Schweizerische Eidgenossenschaft
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Federal Department of Economic Affairs FDEA
Agroscope Reckenholz-Tänikon Research Station ART

The Swiss Inventory of Agricultural Greenhouse Gases

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Agroscope Reckenholz-Tänikon ART

Air Pollution / Climate Group

15.12.2011

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1. Introduction
2. Agricultural GHG-emissions in Switzerland
3. Methodology
4. Accounting of carbon stocks and CSC
5. Uncertainty and related implications
6. Reflections on Mitigation

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Greenhouse Gas Emissions by Sectors

10.8%
Switzerland 2009
IPCC Sector 4 - Agriculture

17-32%
Bellarby et al. 2008

18% Livestock
Steinfeld et al. 2006

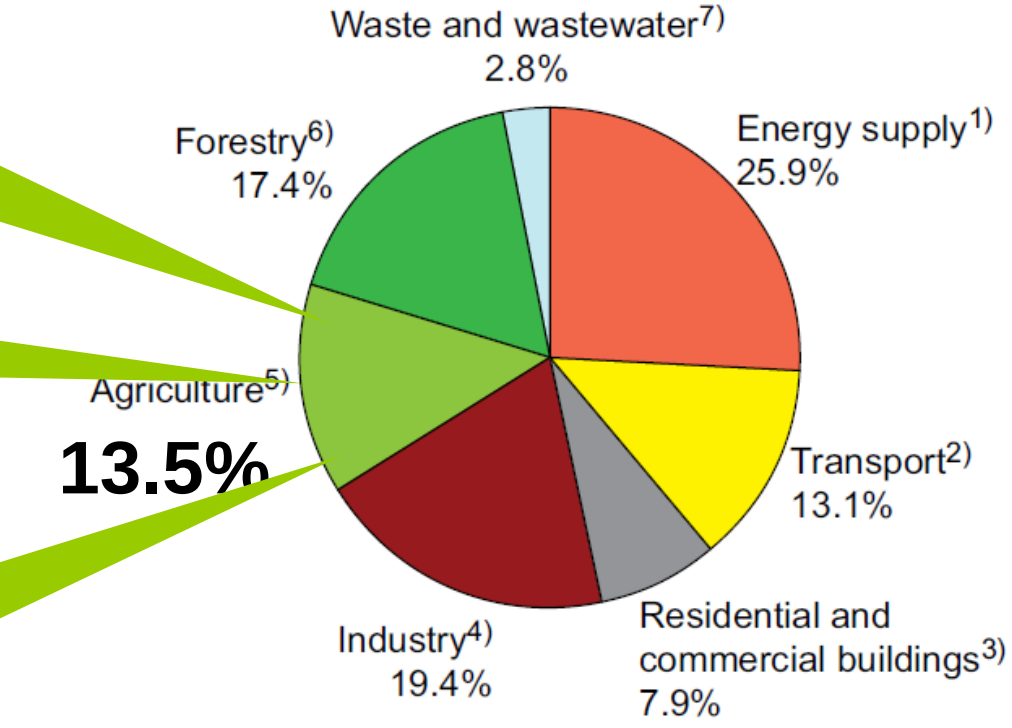

Figure 1.3b: *GHG emissions by sector in 2004.*
Source: Adapted from Olivier et al., 2005; 2006.

Source: AR4, WG III; IPCC 2007

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Methods and Data
Alternative Frameworks

Food chain approach

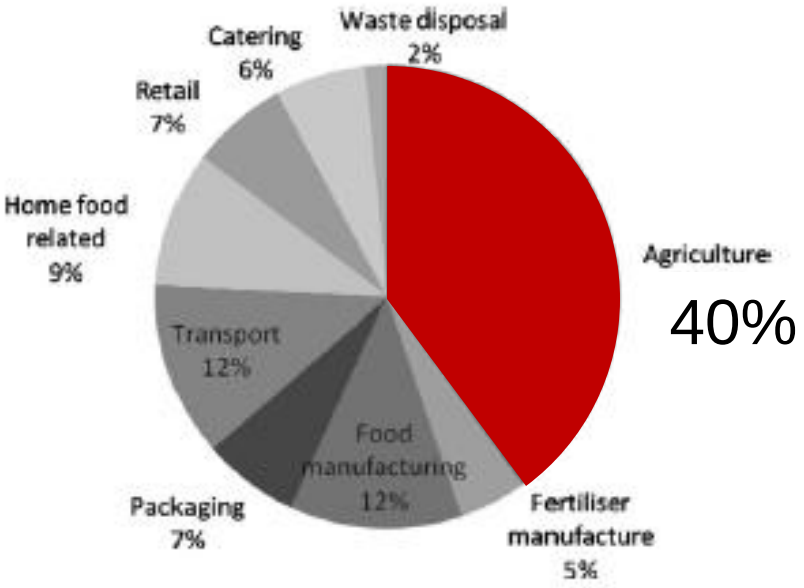

Fig. 2. Breakdown of food chain GHG emissions in the UK excluding land use change. Source: adapted from Garnett (2008).

Source: Garnett 2011

An output-based intensity approach for crediting greenhouse gas mitigation in agriculture: explanation and policy implications

Brian C. Murray* and Justin S. Baker
Nicholas Institute for Environmental Policy Solutions, Duke University, Box 90335, Durham, NC 27708, USA

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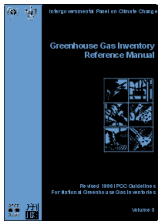
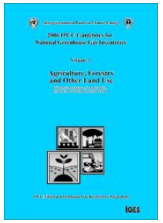
Methods and Data
IPCC Guidelines and Good Practice Guidance



1996 revised IPCC Guidelines

IPCC Good Practice Guidance 2000

IPCC Good Practice Guidance
LULUCF 2003



2006 IPCC Guidelines

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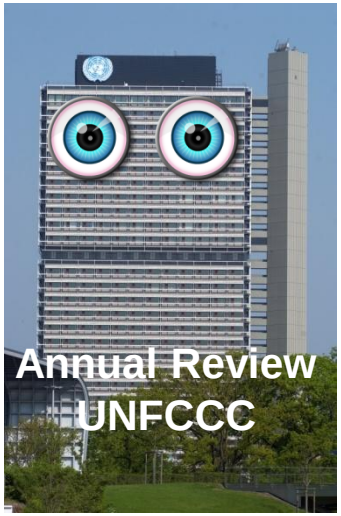
Methods and Data
Basic Approach and Levels of Complexity

Emission = AD * EF

Tier 1: AD * IPCC Default EF
Tier 2: AD * EF calculated according to IPCC Guidelines and GPG
Tier 3: Country Specific

Emission Factor Database EFDB
http://www.ipcc-nggip.iges.or.jp/EFDB/main.php

Official Approval during UNFCCC Annual Review



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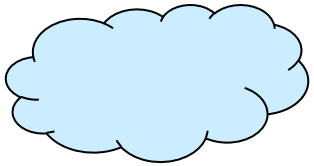
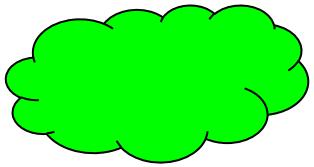
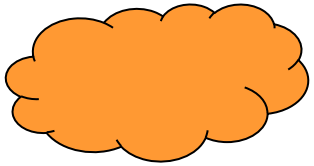
Agricultural Greenhouse Gases

		Global Warming Potential (100 years) CO_2-equivalent
	CO_2 Carbon Dioxide	1
	CH_4 Methane	21
	N_2O Nitrous Oxide	310

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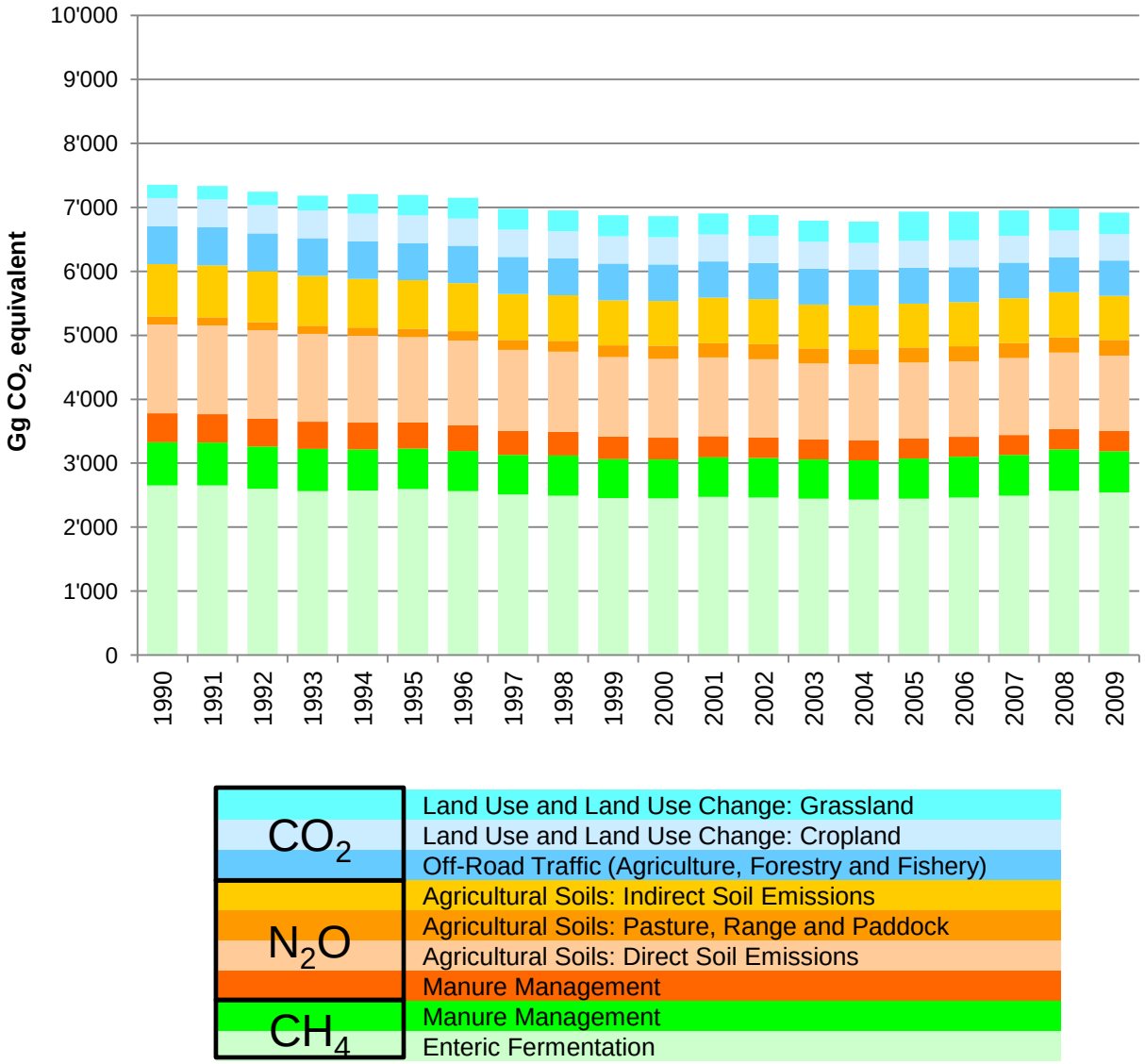
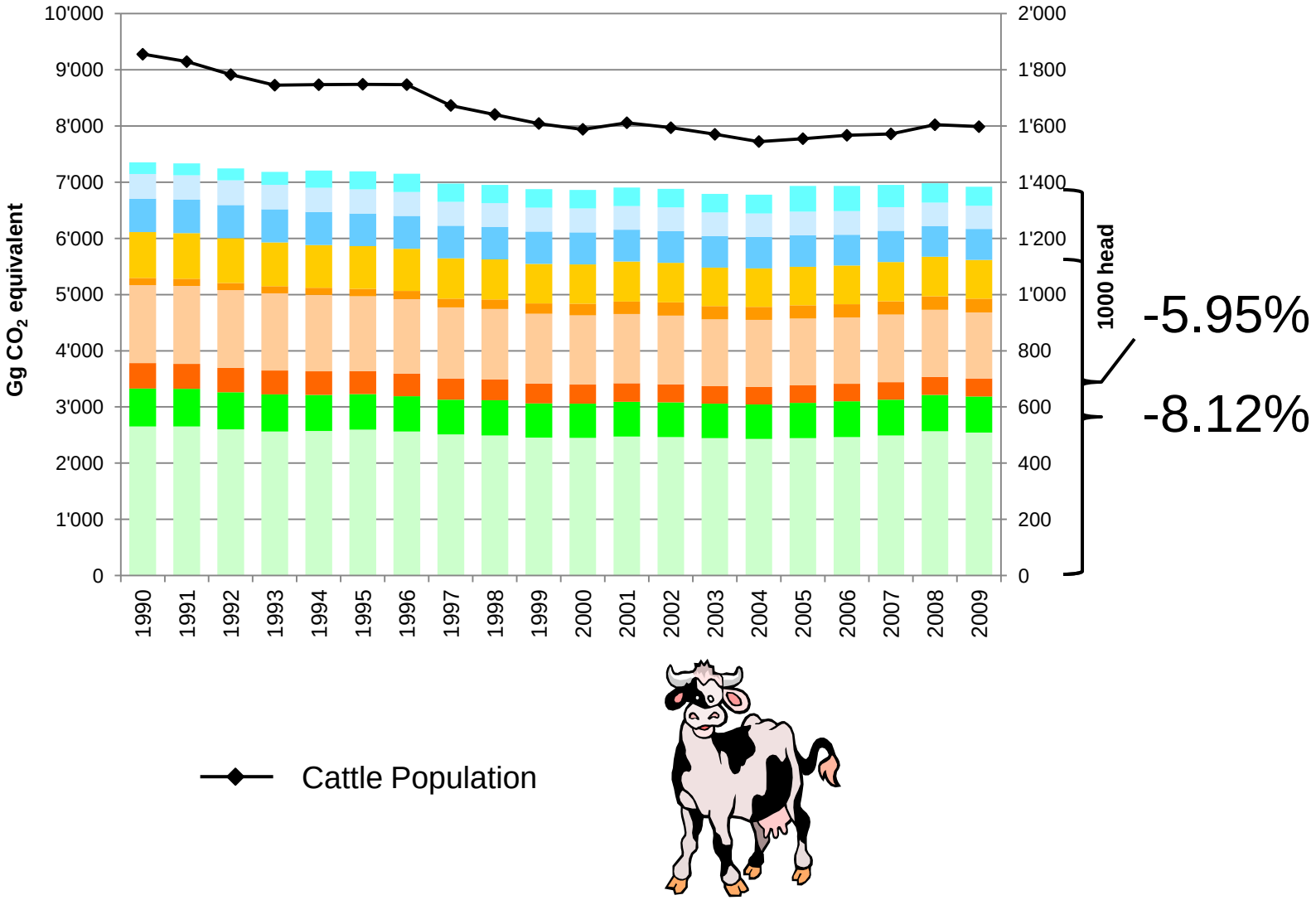
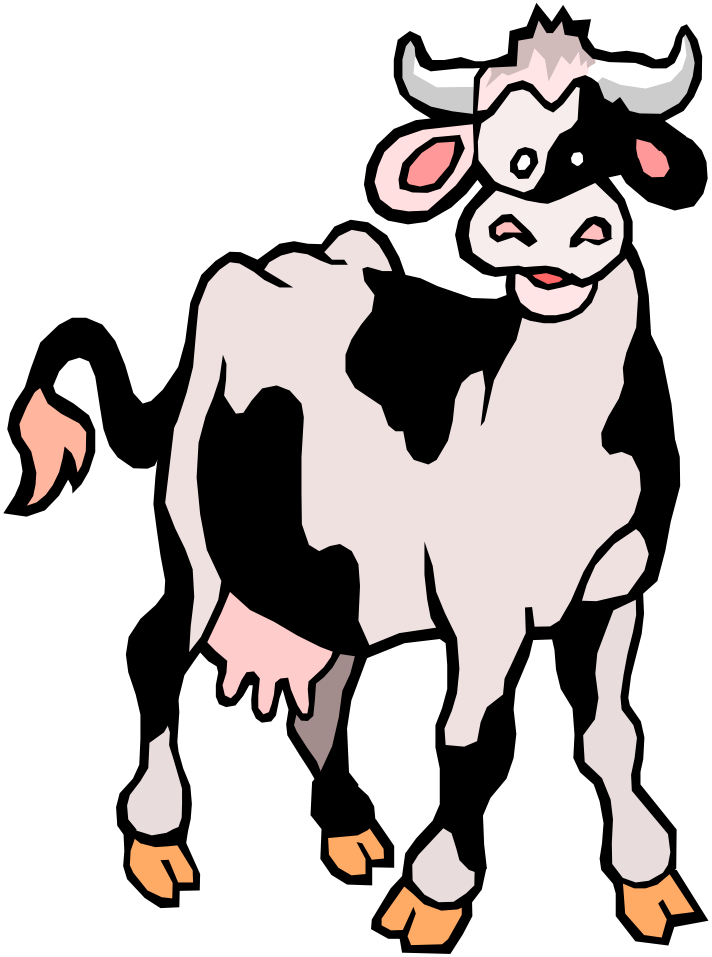
Agricultural Greenhouse Gas Emissions in Switzerland 1990-2009



Agricultural Greenhouse Gas Emissions in Switzerland 1990-2009



Contribution of different livestock categories to methane emissions in Switzerland (2009)



Cattle 87.2%

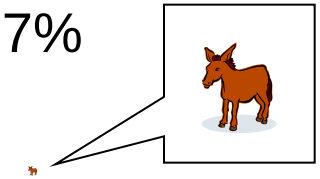
Swine
7.0%

Sheep
3.4%

Horses
1.0%

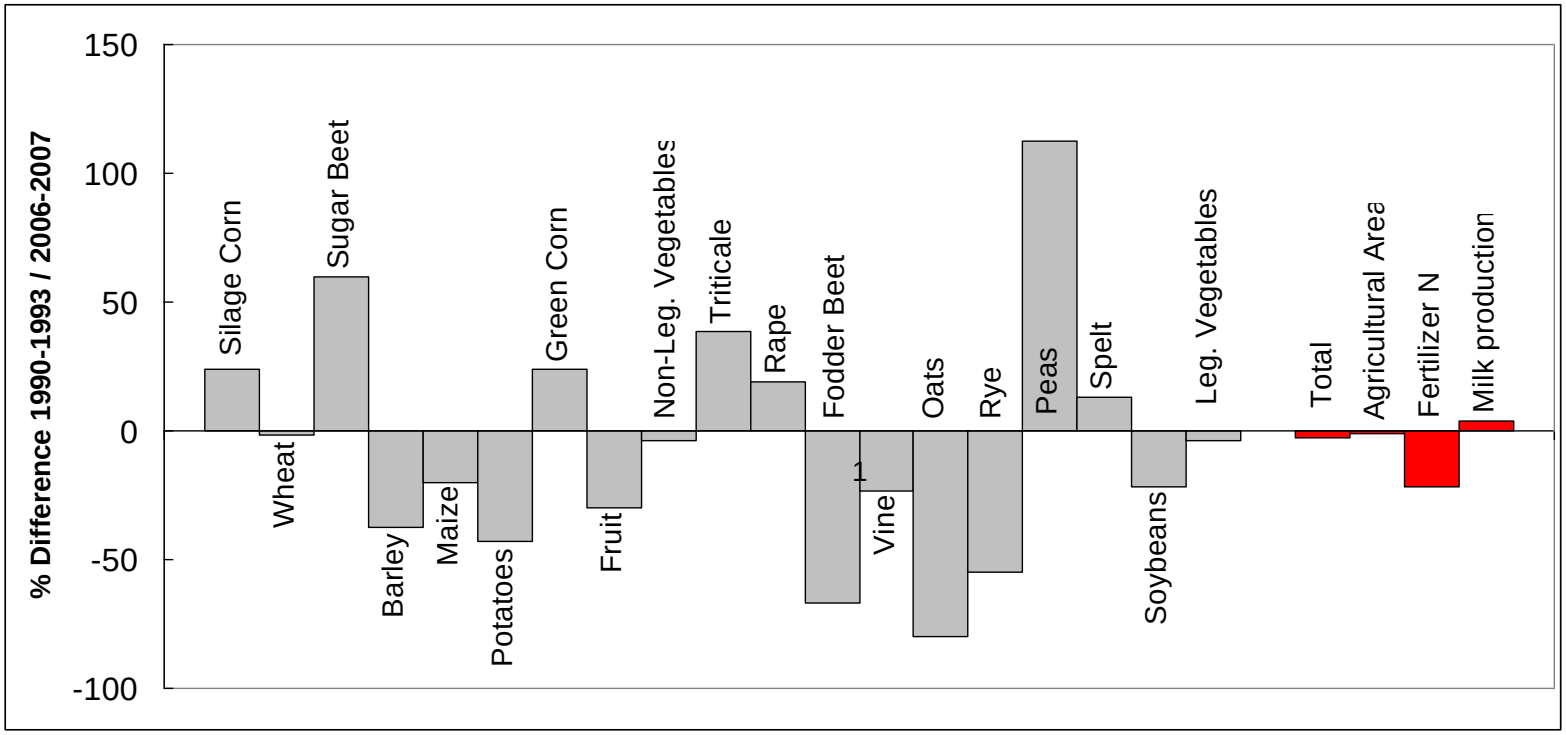
Poultry
0.7%

Goats
0.6%



Mules and Asses
0.2%

Agricultural Production in Switzerland 1990 vs. 2008



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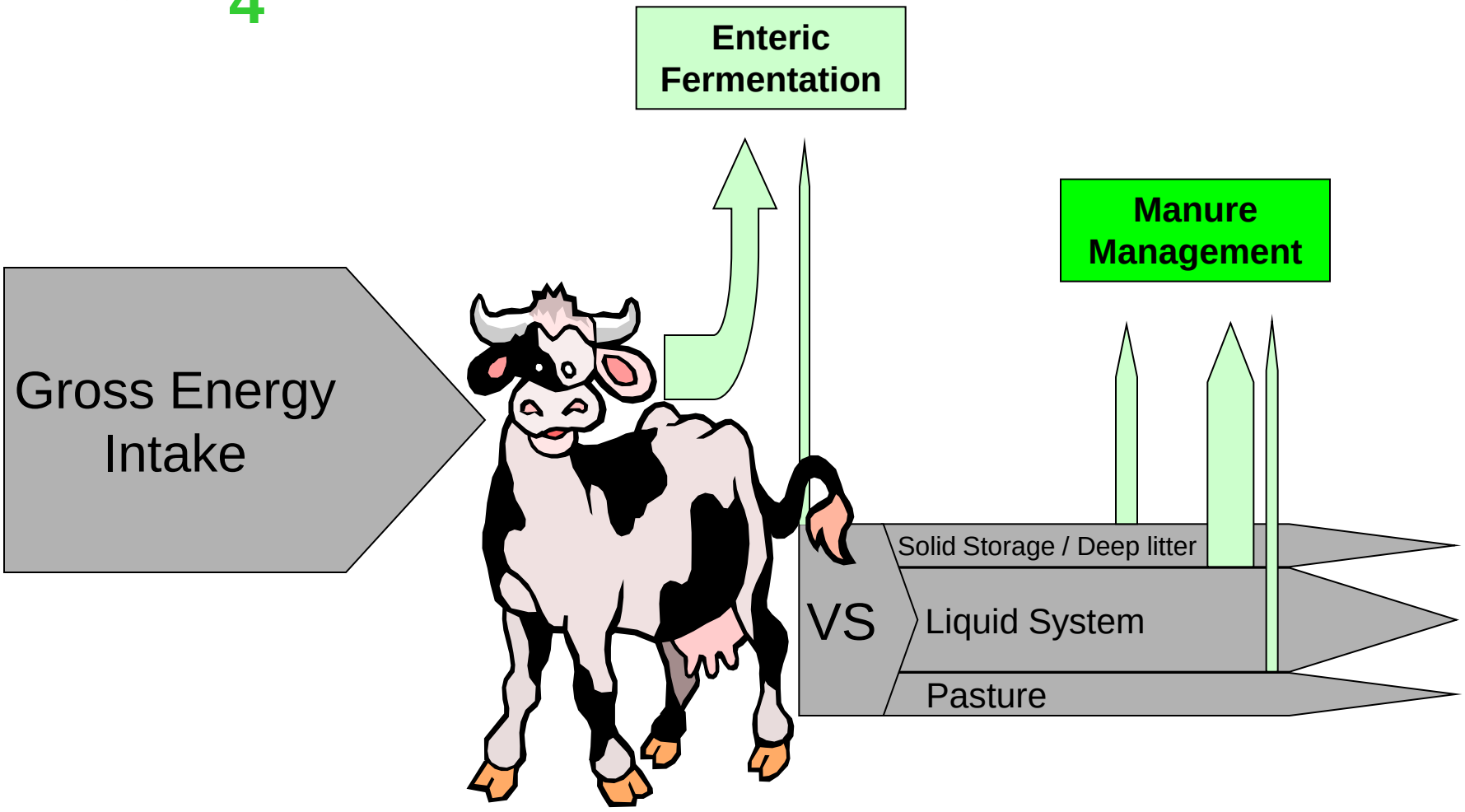
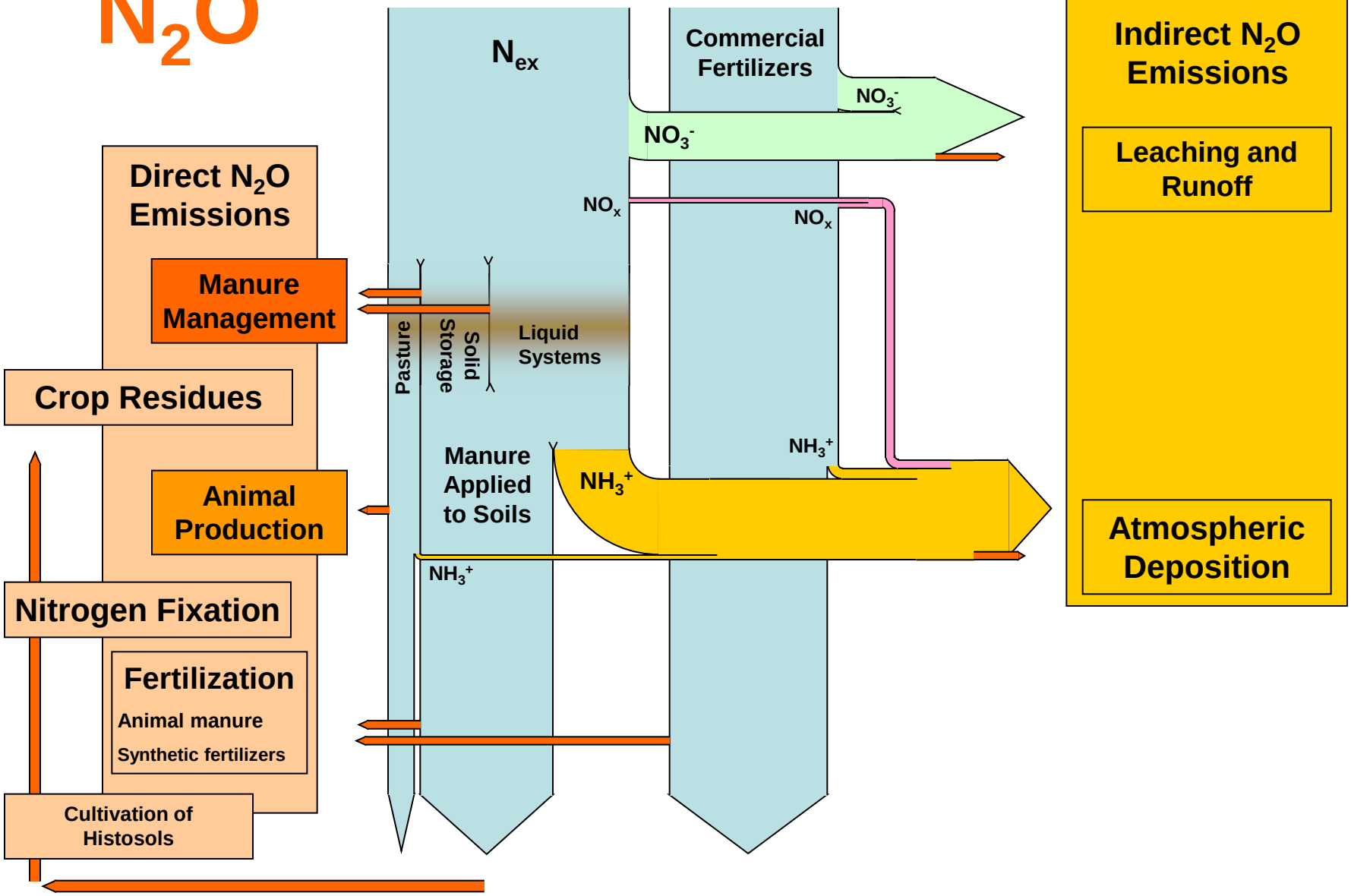
CH_4



Agroscope

N_2O


N_{ex}
Commercial Fertilizers
NO_3^-
NO_3^-
Indirect N_2O Emissions
Leaching and Runoff
Direct N_2O Emissions
NO_x
NO_x
Manure Management
Pasture
Solid Storage
Liquid Systems
Crop Residues
Manure Applied to Soils
NH_3^+
NH_3^+
Animal Production
Atmospheric Deposition
NH_3^+
Nitrogen Fixation
Fertilization
Animal manure
Synthetic fertilizers
Cultivation of Histosols

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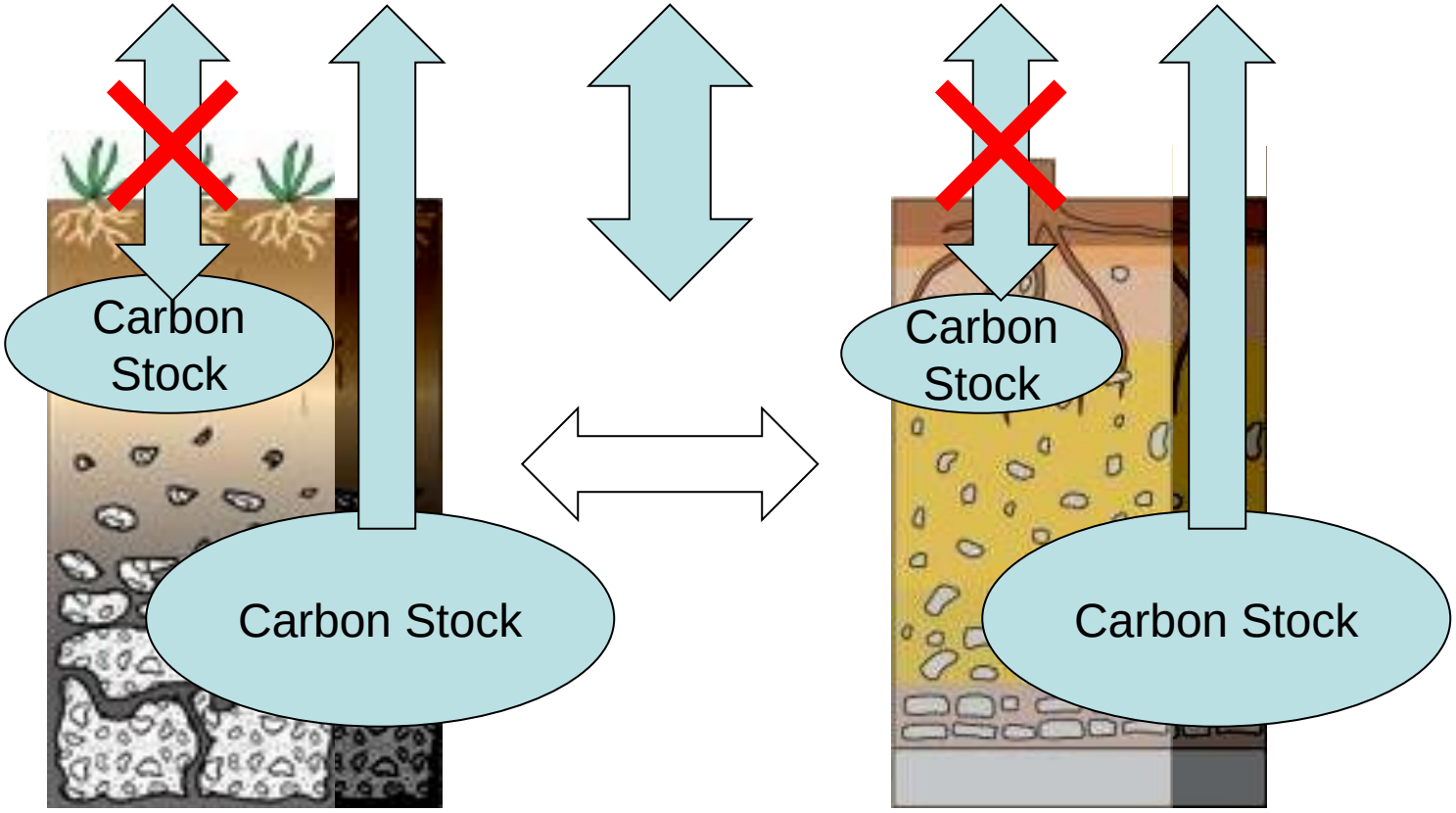
CO_2



Grassland

Cropland

Accounting of Carbon Stock Change: Swiss GHG – Inventory: Soil Organic Carbon 0-30 cm

Carbon stocks and changes in living biomass, in dead organic matter and in soils for the combination categories (CC), disaggregated for altitude, NFI region, and soil type. The values are valid for the whole period 1990-2009 with the exception of biomass and dead organic matter parameters of CC12, which change annually (numbers given here are for the year 1990); cf. Table 7-5.

	land-use code CC	NFI region	altitude zone z	soil type	carbon stock in living biomass (stockCl,i)	carbon stock in dead organic matter (stockCd,i)	carbon stock in soil (stockCs,i)	gain of living biomass (gainCl,i)	loss of living biomass (lossCl,i)	net change in dead organic matter (changeCd,i)	net change in soil (changeCs,i)
		Strata			t C ha^{-1}			t C ha^{-1} yr^{-1}			
Cropland	21	n.s.	n.s.	0	4.54	0	53.40	0	0	0	0
		n.s.	n.s.	1	4.54	0	240.00	0	0	0	-9.52
Grassland	31	n.s.	1	0	7.45	0	62.02	0	0	0	0
		n.s.	1	1	7.45	0	240.00	0	0	0	-9.52
		n.s.	2	0	6.26	0	67.50	0	0	0	0
		n.s.	2	1	6.26	0	240.00	0	0	0	-9.52
		n.s.	3	0	4.45	0	75.18	0	0	0	0
		n.s.	3	1	4.45	0	240.00	0	0	0	-9.52
	32	n.s.	1	n.s.	12.90	0	68.23	0	0	0	0
		n.s.	2	n.s.	12.90	0	68.23	0	0	0	0
		n.s.	3	n.s.	12.90	0	68.23	0	0	0	0
	33	n.s.	n.s.	0	3.74	0	53.40	0	0	0	0
		n.s.	n.s.	1	3.74	0	240.00	0	0	0	-9.52
	34	n.s.	1	n.s.	12.90	0	68.23	0	0	0	0
		n.s.	2	n.s.	12.90	0	68.23	0	0	0	0
		n.s.	3	n.s.	12.90	0	68.23	0	0	0	0
	35	n.s.	n.s.	0	24.63	0	64.76	0	0	0	0
		n.s.	n.s.	1	24.63	0	240.00	0	0	0	-9.52
	36	n.s.	n.s.	n.s.	4.52	0	26.31	0	0	0	0
	37	n.s.	n.s.	n.s.	6.05	0	68.23	0	0	0	0

Source: FOEN 2011

Accounting of Carbon Stock Change: Swiss GHG – Inventory: Soil Organic Carbon 0-30 cm

Carbon stocks and changes in living biomass, in dead organic matter and in soils for the combination categories (CC), disaggregated for altitude, NFI region, and soil type. The values are valid for the whole period 1990-2009 with the exception of biomass and dead organic matter parameters of CC12, which change annually (numbers given here are for the year 1990); cf. Table 7-5.

land-use code CC	NFI region	altitude zone z	soil type	carbon stock in living biomass (stockCl,i)	carbon stock in dead organic matter (stockCd,i)	carbon stock in soil (stockCs,i)	gain of living biomass (gainCl,i)	loss of living biomass (lossCl,i)	net change in dead organic matter (changeCd,i)	net change in soil (changeCs,i)
	Strata			t C ha^{-1}			t C ha^{-1} yr^{-1}			

Cropland

Cropland **53.4 t C ha^{-1}**

Grassland

Permanent Grassland **68.2 t C ha^{-1}**

Organic Soils **240.0 t C ha^{-1}**

Source: FOEN 2011

Accounting of Carbon Stock Change: Swiss GHG – Inventory: Land Use Change

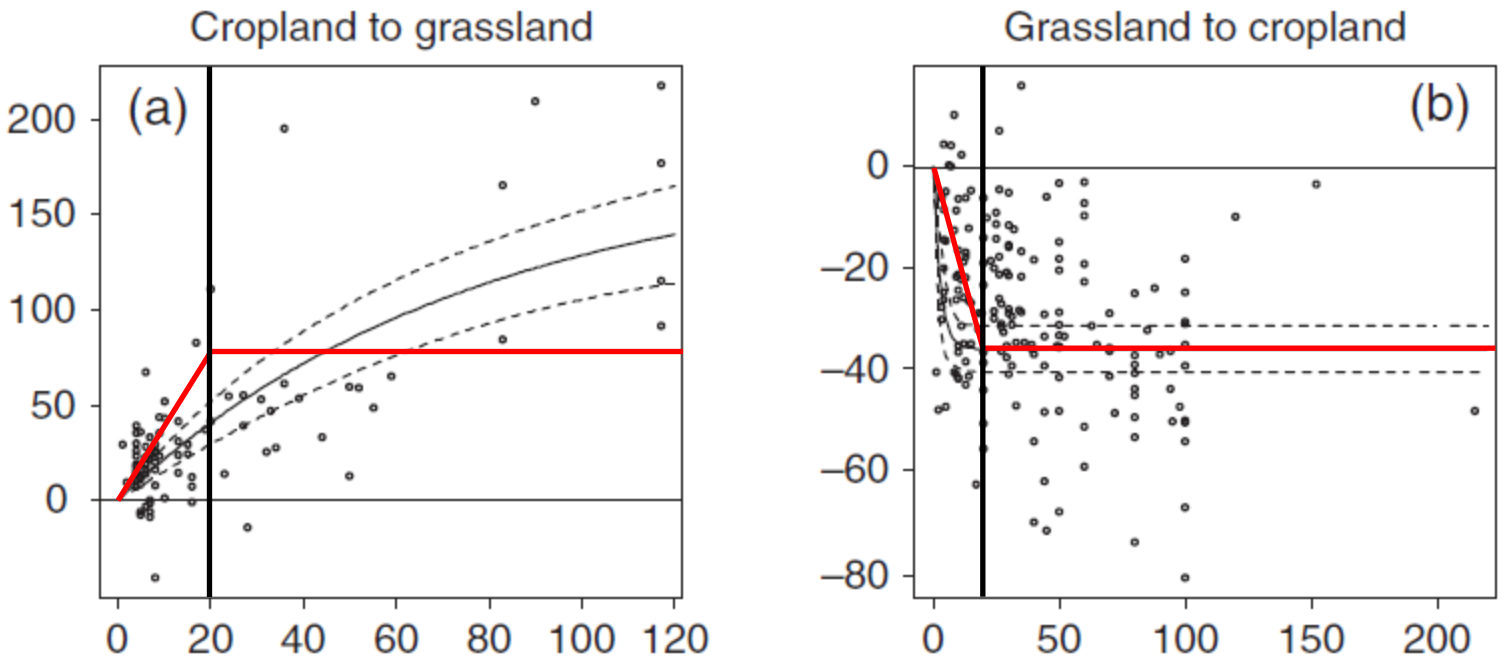


Fig. 1 Temporal dynamic of relative soil organic carbon (SOC) change (%) and forest floor carbon (C) accumulation (Mg ha^{-1} yr^{-1}) after land-use change with fitted carbon response functions (± 95% confidence interval): (a) cropland to grassland, (b) grassland to cropland,

Source: Poeplau et al. 2011

20 Years conversion time vs. “Slow in Rapid out”

Accounting of Carbon Stock Change: Swiss GHG – Inventory: Land Use - Carbon Stock changes

Carbon stocks and changes in living biomass, in dead organic matter and in soils for the combination categories (CC), disaggregated for altitude, NFI region, and soil type. The values are valid for the whole period 1990-2009 with the exception of biomass and dead organic matter parameters of CC12, which change annually (numbers given here are for the year 1990); cf. Table 7-5.

land-use code CC	NFI region	altitude zone z	soil type	carbon stock in living biomass (stockCl,i)	carbon stock in dead organic matter (stockCd,i)	carbon stock in soil (stockCs,i)	gain of living biomass (gainCl,i)	loss of living biomass (lossCl,i)	net change in dead organic matter (changeCd,i)	net change in soil (changeCs,i)
	Strata			t C ha^{-1}			t C ha^{-1} yr^{-1}			
21	n.s.	n.s.	0	4.54	0	53.40	0	0	0	0
	n.s.	n.s.	1	4.54	0	240.00	0	0	0	-9.52
31	n.s.	1	0	7.45	0	62.02	0	0	0	0
	n.s.	1	1	7.45	0	240.00	0	0	0	-9.52
	n.s.	2	0	6.26	0	67.50	0	0	0	0
	n.s.	2	1	6.26	0	240.00	0	0	0	-9.52
	n.s.	3	0	4.45	0	75.18	0	0	0	0
	n.s.	3	1	4.45	0	240.00	0	0	0	-9.52
32	n.s.	1	n.s.	12.90	0	68.23	0	0	0	0
	n.s.	2	n.s.	12.90	0	68.23	0	0	0	0
	n.s.	3	n.s.	12.90	0	68.23	0	0	0	0
33	n.s.	n.s.	0	3.74	0	53.40	0	0	0	0
	n.s.	n.s.	1	3.74	0	240.00	0	0	0	-9.52
34	n.s.	1	n.s.	12.90	0	68.23	0	0	0	0
	n.s.	2	n.s.	12.90	0	68.23	0	0	0	0
	n.s.	3	n.s.	12.90	0	68.23	0	0	0	0
35	n.s.	n.s.	0	24.63	0	64.76	0	0	0	0
	n.s.	n.s.	1	24.63	0	240.00	0	0	0	-9.52
36	n.s.	n.s.	n.s.	4.52	0	26.31	0	0	0	0
37	n.s.	n.s.	n.s.	6.05	0	68.23	0	0	0	0

Source: FOEN 2011

Accounting of Carbon Stock Change: Swiss GHG – Inventory: Land Use - Carbon Stock changes

Carbon stocks and changes in living biomass, in dead organic matter and in soils for the combination categories (CC), disaggregated for altitude, NFI region, and soil type. The values are valid for the whole period 1990-2009 with the exception of biomass and dead organic matter parameters of CC12, which change annually (numbers given here are for the year 1990); cf. Table 7-5.

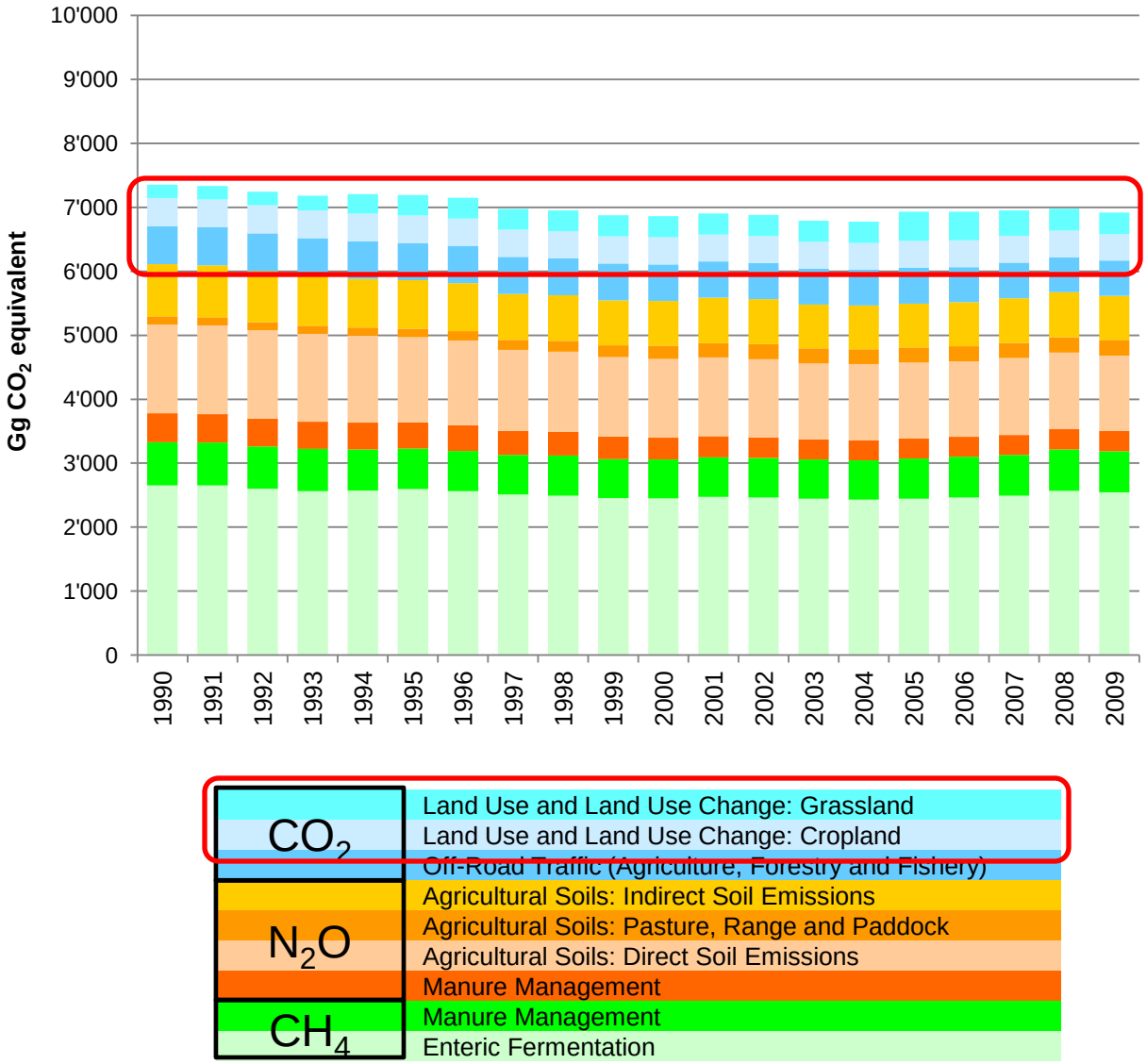
land-use code CC	NFI region	altitude zone z	soil type	carbon stock in living biomass (stockCl,i)	carbon stock in dead organic matter (stockCd,i)	carbon stock in soil (stockCs,i)	gain of living biomass (gainCl,i)	loss of living biomass (lossCl,i)	net change in dead organic matter (changeCd,i)	net change in soil (changeCs,i)
	Strata			t C ha^{-1}			t C ha^{-1} yr^{-1}			

Mineral Soils **0.00 t C ha^{-1} yr^{-1}**

Organic Soils **-9.52 t C ha^{-1} yr^{-1}**

Source: FOEN 2011

Agricultural Greenhouse Gas Emissions in Switzerland 1990-2009



Accounting of Carbon Stock Change: Swiss GHG – Inventory: Measuring Data NABO - Grassland

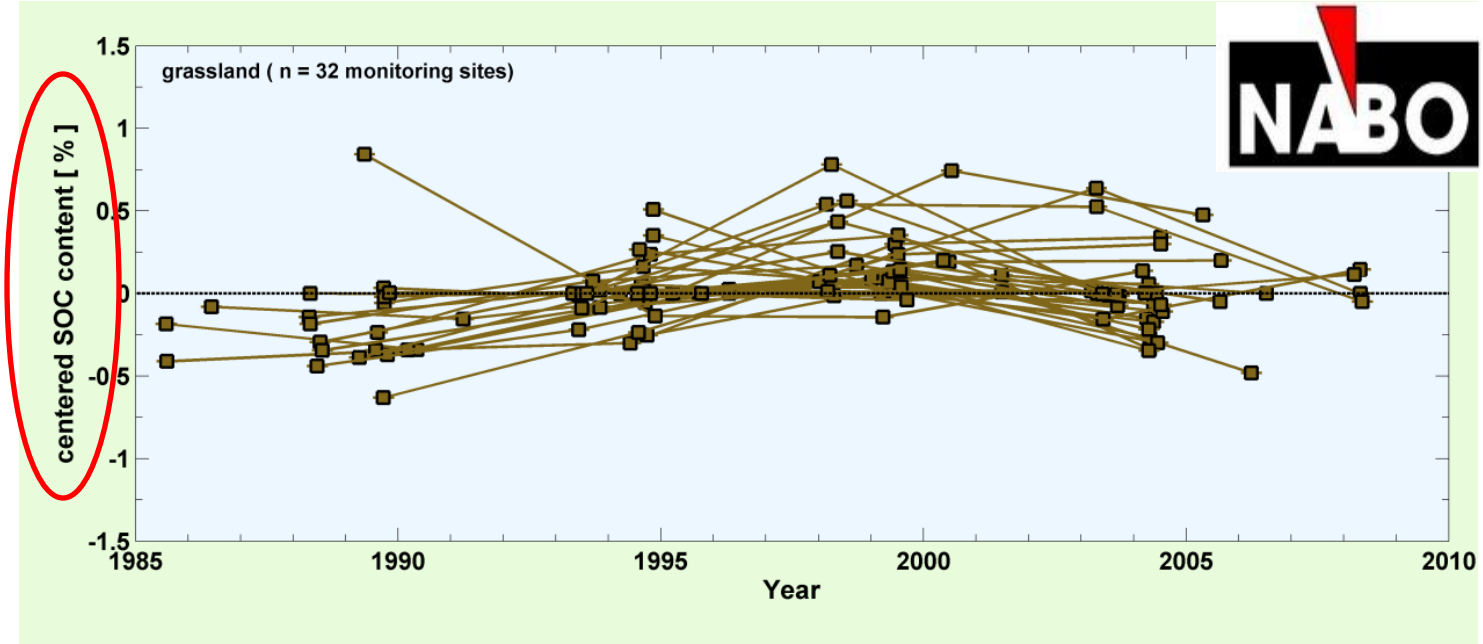


Figure 7-12: Time series of measured SOC content in the top soil (0-20 cm) at the 32 NABO grassland sites from the 1st to the 4th re-sampling campaigns (including some sites with the 5th). Values were centered by the median SOC content of all re-samplings of the monitoring site. Each value presents the median of four bulked soil samples per campaign. The altitude of the grassland sites ranges between 265 and 2340 m.a.s.l.

Source: FOEN 2011

Accounting of Carbon Stock Change: Swiss GHG – Inventory: Measuring Data NABO - Cropland

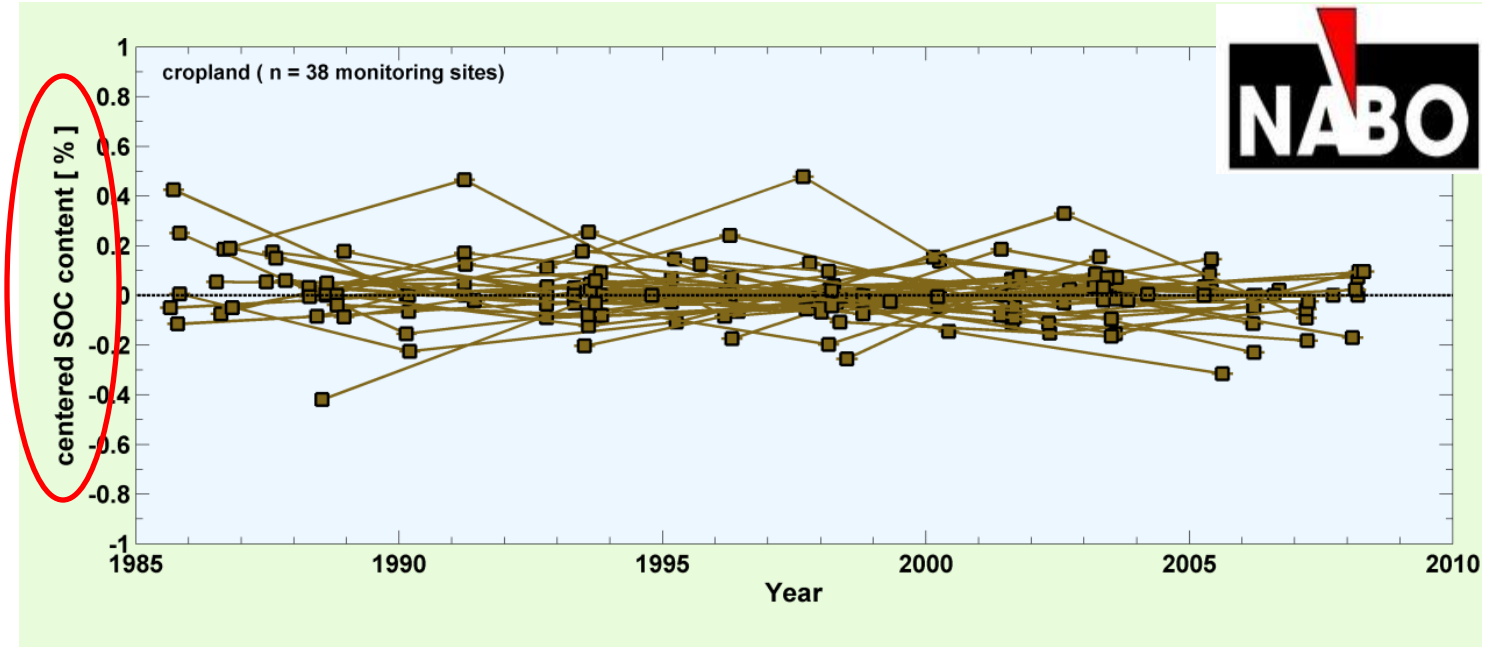


Figure 7-11: Time series of measured SOC content in the top soil (0-20 cm) at the 38 NABO cropland sites from the 1st to the 4th re-sampling campaigns (including some sites with the 5th). Values were centered by the median SOC content of all re-samplings of the monitoring site. Each value presents the median of four bulked soil samples per campaign. The altitude of the cropland sites ranges between 209 and 945 m.a.s.l.

Source: FOEN 2011

Accounting of Carbon Stock Change: Swiss GHG – Inventory: Long Term Field Trials- Cropland

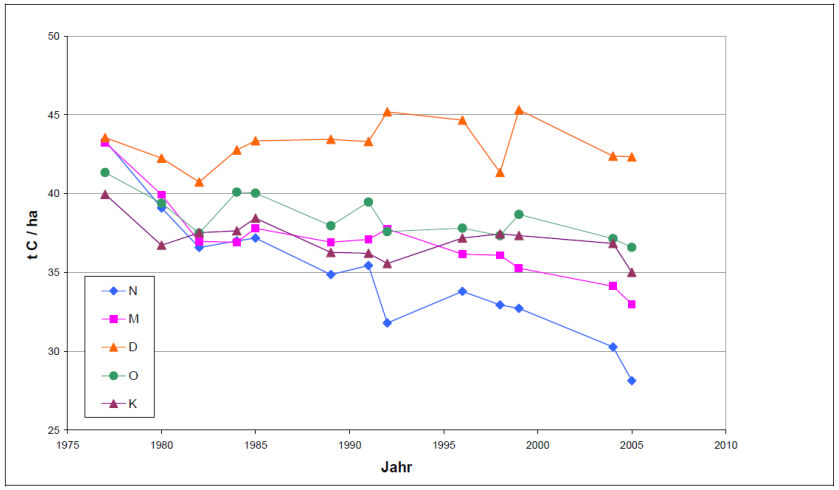


Abbildung 7: DOK Messwerte: C-Verlauf von 1977 bis 2005

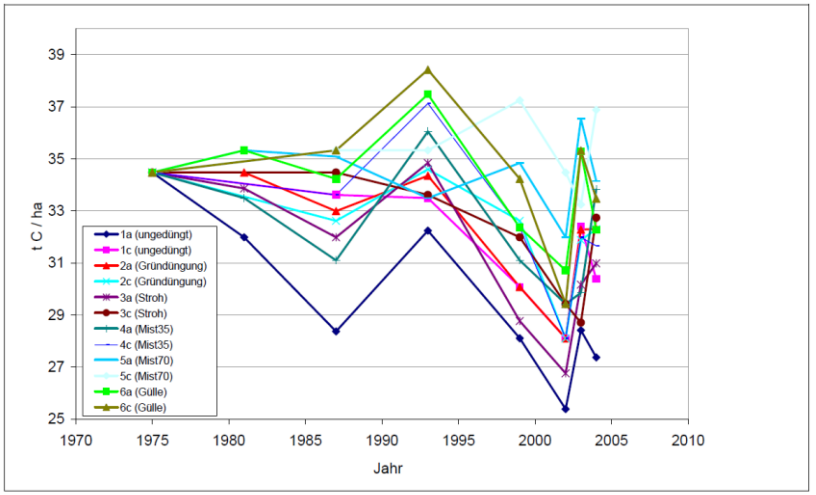


Abbildung 15: p24A Messwerte: C-Verlauf von 1976 bis 2004

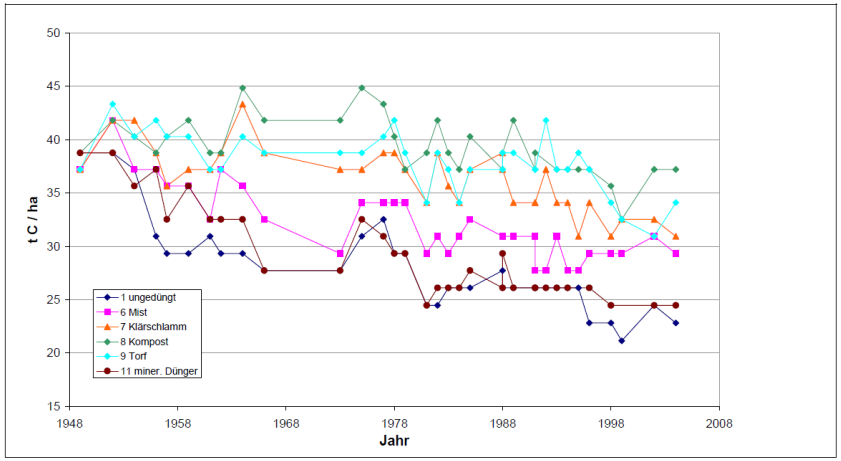
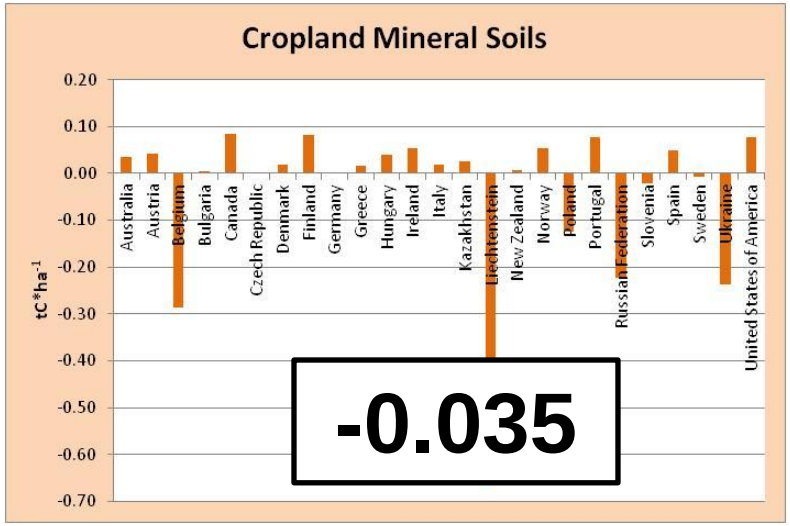
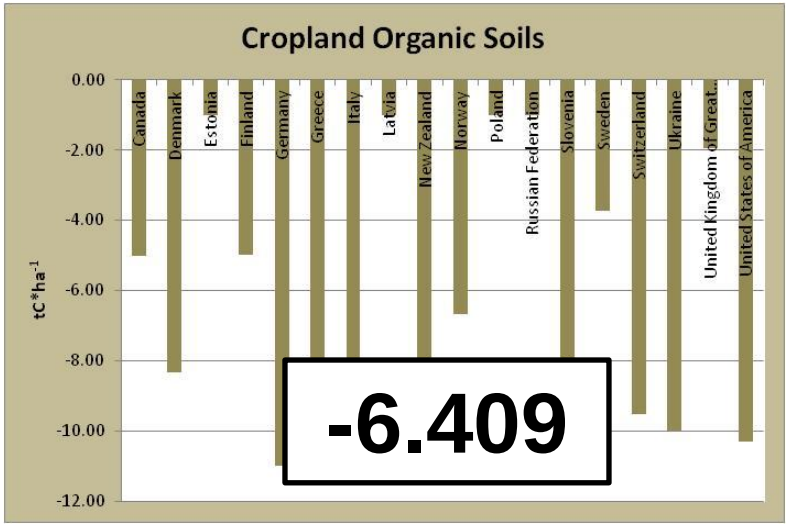


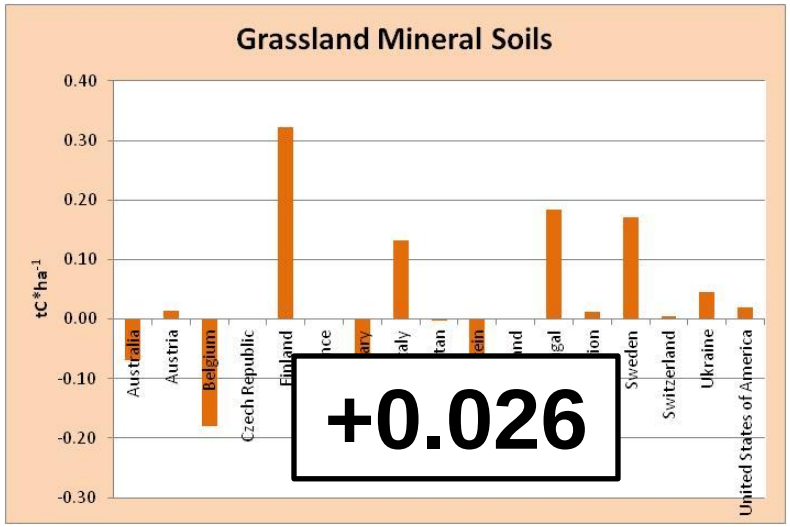
Abbildung 11: A493 Messwerte: C-Verlauf von 1949 bis 2004

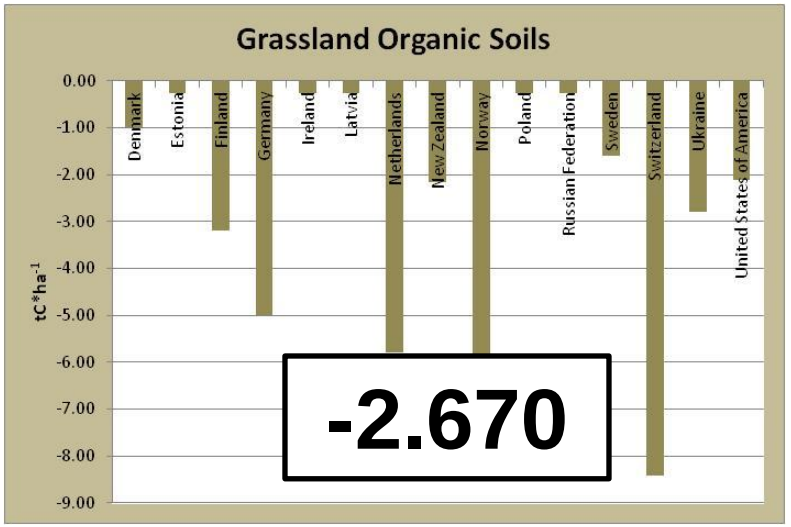
Source: Holenstein 2011

Accounting of Carbon Stock Change: Annex I Countries: CSC 2009: $tC*ha^{-1}*yr^{-1}$









Accounting of Carbon Stock Change: Annex I Countries: Reporting

Methods and emission factors (EF) used for CO_2 emissions in National Inventory Reports for the six land-use categories. Tier 3 methods are shaded in blue, Tier 2 methods in light blue.

42 Annex I Countries

	Forest		Cropland		Grassland		Wetlands		Settlements		Other land	
	Method	EF	Method	EF	Method	EF	Method	EF	Method	EF	Method	EF
Australia	T1,T2,T3	CS,M	T3	M	T2,T3	CS,M	NA	NA	NA	NA	NA	NA
Austria	T1,T2,T3	CS	T2	CS,D	T2	CS	T2	CS	T2	CS	T2	CS
Belarus	T1	CS,D	T1	D	NA	NA	T2	CS	NA	NA	NA	NA
Belgium	CS,T1,T2	CS	CS,T1,T2	CS	CS,T1,T2	CS	CS,T1	CS	CS,T1	CS	CS,T1	CS
Bulgaria	T1,T2	CS,D	T1,T2	CS,D	T1	CS	T1	CS	T1	CS	NA	NA
Canada	T3	CS	CS,T1,T2,T3	CS,D	NA	NA	T2,T3	CS	T1,T2,T3	CS	NA	NA
Croatia	T1,T2	D	NA	NA	NA	NA	NA	NA	T1	D	NA	NA
Czech Republic	CS,T1,T2	CS,D	CS,T1,T2	CS,D	CS,T1,T2	CS,D	T1	CS,D	T1	CS,D	NA	NA
Denmark			T1,T3	CS	T2	D					NA	NA
Estonia	T1,T2	D	T1	D	T1,T2	D	T1	D	NA	NA	NA	NA
Finland	T2,T3	CS,D	D,T1,T3	CS,D	CS,T1,T3	CS,D	T2	CS	NA	NA	NA	NA
France	CR,CS,T2	CS	CS,T2	CS	CS,T2	CS	CS,T2	CS	CS,T2	CS	CS,T2	CS
Germany	CS,T1,T2	CS,D	CS,D,T2	CS	CS	CS	CS,T1	D	CS,T1	CS,D	NA	NA
Greece	T1,T2	CS,D	T1,T2	CS,D	NA	NA	NA	NA	NA	NA	NA	NA
Hungary	T1,T2	CS,D	T1	D	T1,T2	CS,D	NA	NA	T1,T2	CS,D	NA	NA
Iceland	T2,T3	CS	T1,T2	CS,D	T1,T2,T3	CS,D	RA,T2	CS	NA	NA	NA	NA
Ireland	D,T1,T3	CS,D	T1	D	T1	D	T1	D	T1,T2	CS,D	D,T1	CS,D
Italy	T1,T2,T3	CS,D	T1,T2,T3	CS,D	T1,T2,T3	CS,D	NA	NA	T1	CS,D	NA	NA
Japan	T1,T2,T3	CS,D	T1,T2	CS,D	T1,T2	CS,D	T2	CS,D	T1a,T1b,T2	CS,D	T2	CS,D
Kazakhstan	T2	CS	T1	D	T1	D	NA	NA	T1	D	NA	NA
Latvia	T1,T2	CS,D	D,T1,T2	CS,D	T1	D	T1	D	T2	CS	NA	NA
Liechtenstein	T2	CS	T2	CS	T2	CS	T2	CS	T2	CS	T2	CS
Lithuania	T1,T2	CS,D	NA	NA	NA	NA			T1	D	T1	D
Luxembourg	T1,T2	CS,D	T1	CS,D	T1	CS,D	T1	CS,D	T1	CS,D	T1	CS,D
Malta	CS	D	CS	D	NA	NA	NA	NA	NA	NA	NA	NA
Monaco	NA	NA	NA	NA	NA	NA	NA	NA	T1a	D	NA	NA
Netherlands	CS	CS					NA	NA	NA	NA		
New Zealand	T1,T2	CS,D	T1,T2	CS,D	T1,T2	CS,D	NA	NA	T1,T2	CS,D	T1,T2	CS,D
Norway	T1,T3	CS,D	T1,T2,T3	CS,D	T1	CS	T1	CS	T3	CS	T3	CS
Poland	T2	CS	D,T2	CS,D	T2	D	D,T1	CS,D	T1	D	NA	NA
Portugal	CS,T2	CS,D	T2	CS,D	T2	CS,D	D,T2	CS,D	D,T2	CS,D	D,T2	CS,D
Romania	T1,T2	CS,D	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Russian Federation.	CS,T2	CS	T1	D	CS,T1,T3	CS,D	T1	D	CS	CS	NA	NA
Slovakia	T2	CS	T1,T2	CS,D	T2	CS	NA	NA	T2	CS	T2	CS
Slovenia	CS,D,T1,T2, T3	CS,D,PS	D,T1,T2	CS,D	D,T1,T2	CS,D	NA	NA	T1,T2	CS,D	NA	NA
Spain	CS,T1,T2	CS,D	T2	CS,D	T2	CS,D	NA	NA	T1	CS,D	NA	NA
Sweden	T1,T2,T3	CS	T1,T2,T3	CS	T1,T2,T3	CS	T3	CS	T2,T3	CS	NA	NA
Switzerland	T2	CS	T2	CS	T2	CS	T2	CS	T2	CS	T2	CS
Turkey	T1,T2	CS,D										
Ukraine	T1,T2	CS,D	CS,T1,T2	CS,D	CS,T2	CS,D	T1,T2	CS,D	T2	CS	T2	CS
United Kingdom	CS,D,T3	CS	CS,D,T3	CS	CS,D	CS	D	CS	CS,D,T3	CS	NA	NA
United States	T3	CS	T1,T2,T3	CS,D	T2,T3	CS	T1	D	T2,T3	CS	NA	NA

Source: UNFCCC 2011

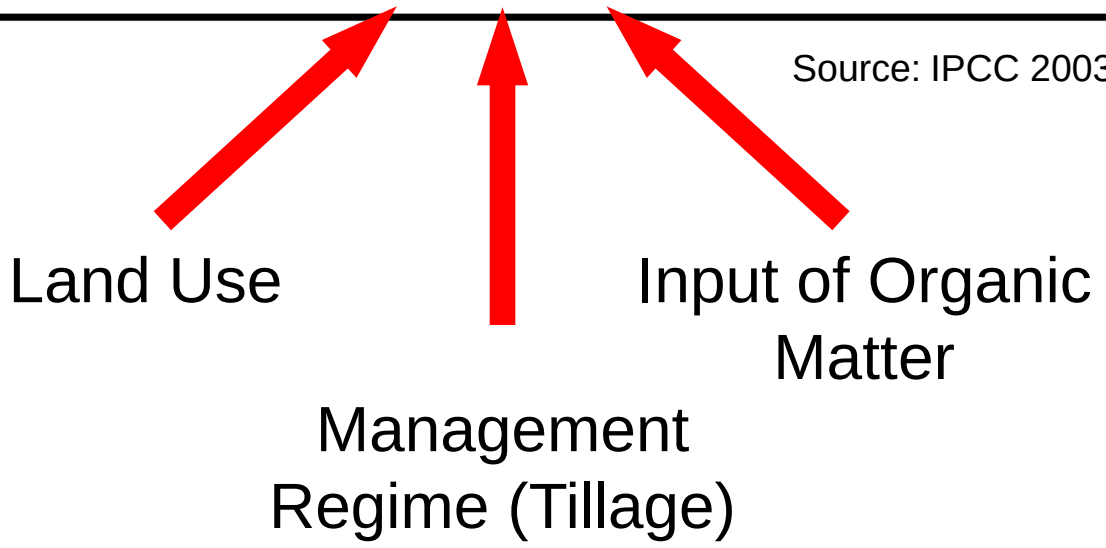
Accounting of Carbon Stock Change: Annex I Countries: Suggested Method IPCC

EQUATION 3.3.3
ANNUAL CHANGE IN CARBON STOCKS IN MINERAL SOILS FOR A SINGLE CROPLAND SYSTEM

$$\Delta C_{CC_{Mineral}} = [(SOC_0 - SOC_{(0-T)}) \bullet A] / T$$

$$SOC = SOC_{REF} \bullet F_{LU} \bullet F_{MG} \bullet F_I$$

Source: IPCC 2003



Accounting of Carbon Stock Change: Annex I Countries: Suggested Method IPCC

EQUATION 3.3.3
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$$\Delta C_{CC_{Mineral}} = [(SOC_0 - SOC_{(0-T)}) \bullet A] / T$$

$$\ldots F_I$$

Source: IPCC 2003

- Animal manure
- Crop type (N-fixing crops)
- Crop yield (fertilization)
- Improved vegetated fallows (green manure, cover crops)
- Irrigation
- Frequent use of perennial grasses in annual crop rotations
- Farming system

Input of Organic Matter

…ient

…(Tillage)

Accounting of Carbon Stock Change: Annex I Countries: Suggested Method IPCC

$$\text{Soil Carbon}_{\text{managed}} = \text{Soil Carbon}_{\text{native}} \times \text{Base factor} \times \text{Tillage factor} \times \text{Input factors}$$

TABLE 5-12[a]
COEFFICIENTS USED IN DEFAULT CALCULATION PROCEDURES FOR ESTIMATING CARBON STOCKS IN MINERAL SOILS

System	SG[b]	BF[c]	Tillage Factor[d]			Input Factors[e]				
			No-tillage	Reduced tillage	Full tillage	Low input	Medium input	High input	Mature fallow	Shortened fallow
Temperate										
Long-term cultivated	A,B,C,D	0.7	1.1	1.05	1.0	0.9	1.0	1.1/1.2		
Long-term cultivated	E	0.6	1.1	1.05	1.0	0.9	1.0	1.1/1.2		
Improved pasture	All soils	1.1				ND	ND	ND		
Set aside (<20 years)	All soils	0.8				ND	ND	ND		
Set aside (>20 years)	All soils	0.9				ND	ND	ND		

Source: IPCC 1997

Accounting of Carbon Stock Change: Annex I Countries: Suggested Method IPCC

$$\text{Soil Carbon}_{\text{managed}} = \text{Soil Carbon}_{\text{native}} \times \text{Base factor} \times \text{Tillage factor} \times \text{Input factors}$$

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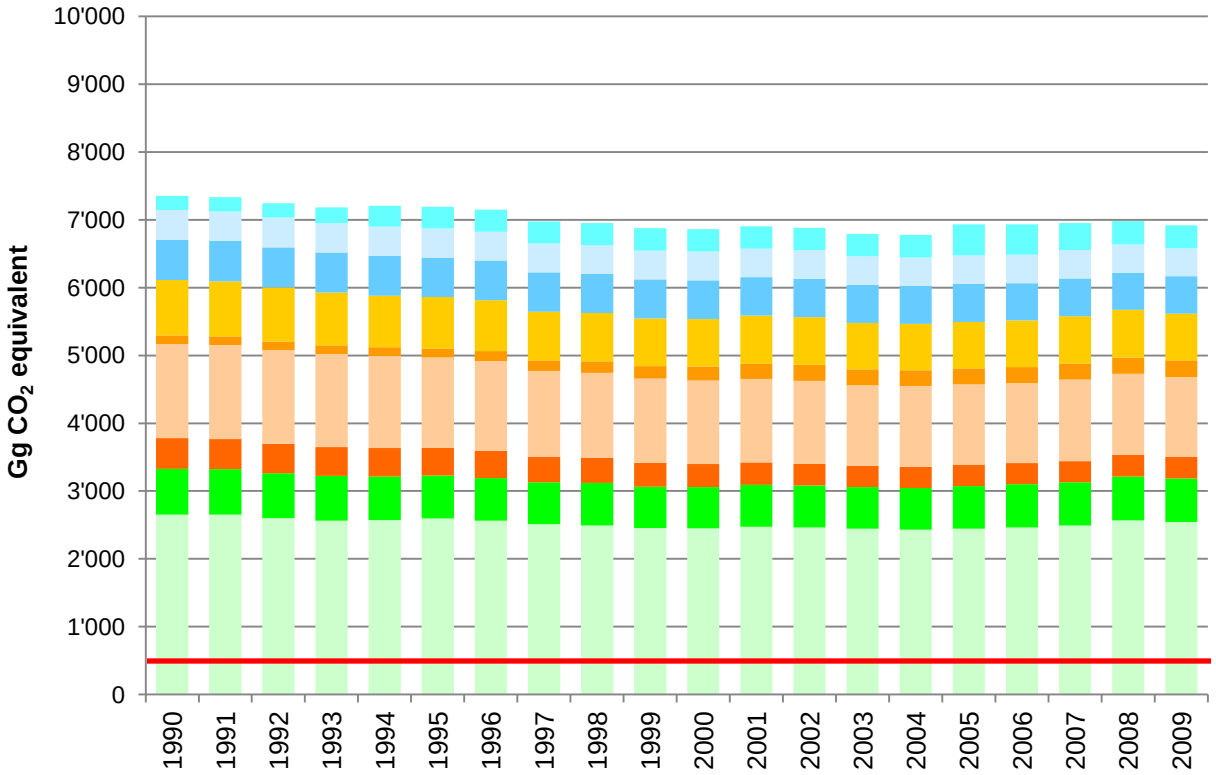
Long-term cultivated	E	0.6	1.1		1.0	0.9	1.0	1.1/1.2		
Improved pasture	All soils	1.1								
Set aside (<20 years)	All soils	0.8								
Set aside (>20 years)	All soils	0.9								

$0.267\ t*ha^{-1}*y^{-1}$
For Cropland in Switzerland

Source: IPCC 1997

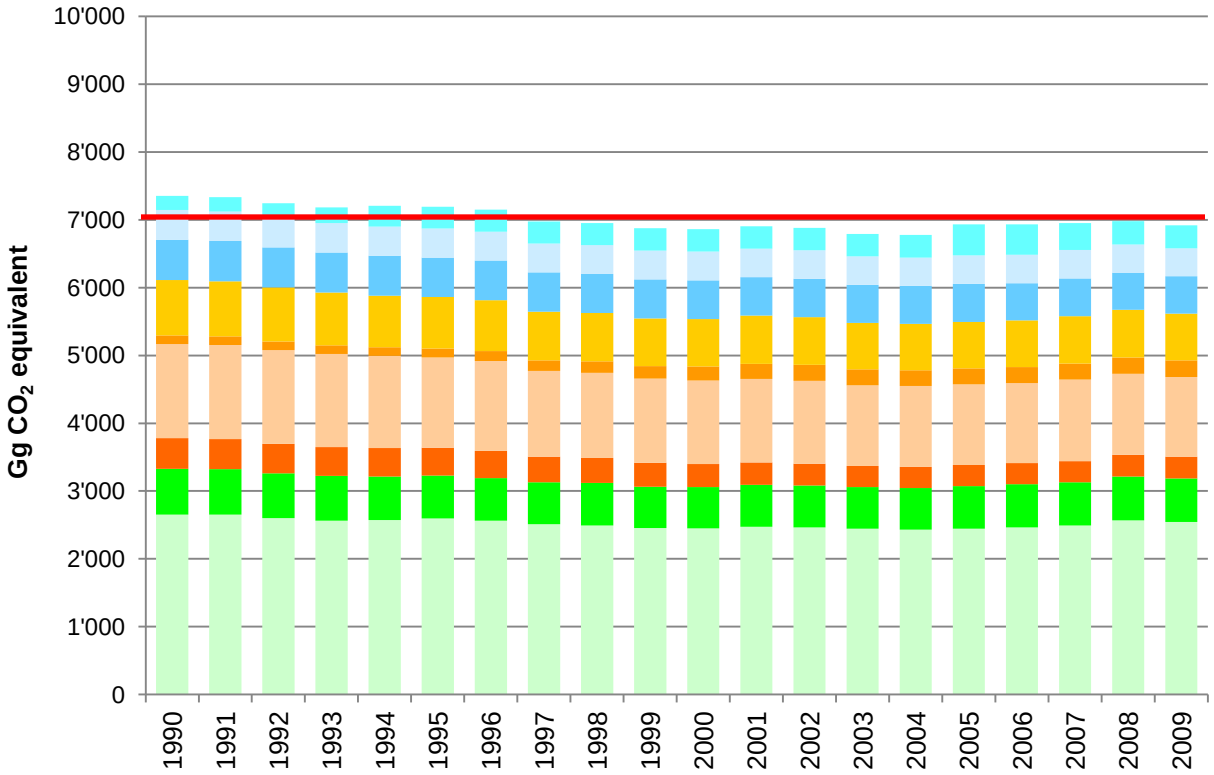
Agricultural Greenhouse Gas Emissions in Switzerland 1990-2009



All Cropland under No-tillage:

405 Gg CO_2 equ.

Agricultural Greenhouse Gas Emissions in Switzerland 1990-2009



100% compensation of agricultural emissions (7'000 Gg CO_2 equ.) with cropland and favorable grassland carbon sequestration:

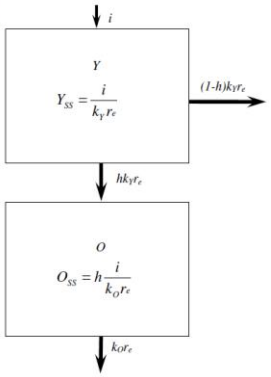
2.1 tC * ha^{-1} * yr^{-1}

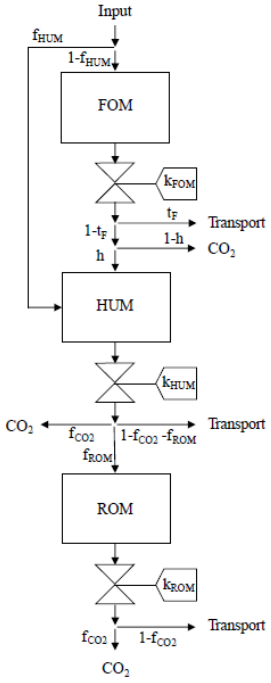
Accounting of Carbon Stock Change: Annex I Countries: Other Methods

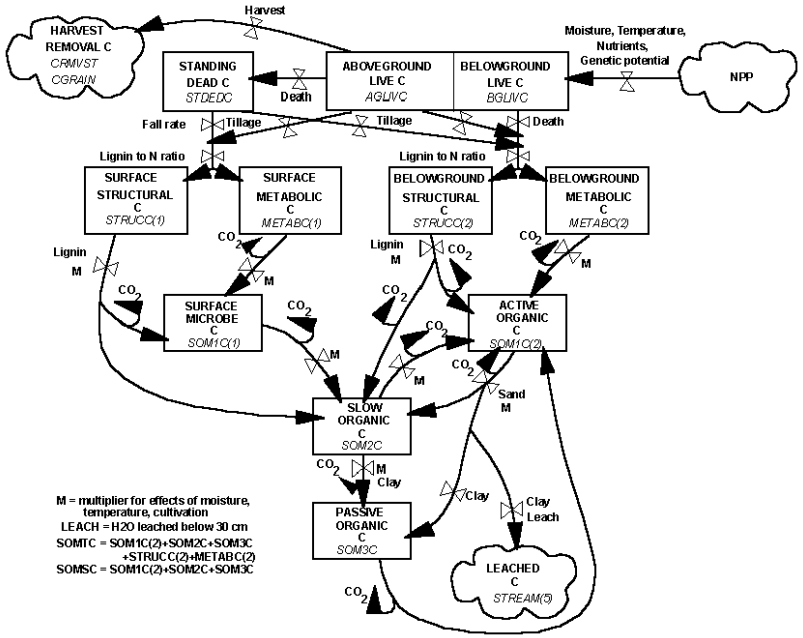
EQUATION 3.3.3
ANNUAL CHANGE IN CARBON STOCKS IN MINERAL SOILS FOR A SINGLE CROPLAND SYSTEM

$$\Delta C_{CC_{Mineral}} = [(SOC_0 - SOC_{(0-T)}) \bullet A] / T$$

$$SOC = SOC_{REF} \bullet F_{LU} \bullet F_{MG} \bullet F_I$$

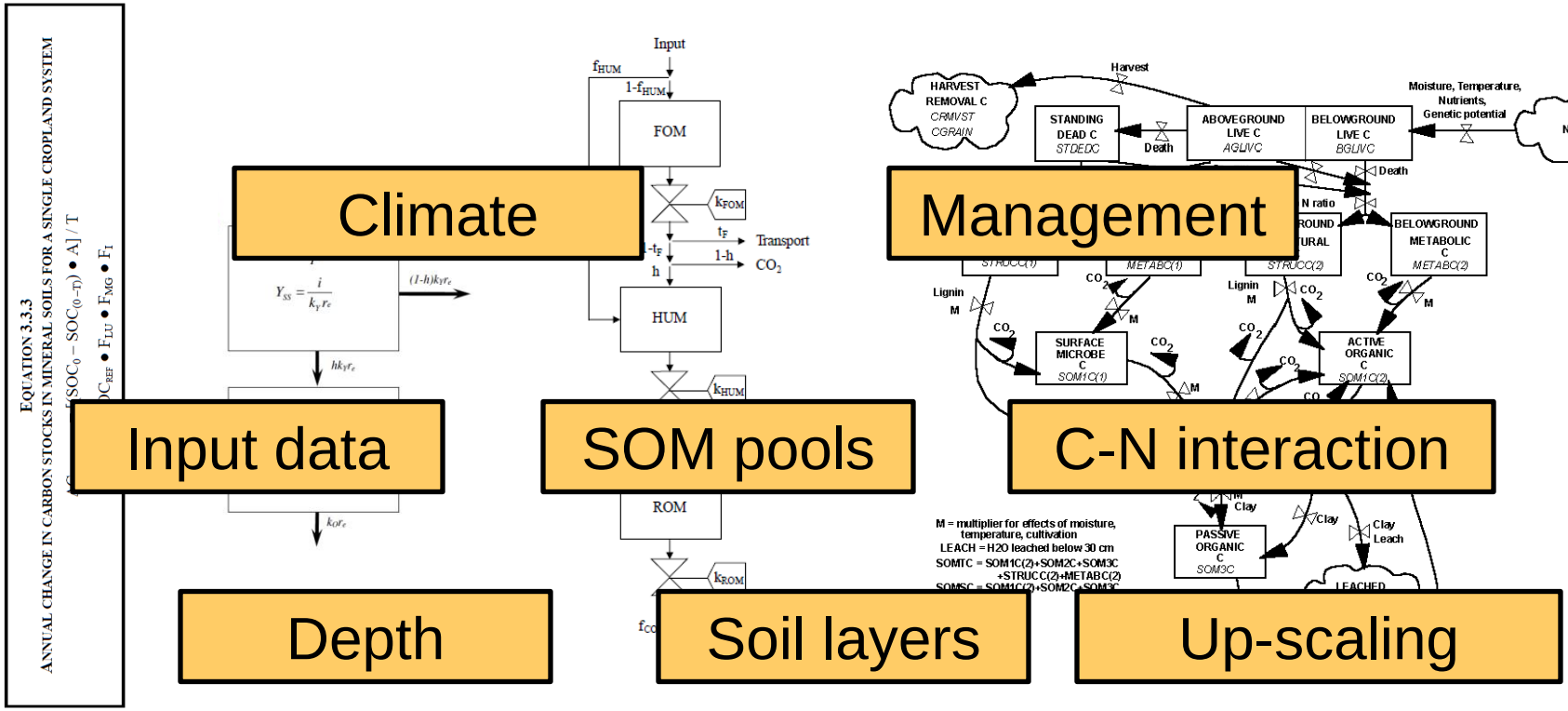






IPCC Tier1 ICBM Sweden C-Tool Denmark Century USA

Accounting of Carbon Stock Change: Annex I Countries: Other Methods



IPCC Tier1 ICBM Sweden C-Tool Denmark Century USA

Accounting of Carbon Stock Changes: Tools & Models

Table 3.3 Agricultural Activities and Their Associated Quantification Tools

Agricultural Activity	Tool
Soil Management	AOS Tillage APEX Australian Farm GAS Carbon Trust CASA Express or CASA CQUEST CCX -- Agricultural Best Management Practices CLA CALM COMET-VR/ -FARM Cool Farm Tool DAYCENT/ CENTURY DNDC/ DNDC NUGGET FAO Carbon ExACT Holos RothC VCS Grassland Management

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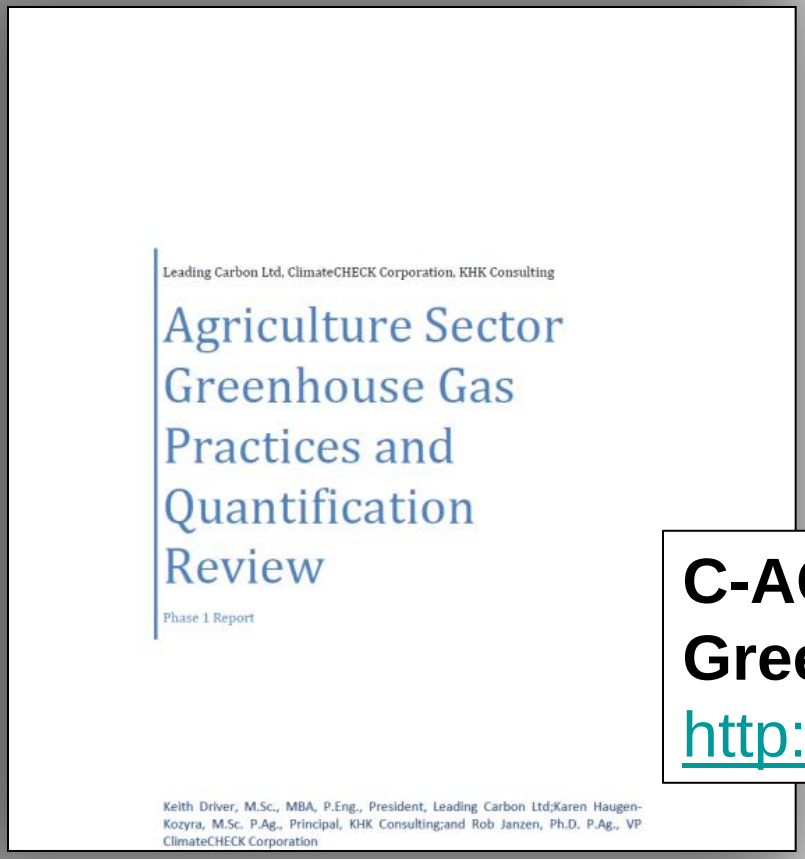
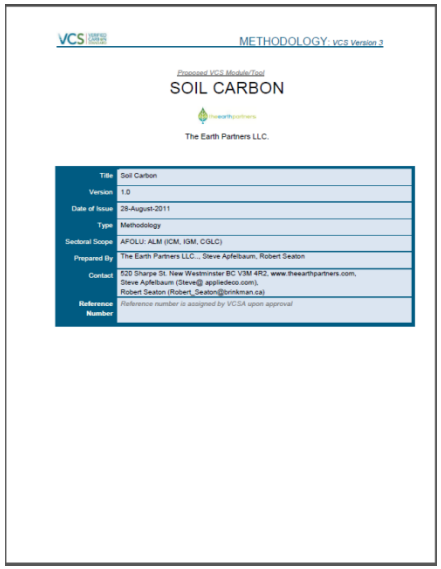
Accounting of Carbon Stock Changes: Tools & Models



C-AGG: Coalition on Agricultural Greenhouse Gases
http://www.c-agg.org/index.html

Source: Driver et al. (2010)

Accounting of Carbon Stock Changes:
Emission Trading System – Voluntary Carbon Market


VCS METHODOLOGY VCS Version 3

Proposed VCS Module/Tool

SOIL CARBON

The Earth Partners LLC.

Title	Soil Carbon
Version	1.0
Date of Issue	26-August-2011
Type	Methodology
Sectoral Scope	AFOLU: ALM (IGM, IGM, CGLC)
Prepared By	The Earth Partners LLC.,, Steve Apfelbaum, Robert Seaton
Contact	520 Sharpe St. New Westminster BC V3M 4R2, www.theearthpartners.com, Steve Apfelbaum (Steve@ appliedeco.com), Robert Seaton (Robert_Seaton@brinkman.ca)
Reference Number	Reference number is assigned by VCSA upon approval


VCS METHODOLOGY VCS Version 3

METHODOLOGY TITLE

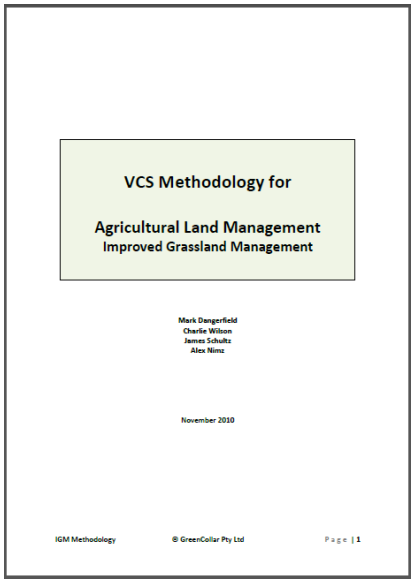
Title	Methodology for Sustainable Grassland Management (SGM)
Version	Version 01
Date of Issue	20-06-2011
Type	Methodology
Sectoral Scope	Sectoral scope: 14. Agriculture, Forestry, Land Use Specific project type: Agricultural Land Management (ALM)
Prepared By	Yue Li & Hongmin Dong, Institute of Environment and Sustainable Development in Agriculture, CAAS Timm Tennigkeit, UNIQUE Andreas Wilkes, World Agroforestry Center China & East Asia Node Shiping Wang, Northwest Institute of Plateau Biology, CAS Benjamin Henderson and Pierre Gerber, Animal Production and Health Division, Leslie Lipper, Agricultural Development Economics Division, Food and Agricultural Organization of the United Nations.
Contact	12 Zhongguancun South Street, Haidian District, Beijing, 100081 0086-10-82105615 ysli@ami.ac.cn
Reference Number	

Relationship to Approved or Pending Methodologies

There is no similar Methodology approved under the VCS Program.

There are three related methodologies are under development: "ALM Adoption of Sustainable Grassland Management through Adjustment of Fire and Grazing"; "Agricultural Land Management – Improved Grassland Management"; and "Adoption of Sustainable Agricultural Land Management (SALM)". The first of these is applicable only to projects where land is potentially subject to burning and wildfires, and, where the use of cultivation and fertilizer for improved grassland management are unallowable activities. The second methodology includes some applicability conditions, such as "a yedi organic carbon model applicable to the project area", and "increase the proportion of perennial species above the baseline scenario" which may restrict is applicability to potential grassland management activities. The second

v3.0 1

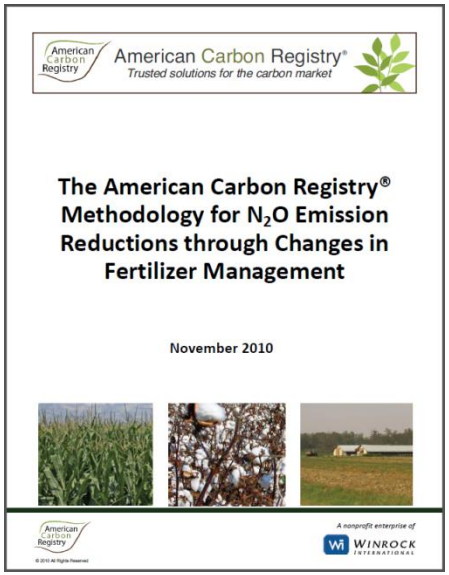

VCS Methodology for

Agricultural Land Management
Improved Grassland Management

Mark Dangerfield
Charlie Wilson
James Schultz
Alex Nimz

November 2010

IGM Methodology © GreenCollar Pty Ltd Page | 1


American Carbon Registry®
Trusted solutions for the carbon market

The American Carbon Registry® Methodology for N_2O Emission Reductions through Changes in Fertilizer Management

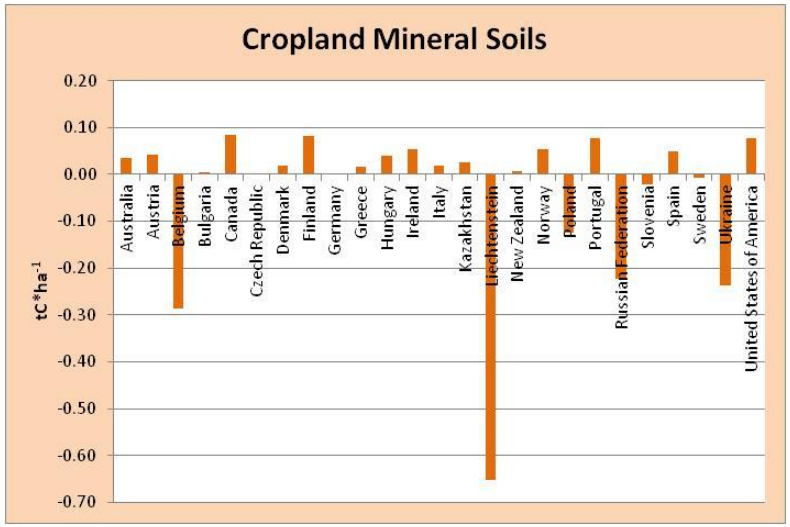
November 2010

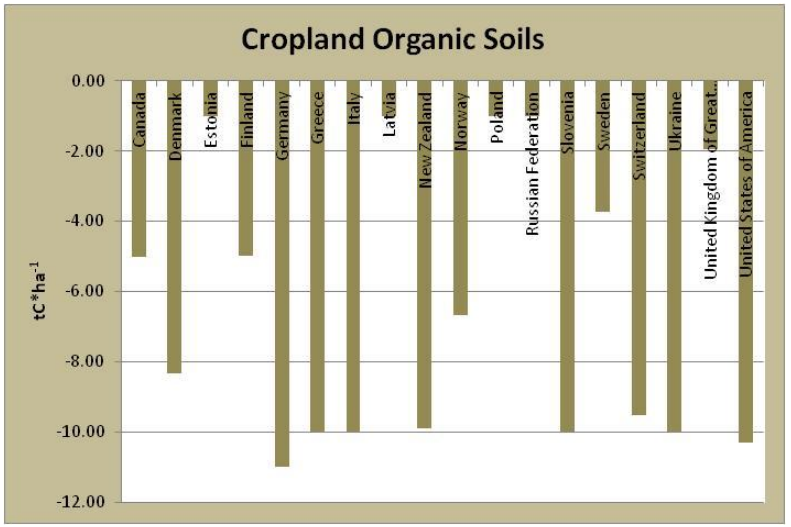
A nonprofit enterprise of WINROCK INTERNATIONAL

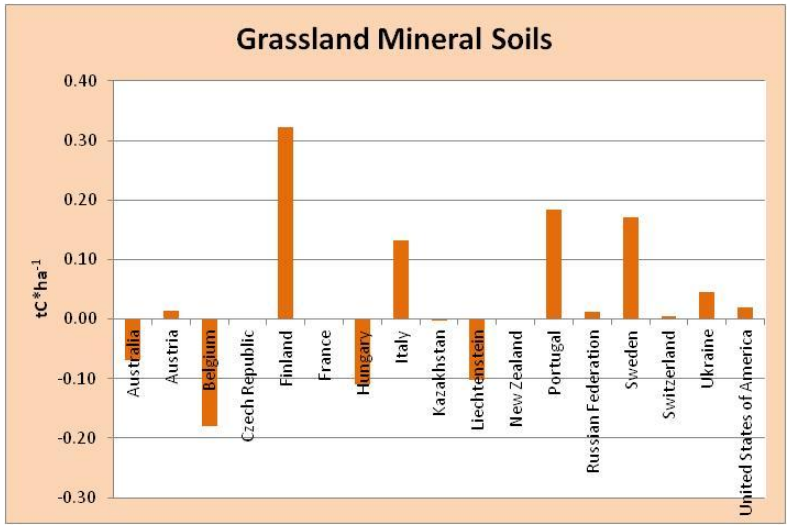
http://www.v-c-s.org/

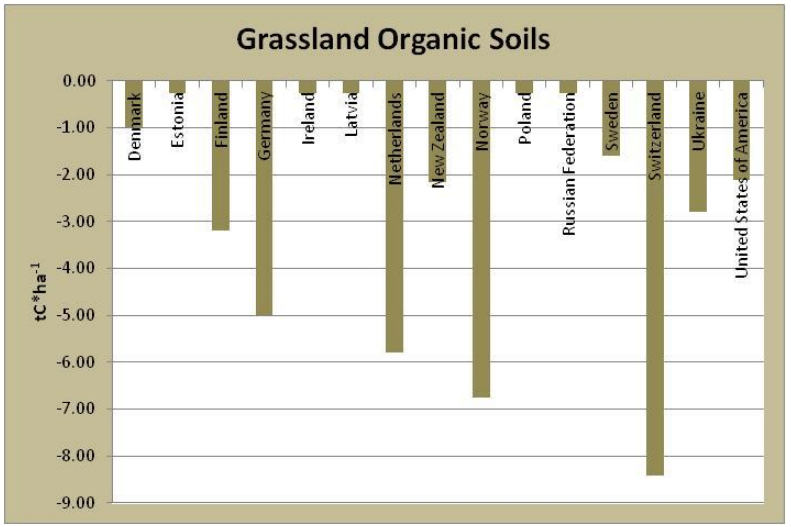
http://www.americancarbonregistry.org/

Accounting of Carbon Stock Change: Annex I Countries: CSC 2009: $tC*ha^{-1}*yr^{-1}$









Content

1. Introduction
2. Agricultural GHG-emissions in Switzerland
3. Methodology
4. Accounting of carbon stocks and CSC
5. Uncertainty and related implications
6. Reflections on Mitigation

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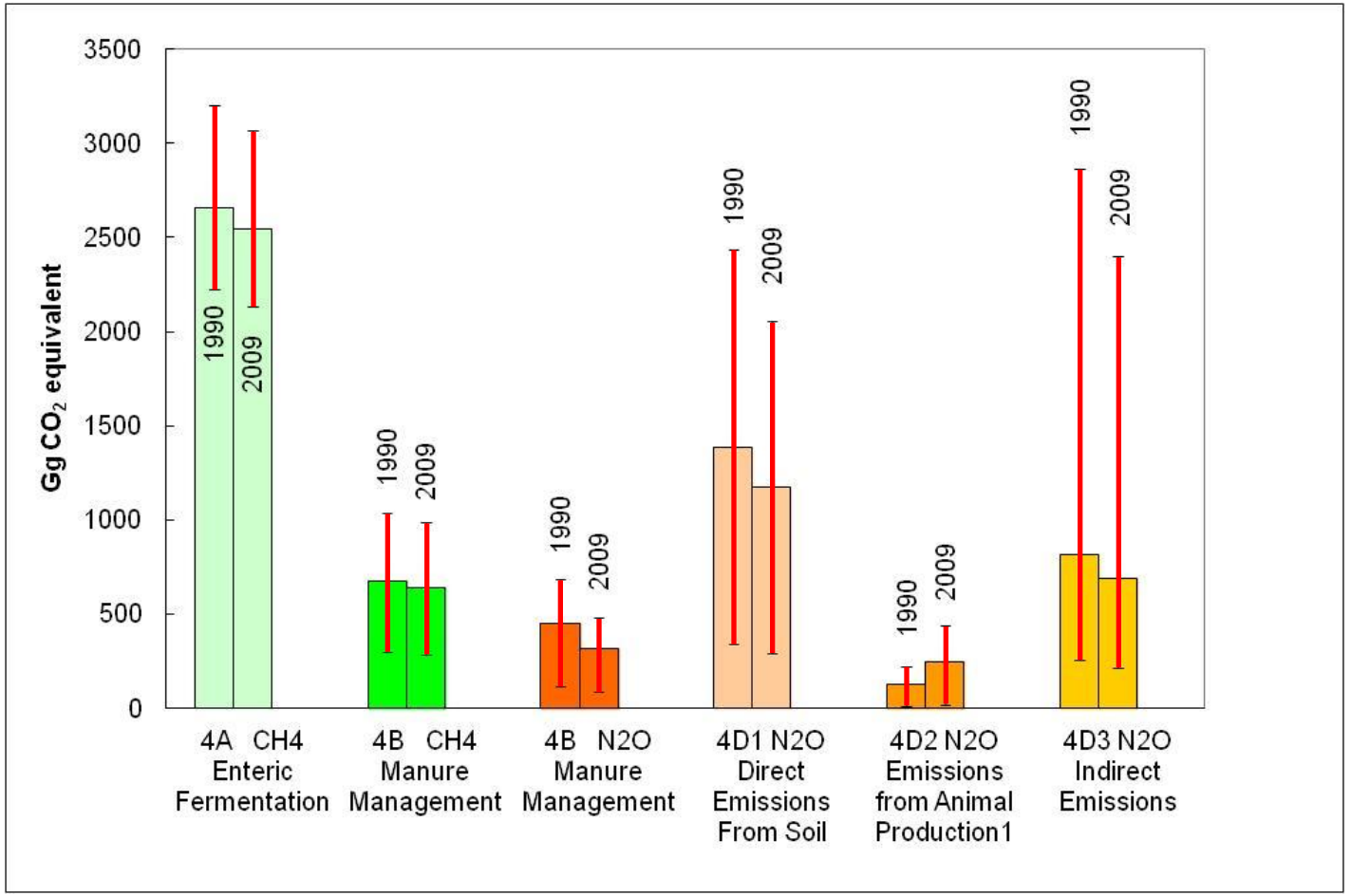
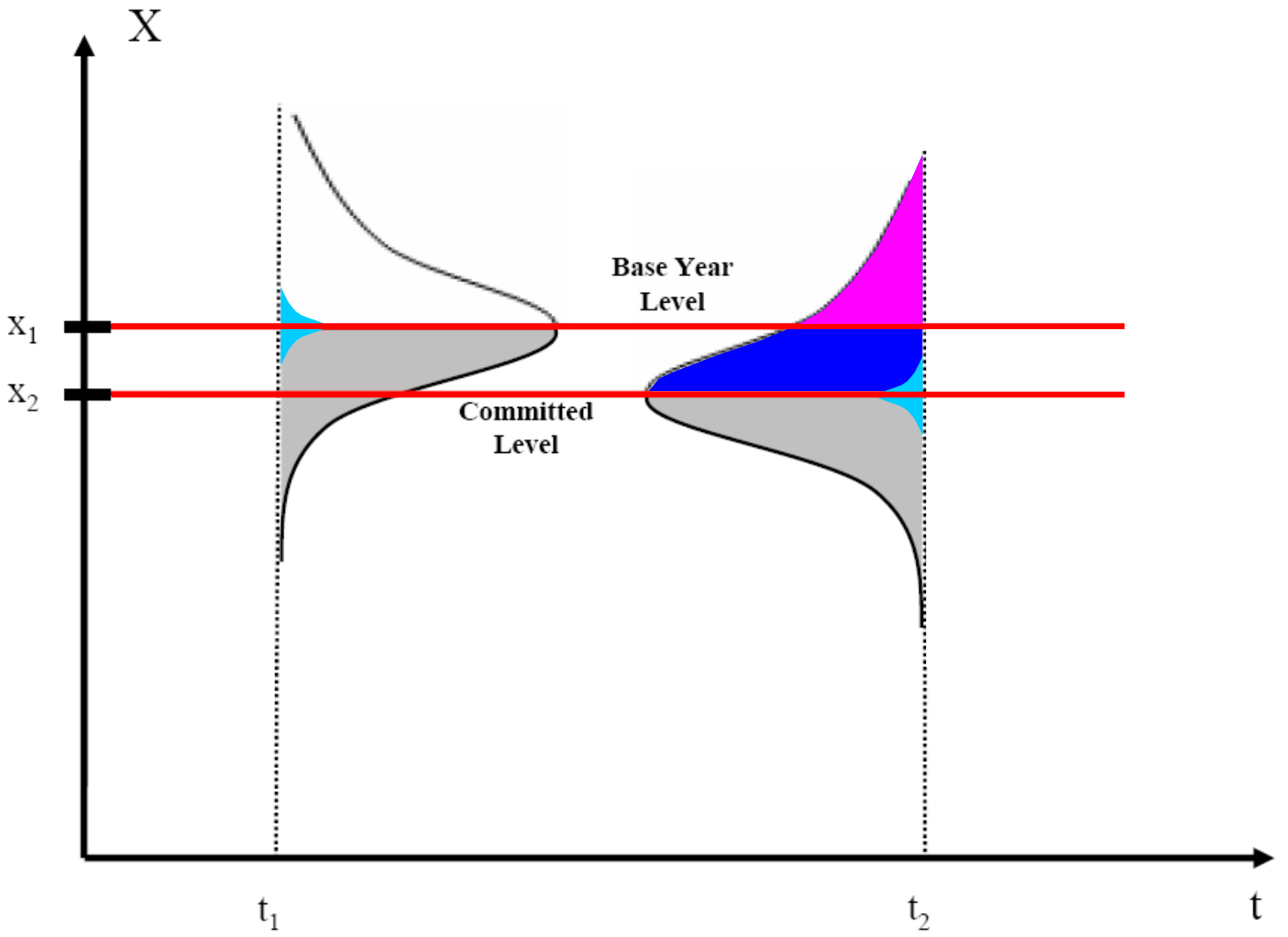
Agricultural Greenhouse Gas Emissions in Switzerland 1990 vs. 2009



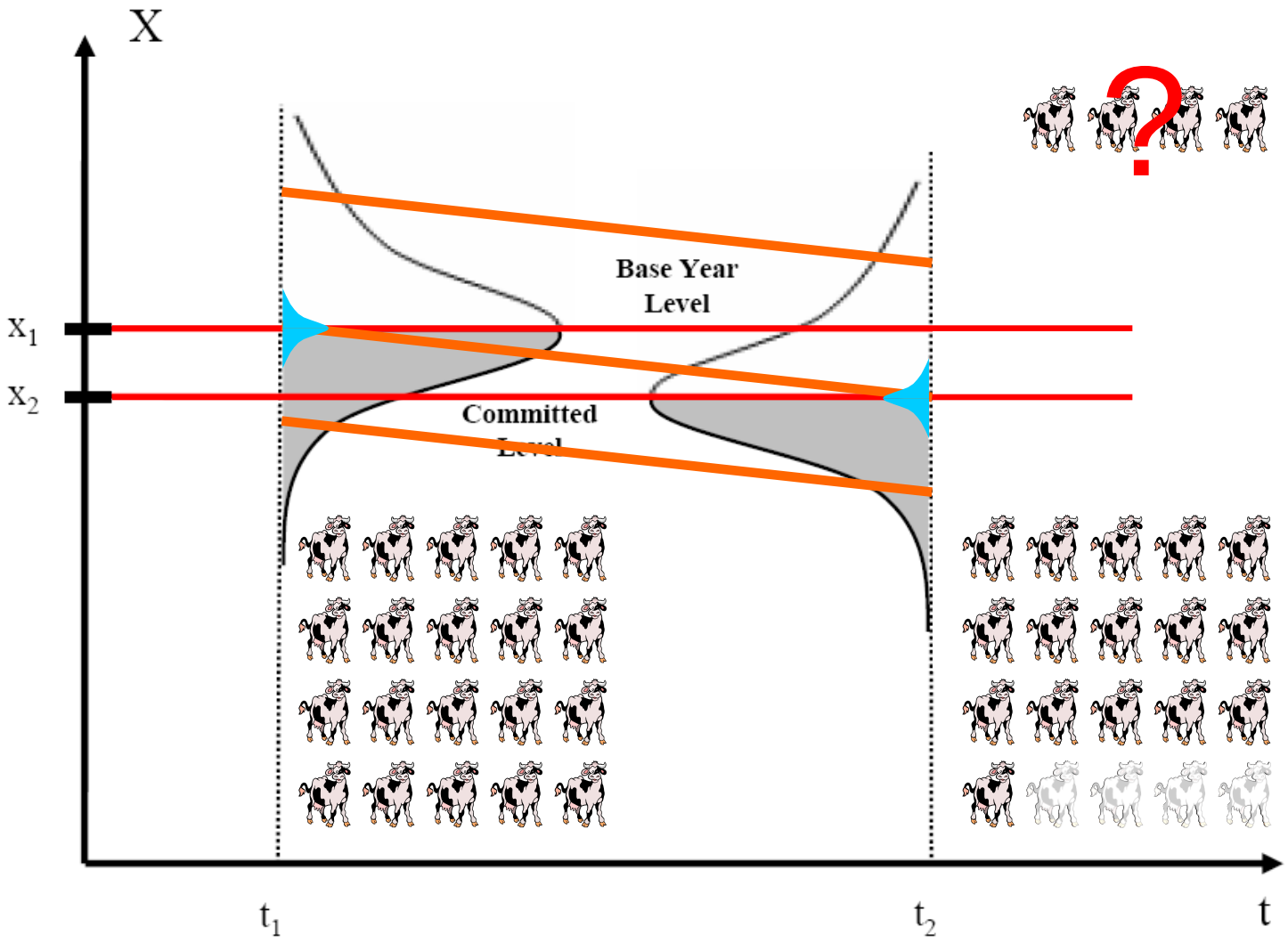
Error bars correspond to the 95% confidence interval

Compliance and Confidence: Uncertainties



Source: Jonas and Nilsson (2007) modified

Compliance and Confidence: Uncertainties



Source: Jonas and Nilsson (2007) modified

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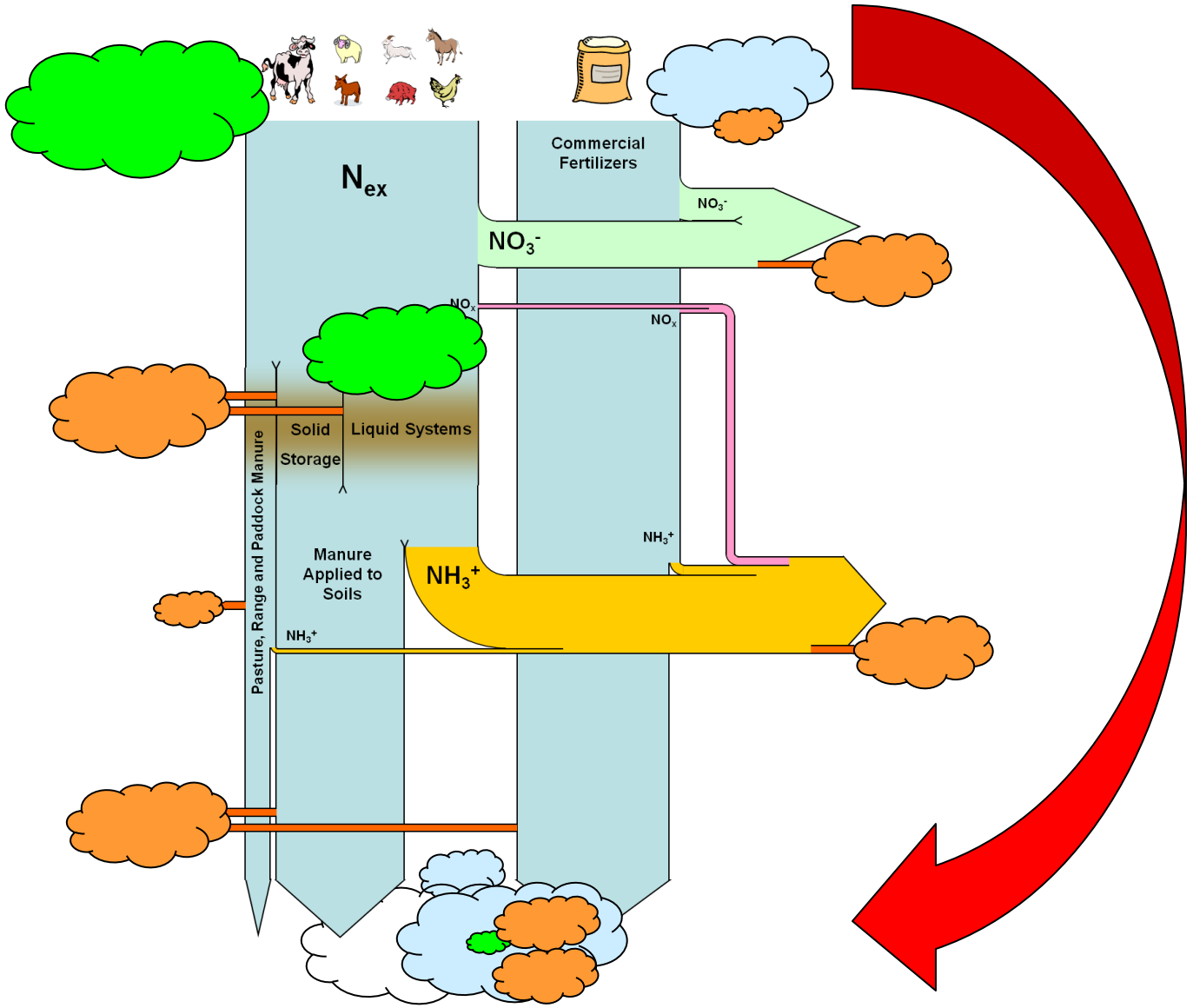
Agroscope

Mitigation Strategies in Agriculture



Mitigation Strategies in Agriculture

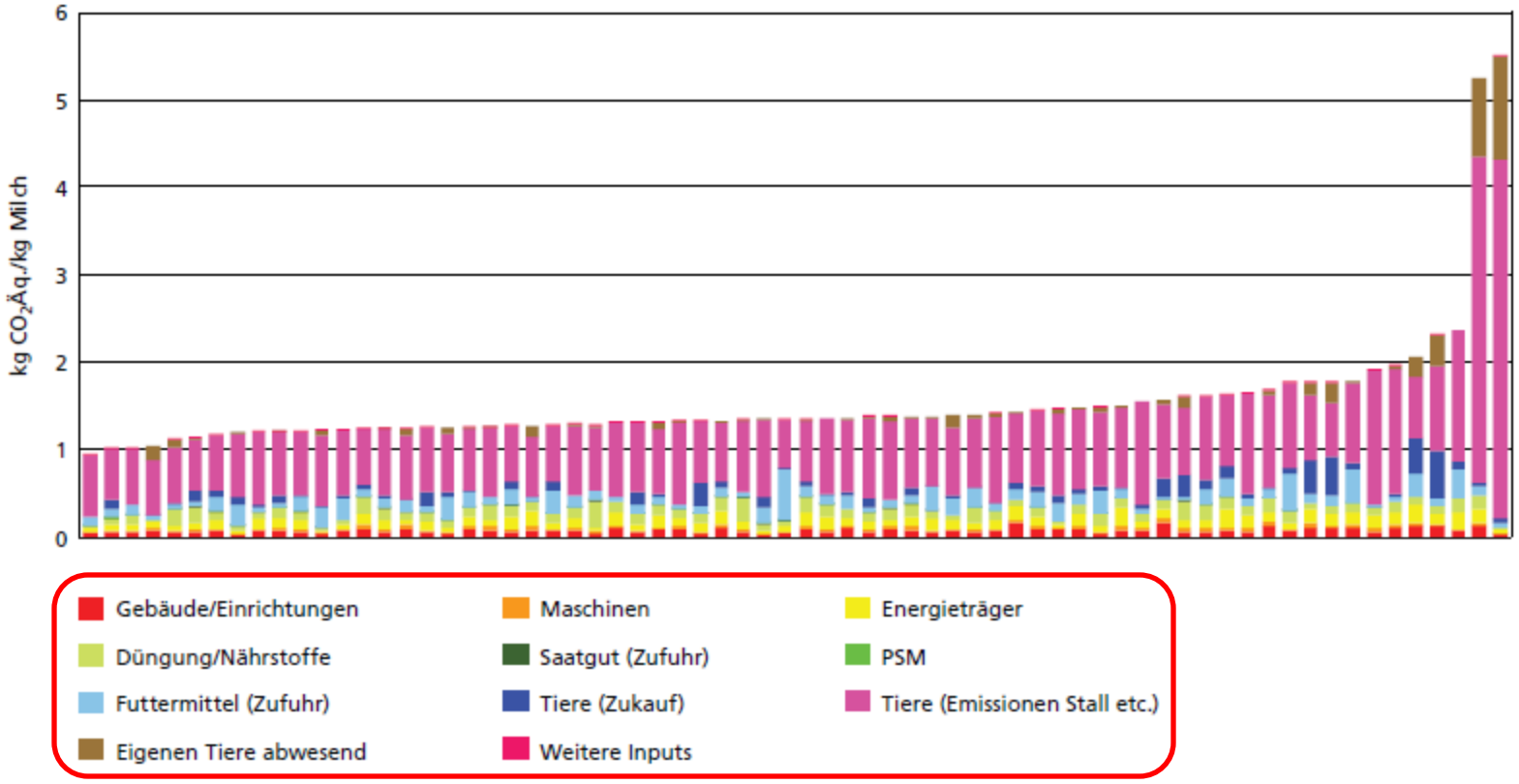


Abbildung 28: Treibhauspotenzial pro kg Milch der 68 Betriebe der reduzierten Stichprobe, aufgeteilt nach Inputgruppen.

Source: Hersener et al. (2011)

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Mitigation Strategies in Agriculture

- Baseline Method
  - IPCC default
  - National inventories
  - MRV-Guidelines
- Integrative approach (source and sink interactions)
- Pollution swapping (GHG, other polluting agents)
- System boundaries
  - food chain approach
  - grey (precursor) GHG emissions
  - post farm gate emissions
  - LULUCF
  - landscape approach
- Leakage (displacement of activities)
- Output based approach
- Permanence
- Reliability (how to deal with uncertainties?)

Thank you!

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Agroscope

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