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ABSTRACT BOOK

INNOVATIVE CROPPING AND FARMING SYSTEMS FOR HIGH QUALITY FOOD PRODUCTION SYSTEMS

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Agroforestry for Climate Change Mitigation in Europe – a Continental Scale Analysis

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Abstract: Agroforestry (AF), the combination of woody elements with arable crops or permanent fodder plants, contributes significantly to the global carbon pool (Zomer et al. 2016). In Europe the total storage by AF is estimated at 4 t C ha^{-1} located on 8.8 % of agricultural land (den Herder et al. 2017) and is seen as the land-use option with the greatest potential for climate mitigation and adaption (Hart et al. 2017).

Whilst storing carbon, AF also enhances biodiversity and provides regulating ecosystem services (Torralba et al. 2016). We therefore opted for an inter- and transdisciplinary approach to evaluate a range of environmental deficits in European agricultural land and assess the potential of AF for climate change mitigation. Firstly, we identified areas with potential environmental deficits regarding soils (soil erosion, low soil organic carbon) and water (water pollution by nitrates, salinization by irrigation), affected by climate change (e.g. rising temperature) and by losses in functional biodiversity (pollination and pest control deficits, loss of soil biodiversity). This resulted in continental scale ecosystem service deficit maps, which were overlaid to localize areas where several deficits accumulate. In total, more than half of European agricultural was in good condition and grasslands were less affected than croplands. While e.g. climate change (temperature rise > 2°C until 2050) affected more than 80% of arable and grasslands, soil erosion by wind was almost not relevant. The worst 10 % of the area with accumulated deficits were defined as priority regions, where the implementation of AF can be particularly effective. Regional hotspot areas for environmental deficits are – amongst others – the north-western part of France, Denmark, the centre of Spain, the North (Po region) and the south-west (Sicily) of Italy and the eastern part of Romania.

For each priority region, experts proposed AF systems that are adapted for the specific region, based on their expertise and interaction with farmers (AF pioneers). This collection of ideal AF systems is then used to assess the potential of carbon stored, if they were systematically implemented in the priority regions.

The presentation will summarize the results of the potential contribution of AF systems for mitigating environmental deficits at the European scale in a spatially explicit way, based on a combination of modelling and stakeholder interaction.

Keywords: Ecosystem service, carbon, landscape, environmental deficit, spatial modeling

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Shifts in Apple Phenology under Climate Change in Switzerland and Implications for Exposure to Abiotic and Biotic Risks

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Abstract: It is expected that the development of plants and insects will be accelerated by global warming, resulting in an earlier occurrence of phenological stages in the future as compared to today. For plants, this could lead to a higher exposure to climatic shocks (late frosts in spring, and critical high temperatures in summer) and changes in the incidence of insect pests. Assessing the implications of such shifts in phenology is important to be able to devise, where necessary, means for reducing biotic and abiotic risks in plant production.

In this contribution we present an analysis of the potential impacts of climate change on the risk of late frost and damages to fruits caused by critically high temperatures in apple orchards across Switzerland. We further discuss the possible effects of climate change on the appearance of the codling moth (*Cydia pomonella* L.), the key apple pest in many areas of the world. To conduct the analysis, we run carefully calibrated phenological models for different apple cultivars and the codling moth, feeding them with updated, transient climate change scenarios covering 1980-2100 developed for Switzerland on a 2 km x 2 km spatial-resolution grid. The climate scenarios represent three different emissions pathways allowing for consideration of a wide range of future climates. The results are discussed in a broader context by comparison with findings from other countries.

Keywords: climate change impacts, apple phenology, biotic and abiotic risks, Switzerland