



MIXED
EFFICIENT AND RESILIENT
MIXED FARMING & AGROFORESTRY



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Source: Hochstamm Suisse

Preliminary Results and Take-aways

- Environmental impacts for a high-stem silvopastoral system were modelled to compare economic and biophysical allocation methods.
- Impacts at product level (kg FM fruit, grass) differed between methods when they are more precisely allocated.
- Contribution analysis for *GWP100* showed (biophys vs econ):
 - Pesticide emissions were mainly allocated to the trees
 - Field emissions and fertiliser impacts were mainly allocated to grassland, due to the larger surface area and despite the low economic value
- When including soil and biomass carbon impacts, fruit GHGs can be negative – even more so with biophysical allocation

Improved Impact Allocation for Multifunctional Agroforestry Systems Can Be Achieved Through Biophysical Allocation

Introduction

- Agroforestry systems have received increased attention in temperate regions but data is scarce (Köthke et al., 2022).
- Increasing number of LCA studies, with numerous challenges (carbon storage in soil and biomass, multifunctionality..) (Quevedo-Cascante et al., 2023)
- To date, no standardised methodology exists on how to allocate impacts to trees i.e., in mixed systems like the Swiss high-stem systems.

Methods

- An exemplary mixed farm with grassland, high-stem fruit trees and beef cattle was modelled using the FarmLCA model (De Baan et al. 2024)
- Soil carbon (passive pool only) is estimated according to Tier 2, (IPCC, 2019) while tree biomass follows a calculation adapted from Cardinael et al., (2018). It assumes trees increase their carbon biomass until 20 years.
- A new biophysical allocation approach utilised Hemery et al., (2005) to calculate the basal area of each tree: Trees with surrounding grasslands were modelled separated from the main grassland (Fig.1) and process impacts distributed proportionally to the source.

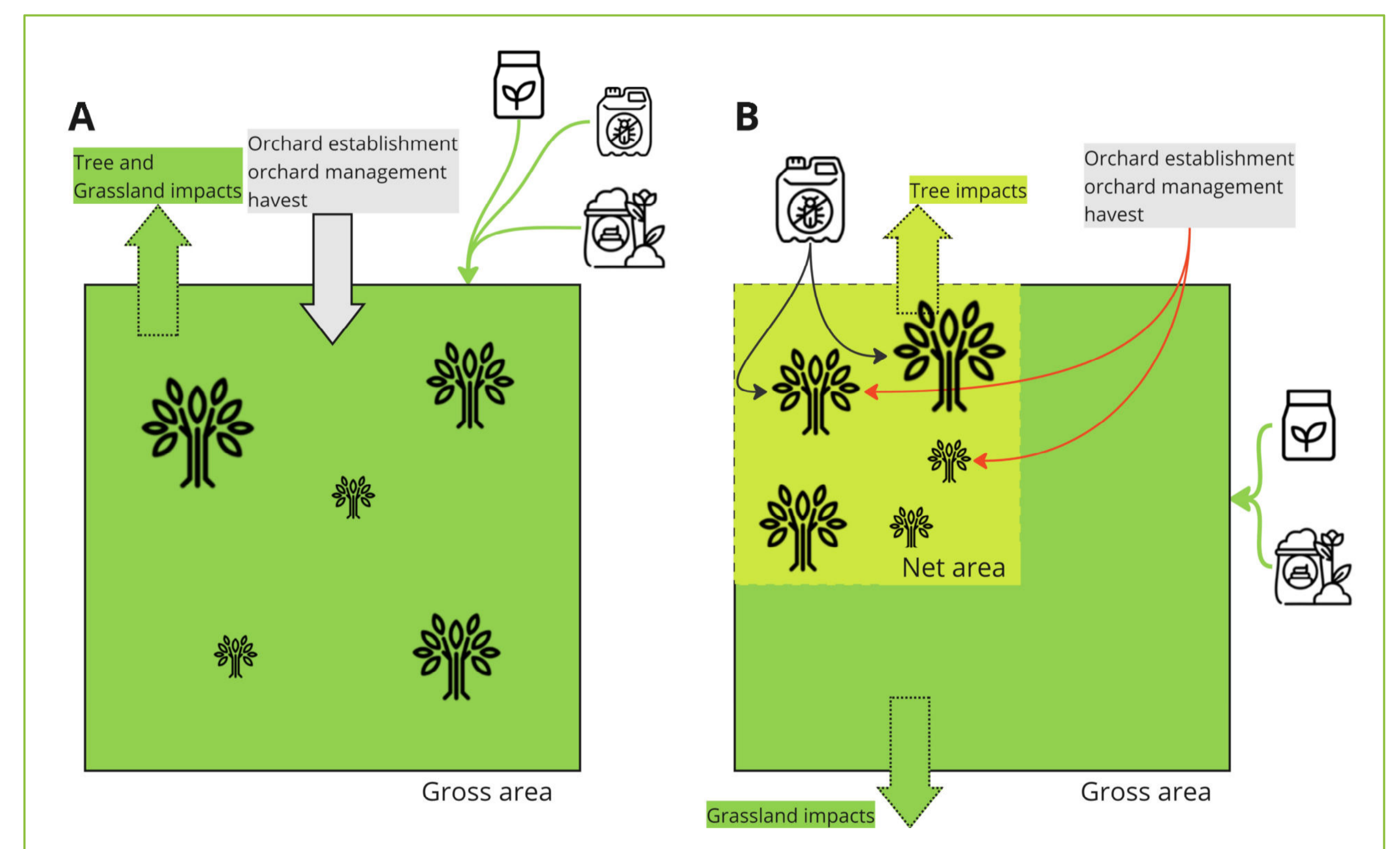


Fig 1: Graphical representation of the method to overcome spatial separation of the scattered trees by collecting them on a single plot based on their space requirements.

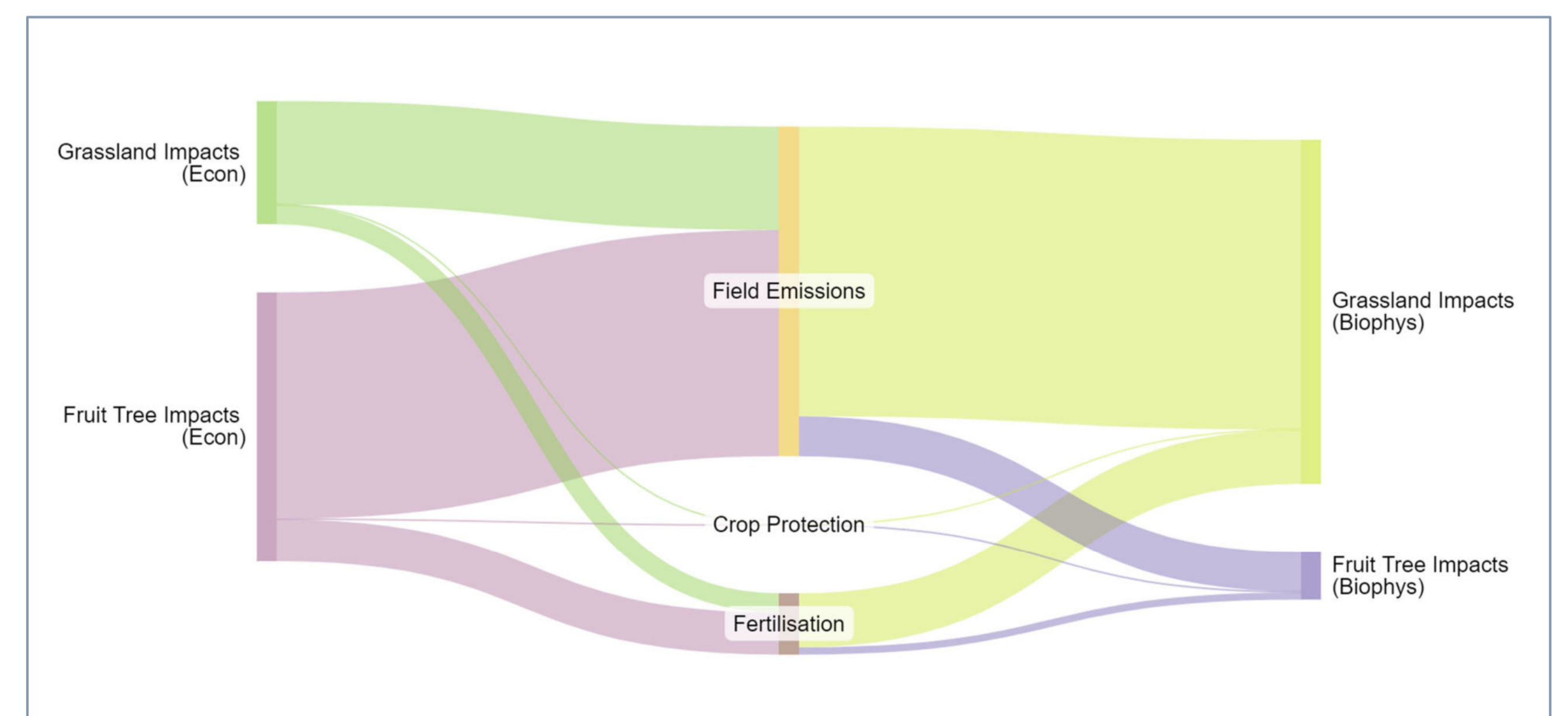


Fig 2: Contribution of Field Emissions, Crop Protection and Fertilisation to GWP100 (kg CO₂eq/kg FM) of fruit trees and grassland. The flows show how product level impacts differ between the two methods - Economic allocation (left) versus biophysical allocation (right).

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