

Integrating fodder tree hedgerows in permanent grasslands to produce supplementary forage during summer drought

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 #AgroForageTreeProject

Context

Climate change is an important driver of losses in **forage yield and quality** in permanent grasslands, especially due to increasing **summer drought** events. Agroforestry for forage production could be a promising solution to provide additional **tree-based forage**, since tree species can be more resistant to drought due to their **larger root system** that can access water in deeper soil layers. Furthermore, leaves of specific fodder tree species can have **excellent digestibility** and **nutritional value** for livestock.

Aims of the project

The **AgroForageTree** project aims at evaluating the potential of fodder tree species to provide supplementary tree-based forage in summer and is organized according to **five main objectives**:

1

Monitoring the survival and growth of fodder tree species along a climatic and altitudinal gradient

2

Determining leaf production, leaf nutrient content and digestibility of these fodder tree species

3

Investigating the impacts of fodder tree hedgerows on ecosystem biodiversity and services

4

Assessing the palatability and selection of the tree species by different livestock categories

5

Economic evaluation at plot and farm scale according to different climatic scenarios

Experimental design

Five tree species were identified as the most interesting fodder tree species in terms of **yield and forage quality**:

Fraxinus ornus



Salix caprea



Tilia platyphyllos



Morus alba



Alnus cordata



Seven on-farm sites along an **altitudinal** (from 450 to 800 m) and climatic gradient (mean annual **temperature** from 11 to 5°C and **precipitation** from 900 to 1600 mm) in **Western Switzerland**. **Six hedgerows** per site (including five species) planted in the middle of permanent grasslands (**Figure 1**). **Grazing** will start from year 4 or 5 with **different livestock categories** depending on site (cows, goats and horses).

Measurements

Fodder tree diameter and branches number, leaf-level carbon uptake and water use efficiency for the five fodder tree species at each site.



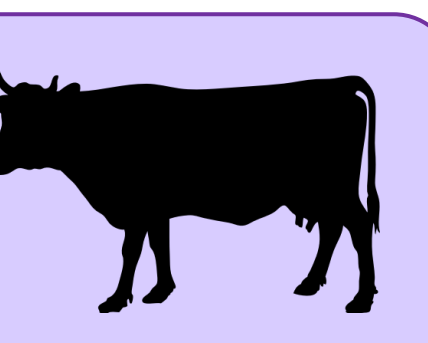
Leaves number, plant functional traits (SLA, LDMC), proximate composition, phenols and condensed tannins.



Soil moisture, soil organic carbon and inorganic nitrogen under and around hedgerows, biodiversity (birds, bats, grasshoppers, pollinators) and grass-based forage biomass.



Digestibility of leaves and methane emissions (*in vitro*), leaves consumption (count of leaves before and after grazing), GPS tracking of animals (tree species preferences).



Plantation and maintenance costs (irrigation, mulching, labour) and benefits (forage yields, biochar made with pruned branches, milk production).

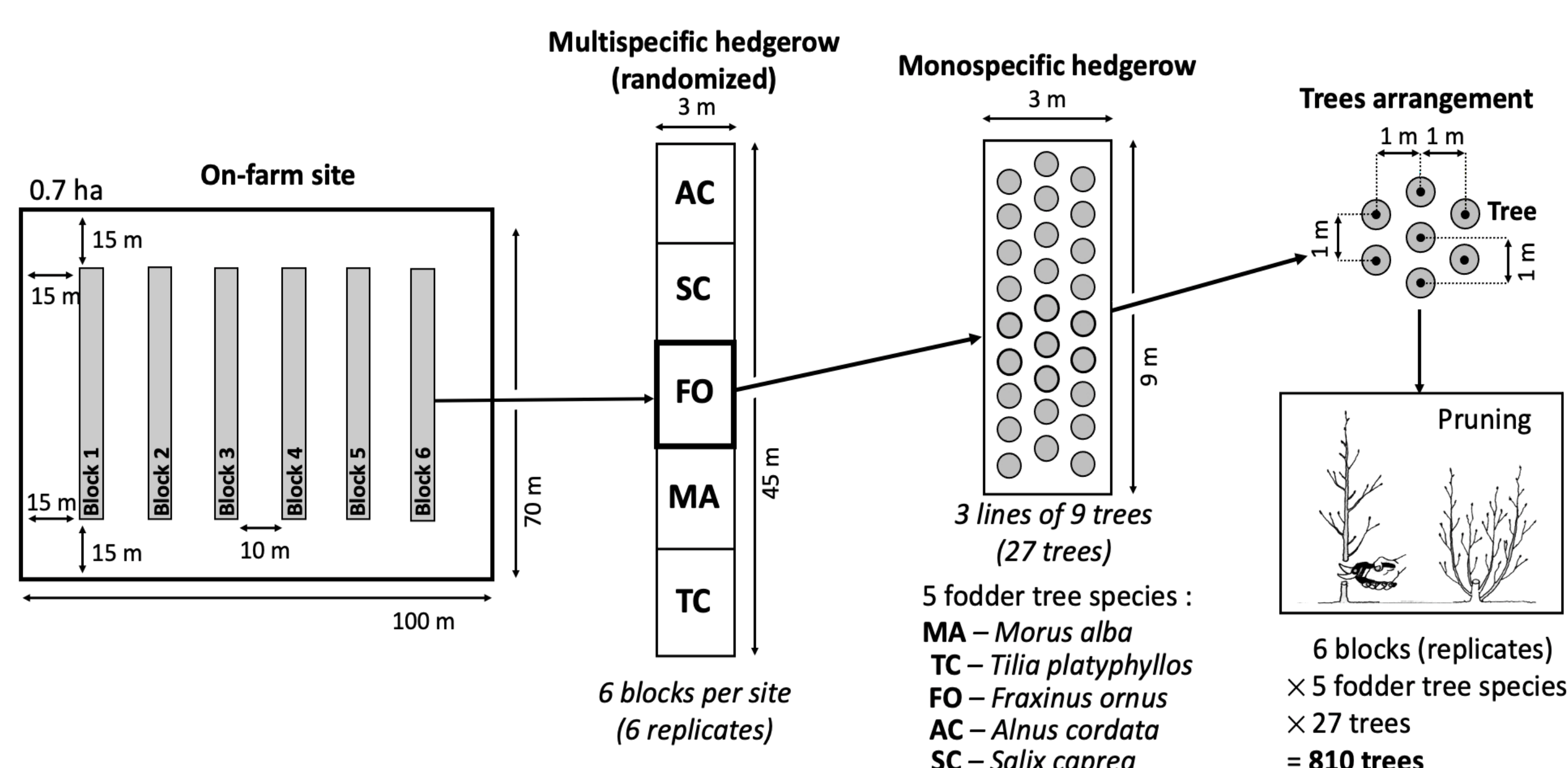
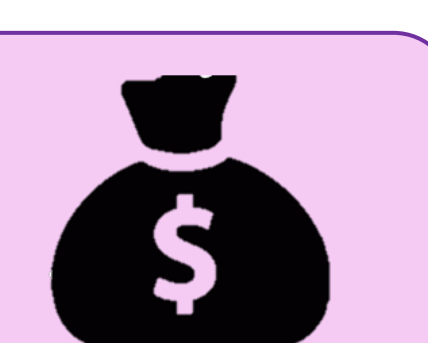


Figure 1: Experimental design of the AgroForageTree project. Each multispecific hedgerow (45 m with 3 parallel lines) is composed out of five randomly arranged monospecific hedgerows of 9 m each, corresponding to the five selected tree species. Tree lines are 1 m apart and trees are separated by 1 m from each other within lines.

Knowledge outcomes

- ✓ **Optimal climatic conditions** for five fodder tree species in Western Switzerland.
- ✓ **Seasonal and interannual variability in forage yield and quality** for the five fodder tree species.
- ✓ Impact of fodder tree hedgerows on **ecosystem biodiversity and services** despite intensive use for forage production.
- ✓ **Appetence and preference** for some fodder tree species rather than others depending on **livestock categories**.
- ✓ **Economic assessment** of forage hedgerows.

