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Bildung und Forschung WBF

Agroscope

The Agri-Environmental Monitoring of Switzerland

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02.06.2026

www.agroscope.ch | gutes Essen, gesunde Umwelt



Agri-environmental monitoring of Switzerland

- Based on the Law on Agriculture, the Swiss government needs to **monitor** the **economical**, **social**, and **ecological** situation in agriculture
- Periodic assessment of the development of the ecological performance of farms and the impact of agriculture on natural resources

- Agri-environmental monitoring
 - Enforced by the Federal Office for Agriculture
 - Executed by Agroscope: Swiss agri-environmental monitoring system (**MAUS**)
- Assessment of effects of agricultural policy based on **national**, **regional** and **farm-level** agri-environmental indicators (AEIs)



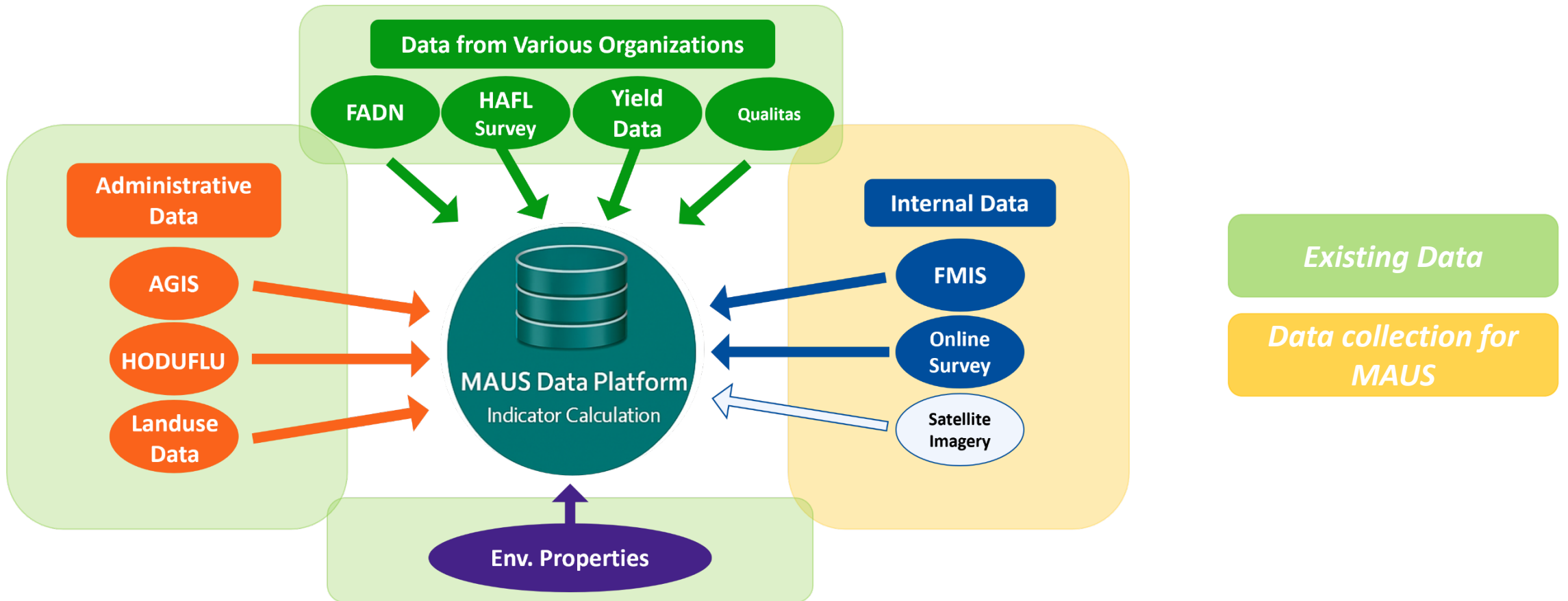
Monitoring Concept

- 1 **Collect Existing Data**
Gather all available farm and environmental data from different sources.
- 2 **Identify Data Gaps**
Determine which data points are missing for calculating indicators.
- 3 **Supplement Missing Data**
Use online surveys, FMIS* records, and satellite data to close information gaps.
*Farm Management Information Systems
- 4 **Calculate Indicators**
Compute environmental indicators at the individual farm level.
- 5 **Aggregate Regionally**
Combine farm-level results to produce regional environmental results.





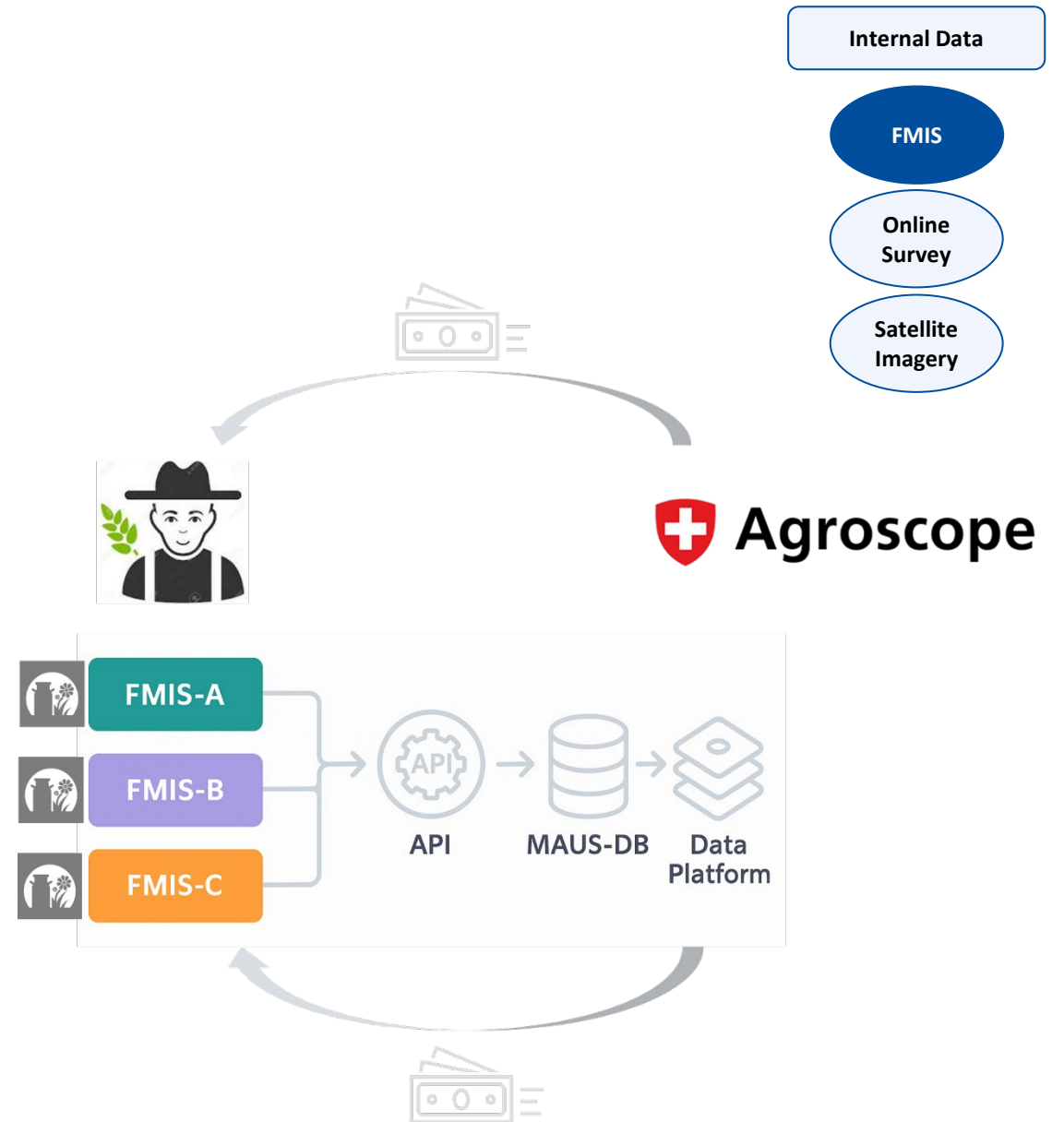
Data Ecosystem of the Monitoring (MAUS)





Integration of FMIS data

- Specific MAUS module in **3 different softwares**
- Extension of existing FMIS to deliver **management data**
- Data standardization and delivery over API
- Financial compensation for farmers





Insights in one year of FMIS data delivery

- Around 80 farms delivered 2025
- Clear specifications for merging and mapping the data to the standard
- Define a comprehensive test framework
- Data plausibility checks are essential
- Exchange and dialogue with users is key

- The goal is to calculate specific standard values as soon as we have enough data





Online Survey

- Sent to a representative sample of farms (stratified sample)
- Every other year among all-year farms and summering farms
- Feedback of ~800-1000 all-year farms and ~450 summering farms
- Main topics:
 - Nutrients (e.g. mineral fertilizer)
 - Energy consumption (e.g. diesel)
- e.g.: mineral fertilizer usage per year
→ train a regression model with the survey results

Internal Data

FMIS

Online
Survey

Satellite
Imagery



Führten Sie für Ihre Schweine und/oder Ihr Geflügel eine lineare Korrektur und/oder eine Import-Export-Bilanz für die Suisse-Bilanz durch?

Entsprechendes bitte auswählen.

Schweine

- ☐ Lineare Korrektur
- ☐ Import-Export-Bilanz
- ☐ Nein

Geflügel

- ☐ Lineare Korrektur
- ☐ Import-Export-Bilanz
- ☐ Nein

ZURÜCK

WEITER



Usage of remote sensing in MAUS

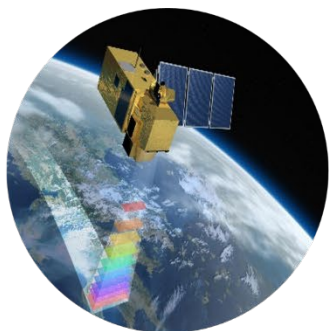
Example of erosion risk

Internal Data

FMIS

Online
Survey

Satellite
Imagery



Use **satellite data** to see what is actually happening on the field



Sentinel-2 timeseries

>>



**Machine
Learning**

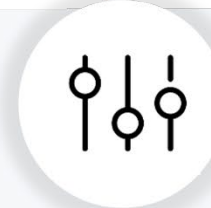
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Predicted fractions of

- Soil
- Photosynthetic vegetation (PV)
- Non-photosynthetic vegetation (NPV)

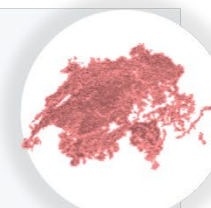
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Calibration

- Combine with rainfall erosivity
- Convert fractional cover to soil loss ratio
- Calibrate to measured C factors

>>



**Updated erosion
indicator**

- Spatially explicit
- Updated in time

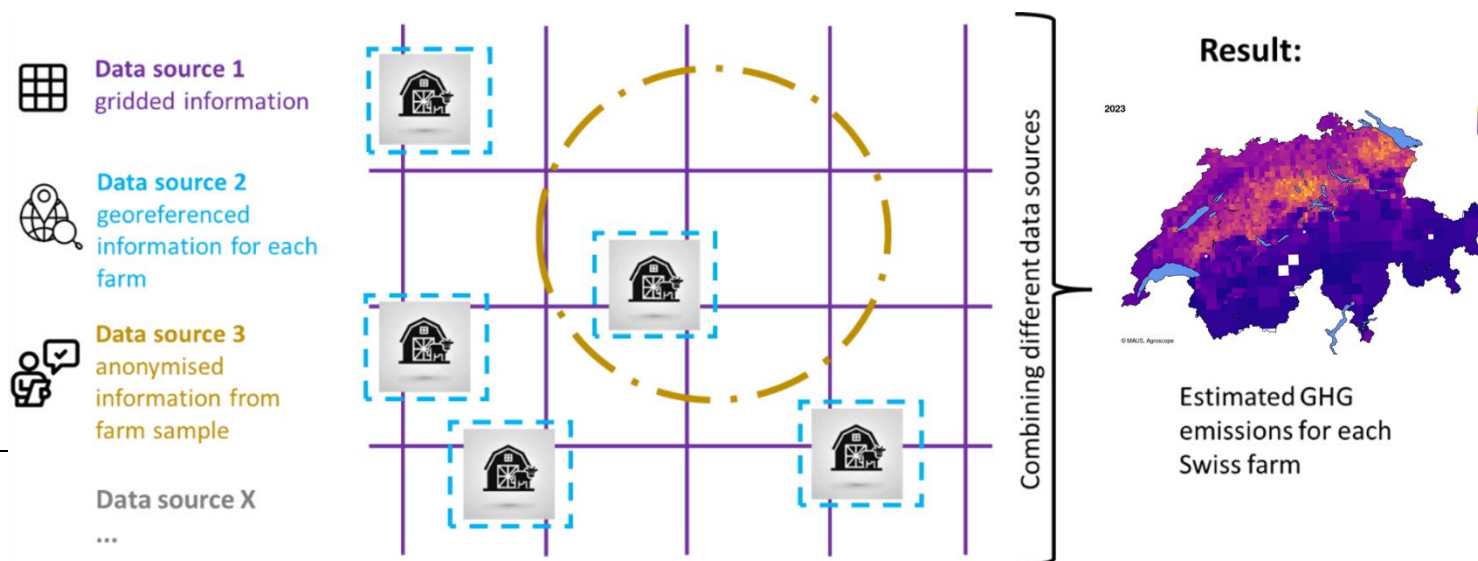




Calculation & Results



- Combination of the different data sources per farm
 - Single farm values and calculated/representative values
- All indicators are calculated **for each Swiss farm** (farm or field level)
- Results are then **aggregated per region and/or farming system**
- Plotting results on a map with an **adaptive grid**
- Aggregated results (maps and tables) are **published annually** by the FOAG and on [Zenodo](https://zenodo.org/)





Agri-environmental indicators of MAUS

Impact Scale	Indicators
Local effect	Humus balance Heavy metal balances (Cu, Zn & Cd) Erosion risk
Regional effect	Nutrient balances (N & P) Ammonia emissions Pesticide use Pesticide risk (aquatic) Nitrate leaching Impact on biodiversity Feed/Food competition
Global effect	GHG emissions Energy demand Pre-chain GHG emissions <i>Produced calories</i>



Results



Greenhouse gas emissions:

- Highest emissions in regions with highest animal densities
- Low emissions in alpine regions
- No big temporal changes due to stable animal populations

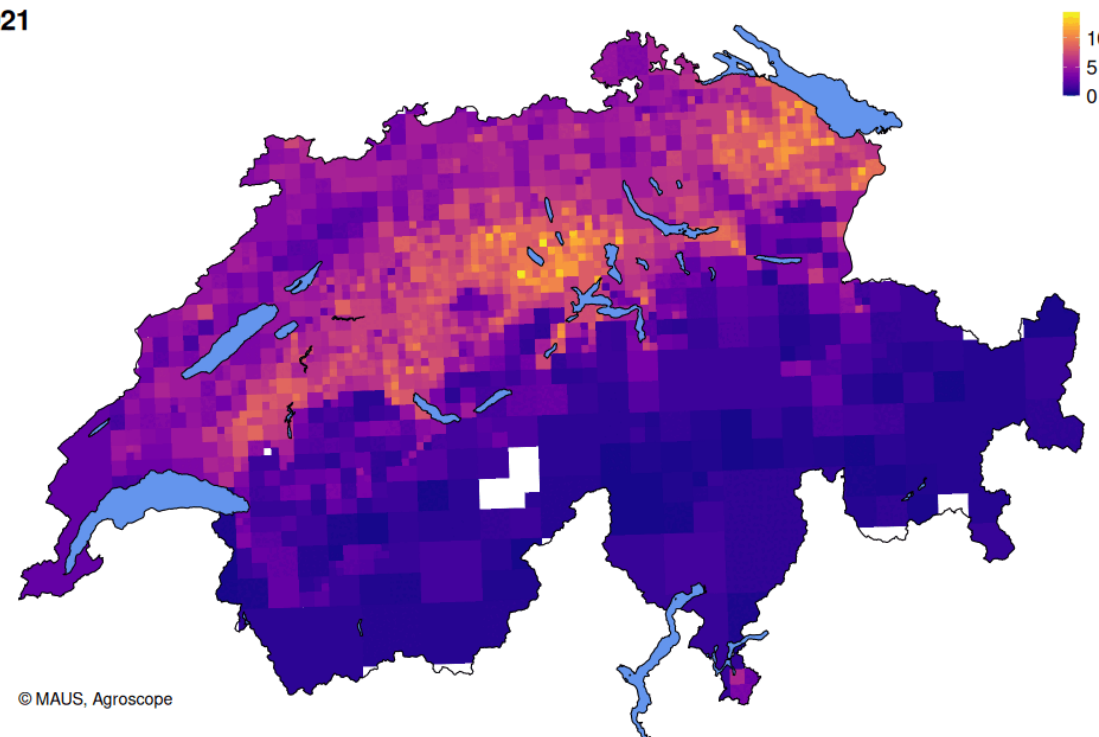
Treibhausgasemissionen / Émissions de gaz à effet de serre / Emissioni di gas serra

in Tonnen CO₂-Äquivalent pro Hektare landwirtschaftlicher Fläche (LN + Sömmerung)

en tonnes d'équivalent CO₂ par hectare de surface agricole (SAU + estivage)

in tonnellate di CO₂ equivalente per ettaro di superficie agricola (SAU + estivazione)

2021



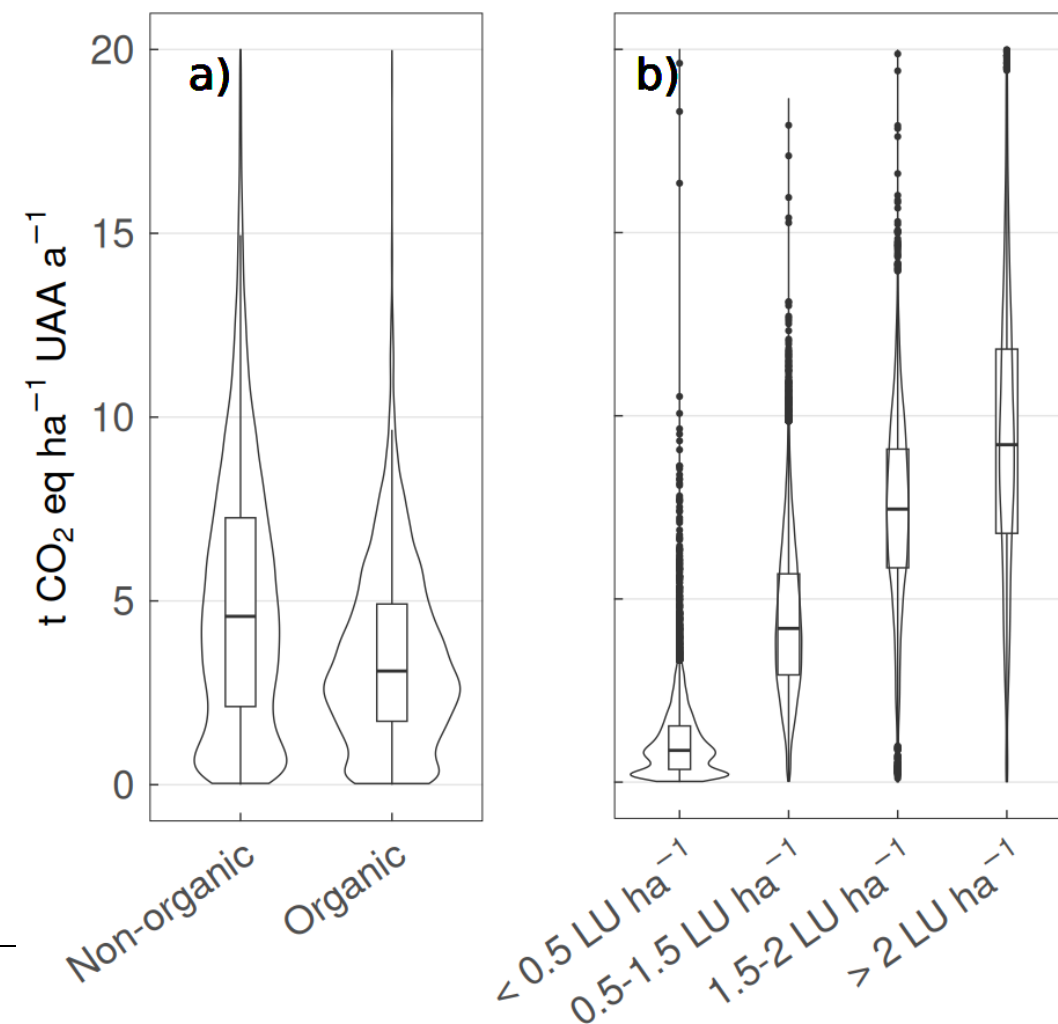
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Results – Farm structures



- Higher emissions for farm with **higher animal densities**
- Lower emissions for organic farms mainly due to **lower animal densities**
- Lasso regression confirmed **livestock density** as the most influential predictor on GHG emissions





Results



Nitrogen balance:

- Highest N-surplus in regions with highest animal densities + across the Swiss Plateau (intensive mineral fertiliser use)
- Lower N-surplus in alpine regions
- High balances decrease from 2021-2023
 - Reduced mineral fertiliser import compared to 2021
 - Increase in yields

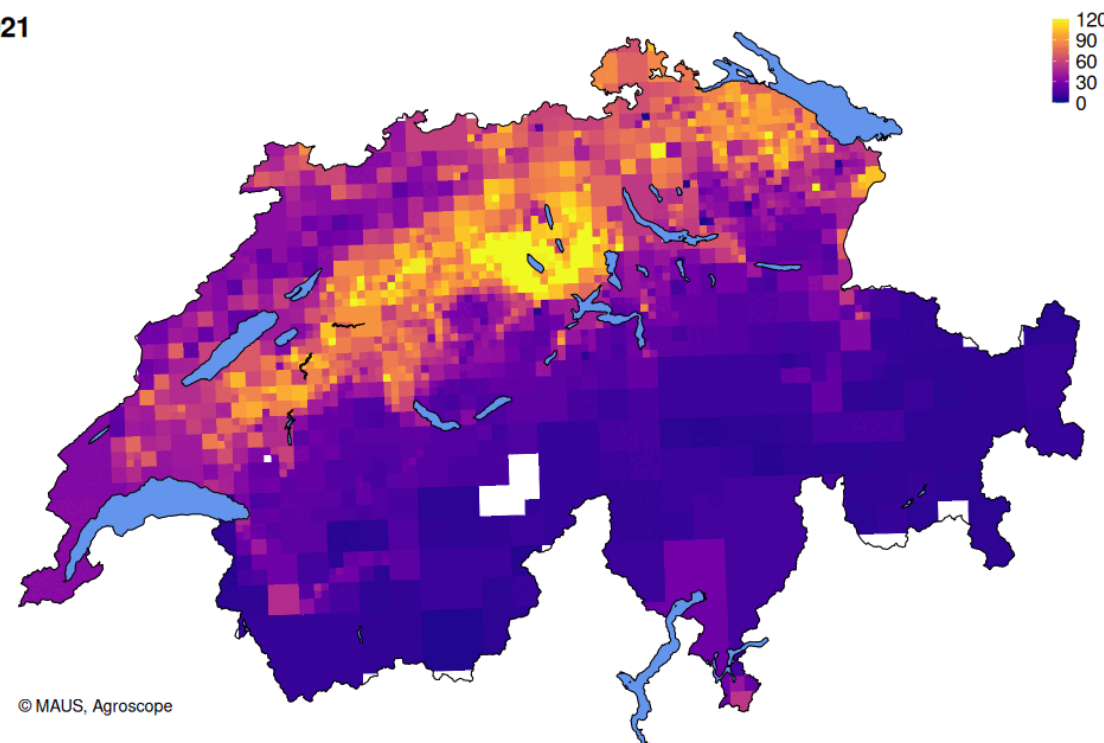
Stickstoffbilanz / Bilan azoté / Bilancio dell'azoto

in kg N_{tot} pro Hektare landwirtschaftlicher Fläche (LN + Sömmerung)

en kg N_{tot} par hectare de surface agricole (SAU + estivage)

in kg N_{tot} per ettaro di superficie agricola (SAU + estivazione)

2021



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Results



Energy demand:

- Energy demand of all year farms only (summering farms not yet calculated)
→ lower resolution grid in alpine regions
- Total energy demand =
fuel consumption (for vehicles) +
heating fuel consumption (stables) +
→ *large regional differences (pig & poultry)*
heating fuel consumption (greenhouses) +
→ *large regional differences*
electricity consumption

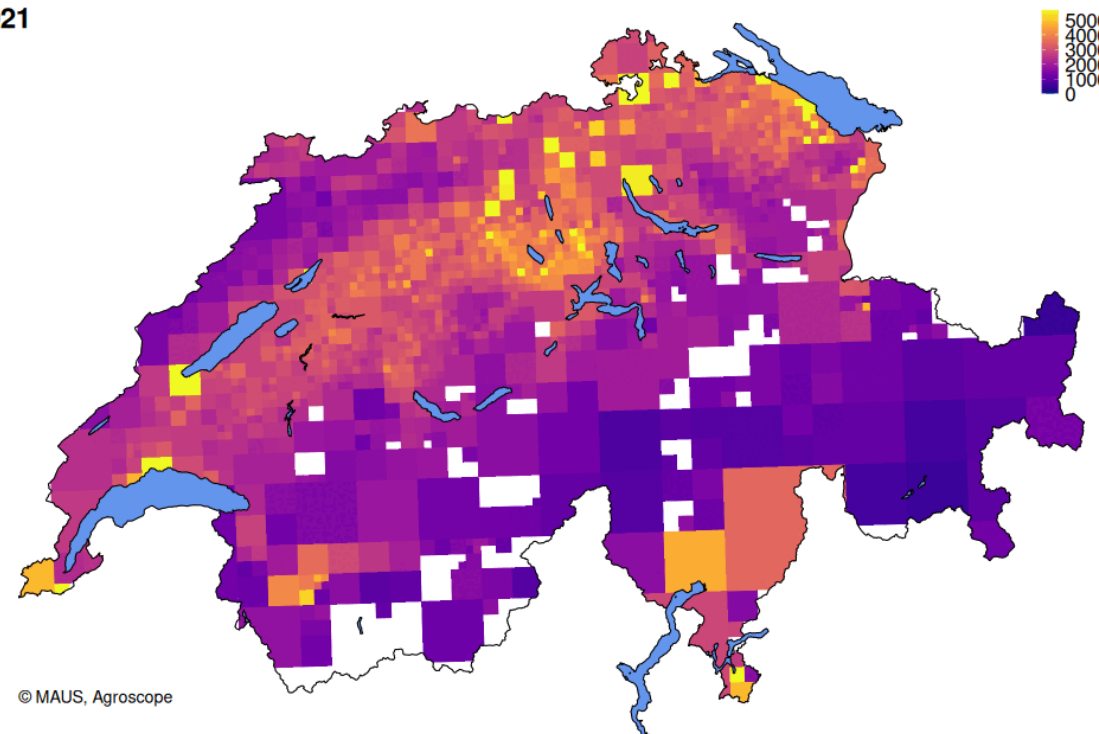
Energiebedarf / Besoins en énergie / Fabbisogno di energia

in kWh pro Hektare landwirtschaftlicher Nutzfläche (LN)

en kWh par hectare de surface agricole utile (SAU)

in kWh per ettaro di superficie agricola utile (SAU)

2021



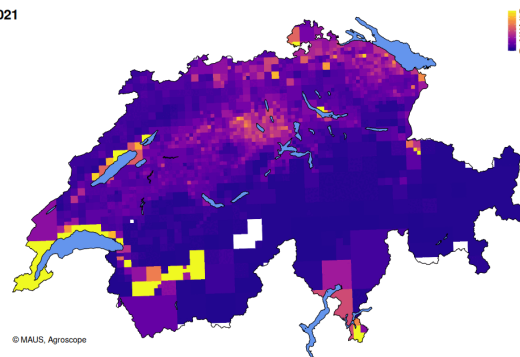


Results



Kupferbilanz / Bilan du cuivre / Bilancio del rame
in g Cu pro Hektare landwirtschaftlicher Fläche (LN + Sömmerung)
en g Cu par hectare de surface agricole (SAU + estivage)
in g Cu per ettaro di superficie agricola (SAU + estivazione)

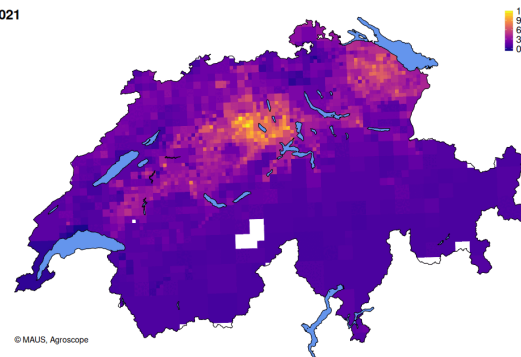
2021



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Zinkbilanz / Bilan du zinc / Bilancio dello zinco
in g Zn pro Hektare landwirtschaftlicher Fläche (LN + Sömmerung)
en g Zn par hectare de surface agricole (SAU + estivage)
in g Zn per ettaro di superficie agricola (SAU + estivazione)

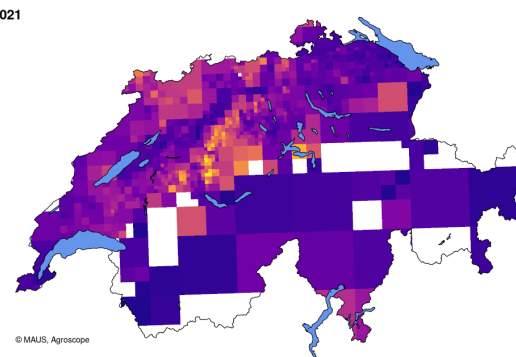
2021



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Erosionsrisiko / Risque d'érosion / Rischio di erosione
in t Bodenabtrag pro Hektare Ackerfläche
en t d'érosion du sol par hectare de terres arables
in t di perdita di suolo per ettaro di superficie coltiva

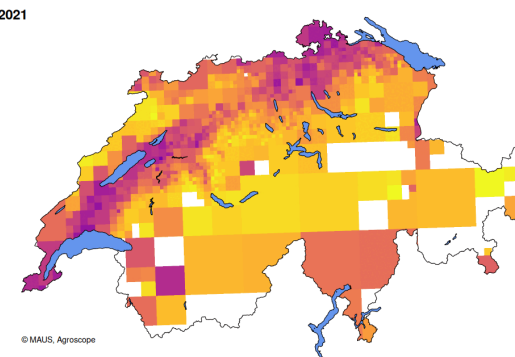
2021



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Flächenkonkurrenz / Concurrence pour l'utilisation des surfaces / Concorrenza tra superfici
Anteil der Ackerfläche (in %), der nicht direkt für die Lebensmittelproduktion verwendet wird
Part des terres arables (en %) qui ne sont pas directement utilisées pour la production alimentaire
Percentuale di superficie coltiva (in %) non utilizzato direttamente per la produzione alimentare

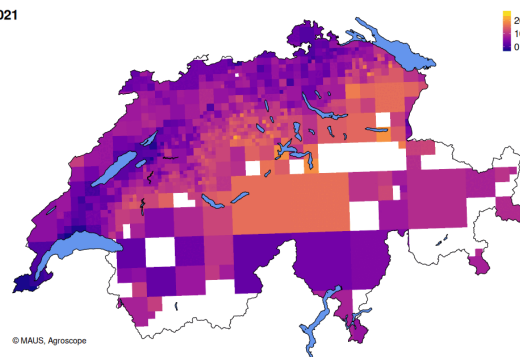
2021



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Humusbilanz / Bilan d'humus / Bilancio dell'humus
in kg Humus pro Hektare Ackerfläche
en kg humus par hectare terres arables
in kg humus per ettaro di superficie coltiva

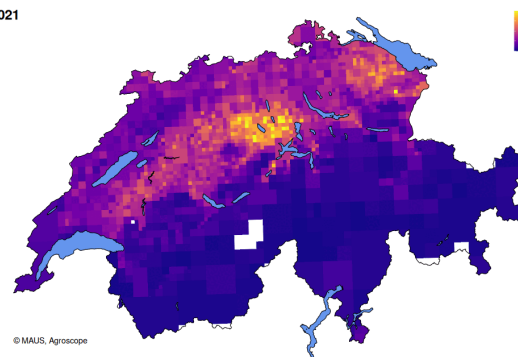
2021



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Ammoniakemissionen / Émissions d'ammoniac / Emissioni di ammoniaca
in kg NH₃-N pro Hektare landwirtschaftlicher Fläche (LN + Sömmerung)
en kg NH₃-N par hectare de surface agricole (SAU + estivage)
in kg NH₃-N per ettaro di superficie agricola (SAU + estivazione)

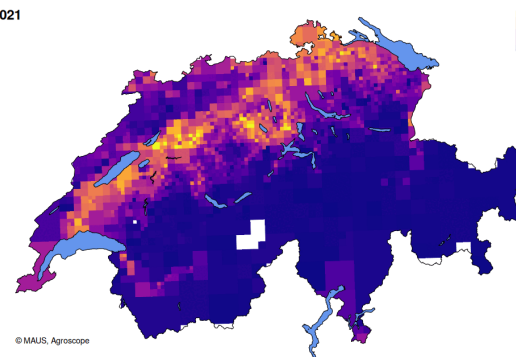
2021



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Phosphorbilanz / Bilan phosphorique / Bilancio del fosforo
in kg P pro Hektare landwirtschaftlicher Fläche (LN + Sömmerung)
en kg P par hectare de surface agricole (SAU + estivage)
in kg P per ettaro di superficie agricola (SAU + estivazione)

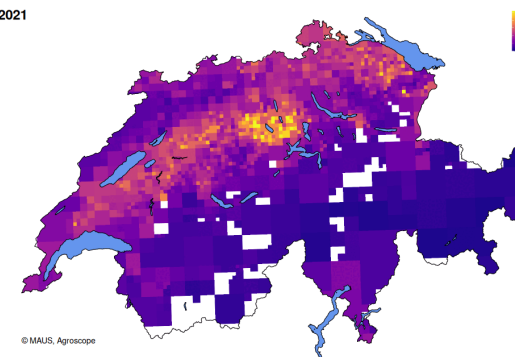
2021



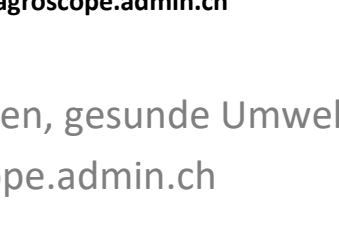
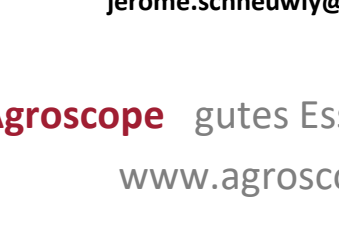
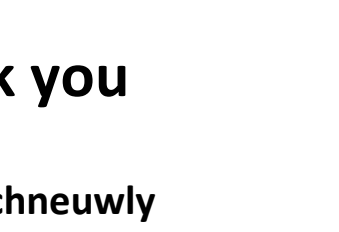
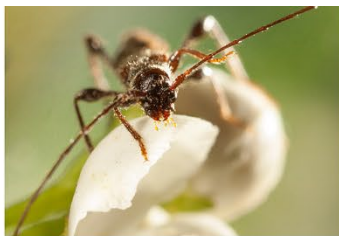
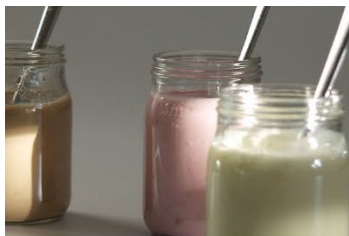
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Vorkettenemissionen / Émissions en pré-chaine / Emissioni della catena preliminare
in kg CO₂-Äquivalent pro Hektare landwirtschaftlicher Nutzfläche (LN)
en kg d'équivalent CO₂ par hectare de surface agricole utile (SAU)
in kg di CO₂ equivalente per ettaro di superficie agricola utile (SAU)

2021



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Thank you

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