Calculation of the Melting Ice Floe currency (MIF) for the format “Did you know?” as part of the project “For Us No Planet B!”

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General Information

Many different greenhouse gases contribute to the man-made greenhouse effect to varying degrees. The scientific unit CO_2-eq includes the weighted climate impact of all greenhouse gases produced regardless of whether more CO_2 or other greenhouse gases are produced. All CO_2-eq values were transformed to the Melting Ice Floe currency (MIF) according to Blaurock (2024). The calculations are made based on the assumption that the emission of one ton of CO_2-eq leads to the loss of 2.7 m^2 of Arctic sea ice (Notz & Stroeve, 2016; Notz & SIMP, 2020).

The Meat Dilemma

For The Meat Dilemma, CO_2-eq values of beef, pork, chicken and vegetables were compared. A portion size of 150 g per person was assumed. For the meat options, CO_2-eq values were calculated by averaging the values from Clune et al. (2017) and Climpact (2024). For the vegetables, the CO_2-eq value for field grown vegetables listed in Clune et al. (2017) was used.

Table 1: Calculation of MIF values for the “The Meat Dilemma”.

	$kgCO_2$-eq / kg	Persons * portion	$kgCO_2$-eq / 4 portions	tCO_2-eq / 4 portions	Sea ice loss (m^2)	MIF
beef	27,0	4 * 150 g	16,2	0,016	0,044	44
chicken	6,7	4 * 150 g	4,0	0,004	0,011	11
pork	6,9	4 * 150 g	4,2	0,004	0,011	11
vegetables	0,5	4 * 150 g	0,3	0,000	0,001	1

Table 2: Calculation of MIF values of the specific portions chosen by Family Rodriguez.

	$kgCO_2$-eq / kg	Specific portion	$kgCO_2$-eq / specific portion	tCO_2-eq / specific portion	Sea ice loss (m^2)	MIF
chicken	6,7	300 g	2,0	0,002	0,005	5
vegetables	0,5	900 g	0,4	0,000	0,001	1
sum (300 g chicken + 900 g vegetables)					0,006	7

The Transportation Dilemma

For The Transportation Dilemma, CO_2-eq values for the transportation of 1100 km were calculated if travelling via car, airplane and long-distance bus. All CO_2-eq values were calculated using the online tool “CO2-Rechner” by Quarks. An average fuel consumption of 6.5 L/km for the car was assumed.

Also, the PRO mode was used, which includes the CO_2 emissions caused by the production assuming that the service life of the car is 220.000 km.

The CO_2-eq values for the transportation by airplane and long-distance bus refer to one person and therefore are multiplied by four, when the entire Family Rodriguez is travelling. This is due to the assumption of a certain load factor for long-distance buses and planes as the capacity utilization is unknown. However, we know the exact emissions caused by transport by car and they do not change whether only one person or the whole Family Rodriguez is using the same car. Therefore, the CO2-eq value is not multiplied by four (Table 3).

Table 3: Calculation of MIF values for the "The Transportation Dilemma".

	kgCO_2-eq (1 person)	**persons**	**kgCO_2-eq (4 persons)**	**tCO_2-eq (4 persons)**	**Sea ice loss (m^2)**	**MIF**
car	245,5	4	245,5	0,246	0,663	663
airplane	263,3	4	1053,2	1,053	2,844	2844
long-distance bus	35,0	4	140,0	0,14	0,378	378

The Bag Dilemma

For The Bag Dilemma, four different types of bags were compared using CO_2-eq values by Bisinella et al. (2018):

- A thin plastic bag: Low-density polyethylene (LDPE)
- A thick plastic bag: Recycled polyethylene terephthalate (PETrec)
- A non-bleached paper bag (PAP)
- A non-organic cotton bag (COT)

All CO_2-eq values by Bisinella et al. (2018) are referring to a reference flow and therefore are based on the assumption that the different bags are equally strong (same volume and weight can be carried). It is also assumed the bags are not recycled and that they are incinerated after a single use (end-of-life scenario EOL1). The CO_2-eq values include production, distribution, packaging and incineration for the bags. They do not include effects on the ozone hole, freshwater quality, toxicity and other environmental effects.

Table 4: Calculation of MIF values for the "The Transportation Dilemma", assuming that four bags are needed.

	kgCO_2-eq (1 bag)	**Number of bags**	**kgCO_2-eq (4 bags)**	**tCO_2-eq (4 bags)**	**Sea ice loss (m^2)**	**MIF**
thin plastic bag (LDPE)	0,170	4	0,7	0,0007	0,0018	2
thick plastic bag recycled (PETrec)	0,770	4	3,1	0,0031	0,0083	8
paper bag (PAP)	0,060	4	0,2	0,0002	0,0006	1
cotton bag (COT)	3,900	4	15,6	0,0156	0,0421	42

The Milk Dilemma

For The Milk Dilemma, four different types of milk or "drinks" were compared using CO_2-eq values by Geburt et al. (2022):

- Cow milk conventional (origin: Switzerland)
- Oat drink (origin: Switzerland)
- Soy drink: The mean value of the value of "Soy Drink BR/USA" and "Soy Drink CH" was used
- Almond drink (origin: USA)

	kgCO_2-eq/L	tCO_2-eq/L	Sea ice loss (m^2)	MIF
Cow milk conventional	1,41	0,0014	0,0038	4
Oat drink	0,46	0,0005	0,0012	1
Soy drink	0,43	0,0004	0,0012	1
Almond drink	0,61	0,0006	0,0016	2

The Chocolate Dilemma

For The Chocolate Dilemma, three different types of chocolate were compared using CO_2-eq values by Wang & Dong (2025): dark chocolate, white chocolate and milk chocolate.

	kgCO_2-eq/kg	tCO_2-eq/100g Tafel	Sea ice loss (m^2)	MIF
Dark chocolate	3,11	0,0003	0,0008	1
White chocolate	5,39	0,0005	0,0015	2
Milk chocolate	5,94	0,0006	0,0016	2

The reason for the higher CO_2-eq values of dark chocolate is the higher content of cocoa derivates (cocoa powder, cocoa liquid) in comparison to white and milk chocolate, which contain more milk powder. The emission factor of milk poser is 7.4 CO_2-eq/kg whereas the emission factor s of cocoa derivates range from 1.0 – 4.3 kg CO_2-eq. The production of the raw products contributes most to the global warming potential of chocolate (79 %), followed by manufacturing (16 %).

The Bottle Dilemma

For The Bottle Dilemma, three different types of drink containers were compared including three "end of life" (EoL) scenarios using CO_2-eq values by Simon et al. (2016):

- Aluminium can: 500 ml standard cylindrical aluminium can, equipped with stay-tab easy opening, ca. 170 mm height
- PET bottle: generic PET bottle of a popular soft drink company. Bottle hieght is ca. 215 mm. Polyethylene cap and paper label
- Glass bottle: generic beer bottle with aluminium crown cork, ca. 260 mm height

The original CO_2-eq values refer to a functional unit of 1000L packed beverage but are here shown for 500 ml drink containers. They include the production, delivery, collection and waste treatment of the drink containers (not the drinks!). The EoL scenarios included landfill, recycling and incineration. The recycling option credited the production of secondary materials.

	kgCO2-eq / bottle	tCO2-eq / bottle	Sea ice loss (m^2)	MIF
aluminium can (landfill)	0,5	0,0005	0,0013	1
aluminium can (recycling)	0,1	0,0001	0,0002	0,2
aluminium can (incineration)	0,5	0,0005	0,0013	1
glass bottle (landfill)	5,2	0,0052	0,0140	14
glass bottle (recycling)	0,1	0,0001	0,0002	0,2
glass bottle (incineration)	5,2	0,0052	0,0139	14
PET bottle (landfill)	0,5	0,0005	0,0014	1
PET bottle (recycling)	0,1	0,0001	0,0004	0,4
PET bottle (incineration)	0,5	0,0005	0,0014	1

The production of the material contributed the highest to emissions followed by the distribution system. Recycling of materials was found to be beneficial in all cases and significant amount of emissions could be credited particularly in the case of Al-cans and glass, which have energy intensive (thermal) production processes. It creates an opportunity to making more creditable emissions savings through using the secondary material.

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