



OUTLOOK

SIGNAL will answer the question if and under which conditions the so-called Land Equivalent Ratio (LER), i.e. the yield of intercropping agroforestry applications compared to mono cropping systems, will be significantly and sustainably enhanced.

Main criteria to evaluate sustainability are the efficiencies with which nutrients and water resources are used in agroforestry systems compared to conventional systems. Increased litter deposition in agroforestry systems is expected to promote the soil biocoenosis and its functions (litter decomposition, mineralization, nutrient cycling), as well as further soil properties (water holding capacity, aggregation), to finally improve and consequently lead to a sustainable increase in yield.

SIGNAL is one of ten collaborative projects which together with the BonaRes Centre for Soil Research (www.bonares.de) are funded by the German Ministry for Education and Research (BMBF) in the framework of the initiative 'Soil as a sustainable resource for the bioeconomy – BonaRes'.

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SUSTAINABLE INTENSIFICATION OF AGRICULTURE THROUGH AGROFORESTRY



PROJECT AIM

Agroforestry is a worldwide applied and historically rooted practice of deliberately integrating woody vegetation with crop or animal farming systems to benefit from the resulting ecological and economic interactions.

The central aim of SIGNAL is to evaluate whether innovative agroforestry systems, in which crop- or grassland is combined with strips of fast growing tree species, might be a promising land use option, which can improve ecological as well as economic results and social aspects in agriculture in Germany. Furthermore, this land use type could simultaneously offer a sustainable supply of food, fodder, as well as feedstock for energetic or material use, needed in a modern Bioeconomy.

BACKGROUND

Agricultural production has increased remarkably over the past four decades. However, the same agricultural practices which have been so successful in increasing global food supply have also resulted in unintended, negative impacts on the environment and on ecosystem services, emphasizing the need for more sustainable agricultural methods.

At present, intensification of agriculture does not try to take advantage of ecological interactions within agricultural systems, which are crucial to secure a high-productive and sustainable agriculture in the future. Agroforestry systems mimic natural ecosystems, in which the activity of a highly diverse community of soil microorganisms and invertebrates regulates key ecosystem properties such as decomposition, soil nutrient cycling and soil structure, which directly affect productivity.

Possible benefits are:

- ▶ Protection from wind and water erosion
- ▶ Increasing water use efficiency
- ▶ Providing a “safety net” against nitrate leaching
- ▶ Promoting a more efficient use of available nutrients
- ▶ Increasing C-sequestration
- ▶ Enhancing biodiversity
- ▶ Promoting the overall value of ecosystem services.

CORE DESIGN

The project follows an integrated approach by studying different environmental compartments and processes which are regarded as critical for the studied land use systems:

- ▶ Evaporation and transpiration
- ▶ Nutrient use and retention efficiencies
- ▶ Soil organisms
- ▶ Soil carbon and rhizosphere
- ▶ Soil hydrology
- ▶ Quality and quantity of biomass
- ▶ Socio-economic evaluation
- ▶ Modeling (yield, C, N, water cycling)

Six experimental agroforestry sites in northern to central Germany and adjacent conventional agricultural sites are compared. The common sampling design considers distances from the tree strips in grassland- and cropland agroforestry.

