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Agroscope

Importance of Greenhouse Gas Emissions of Swiss Agriculture and Associated Mitigation Potentials

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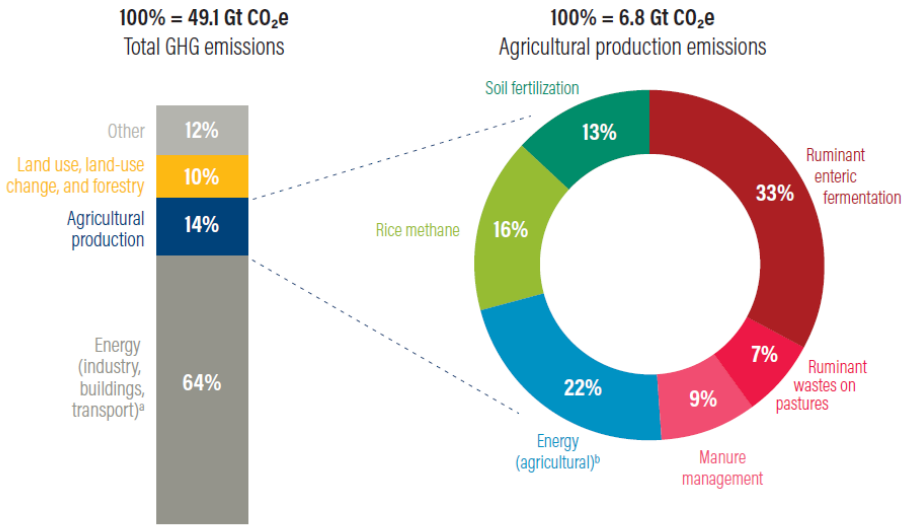
Agroscope
Climate and Agriculture

SVT-Conference 2022
Scientific Facts on Environmental Impacts of Livestock
13th April 2022

Content

Global Agricultural GHG Emissions 2010

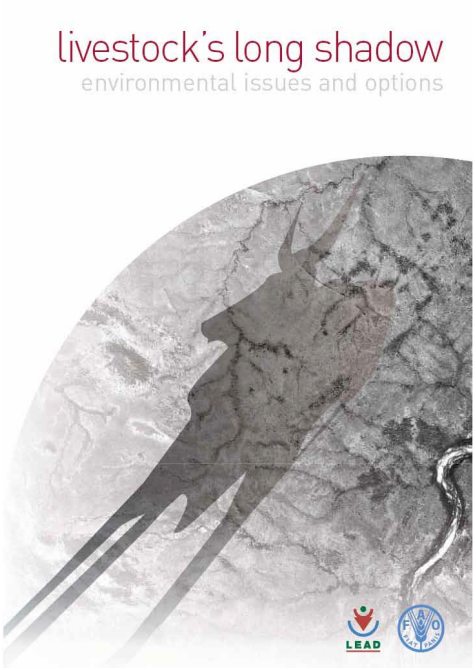
Figure 1-2 | Agriculture accounts for about one-quarter of global GHG emissions (~2010)



Note: Numbers may not sum to 100% due to rounding.
[a] Excludes emissions from agricultural energy sources described above.
[b] Includes emissions from on-farm energy consumption as well as from manufacturing of farm tractors, irrigation pumps, other machinery, and key inputs such as fertilizer. It excludes emissions from the transport of food.
Sources: GlobAgri-WRR model (agricultural production emissions); WRI analysis based on UNEP (2012); FAO (2012a); EIA (2012); IEA (2012); and Houghton (2008) with adjustments.

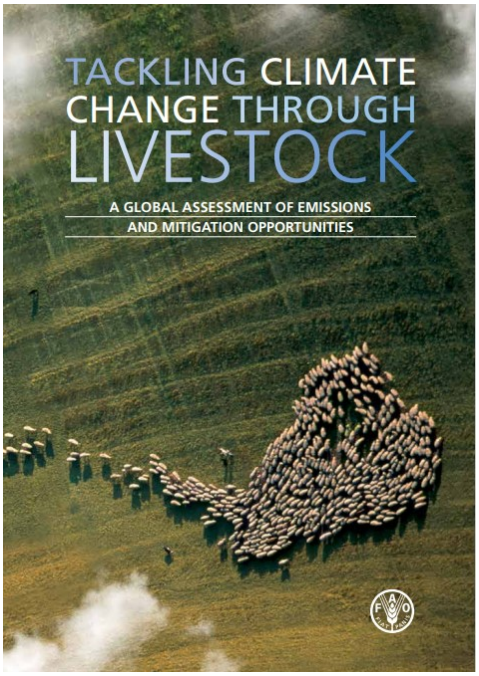
Source: Searchinger et al. 2019

Global Contribution of Livestock



Livestock 18%

Source: FAO 2006



Livestock 14.5%

Source: Gerber et al. 2013

Agricultural GHG Emissions

Scope and System Boundaries in Switzerland

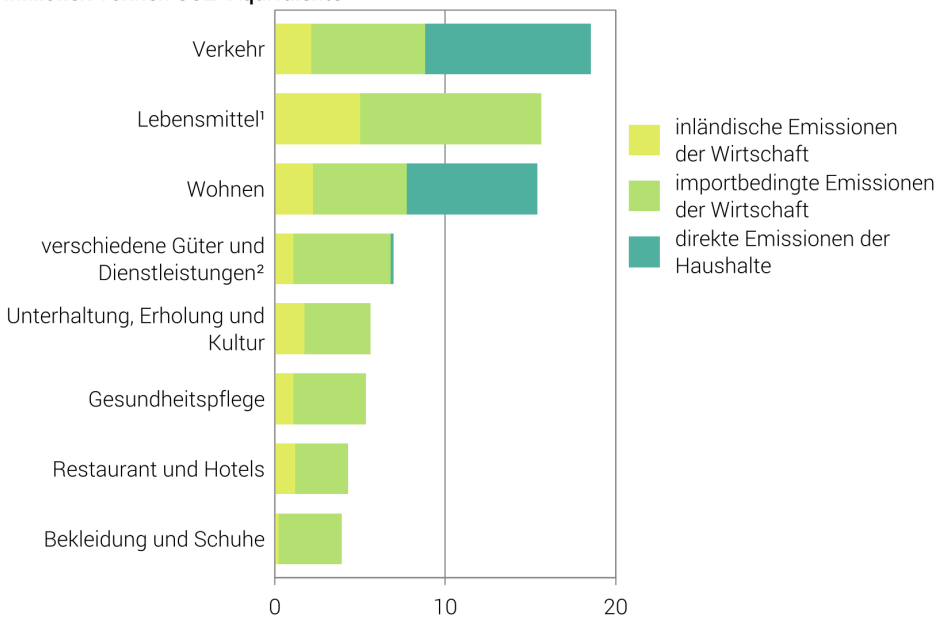
12.7%
Source: FOEN 2021

15%
Source: BFS 2009

Consumption Perspective

Treibhausgas–Fussabdruck der Haushalte nach Ausgabeposten, 2018

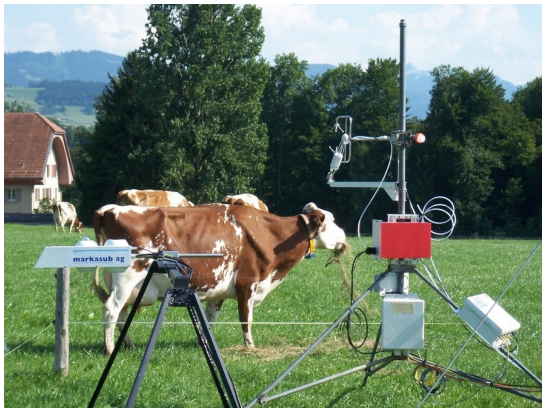
Millionen Tonnen CO2–Äquivalente



¹ Nahrungsmittel, alkoholfreie und alkoholische Getränke, Tabakwaren
² Möbel, Haushaltsgeräte, Nachrichtenübermittlung, Unterrichtswesen u. a.

Quelle: BFS – Umweltgesamtrechnung

Content



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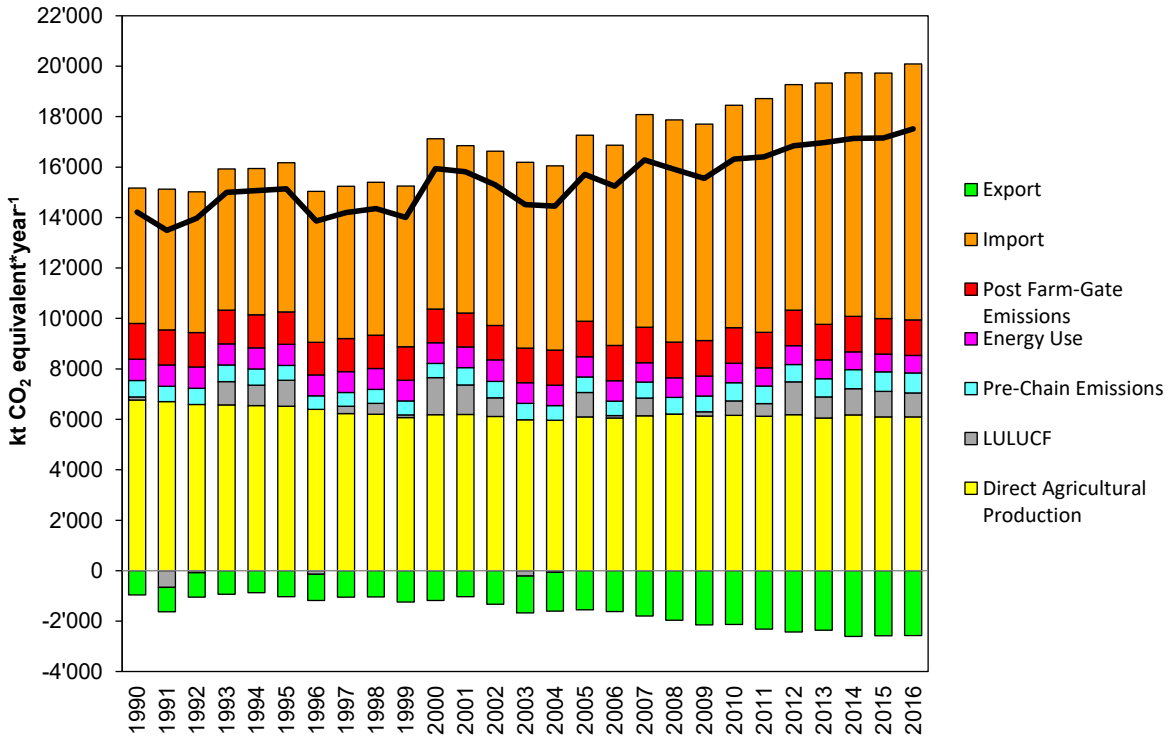
GHG Emissions in the Swiss Agriculture- and Food Sector 1990-2016



Source: Based on Bretscher et al. 2014

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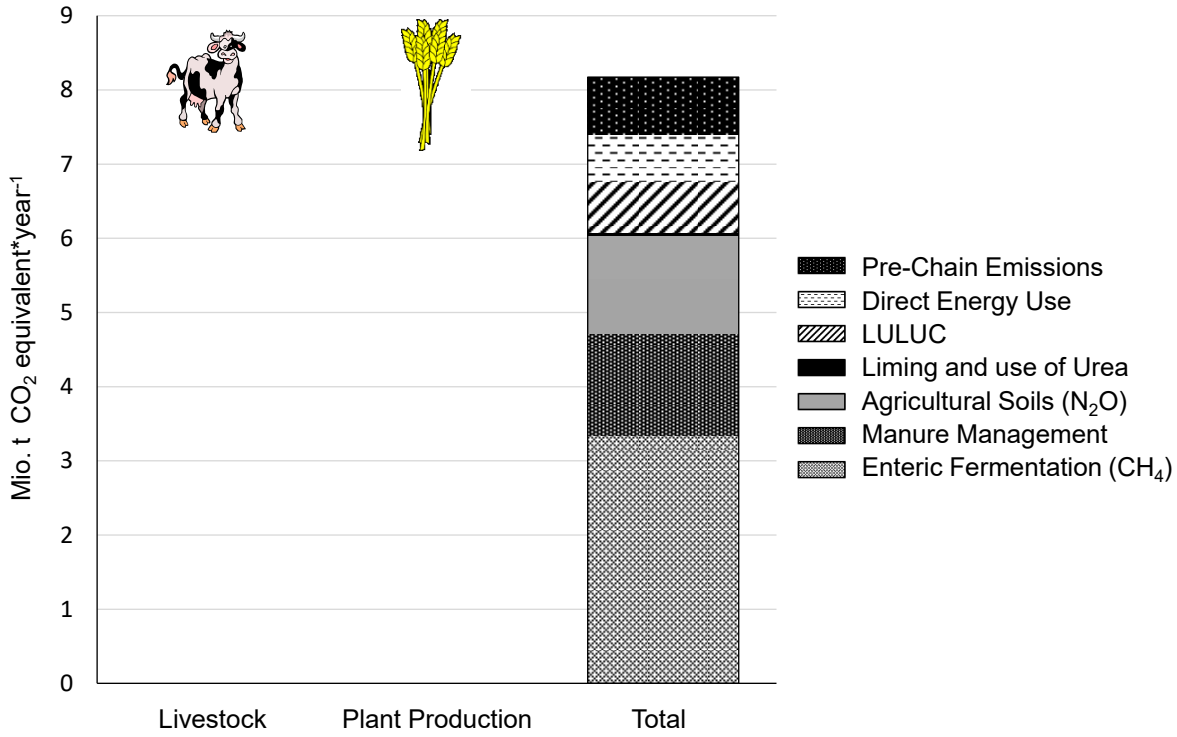
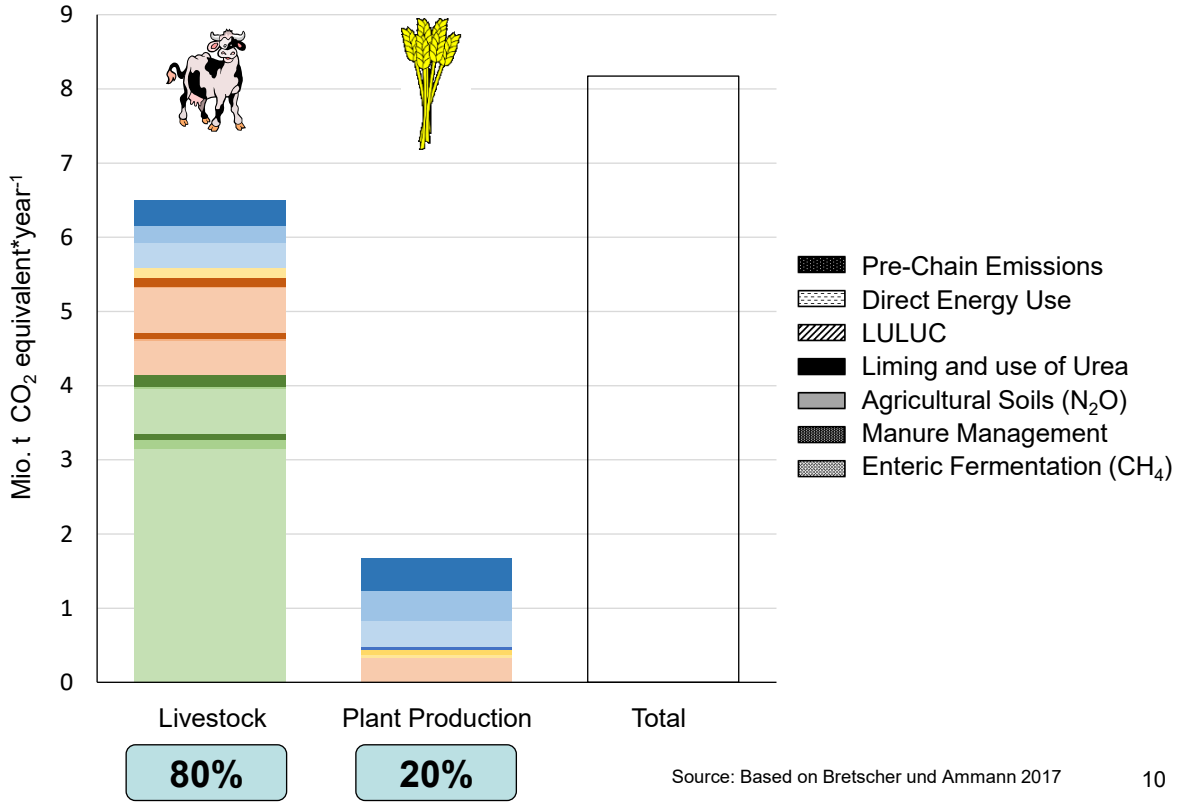
Allocation of Emissions:
Livestock and Crop Production



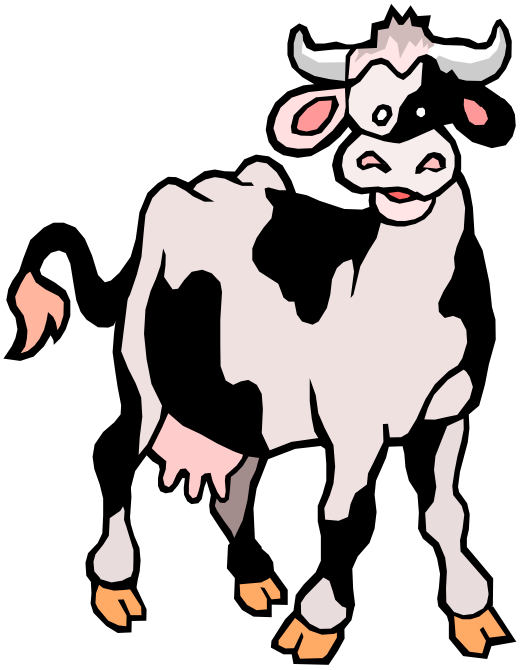
Source: Based on Bretscher und Ammann 2017

Allocation of Emissions:
Livestock and Crop Production



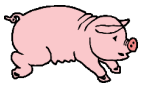
Source: Based on Bretscher und Ammann 2017

Allocation Livestock Categories CH_4



Cattle 90.1%

Dairy Cattle 57.7%



Swine
4.8%

Sheep
2.9%

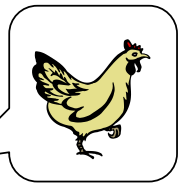
Horses
0.9%

Poultry
0.2%

Goats
0.7%

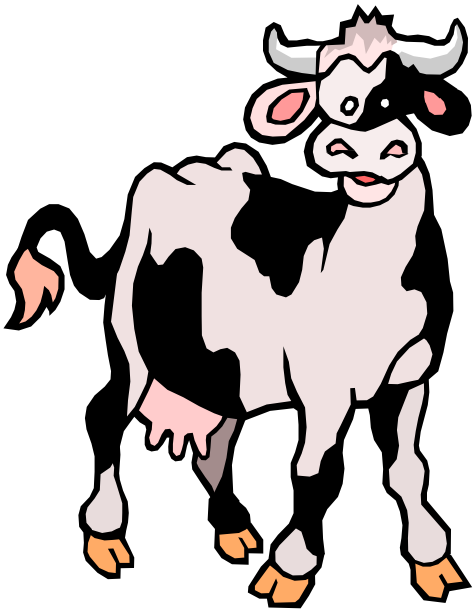
Mules and
Asses
0.2%

Rest
0.2%



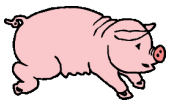
Source: FOEN 2020

Allocation Livestock Categories N_2O



Cattle 77.4%

Dairy Cattle 48.0%



Swine
10.6%

Sheep
3.0%

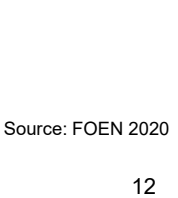
Horses
2.4%

Poultry
5.0%

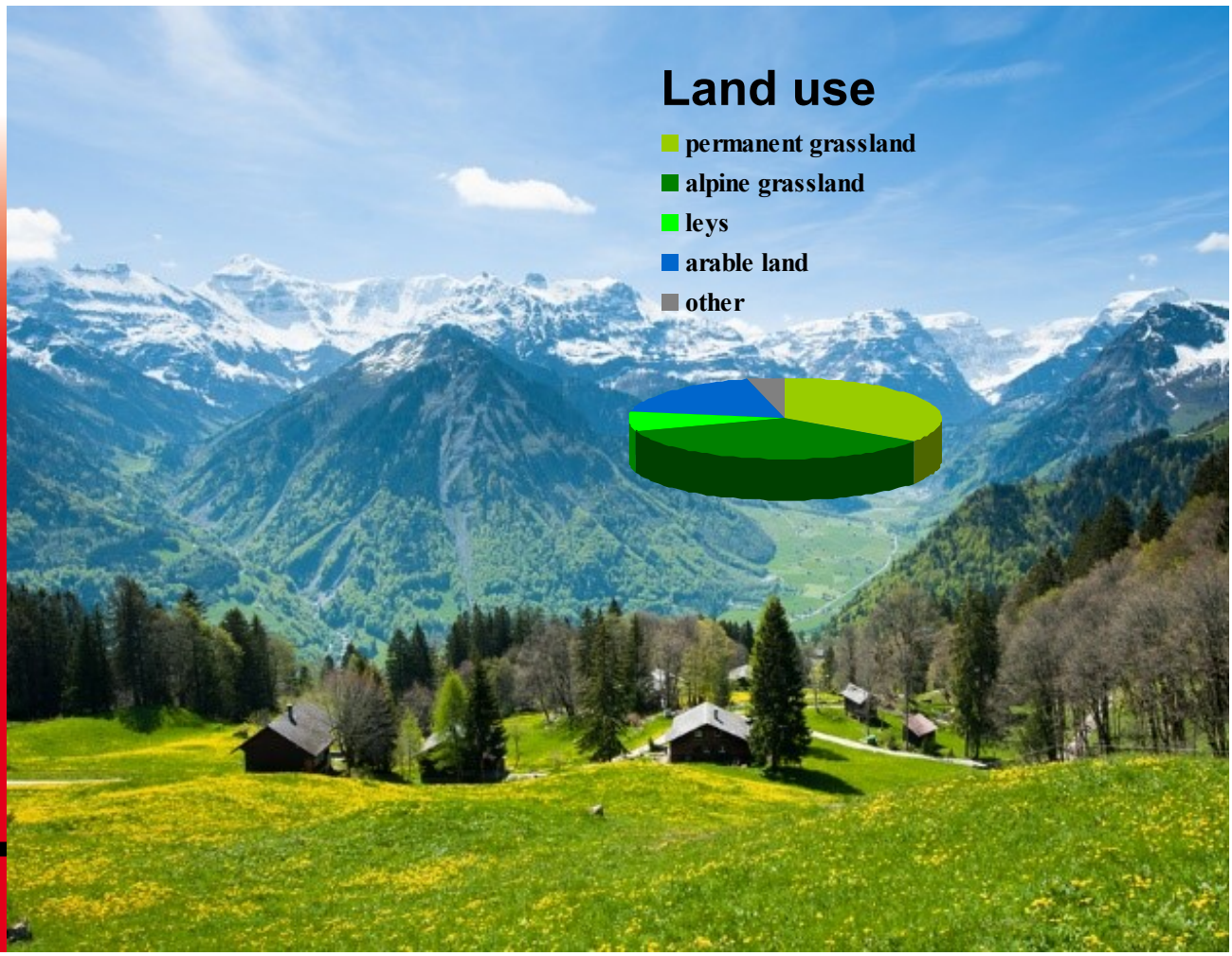
Goats
0.9%

Mules and
Asses
0.4%

Rest
0.2%



Source: FOEN 2020



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Global Warming Potential over 100 Years

1 CO_2 eq. — CO_2

25 CO_2 eq. — CH_4

298 CO_2 eq. — N_2O

Source: IPCC 2007: AR4

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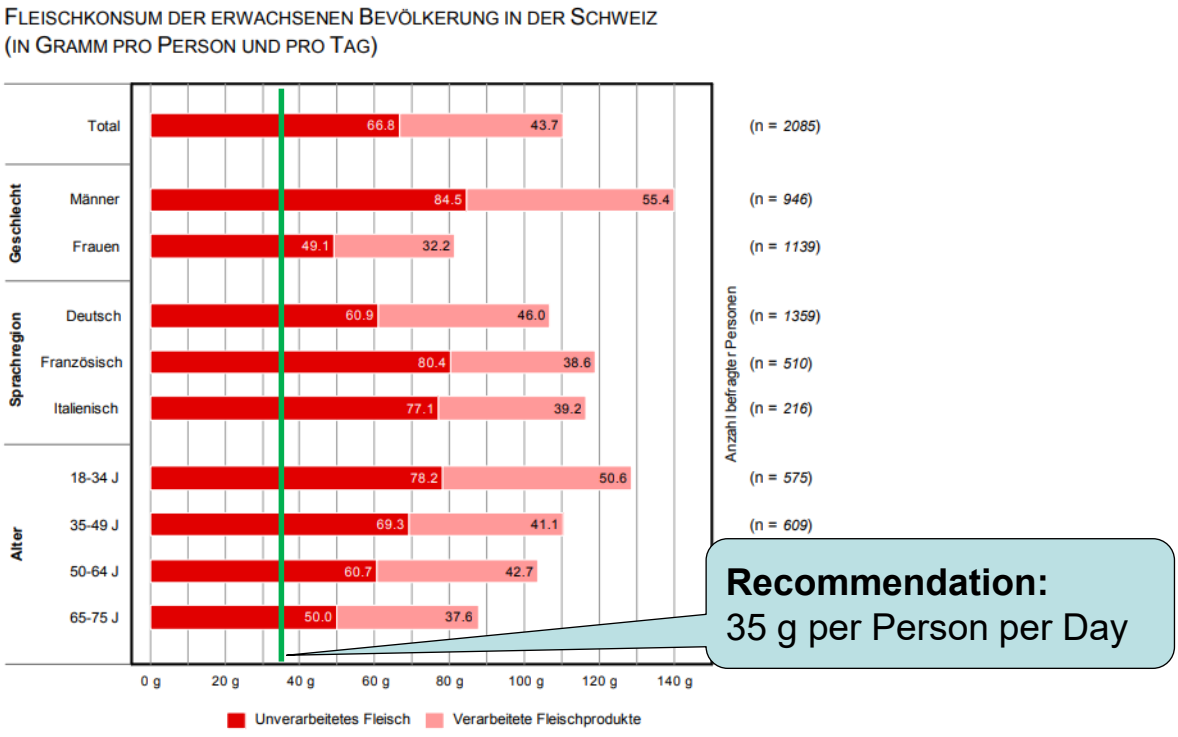
Consideration when discussing GHG mitigation

Arguments on GWP-metrics do often not contribute to a solution oriented discussion.

Which emission reduction pathway should be followed is a socio-political decision. This decision can be informed by:

- «**Necessity**» **of the GHG emission**
- Feasibility of the GHG emission reduction / sinks
- (Financial) Cost of the GHG emission reduction / sinks
- Additional detrimental effects of GHG
- Marginal contribution to warming

Meat Consumption in Switzerland



Source: BLV 2017

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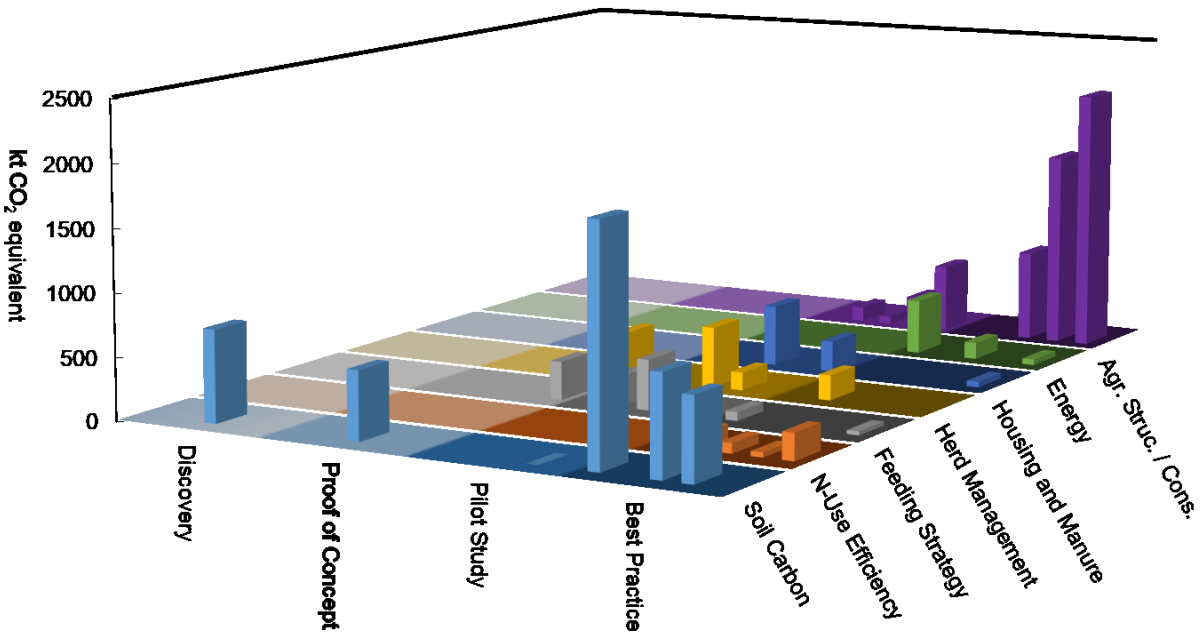
Reduction Potentials in Agriculture



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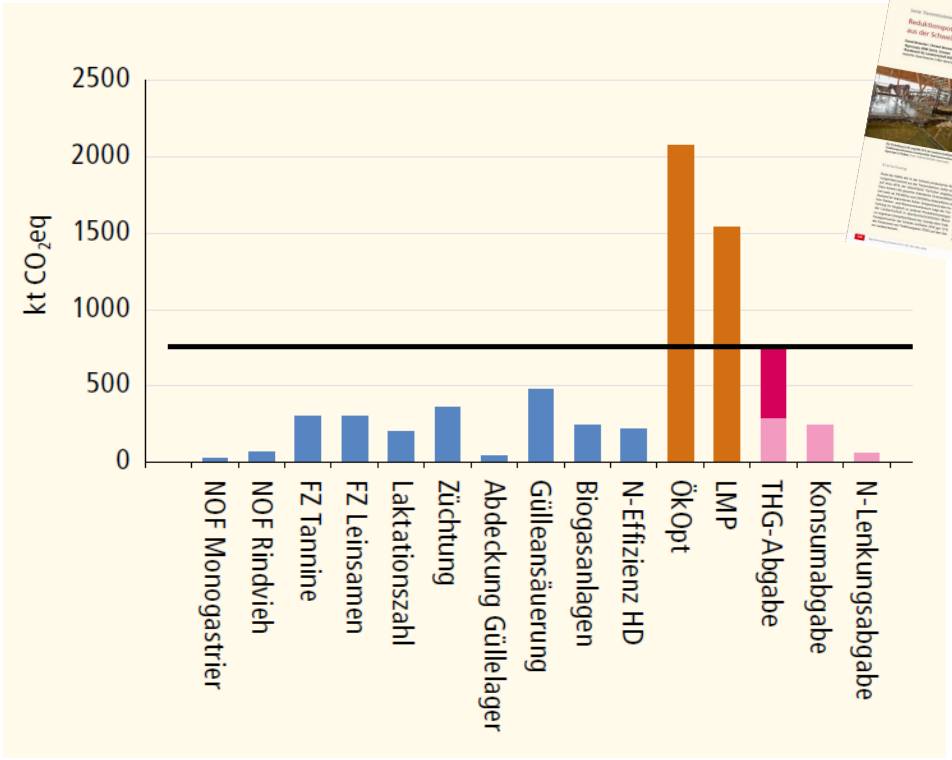
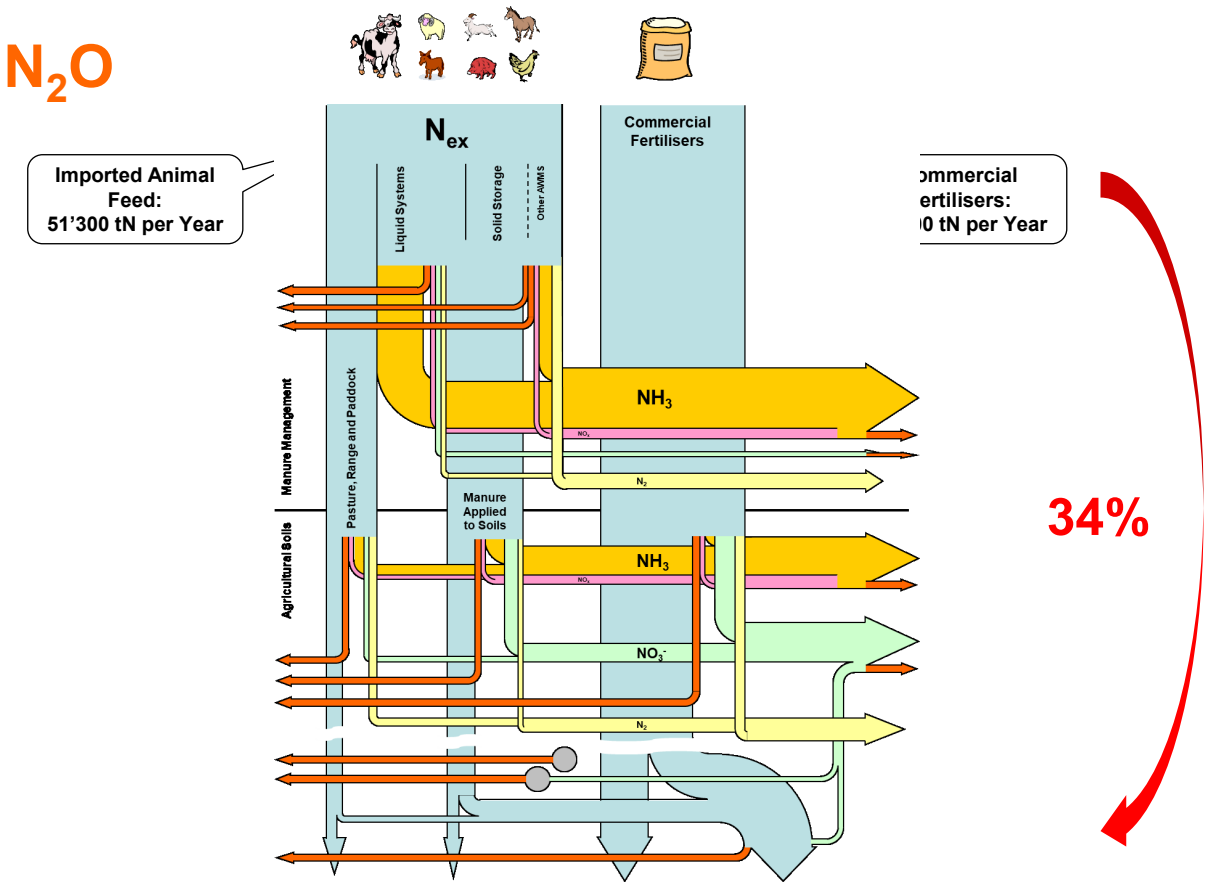
Reduction Potentials in Agriculture



Source: Bretscher et al. 2018



Source: Spiess und Liebisch 2020

Methane Emissions from Enteric Fermentation

Livestock Emissions and Soil-Carbon-Sink

Emissions per Cow (mainly N_2O, CH_4; Enteric Fermentation, Manure Management, Feed Production):	5-6 t CO_2 eq.
Livestock Density (LU per ha):	1.3 LU per ha
	7.2 t CO_2 per ha
Necessary Soil-Carbon-Sink:	**2.00 t C ha^{-1} yr^{-1}**

Estimated Potential CH:

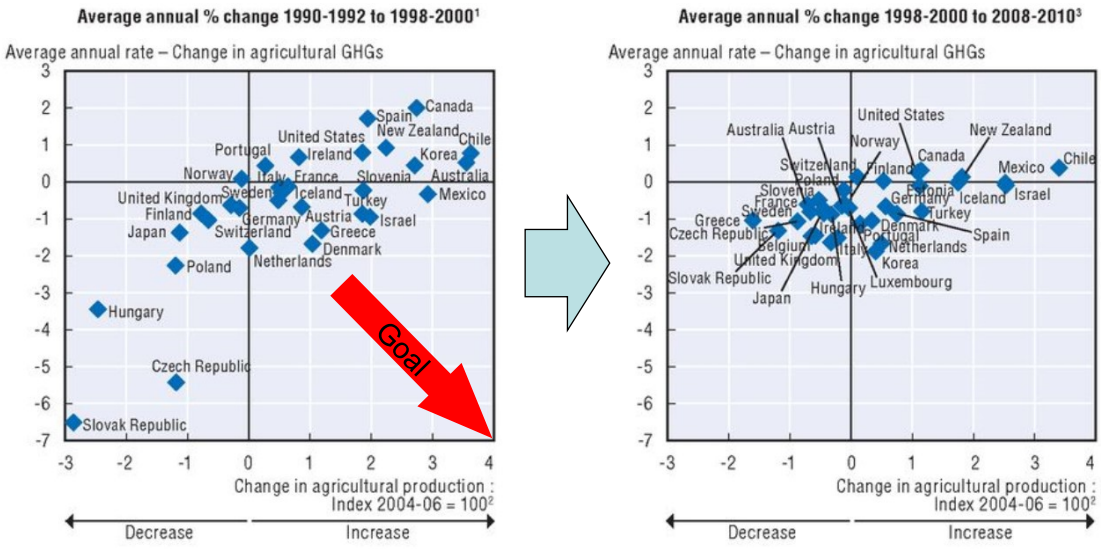
Cropland	**0.63 t C ha^{-1} yr^{-1}**
Grassland	**0.28 t C ha^{-1} yr^{-1}**

Source: Beuttler et al. 2019

Agricultural Production and Greenhouse Gas Emissions in OECD-Countries

Development 1990-2010

Figure 11.2. **Agricultural greenhouse gas emissions and agricultural production volume, OECD countries, 1990-2010**



Source: OECD 2013

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Sources and Processes	Agriculture Livestock GWP
Mitigation Measures	Technical, Production-Side Options **Demand-Side Options**
Outlook, Conclusions	

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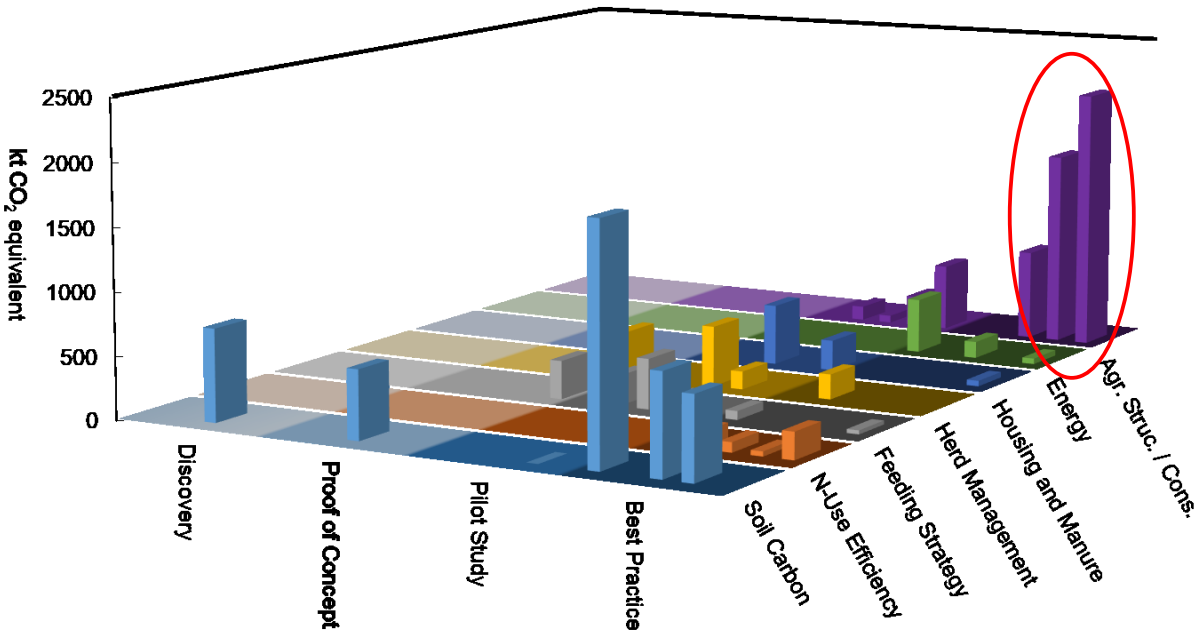
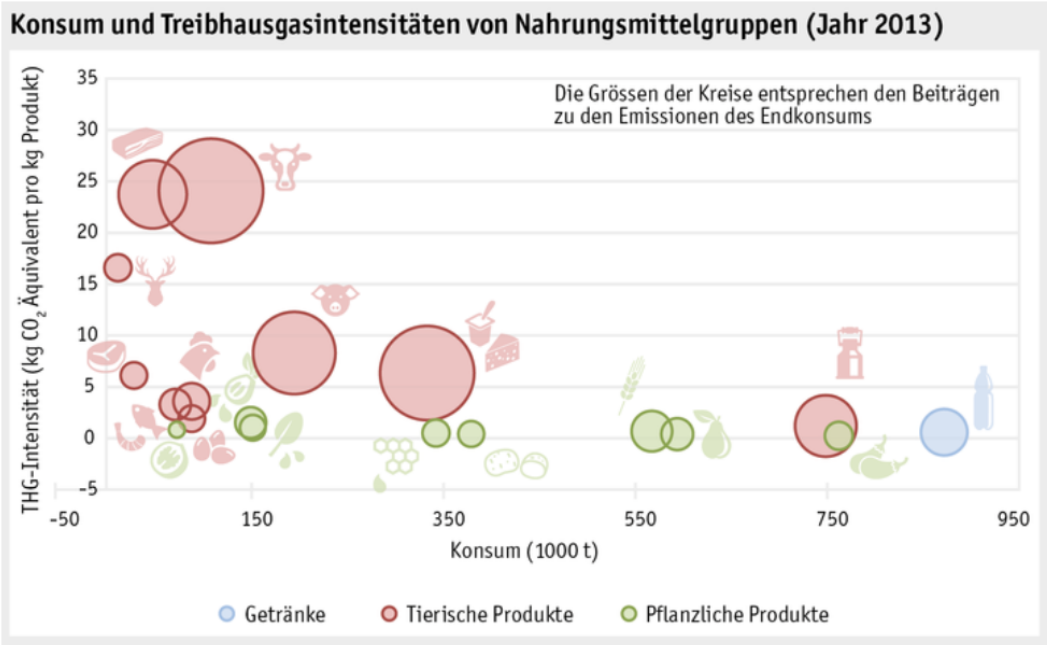
Reduction Potentials in Agriculture



Demand Side Measures

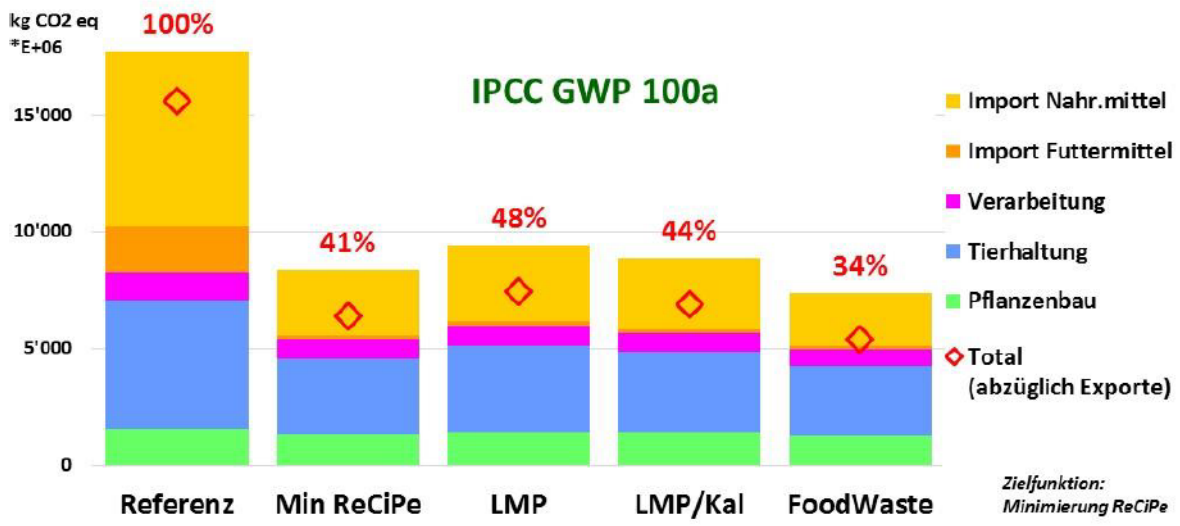


Quelle: Agroscope

80% **20%**

Source: Bretscher et al. 2015

Environmental Optimization of the Swiss Population's Diet



Source: Zimmermann et al. 2017

Environmental Optimization of the Swiss Population's Diet

	2016	LMP	ÖkOpt
Growing Cattle	858'828	432'481	614'600
Dairy Cows	575'766	470'709	439'000
Suckler Cows	120'802	12'183	0
Total Cattle	**1'555'396**	**915'373**	**1'053'600**
		59%	**68%**
Swine	1'453'602	1'572'246	0
Poultry	12'084'736	6'804'140	0

Source: based on Zimmermann et al. 2017; Sutter et al. 2013

Environmental Optimization of the Swiss Population's Diet

	2016	LMP	ÖkOpt
Growing Cattle	858'828	43[illegible]81	614'600
Dairy Cows	575'766	[illegible]09	439'000
Suckler Cows	120'80[illegible]		0
Total Cattle	1'555'39[illegible]		[illegible]0
			[illegible]%
	[illegible]53'60[illegible]		0
	[illegible]34'736	6'804'140	0

Silage Corn: -90%

Feed-Food Competition

Use of Cropland

Food for Humans
- 175.000 ha → ***45%***

Livestock Feed
- 208.000 ha → ***55%***

Source: BLW 2021

Source: based on Zimmermann et al. 2017; Sutter et al. 2013

Environmental Optimization of the Swiss Population's Diet Food-Sovereignty

«Imports of foodstuffs are declining (in calories: -28 %), feedstuffs are only imported to a small extent (-85 %). Correspondingly, the share of domestically produced products and thus the degree of **self-sufficiency** in food energy increases significantly from 61 % to almost 80 %. The total environmental impact of imported foodstuffs falls by around 70 %, and that of food produced in Switzerland - despite the even higher calorie production - by 20 % (ReCiPe indicator).»

Source: Zimmermann et al. 2017

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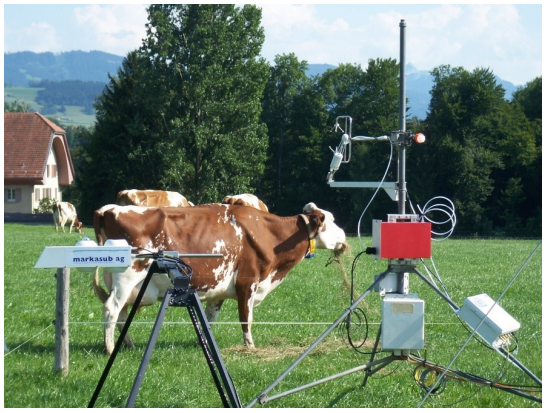

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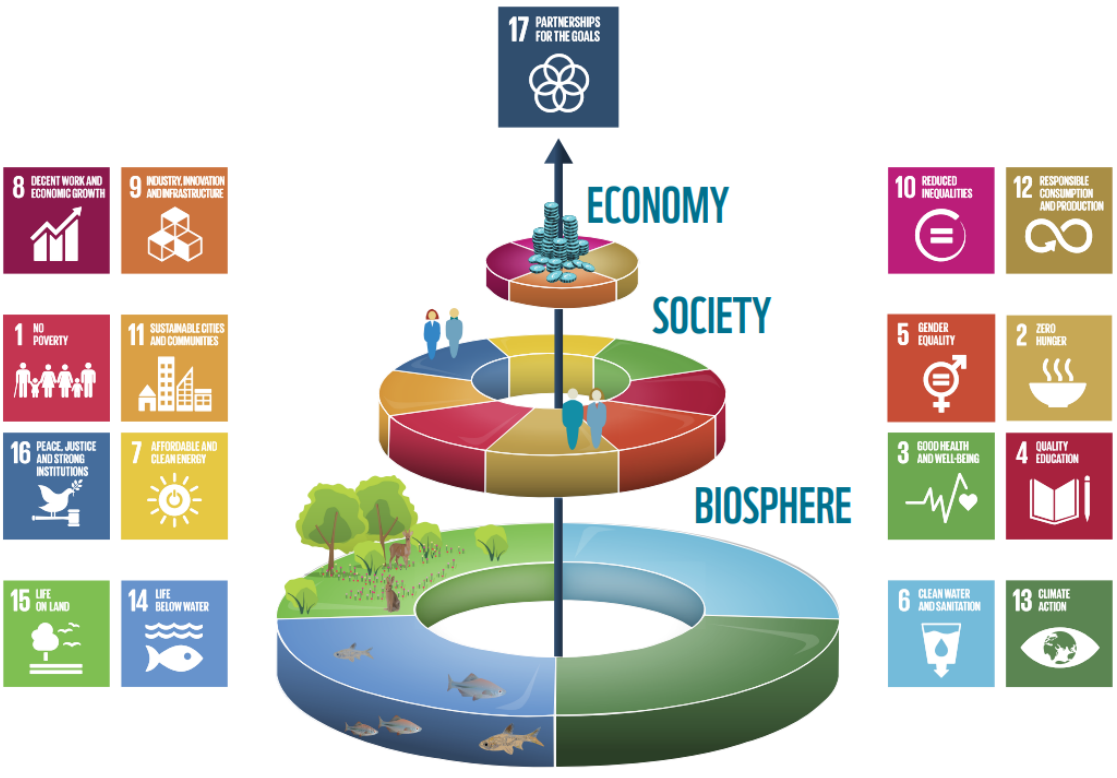
Millennium Development Goals (MDGs)



Source: Bruil et al. 2021 / Azote Images for Stockholm Resilience Centre, Stockholm University

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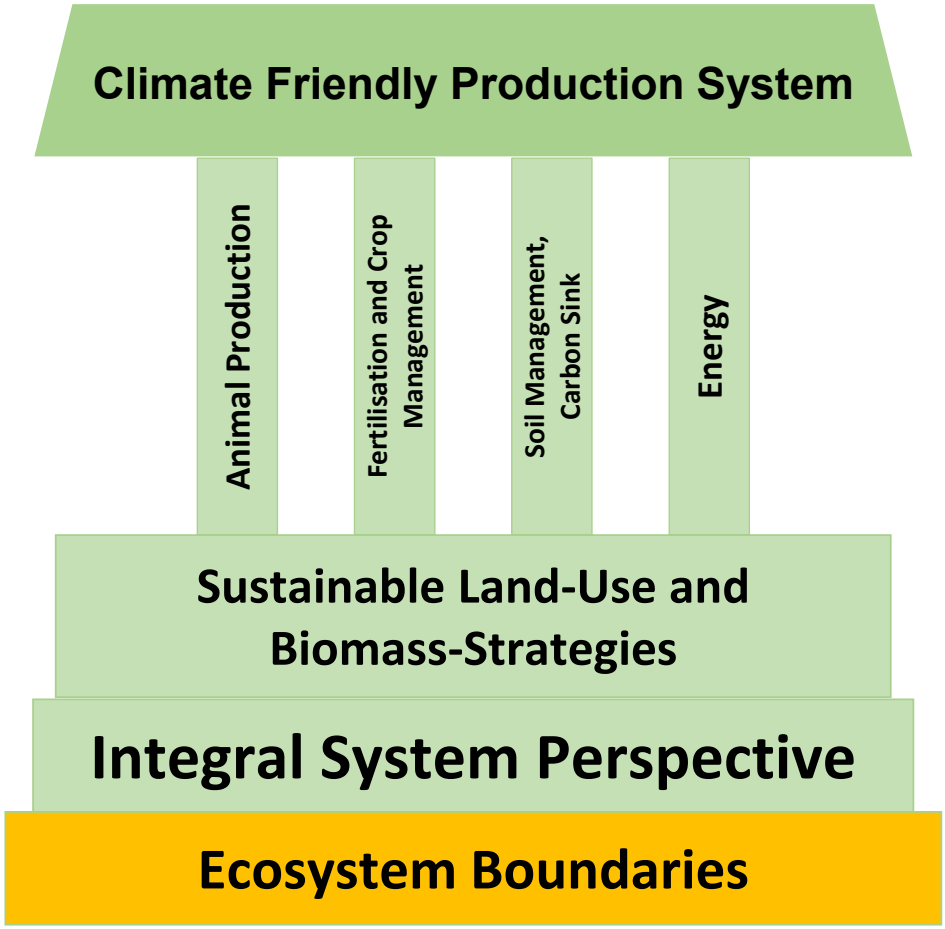
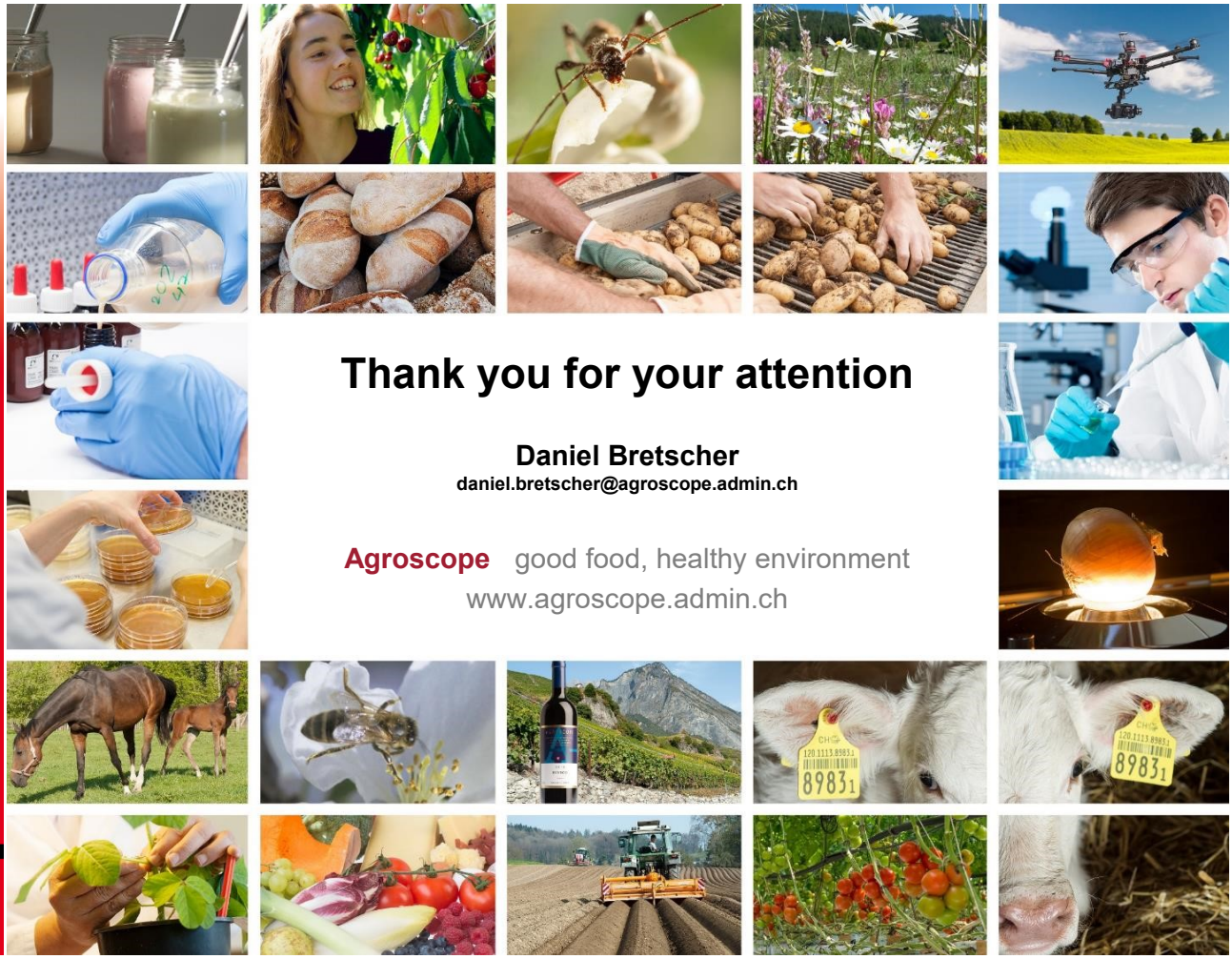


Conclusions

- GHG emissions from agriculture and food production are significant (approx. 25%).
- In Switzerland, about half of the food-related GHG emissions are generated abroad.
- Animal foods in general and specifically beef are particularly greenhouse gas intensive.
- Technical reduction potentials exist. However, these are usually small, difficult to implement and/or associated with negative side effects.
- Larger reduction potentials can possibly be achieved through the consistent implementation of good agricultural practice.
- Feed-Food competition should be considered in locally adapted land use strategies.
- Changes in consumption patterns towards less animal based diets and less food loss and waste can influence agricultural structures. This can reduce agricultural GHG emissions significantly and has hardly any negative side effects.



Thank you for your attention

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Agroscope good food, healthy environment
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