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	<b>Organic</b>	<b>Conventional</b>
GWP kg CO <sub>2</sub> e/kg LW	<b>2.6</b>	<b>2.7</b>
Land use m <sup>2</sup> a/kg LW	<b>11.4</b>	<b>6.2</b>
Direct	4.5	0
Indirect "cereal"	6.8	4.3
Indirect "soy"	0.1	1.9



Well accepted relation between land use **change** and GHG to be accounted for:

PAS 2050 recommend the following numbers for assessment in different countries, Kg CO<sub>2</sub> e per m<sup>2</sup>/y

	Grassland to cropland	Forest to cropland
France/Ger/Poland	0.6	2.0
Brazil	1.0	3.7

Nguyen et al (2010) used a worldwide average of 2.2 to 2.8

Reference: **Nguyen TLT**, Hermansen, J., Mogensen, L. Environmental consequences of different beef production systems in the EU. Journal of Cleaner Production 2010; 18 (8) 756–766.

Assumptions: Basic data Searchinger et al. (2008). When forest is converted to cropland, all carbon in vegetation and ongoing carbon sequestration that would take place each year if forest is not cleared, plus **25%** of soil carbon are lost.

# The question of land use and land use change (LUC) illustrated by organic vs conventional pork

Effect of LUC	Organic	Conventional
GWP kg CO <sub>2</sub> e/kg LW, basis	2.6	2.7
<b>With LUC PAS 2050</b>		
LUC Soy (Brazil)	0.4	7.0
(adjusted total)	(3.0)	(9.7)
LUC cereal (Europe)	13.6	8.6
(adjusted total)	(16.6)	(18.3)
LU – opportunity cost	9	-
(adjusted total)	(25.6)	(18.3)
<b>Nguyen et al. (2010)</b>	35	20

# Conclusion

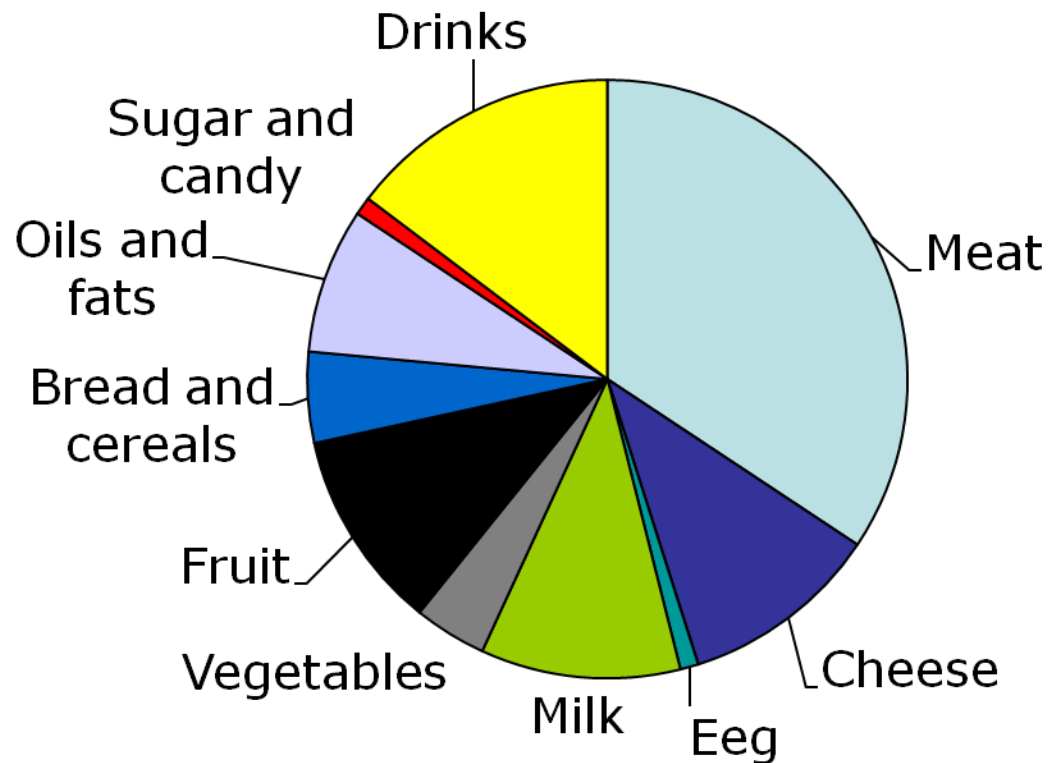
- A wide range of organically produced foods have been compared with foods produced conventionally, and often only small differences is seen in GWP per kg food produced
- The variation within organic production often overshadow differences to conventional production
- It is important to acknowledge and include carbon sequestration related to the (particular) land use pattern in organic farming. While models exist regarding individual fields, models taking into account any effect of soil erosion through a different spatial arrangement of the fields are lacking.
- The GWP of organic food depends very much on how imported manure is considered – it is rarely justified just to consider it as a waste
- The most urgent matter to consider is how the (most often) increased demand for land per unit of food produced in organic production is taken into account ( and how it relates to other environmental/cultural impacts of interest) (maybe rephrased to: How to increase total biomass yield and account for it)

# Globale warming potential is measured in CO<sub>2</sub>-eq.

- 1 kg carbon dioxide (CO<sub>2</sub>) = 1 kg CO<sub>2</sub>-eq.
  - From energy consumption
  - Storage of carbon in soil
- 1 kg Metane (CH<sub>4</sub>) = 23 kg CO<sub>2</sub>-eq.
  - Ruminants digestion
  - Manure stores
- 1 kg Laughing gas (N<sub>2</sub>O) = 296 kg CO<sub>2</sub>-eq.
  - From the nitrogen cycle – from soil and manure stores

(100-year, IPCC)

# Carbon food print of a typical Danish diet, % of different sources of CO<sub>2</sub>-ækv.



# Global warming potential of livestock products, in CO<sub>2</sub>-e expressed per kg of product (after de Vries & de Boer, 2010)

