Harnessing Agricultural Ecosystem Services, Reducing Environmental Impacts, and Increasing the Resilience in Swiss Agriculture using Agroforestry Systems

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Background: Why Agroforestry?

- Combination of trees, shrubs, woody elements …
- … and agricultural production (arable or livestock)
- Integrated on the same field

→ provides Ecosystem Services (Torralba et al. 2016, Hart et al. 2017)

- timber, food, and biomass production
- biodiversity
- soil fertility and nutrient cycling
- erosion control
- climate protection
Background: Agroforestry in Switzerland

- **Highly innovative**
- **With long tradition**

**On farmland**: Vegetable & fruit trees, Fruit orchards, Walnuts & cereals.

**With livestock**: Pigs & elder, Sweet chestnut sylva, Walnuts & hens, Wooded pastures.

- **On ~120 hectares**
- **On ~7.9% of farmland**

Practical information in English & national languages

www.agroforst.ch
www.agroforesterie.ch
Research: Agroforestry landscape services

(Field)Mapping

Modelling
- Biomass Production
- Groundwater Recharge
- Nitrate Leaching
- Erosion
- Carbon Storage
- Biodiversity (Pollination, Habitat Diversity)

Results
- higher carbon storage
- reduced nitrate leaching
- reduced erosion
- higher pollination services and habitat diversity

(Kay et al, 2018)
### Indicators

| Biodiversity & Landscape | Climate & Air | Water | Soil |

### Targets 2008

**Preserve and promote**
- biodiversity (species, habitats, functions)
- regional typical landscape scenery
- adequate watercourse corridors

**Reduce**
- GHG emissions (-0.6% yr⁻¹)
  - nitrogenous pollutants (max. 25 000 t N yr⁻¹)
  - diesel soot (max. 20 t yr⁻¹)

**Mitigate**
- nitrate in waters for drinking water (max. 25 mg N l⁻¹)
- nitrate losses from agriculture (-50% against 1985)
- phosphorous losses (> 4 mg O₂ l⁻¹ lake water)
  - impairments by pesticides
  - Impairments by medications

**Prevent**
- contaminants in soils (*problem* Zn & Cu accumulation)
- erosion (max. 2 or 4 t ha⁻¹)
- soil compaction

### Status 2016

- First positive results visible (*agricultural biodiversity priority areas*), but ongoing negative impacts on species and habitats
- Reduction of air pollution in progress – targets not yet reached
- Reduction of water pollution in progress – targets not yet reached
- Reduction of soil preservation in progress – targets not yet reached

(BAFU und BLW, 2016, 2008)
Application: Farmland Environmental deficit areas

Environmental Maps

- Patchy wildlife corridors
- Low honey bee pollination coverage
- Low pest control index
- Fragmentary water course corridors
- Ammonia concentration
- Nitrate surplus
- Phosphorous surplus
- Soil losses (erosion)
- Temperature rise
- Precipitation changes

Summary

On 13% of Swiss farmland ≥ 3 deficits

ES provision:
Implementing Agroforestry on 13% Swiss farmland can store ~13% of GHG emissions of Swiss agriculture per year

(Kay et al., 2019)
Next steps

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<td>▪ 140 farmers in 4 cantons</td>
<td>Discussed as tool and funding scheme in the Swiss Agricultural Policy 2022 (AP22+) for</td>
<td>▪ AGROforestry and MIXed farming systems-Participatory research to drive the transition to a resilient and efficient land use in Europe</td>
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<td>▪ 240 ha agroforestry in environmental deficit areas</td>
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<td>▪ Scientific monitoring of impact on soils, water, biodiversity, economics, socio-cultural effects</td>
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<td>▪ Climate mitigation</td>
<td>▪ Scenarios for Agricultural Landscapes' Biodiversity and Ecosystem Services</td>
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Thank you for your attention

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Literature