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Forschungsanstalt Agroscope Reckenholz-Tänikon ART

# **Environmental effects of Swiss milk production – an analysis from the project LCA-FADN**

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# Background

- Data from the project LCA-FADN (2004-2011)
- Financed by FOAG
- Aim: Evaluation of the environmental impacts of Swiss farms
- Data collection over three years (2006-2008) on 100 farms
- Data collected on farm level, allocation to 14 product groups
- LCA calculation for the whole farm and for each product group

**=> Results for the product group „MILK“**



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**Agroscope Reckenholz-Tänikon**  
**ART**



**Ökobilanzierungsstelle ÖBS**

*TSM Treuhand GmbH, Bern  
& ArGe Natur und Landschaft, Hergiswil*



# Overview of the data set

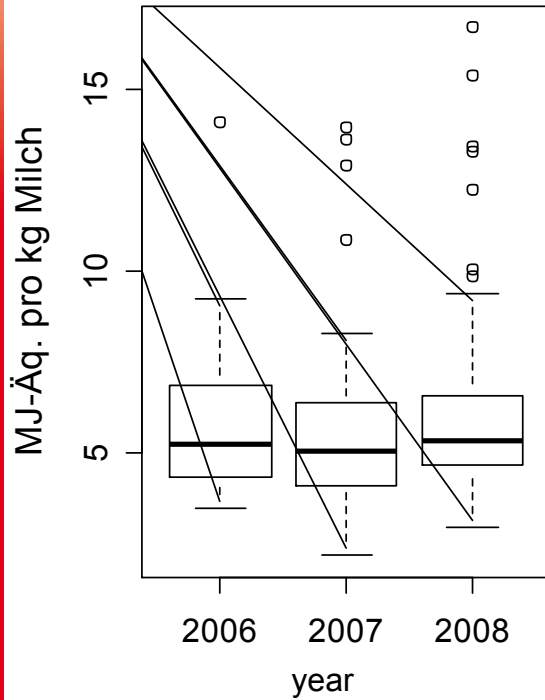
=> All milk producing farms from the projects LCA-FADN

	2006	2007	2008
Number of farms	36	74	69
Usable Agricultural Area (UAA; ha)	24	25	25
Number of dairy cows	21	19	20
Milk yield per cow (kg/year)	6800	6600	6800
Amount of milk sold (kg/year)	133'000	115'000	120'000



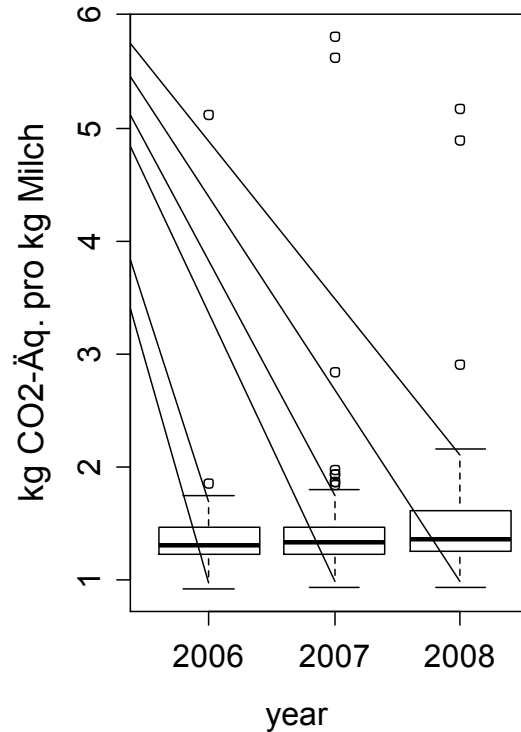
# Overview results (I)

### Energy demand per kg milk



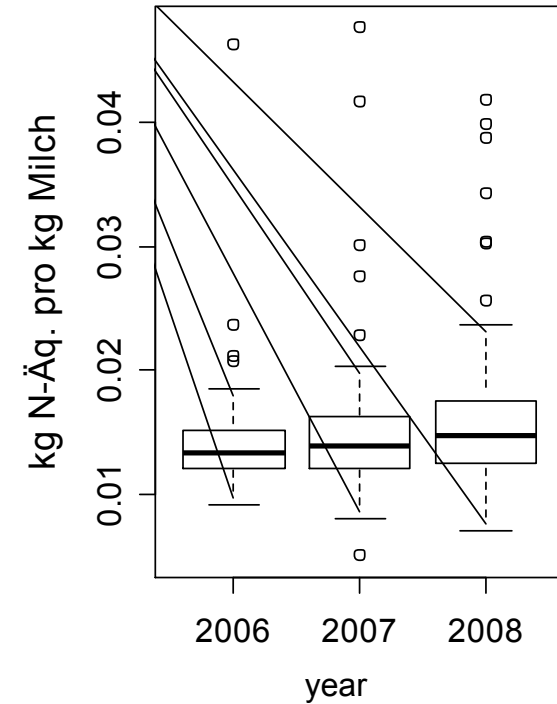
5.24 5.05 5.33  
MJ-eq./kg milk

### GWP per kg milk



1.31 1.33 1.36  
kg CO<sub>2</sub>-eq./kg milk

### Eutrophication per kg milk

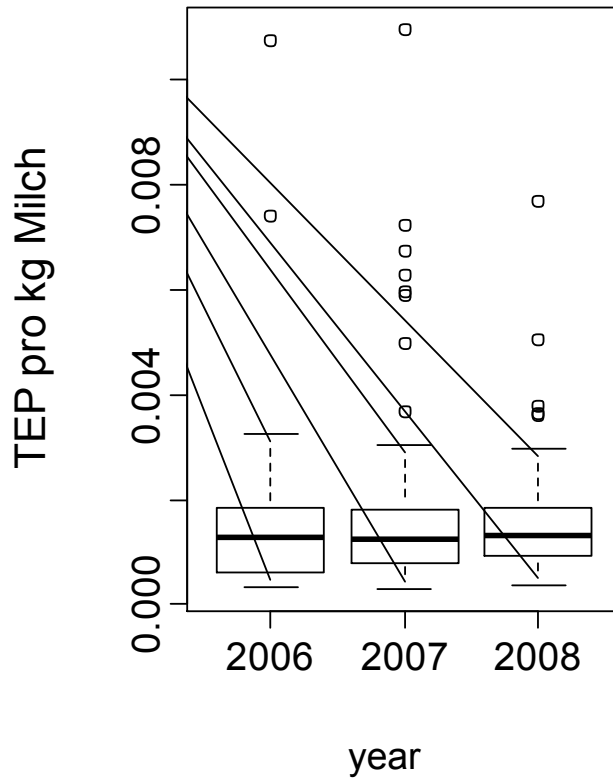


13.4 14.0 14.8  
g N-eq./kg milk



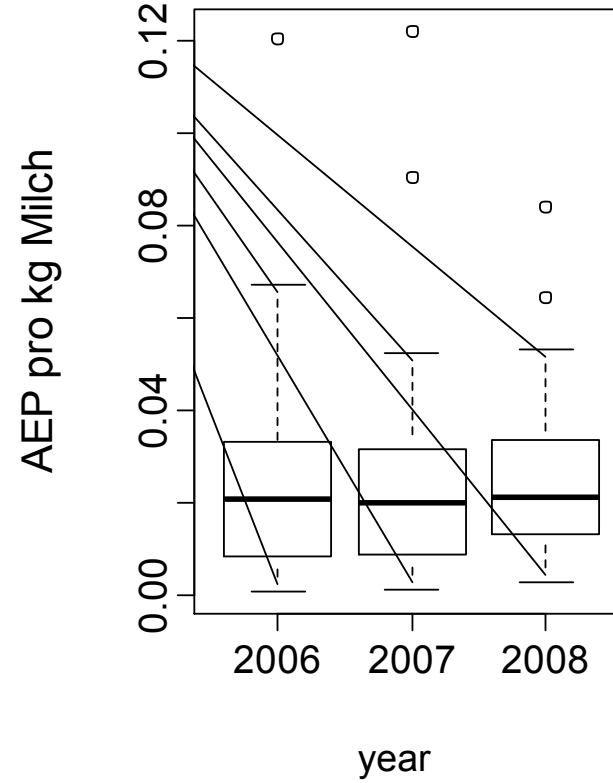
# Overview results (II)

Terr. Ecotoxicity CML per kg milk



0.0013 0.0013 0.0013  
TEP/kg milk

Aq. Ecotoxicity CML per kg milk

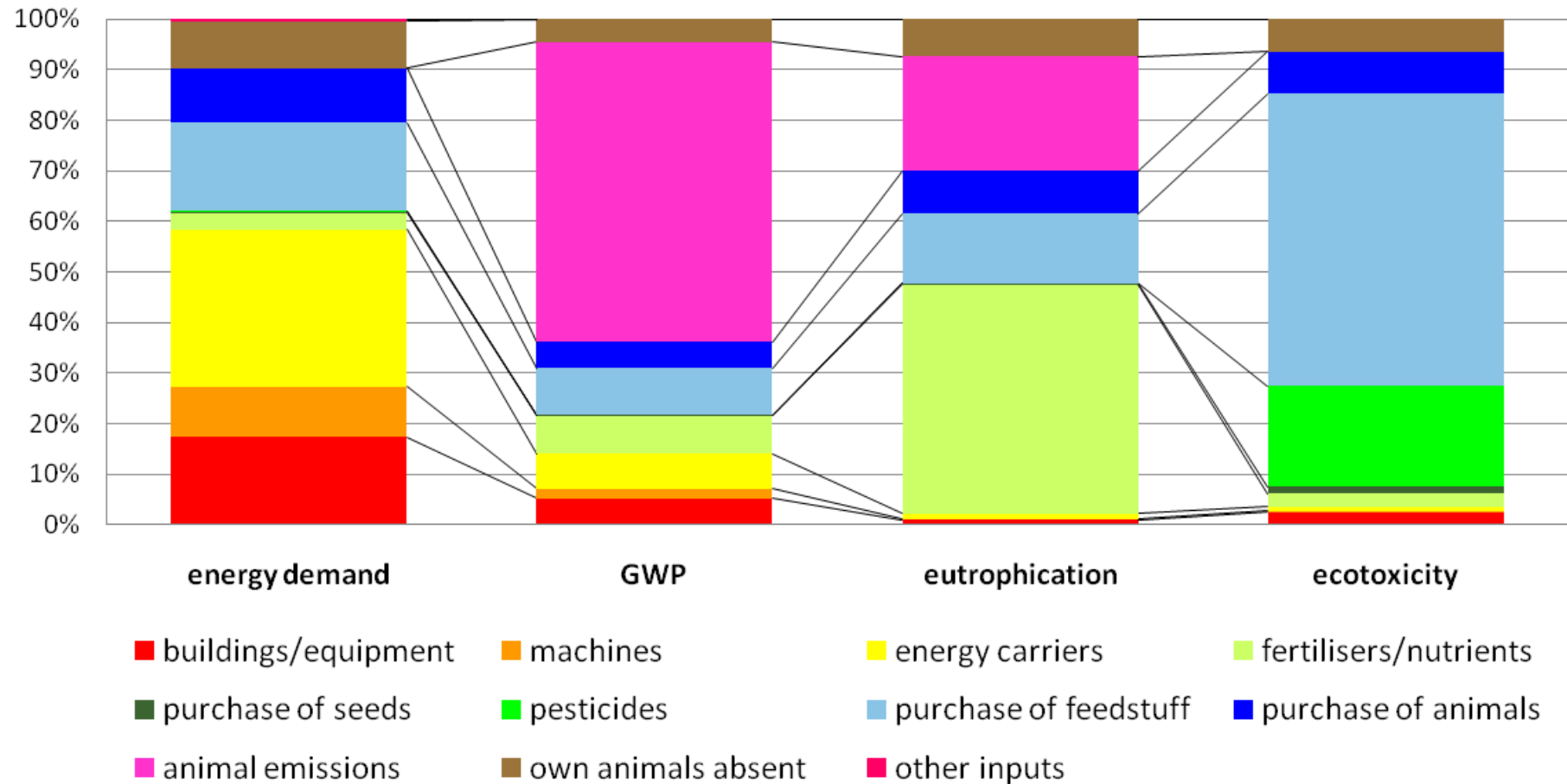


0.020 0.020 0.021  
AEP/kg milk



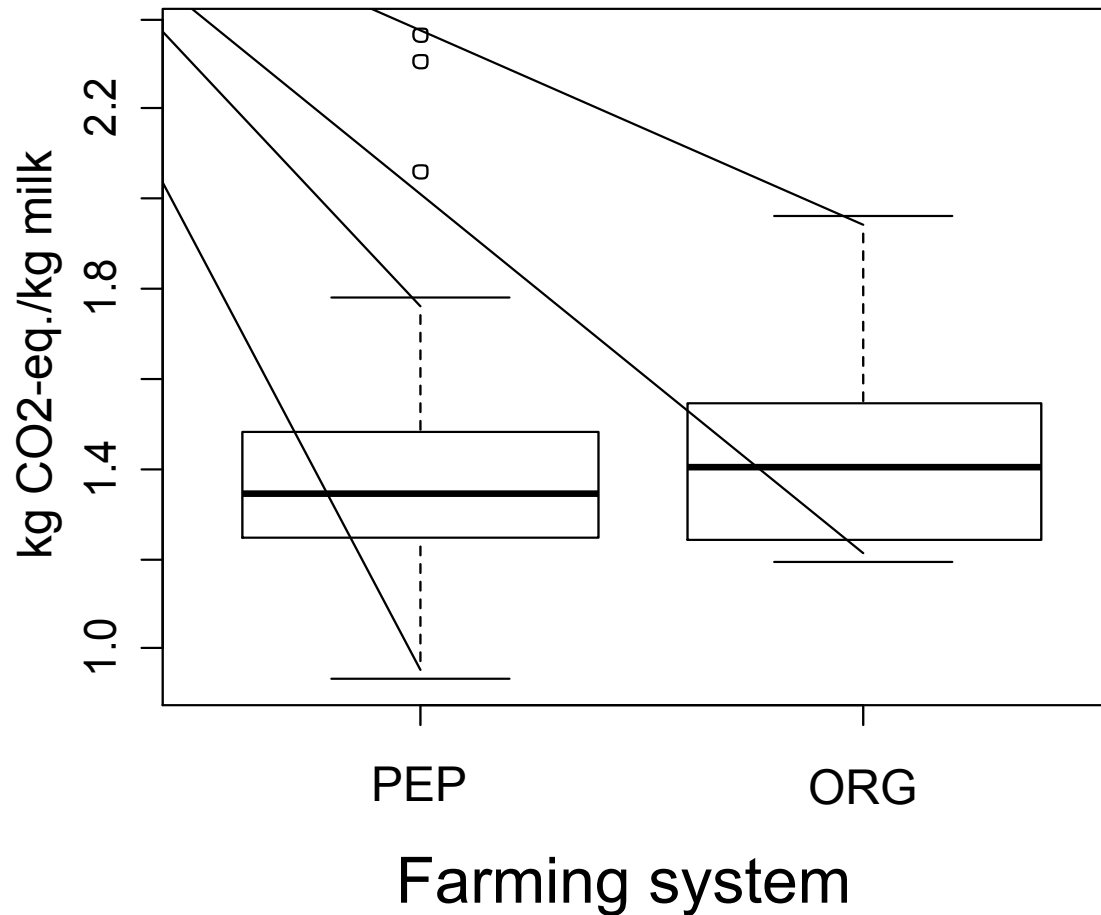
# Important input groups

Share of the input groups in the environmental effects per kg milk



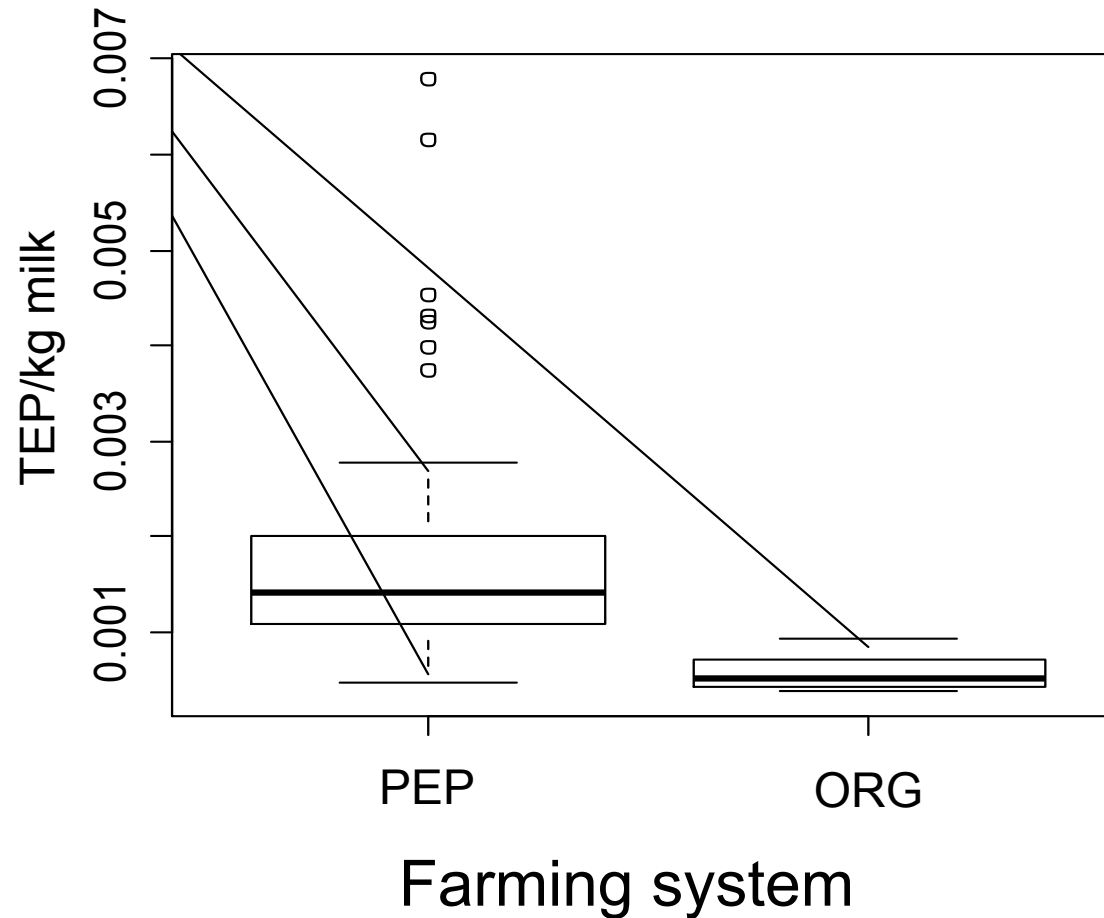


# Comparison PEP - organic milk GWP after farming system





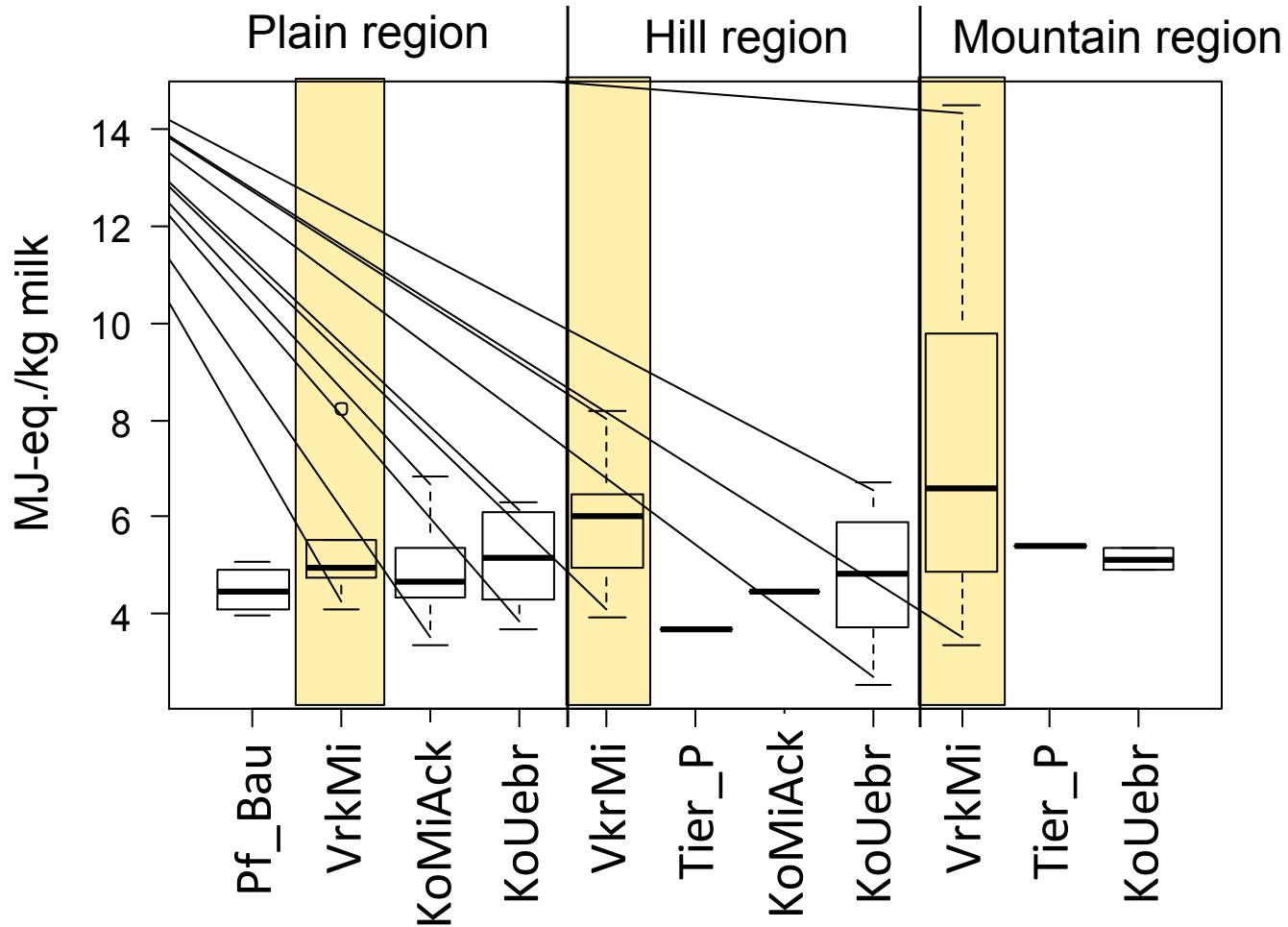
# Comparison PEP - organic milk Terr. ecotoxicity CML after farming system







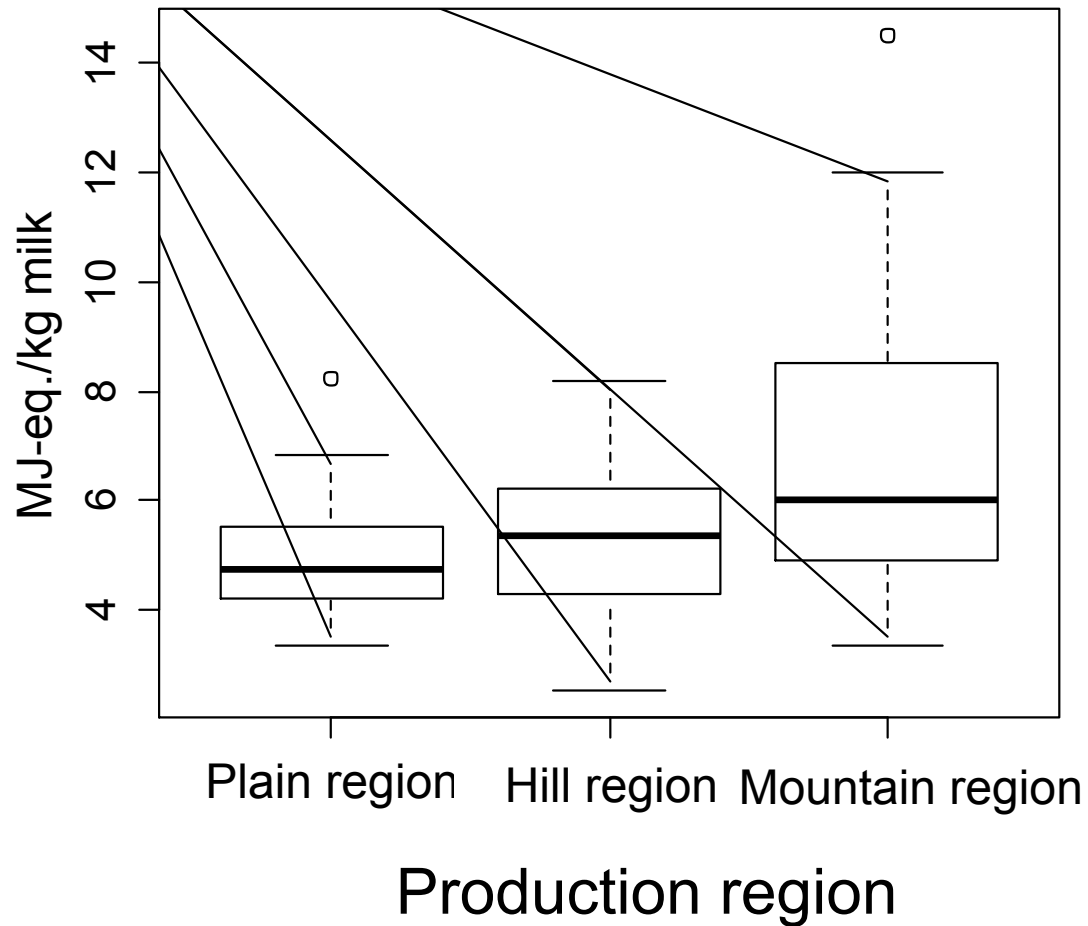
# Comparison farm-types per region Energy demand per kg milk





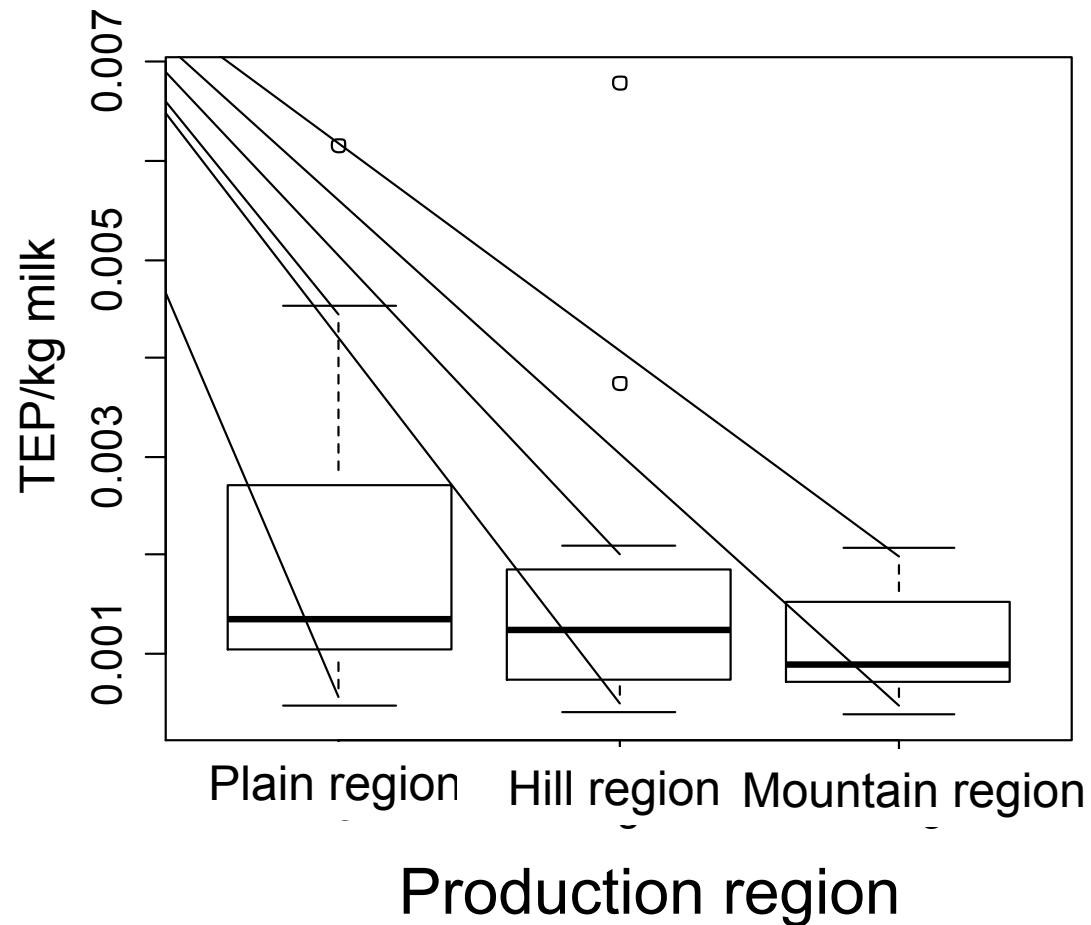
# Comparison of production regions

## Energy demand per kg milk



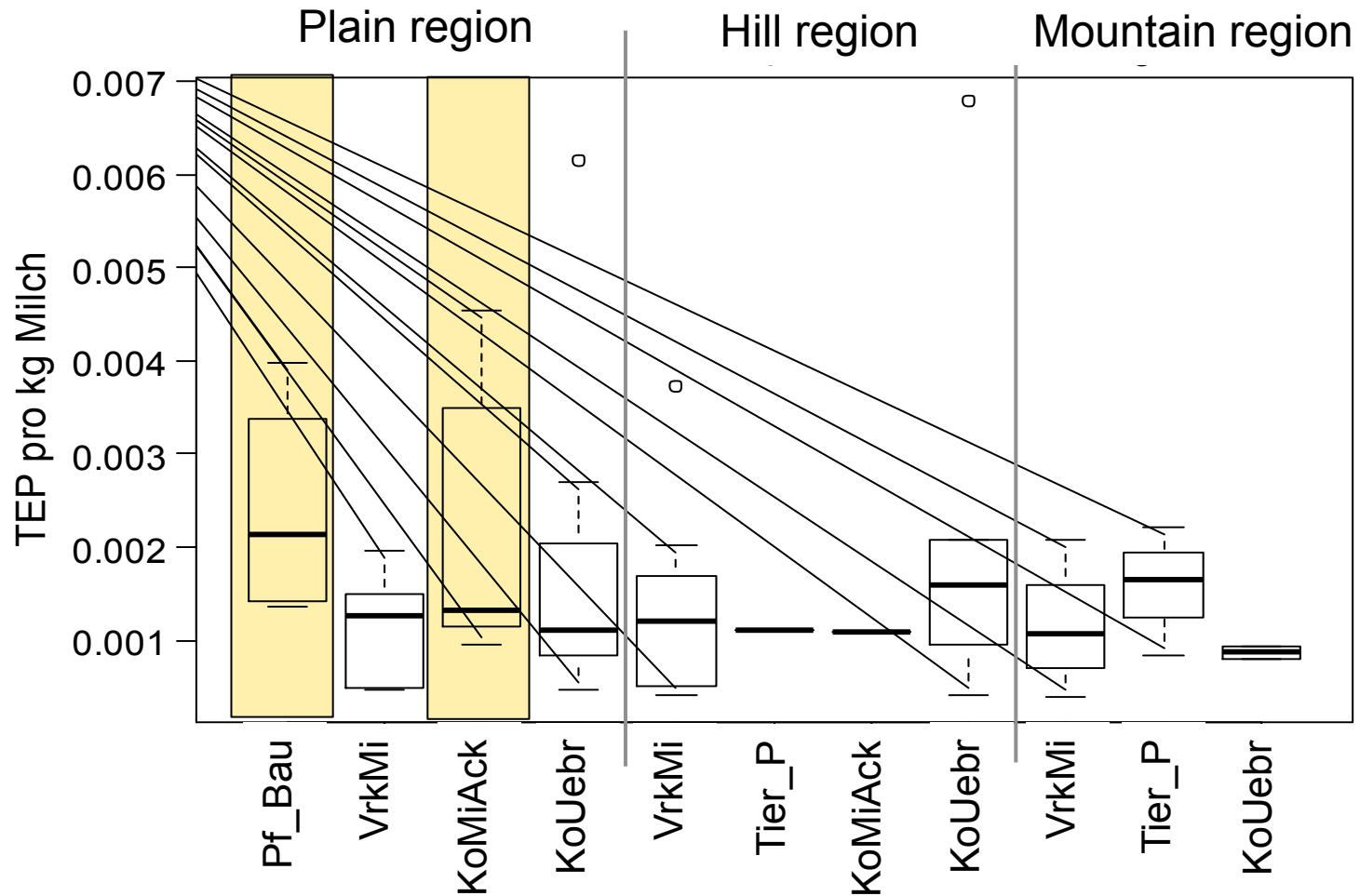


# Comparison of production regions Terr. Ecotoxicity CML per kg milk





# Comparison farm-types per region Terr. Ecotoxicity CML per kg milk





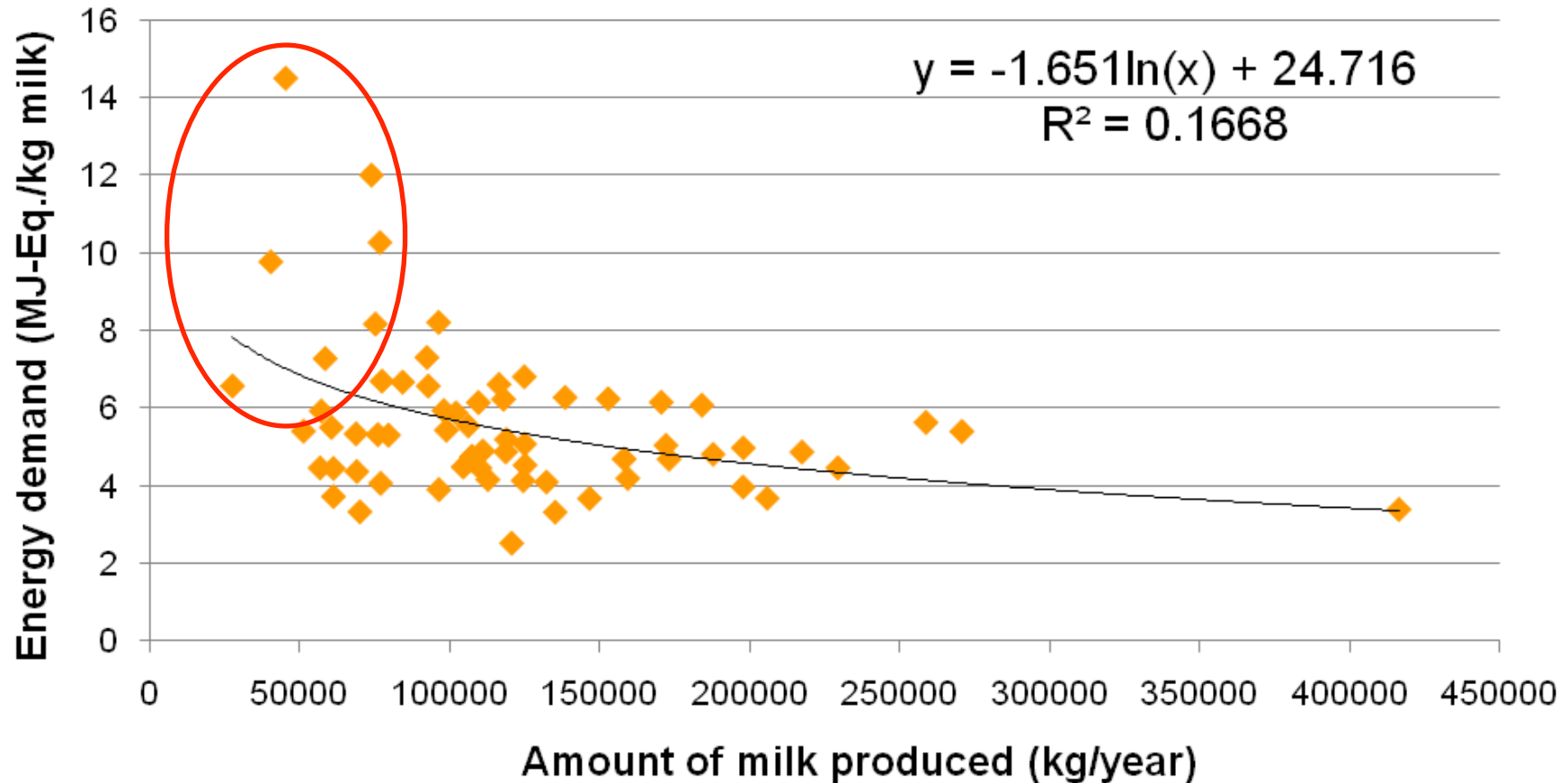
# Summary (I)

- **Big variability** in the environmental impacts of 1kg milk
- **Organic milk** has a significantly **lower ecotoxicity** compared to PEP-milk
- **Use of pesticides** in fodder production **varies highly** and can lead to high ecotoxicity (plain region)
- Farms in the **mountain region** have a **higher energy demand** and **global warming potential** per kg milk than farms in the plain region



# Relationship with amount of milk sold

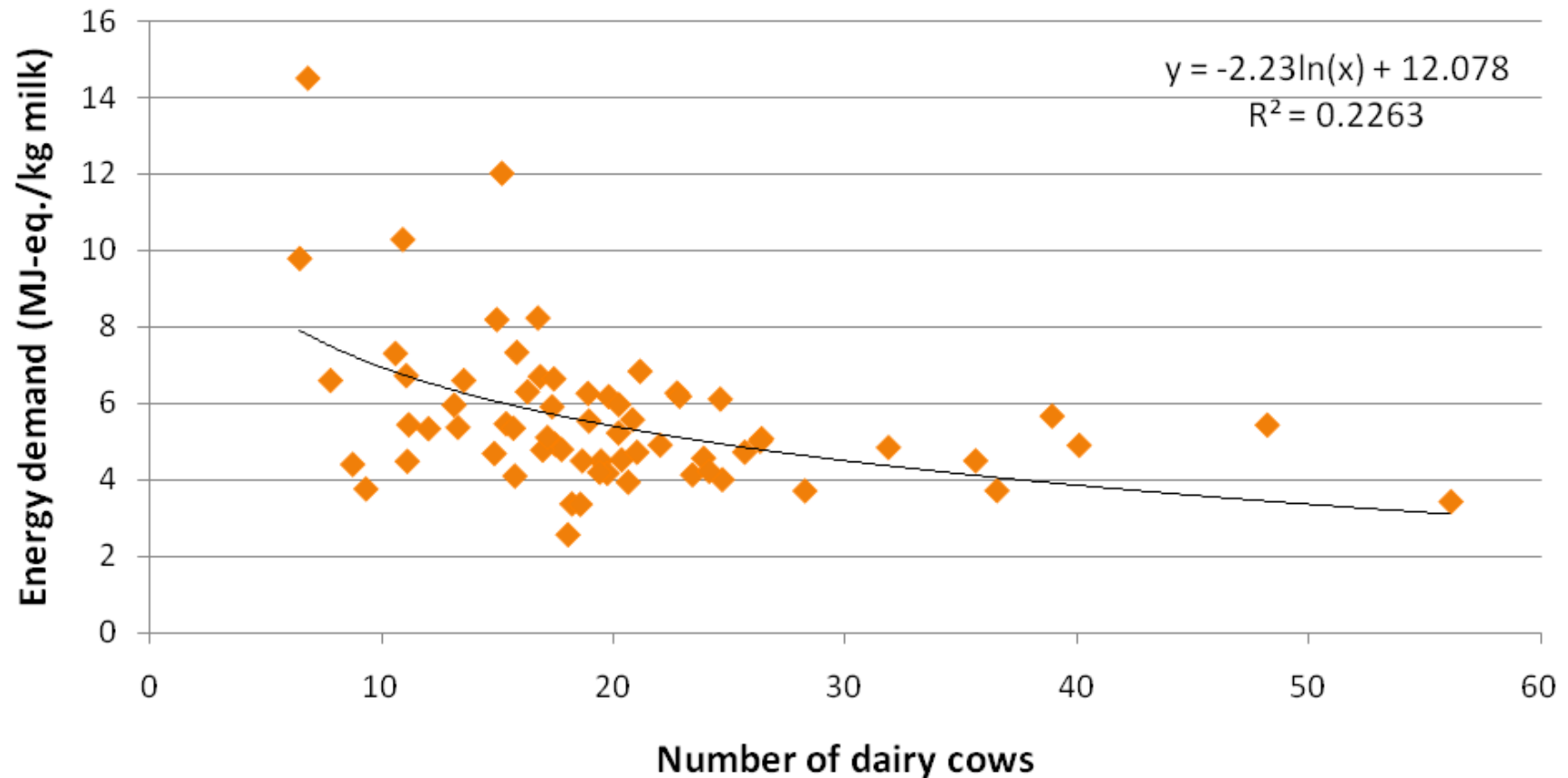
## Energy demand vs. amount of milk produced





# Relationship with number of cows

## Energy demand vs. number of dairy cows





# Analysis Energy Demand

- 2 tendencies:

- **Small farms** (few cows, small amount of milk sold) tend to have a higher energy demand per kg milk

- **Farms in the mountain region** tend to have a higher energy demand per kg milk

- ⇒ There are more small farms in the mountain region than in the plain region

- ⇒ Regression analysis: Only **production region** has a significant influence on the energy demand per kg milk ( $p=0.02$ ) -> environmental conditions in the mountain area matter

- ⇒ BUT: **Variability within a production region** is **higher than the variability between regions** -> it is possible to have a low energy demand per kg milk even in the mountain region!





## Summary (II)

- Big variability in the environmental impacts of 1kg milk
- Organic milk has a significantly lower ecotoxicity compared to PEP-milk
- Use of pesticides in fodder production varies highly and can lead to high ecotoxicity (plain region)
- Farms in the **mountain region** have a **higher energy demand** and **global warming potential** per kg milk than farms in the plain region
- **Small milk producers** tend to have a **higher energy demand** and **global warming potential** per kg milk than big milk producers
- **STILL: Variability** within mountain region / small farms is very high and can **only partly be explained by the altitude / size of a farm**



# Results over different environmental impacts

Agroscope

	ED	GWP	Eutr	A_ETox	T_ETox
⇒	2.942	1.660	0.934	0.008	0.013
⇒	3.340	1.660	0.934	0.011	0.016
⇒	3.389	1.547	0.915	0.015	0.005
⇒	3.499	1.169	0.916	0.016	0.031
⇒	3.692	1.346	0.913	0.013	0.011
⇒	3.697	1.229	0.912	0.012	0.008
⇒	3.742	1.186	0.911	0.011	0.033
⇒	3.921	1.411	0.911	0.011	0.008
⇒	3.988	1.008	0.912	0.012	0.041
⇒	4.081	1.310	0.912	0.012	0.010
⇒	4.115	1.196	0.909	0.009	0.004
⇒	4.182	1.241	0.915	0.015	0.003
⇒	4.177	1.342	0.919	0.019	0.060
⇒	4.207	1.291	0.915	0.015	0.031
⇒	4.336	1.043	0.918	0.018	0.016
⇒	4.466	1.361	0.915	0.015	0.016
⇒	4.478	1.301	0.916	0.016	0.021
⇒	4.476	1.198	0.915	0.015	0.002
⇒	4.480	1.203	0.914	0.014	0.014
⇒	4.504	1.370	0.916	0.016	0.025
⇒	4.549	1.373	0.915	0.015	0.033
⇒	4.670	1.286	0.916	0.016	0.038
⇒	4.703	1.138	0.916	0.016	0.032
⇒	4.706	1.238	0.915	0.015	0.016
⇒	4.761	1.247	0.913	0.013	0.014
⇒	4.773	1.263	0.916	0.016	0.037
⇒	4.829	1.285	0.913	0.013	0.017
⇒	4.886	1.353	0.917	0.017	0.027
⇒	4.892	1.301	0.915	0.015	0.003
⇒	4.912	1.223	0.914	0.014	0.006
⇒	4.993	1.162	0.912	0.012	0.021
⇒	5.059	1.202	0.913	0.013	0.009
⇒	5.091	1.278	0.917	0.017	0.023
⇒	5.209	1.400	0.917	0.017	0.025
⇒	5.321	1.294	0.914	0.014	0.018
⇒	5.334	1.607	0.919	0.019	0.027
⇒	5.354	1.473	0.915	0.015	0.009
⇒	5.416	1.489	0.919	0.019	0.044
⇒	5.424	1.634	0.938	0.038	0.012
⇒	5.449	1.310	0.914	0.014	0.024
⇒	5.521	1.381	0.914	0.014	0.002
⇒	5.599	1.478	0.920	0.020	0.021
⇒	5.649	1.329	0.915	0.015	0.024
⇒	5.895	1.374	0.911	0.011	0.023
⇒	5.940	1.670	0.913	0.013	0.024
⇒	5.955	1.787	0.921	0.021	0.039
⇒	6.095	1.266	0.917	0.017	0.019
⇒	6.159	1.443	0.913	0.013	0.016
⇒	6.167	1.230	0.913	0.013	0.026
⇒	6.244	1.379	0.912	0.012	0.032
⇒	6.266	1.349	0.914	0.014	0.023
⇒	6.290	1.347	0.919	0.019	0.103
⇒	6.585	1.272	0.917	0.017	0.009
⇒	6.596	2.098	0.938	0.038	0.024
⇒	6.626	1.391	0.915	0.015	0.003
⇒	6.683	1.597	0.915	0.015	0.003
⇒	6.710	1.331	0.913	0.013	0.034
⇒	6.823	1.606	0.928	0.028	0.033
⇒	7.291	1.578	0.915	0.015	0.008
⇒	7.319	1.416	0.916	0.016	0.004
⇒	8.179	1.788	0.916	0.016	0.037
⇒	8.221	1.622	0.916	0.016	0.038
⇒	8.779	1.788	0.919	0.019	0.027
⇒	10.276	1.763	0.923	0.023	0.039
⇒	11.380	6.485	0.938	0.038	0.039
⇒	12.009	2.304	0.931	0.031	0.044
⇒	13.623	5.254	0.944	0.044	0.046
⇒	14.898	2.061	0.920	0.020	0.030

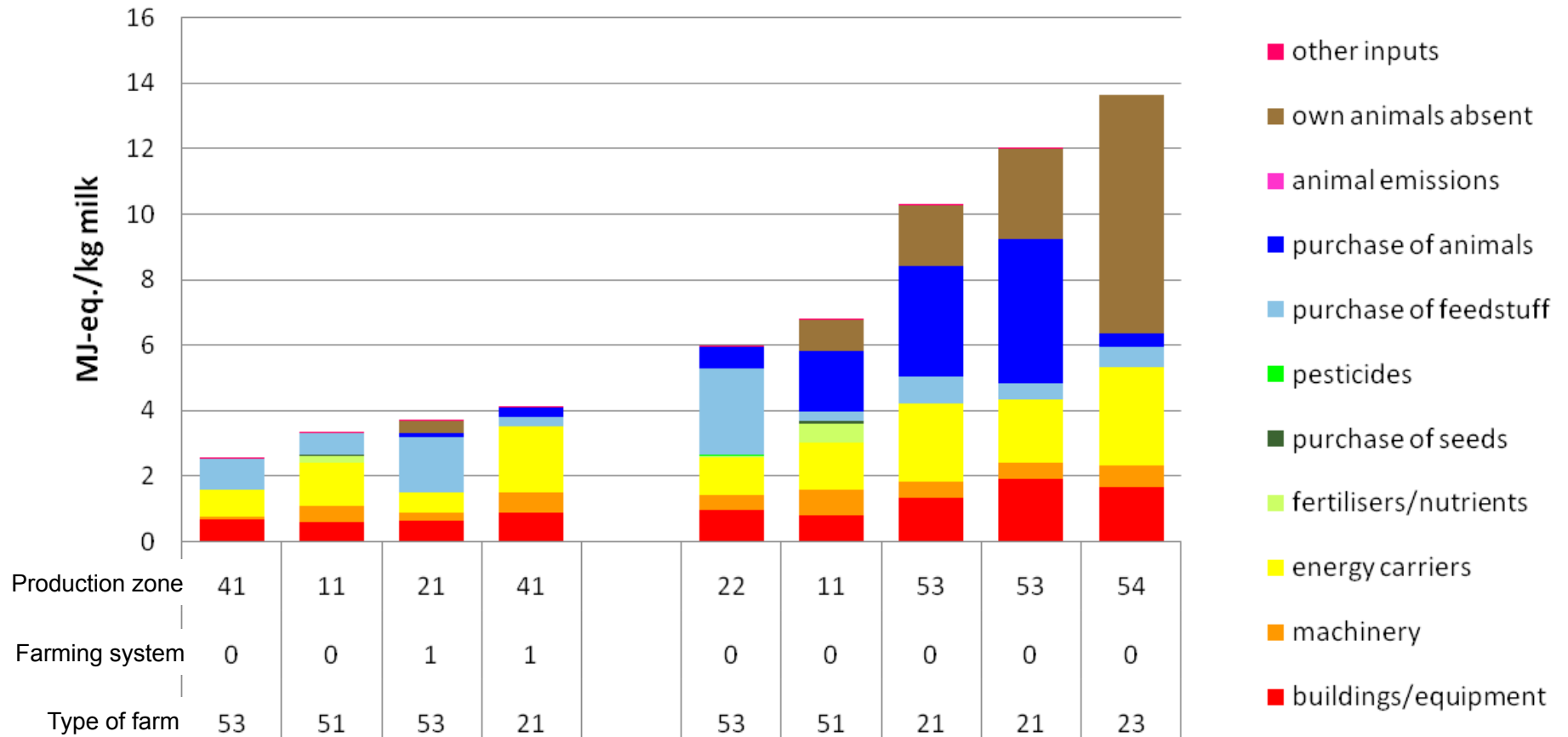


## Overview: low / high group (over all env. impacts, relative to median)

	Everywhere low impacts	Everywhere high impacts
Number of farms	4	5
Types of farms	2 KoVered, 1 VrkMi, 1 KoMiAck	2 VrkMi, 1 KoMiAck, 1 KoVered, 1 AndRi
Farming system	2 organic, 2 PEP	All PEP
Region	2 plain, 2 hill region	2 plain, 3 mountain region
UAA (ha)	31	23
Number of cows	24	15
Milk yield per cow (kg/year)	6700	6600
Amount of milk sold (kg/year)	148'000	77'000

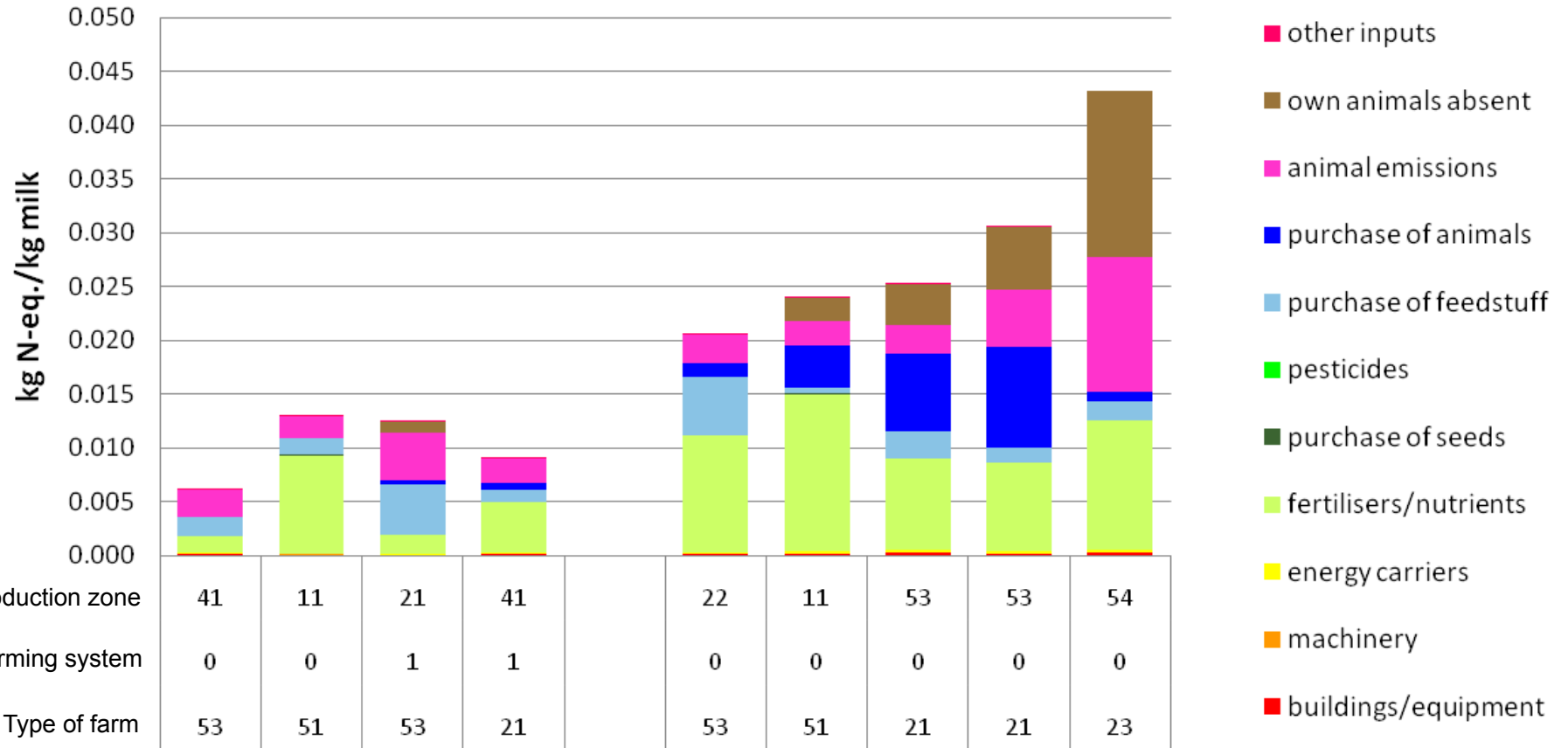


# Comparison energy demand between low and high group



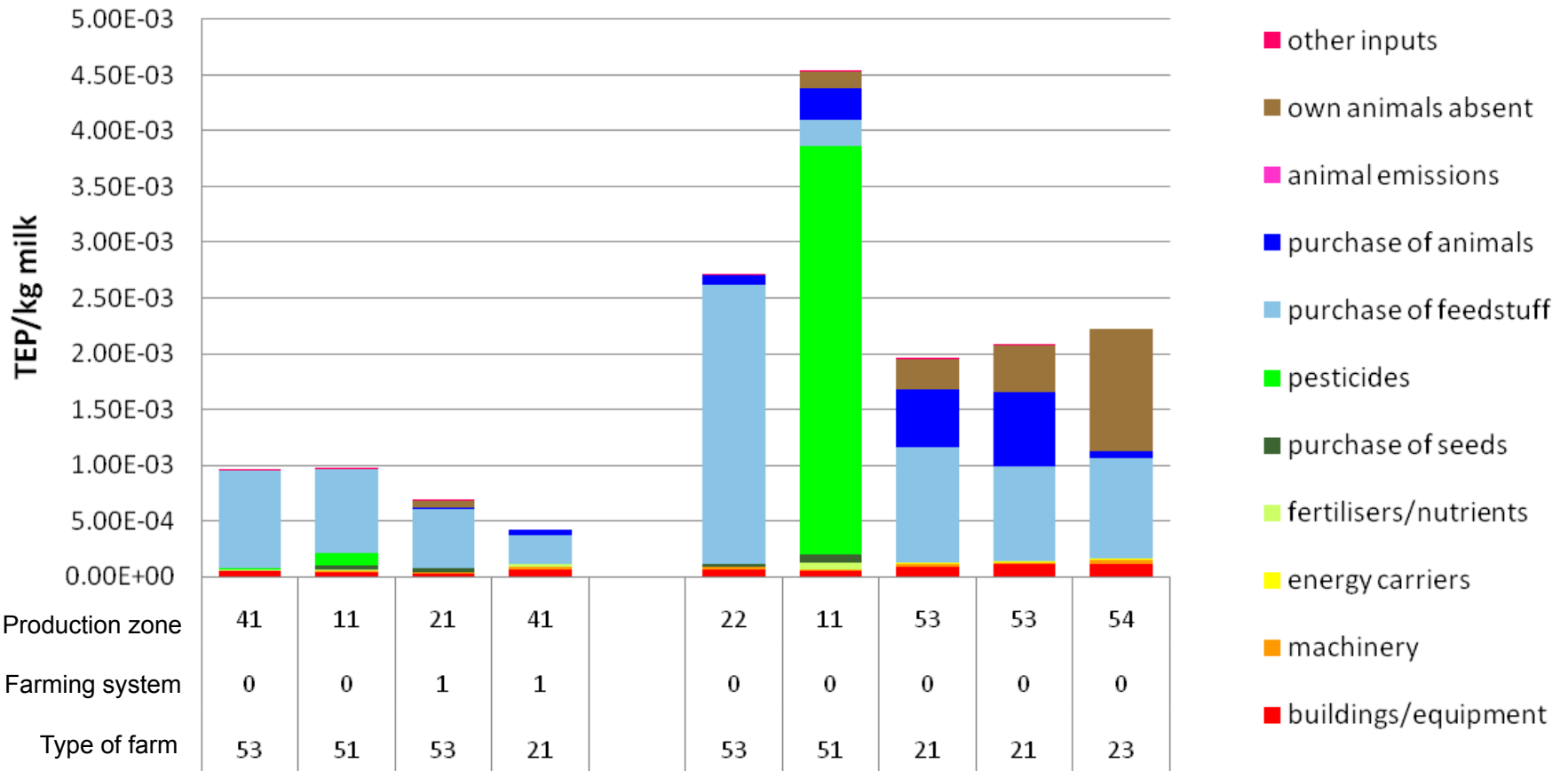


# Comparison eutrophication between low and high group





# Comparison terr. ecotoxicity between low and high group





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- **Big variability** in the environmental impacts of 1kg milk
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- Farms in the **mountain region** have a **higher energy demand** and **global warming potential** per kg milk than farms in the plain region
- **Small milk producers** tend to have a **higher energy demand** and **global warming potential** per kg milk than big milk producers
- **STILL: Variability** within mountain region / small farms is very high and can only partly be explained by the **altitude / size of a farm**
- **Reasons for good / poor results differ according to farm** -> for optimising the environmental impacts of Swiss milk production **analyses on a farm by farm basis are necessary**



# Thank you!



Acknowledgement:  
Project team LCA-FADN and RG LCA ART

ART – Research for  
agriculture and nature





# Comparison of PEP and organic milk

Overview of the dataset (Averages 2007/2008)

	PEP	Organic
Number of farms	52	14
UAA (ha)	25.5	24.4
Number of dairy cows	20	19
Milk yield per cow (kg/year)	7000	5800
Amount of milk sold (kg/year)	127'000	99'000



# Comparison of production regions

(Averages 2007/2008)

	Plain region	Hill region	Mountain region
Number of farms	30	20	16
UAA (ha)	28	23	23
Number of dairy cows	24	20	13
Milk yield per cow (kg/year)	6900	6500	6700
Amount of milk sold (kg/year)	150'000	116'000	73'000