

# COMBINING AGROFORESTRY AND LIVESTOCK FARMING AS AN ADAPTATION

## FROM A LINEAR TO A CIRCULAR AGRICULTURE

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### INTRODUCTION

Swiss agriculture is resource intensive and part of a linear economy. Within a research project at the Institute for Natural Resource Sciences, the current agricultural system in Switzerland was analysed and possibilities and potentials for transformation into a circular system were investigated.

In Switzerland, domestic agriculture is responsible for over 5% of Swiss primary energy consumption, 13.8% of domestic greenhouse gas emissions, 35% of domestic land use and 20% of water consumption.

Agroforestry systems have a high potential to reduce negative environmental impacts of agriculture. Specific positive environmental effects of agroforestry were confirmed by Torralba et al. (2016), Alam et al. (2014) and Hart et al. (2017), among others. They showed that agroforestry systems have a positive effect on soil protection (reduction of erosion and vitalisation of soil life), water protection (higher nutrient efficiency, reduction of nutrient losses, water retention and irrigation requirements), biodiversity (increase in habitat diversity), and climate change (carbon sequestration). In order to support the transformation of Swiss agriculture from a linear system into a more circular system, the project aims in a next step to implement specific agroforestry adaptations of farming practice in partnering farms.



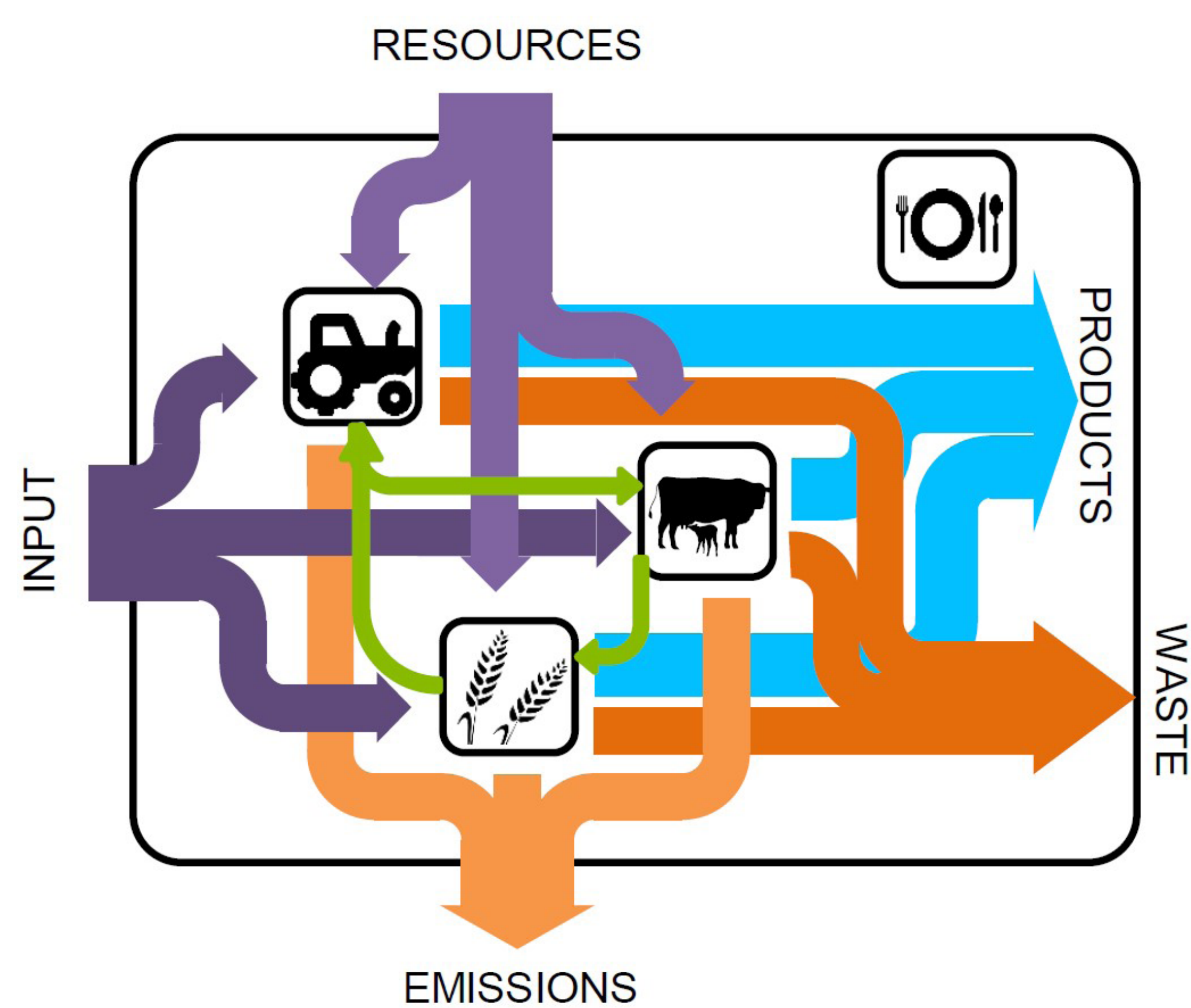
[1] Energy wood production with chicken

[2] Energy wood production on cow pasture

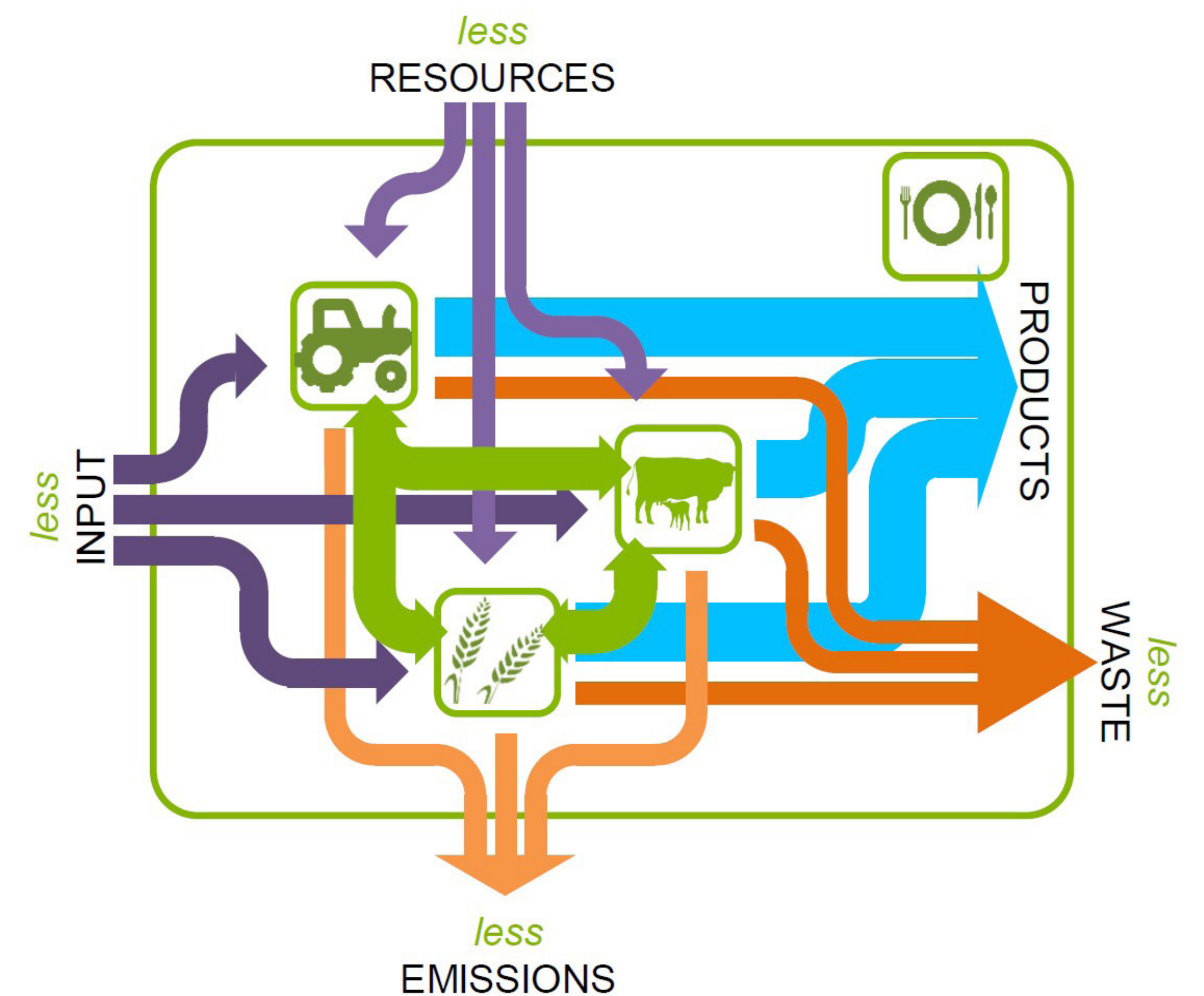


[3] Fodder wood in goat rearing

[4] Fodder wood on cow pasture



Today's system of agriculture, almost linear



Goal of the agricultural system, almost circular

### METHODS

In Switzerland, agroforestry systems are mainly known as silvoarable systems, in which the plantation of trees is combined with arable fields. In a new agroforestry approach, the ZHAW researchers plan to combine tree plantations with livestock farming. This combination has the potential to close nutrient cycles, as the nutrients in animal excrement can be used directly for plant growth. The harvested trees from such an agroforestry system could be utilised for example for energy wood (see figure 1 and 2). Also, trees provide shade and protection for animals. In contrast to most countries in Europe, the cultivation of energy crops is not promoted in Switzerland. Nevertheless, cultivation of energy crops in an agroforestry system could bring sustainability benefits. Another application for agroforestry systems in livestock farming is to grow woody fodder plants that can be eaten directly by the animals (see figure 3 and 4). Woody plants with mineral-rich foliage can be used as additional feed sources to prolong the grazing period of animals and at the same time bind and efficiently use excess nutrients.

### RESULTS AND DISCUSSION

Under Swiss conditions, agroforestry systems have great potential to counteract negative environmental impacts of agriculture (Kay et al., 2019). However, so far, agroforestry systems have only been established in arable farming. Since many negative environmental impacts of agriculture are the result of animal husbandry, combining agroforestry with livestock farming has a yet untapped potential to contribute to a more circular agriculture with lower ecological impacts. In order to be able to develop and offer solutions against locally occurring environmental impacts, we need to test agroforestry systems that are region-specific and attractive to farmers. A short to medium-term valorisation of the agroforestry system through energy wood increases the incentive to adapt animal husbandry systems accordingly. In a next step, the new agroforestry solutions need to be tested and optimised in practice.

### Photo sources

- [1] Jäger, M.
- [2] <https://pxhere.com/en/photo/99325>
- [3] <https://www.wallpaperflare.com/brown-and-black-goat-animal-mammal-antelope-wildlife-zoo-wallpaper-elmnz/>
- [4] <https://www.pxfuel.com/en/free-photo-exzl>

### References

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- Alam, M., Olivier A., Paquette A., Dupras J., Révéret J., Messier Ch. A general framework for the quantification and valuation of ecosystem services of tree-based intercropping systems (2014)
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