GHG Savings from Biological Treatment and Application of Compost

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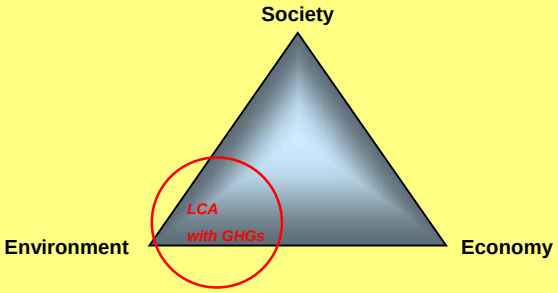
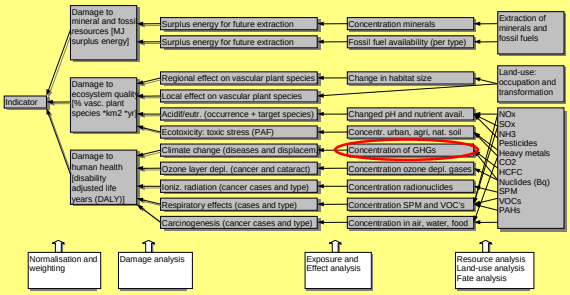
The sustainability triangle



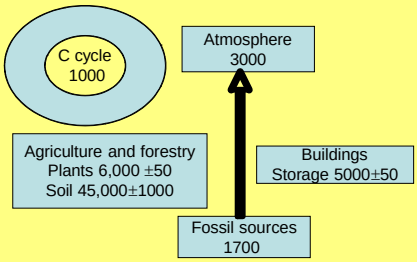
Aim: acting sustainably

LCA: GHGs are only one aspect

Example: ecoindicator



C flux (kg/a) per capita in CH



Estimation of C fluxes in Switzerland for the year 2005 (after Müller & Bacchini EAWAG).

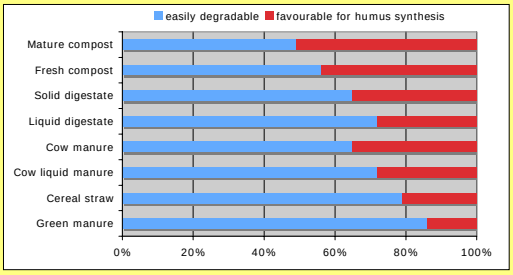
Converting C to CO_2

- 1 kg C ➔ 3.67 kg CO_2
- 1700 kg fossil C per capita and year ➔ 6239 kg CO_2 emitted
- These fossil C sources are the problem, as they enrich the atmosphere
- Aim: substitute fossil resources

Savings from the production of renewable energy from AD

Parameter	Value	Unit
Biogas yield	100	$m^3/ton_{sep.\ coll.\ waste}$
Calorific value of biogas (60% CH_4)	600	kWh/t_{waste}
Electricity generated (30% efficiency)	180	kWh/t_{waste}
Net electricity produced (70% of tot. generated)	120	kWh/t_{waste}
Avoided emissions from electricity production	54	kg_{CO2}/t_{waste}
Heat recovered for the CHP option (80%)	336	kWh/t_{waste}
Net heat exported for the CHP option (80%)	286	kWh/t_{waste}
Avoided emissions from CHP heat export	81	kg_{CO2}/t_{waste}

Soil improvement: crediting C in compost and digestate



Proportions of easily degradable and more persistent organic matter (i.e. more favourable for the synthesis of humus), in various organic fertilisers,
Source: J. Reinhold, VHE BBS e.V.

Substituting peat: a most promising GHG saving

- Crediting organic matter in compost and solid digestate as a substitute of peat
- Peat is not used in agriculture but only in horticulture => only 1/3 of compost utilized may be credited as peat substitution
- With transport (depending on location): 200 - 300 kg CO_2 savings

Savings due to nutrient replacement

Nutrient element	Nutrient content [kg / $ton_{biowaste}$]	Amount accounted for as fertilizer [%]	Emissions from mineral fertilizers [$kg_{CO2\ eq.}$ / $kg_{element}$]	Avoided CO_2 emissions [$kg_{CO2\ eq.}$ / $ton_{biowaste}$]
N	4.0	10	5.30	2.12
P	1.5	100	0.52	0.78
K	3.0	100	0.38	1.14

GHG savings due to substitution of mineral fertilizers, per ton of biowaste treated

Source: *AEA Technology, 2001 Waste Management Options and Climate Change, Report to the European Commission*

Total possible GHG savings from biowaste treatment

GHG saving by	kg CO_2 eq.
Anaerobic digestion with CHP option	135
C-sink in the soil by added humus	80
Peat substitution and avoided transport	200 - 300[1]
Replaced mineral fertiliser	10
Total	**400 - 500**

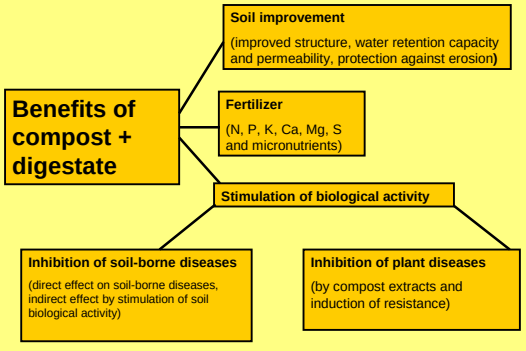
[1] 94 to 188 (substitution) + 120 to 180 (transport)

Maximal CO_2 saving: about 1% of the fossil emissions

Further beneficial properties of compost

- Physical: *soil structure, protection agains erosion, water retention*
- Chemical: *fertilization, soil buffer, multiple fertilization*
- Biological: *microbial inoculum, nourishment for soil organisms, influence on the soil flora, plant roots, seeds, etc...*
- www.codis2008.ch

Positive properties of compost and digestate



Conclusions 1

- To properly assess sustainability, the three main areas of focus, **economy, environment and society** must be considered
- GHGs are **only one aspect** of an ecological assessment (LCA)
- Biowaste only makes up about **1%** of the biogenic C cycle
- Fossil C sources are **larger** than the biogenic C flux
- This fundamental problem cannot be solved by biowaste treatment alone
- But: the use renewable energy sources (AD) and substitution of fossil resources (peat) can nevertheless contribute

Conclusions 2

- CO_2 savings by **AD** are a certain gain
- The savings due to **peat substitution** by 1/3 of the compost (going to horticulture) are even larger
- The savings by **nutrient substitution** are rather marginal
- The benefits brought by **physical effects** on the soil (water retention, less erosion.....) are promising
- A **lot of research** is still necessary before we can integrate these aspects correctly in LCAs
- An LCA aims to be a **comprehensive** ecological assessment
- But only if it is **really** comprehensive will we get the right picture!

Thank you for your attention !