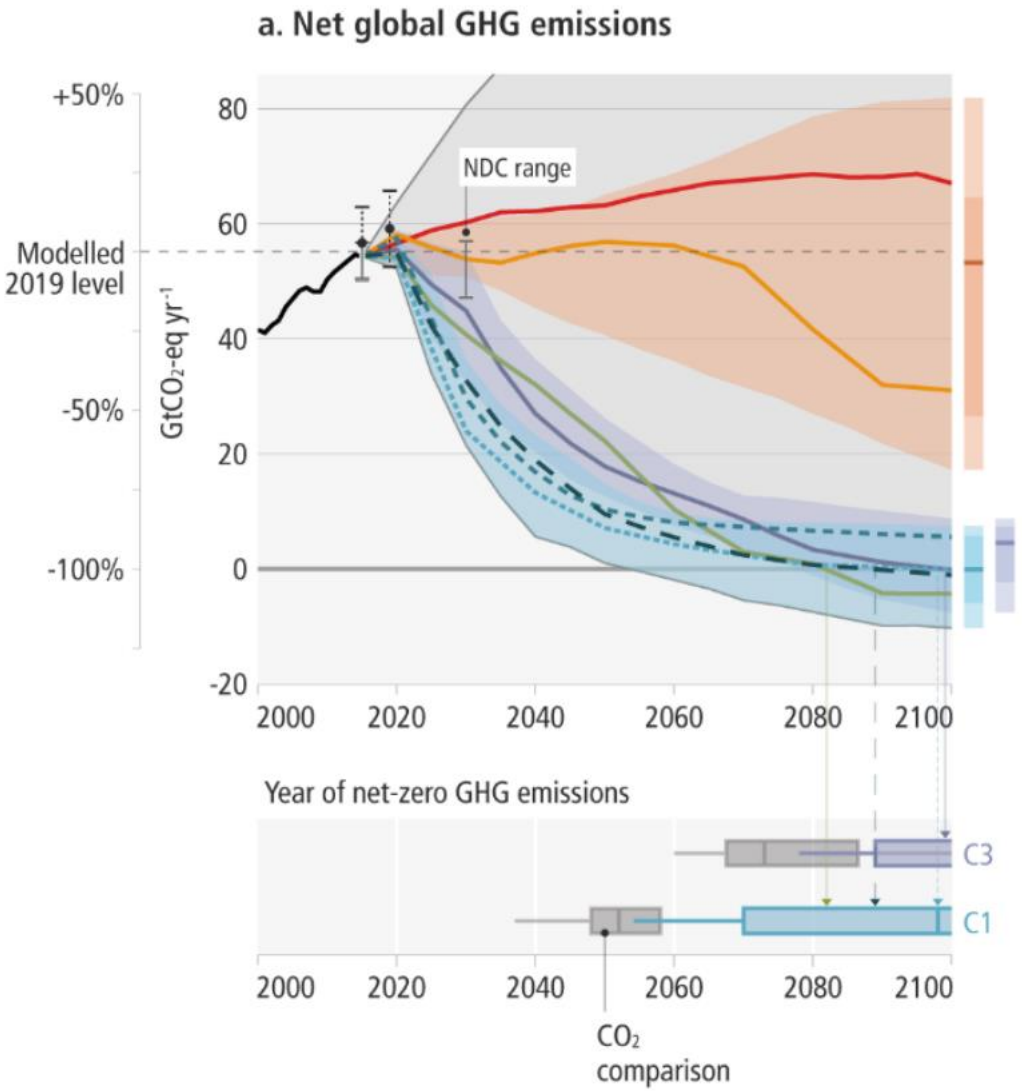
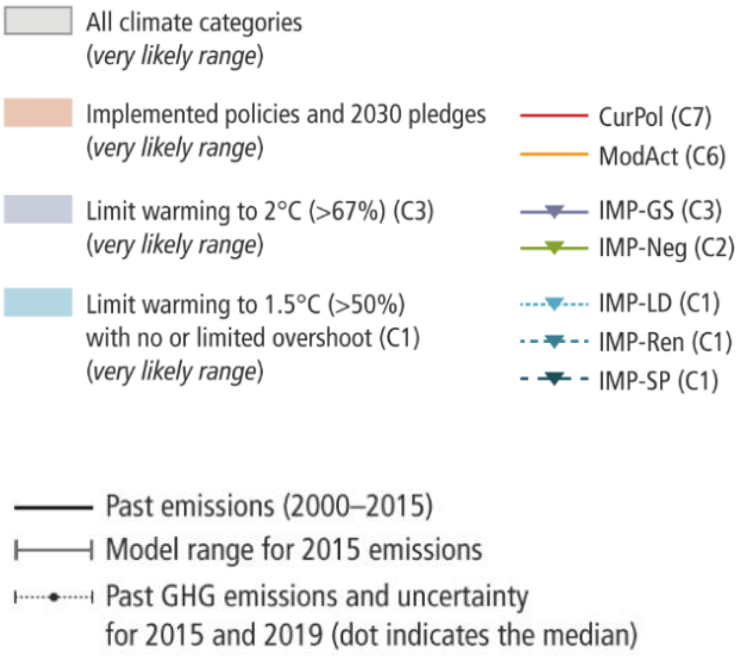
Centro Euro-Mediterraneo sui Cambiamenti Climatici

Paris Agreement target: Temperature increase under 2° C



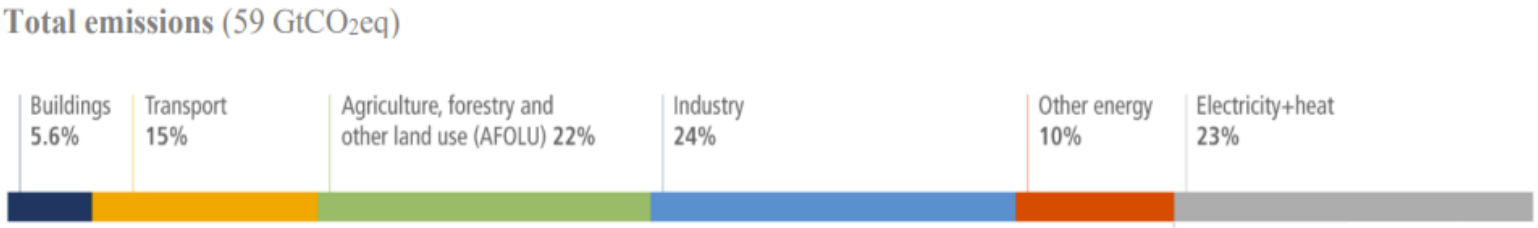


Malaysia is committed to become a carbon-neutral nation by as early as 2050 and plans to reduce in 2030 the intensity of greenhouse gas (GHG) emissions by 45% based on 2005 level.

IPCC AR6 (2022)

Food systems

IPCC AR6 (2022)



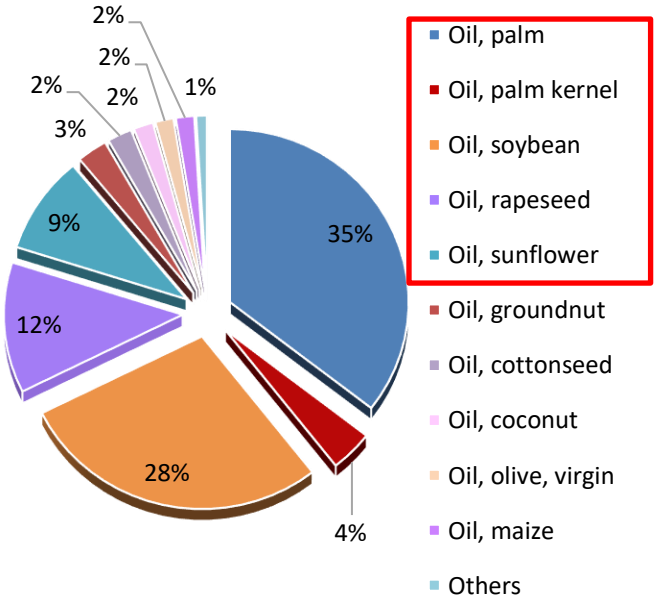
- 23-42% of global GHG emissions are associated with food systems
- Absolute GHG emissions from food systems increased from 14 to 17 GtCO2-eq yr-1 in the period 1990-2018.

Making agricultural production, processing and food consumption more sustainable is an imperative to control and address the climate crisis.

Vegetables oils

Global production > 200 million tonnes per year

- Palm oil -> 36% (40% with palm kernel oil), with 82 million tonnes/year
- Soybean oil (29%) with almost 60 million tonnes/year
- Rapeseed oil (12%) with over 24 million tonnes/year
- Sunflower oil (10%) with over 20 million tonnes/year

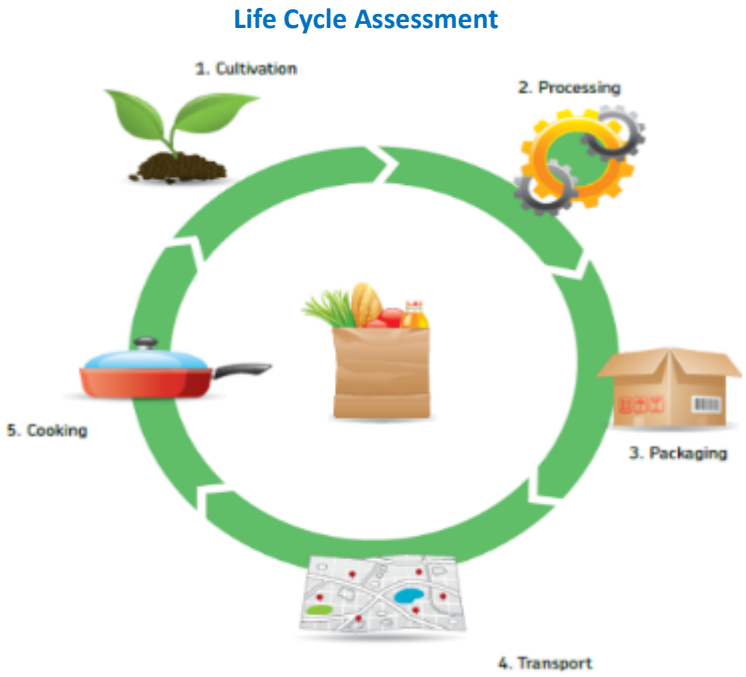


Palm oil is the most used vegetable oil and the most criticized, for the observed loss of primary tropical forests for its expansion.

The focus on this led to two different responses:

1) replacing it with other vegetable oils
2) producing and/or using sustainable palm oil (without deforestation or drainage of peatlands)

Life Cycle Assessment (LCA) and carbon footprint



«from cradle to grave»

Boundaries: **FARM GATE -> <u>the GHG emissions from the field</u>**

Inputs include: *raw materials, seeds, fertilizers, transports, field operations, fuel, pest and weed control, etc.)*

[Primay Data] x [Emission Factors GHG]

SimaPro 7.3.3

Indicators:

1) Carbon footprint per unit of land (i.e. GHG emissions in Mg CO_2eq per ha);
2) Carbon footprint per unit of product (i.e. Mg CO_2eq per ton of oil);
3) Land needed to produce 1 ton of oil (i.e. ha required per ton of oil) - *directly dependent on the crop yield.*

Annual production avg 2017-2019 (FAOSTAT, 2021)

	Top 3 Countries	Ha	Grain yield t/ha	Oil (ton)	Oil t/ha	
Soybean	Brazil	34,873,087	3.32	10,258,591	0.66	Oil yield: 18-21%
	USA	34,012,440	3.30	10,851,333	0.66	
	Argentina	16,743,016	2.94	7,798,600	0.59	
Rapeseed	Canada	8,904,000	2.26	4,116,743	0.79	Oil yield: 30-48%
	China	6,591,137	2.03	3,433,500	0.71	
	India	6,058,303	1.41	2,362,367	0.49	
Sunflower	Russia	7,870,710	1.63	4,902,243	0.41	Oil yield: 35%
	Ukraine	6,062,033	2.29	5,420,529	0.57	
	Argentina	1,791,005	2.03	1,345,500	0.51	

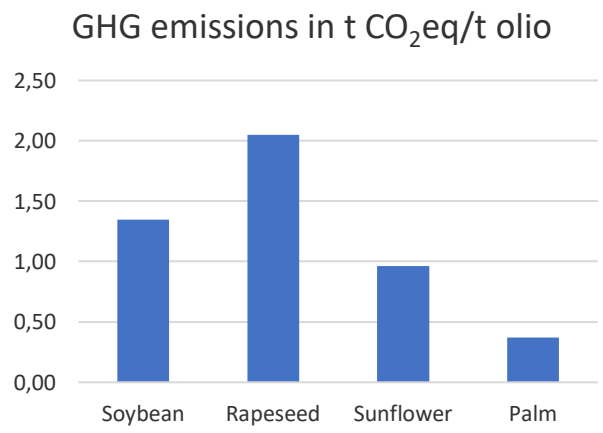
	Top Countries	Ha	Fruit yield t/ha	Palm oil (ton)	Palm kernel oil (ton)	Palm oil t/ha	Palm kernel oil t/ha
Oil palm	Malaysia	5,172,293	19.29	19,764,613	2,301,027	3,7	0,4
	Indonesia	14,351,125	16.81	40,467,294	4,277,167	2,8	0,3

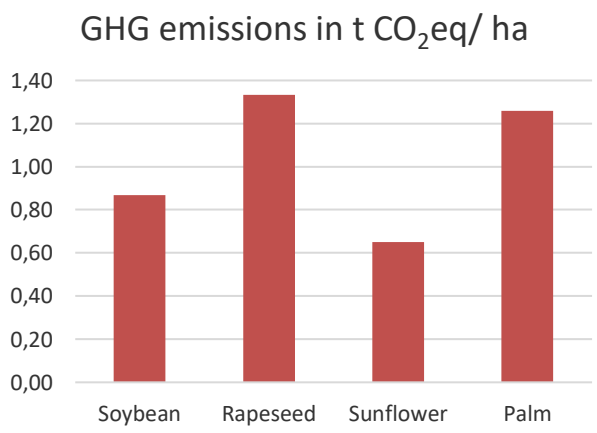
Primary data (from literature)

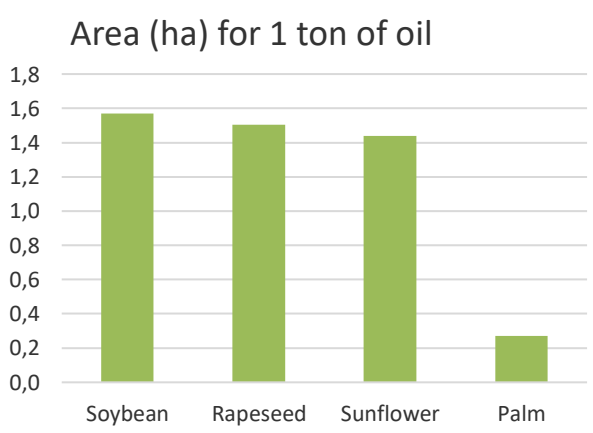
			Earthstat, 2021			FAOSTAT, 2021	
	Top 3 Countries	**Seed density**	**N (kg/ha)**	**P2O5 (kg/ha)**	**K2O (kg/ha)**	**Pesticidi (kg/ha)**	**Field operations (Fuel)**
Soybean	Brazil	60 kg/ha	17	31	48	5.9	1 tillage, 2 arrowing, seeding, 5 treatments, mechanical harvest
	USA		28	19	30	2.5	
	Argentina		20	7	0.36	5.6	
Rapeseed	Canada	5 kg/ha	38	6	4	2.3	1 tillage, 2 arrowing, seeding, 5 treatments, mechanical harvest
	China		148	27	22	13.1	
	India		63	16	2	0.36	
Sunflower	Russia	5 kg/ha	9	3	0.38	0.63	1 tillage, 2 arrowing, seeding, 5 treatments, mechanical harvest
	Ucraina		29	3	2	0.74	
	Argentina		25	8	0.42	5.6	
Palm oil	Malaysia	Plant density: 9x9x9	116	24	170	5.55	6 treatments for weed control, 2 treatments for pest control, manual harvest with tractor
	Indonesia		76	11	24	0.03	

GHG emissions through LCA

Oil	Leading producer countries	Emissions per unit of product ($t CO_2eq/t$ oil)	Avg	Emissions per unit of cultivated area ($t CO_2eq/ha/year$)	Avg	Area (ha) required to produce 1 tonne of oil	Avg
Soybean	Brazil	1.30		0.86		1.51	
	USA	1.37	**1.35**	0.90	**0.87**	1.51	**1.6**
	Argentina	1.39		0.82		1.70	
Rapeseed	Canada	1.10		0.87		1.27	
	China	3.04	**2.05**	2.15	**1.33**	1.41	**1.5**
	India	2.27		1.12		2.03	
Sunflower	Russia	0.96		0.54		1.76	
	Ukraine	0.94	**0.96**	0.75	**0.65**	1.25	**1.4**
	Argentina	1.07		0.76		1.41	
Palm	Malaysia	0.40	**0.37**	1.71	**1.26**	0.23	**0.3**
	Indonesia	0.35		1.10		0.32	







Vegetable oils and deforestation

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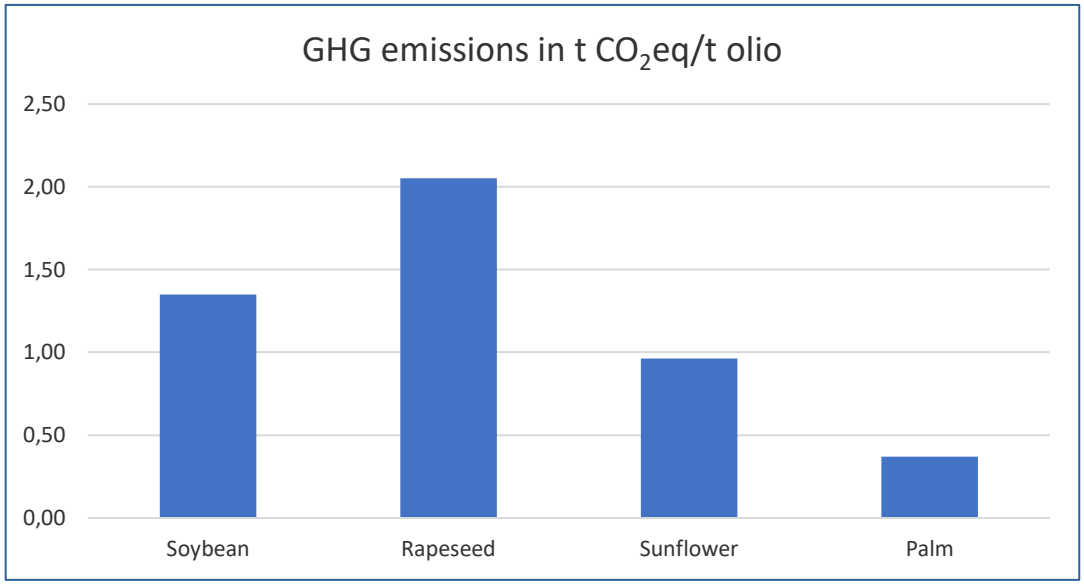
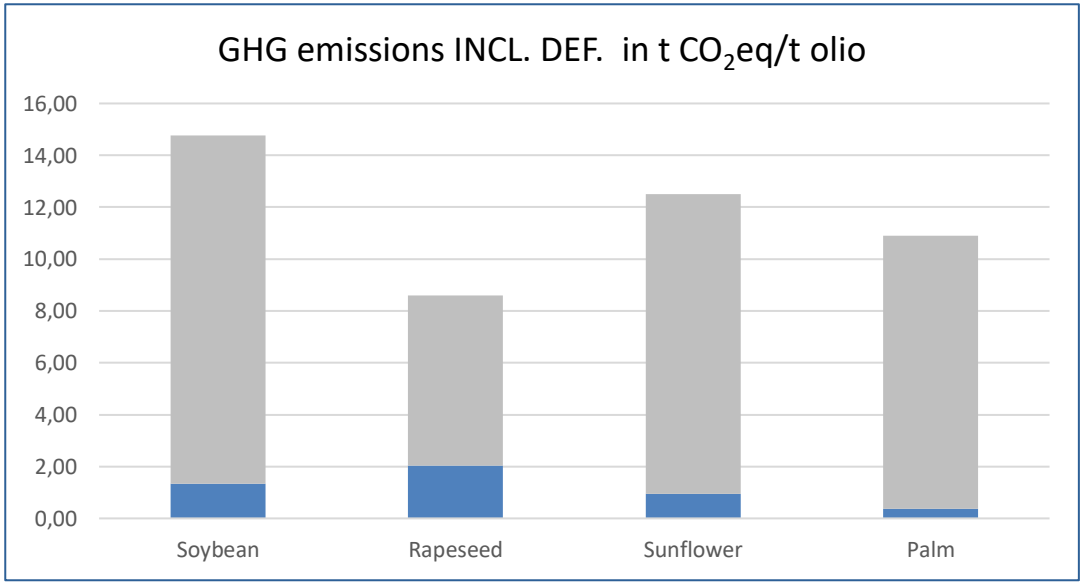
Oil producer countries	Carbon stock in forest living biomass ($Mg\ CO_2/ha$)	Potential annual emissions from deforestation [cycle: 25 years] ($Mg\ CO_2/ha/year$)
Indonesia	382	15.3 (9.4*)
Malaysia	448	17.9 (12.1*)
Ukraine	306	12.24
Argentina	407	16.28
Brazil	383	15.32
Canada	207	8.28
China	141	5.64
India	152	6.08
Russia	181	7.24
USA	208	8.32

(FAO FRA, 2020)

*Carbon sink in oil palm plantations: ~ 35 t C/ha (25 years)

GHG emissions per ton of oil





Thanks

Socio-economic aspects of palm oil and SDGs

Soon in english

https://www.cmcc.it/it/lectures_conferences/145177-2