Agroforestry in southern Africa - new pathways of innovative land use systems under a changing climate (ASAP)

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The research project ASAP (Agroforestry in southern Africa - new pathways of innovative land use systems under a changing climate) aims at investigating ecosystem services as well as socio-economic and environmental benefits of AFS in the southern Africa region. The chosen transdisciplinary approach to investigate the biophysical environment and ecosystem services in conjunction with socio-economic aspects of AFS will help to develop a better understanding of a range of possible solutions using AFS for different agro-climatic zones and landscape scales. The following outlines some of the major methodological approaches applied to reach the stated goals.

Soils & Land Degradation

- Assessment of the potential of AFS to decrease soil erosion.
- Definition of soil properties that influence soil erodibility
- Identification of vulnerable soil types
- Assessment of carbon sequestration potential of soils in AFS.
- Evaluation of the impact of AFS on soil fertility, nutrient stocks and nutrient availability

Social and Economic

The extent to which AFS are embedded in policymaking processes on national level is poorly understood.

- Comparative analysis of different national institutional, political, social and economic factors.
- Data collection methods to include, expert interviews, focus group discussions, questionnaire surveys in selected case study areas and literature review.

Wind Erosion

▲ Field Setup: Collection bottles at different vertical heights

- Analysis of the susceptibility and stability of AFS towards wind erosion.
- Use of GIS-based estimates and established models to calculate scenarios in respect to land use and climate change.
- Validation by the measurement of wind erosion and dust deposition in different AFS.

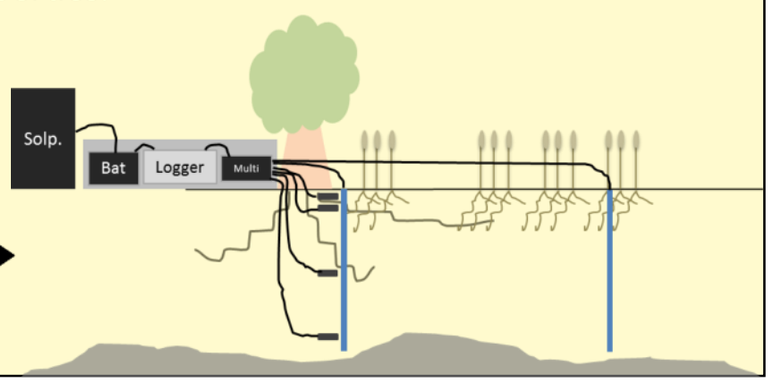
Carbon Sequestration

For gathering information about the carbon sequestration potential of trees, Terrestrial laser scanning (TLS) technology is used.

- Point clouds derived from TLS as basis for the quantification of the wood volume of different tree parts and to model the growth patterns of different tree species
- Estimation of above-ground C-sequestration potential of trees in African AFS based on the calculated volume.

Water Fluxes

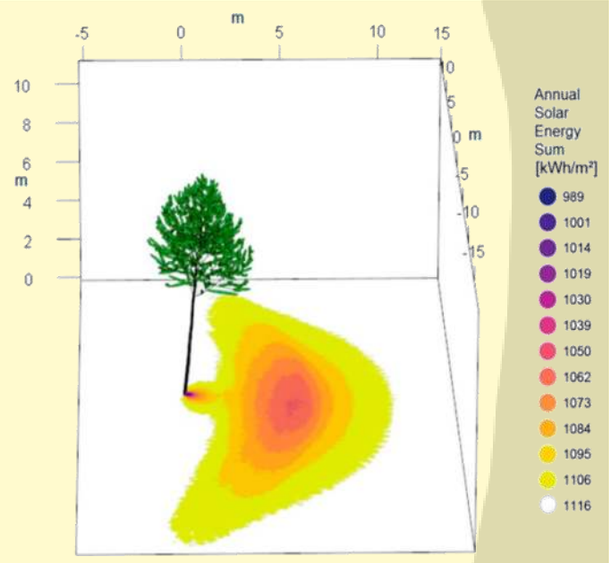
- Investigation on water redistribution and limitations between trees and crops
- Two monitoring stations: One in close vicinity to a tree and crops and one without tree influence. TDR profile sensors and sensors measuring matric potential.
- Collection of soil samples for the determination of soil hydraulic properties.



Schematic showing measurement setup ▶

Tree – Crop Interactions

- Environmental interactions between trees and crops.
- Collection of micro-climatic and eco-physiological data
- Development of a model to optimise tree density and tree-crop interactions.
- TLS used for modelling the shading effect of trees on intercrops.



3D tree model with its resulting energy loss due to shading (darker colour means higher energy loss) (Rosskopf *et al.* 2017)

References

Rosskopf E., Morhart C., Nahm M. (2017): Modelling Shadow Using 3D Tree Models in High Spatial and Temporal Resolution. Remote Sensing 9(7):719. doi:10.3390/rs9070719

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