

Developing Hi-sAFe-machine learning hybrid approach as a field-specific decision support system for agroforestry systems

Ahmed Kheir¹, Marie Gosme², Navid Bakhtiary¹, Priscilla Kephe¹, Juvenal Assou³, Maren Langhof³, Jörn Strassemeyer¹, Til Feike¹

¹Julius Kühn Institute (JKI)—Federal Research Centre for Cultivated Plants, Institute for Strategies and Technology Assessment, Kleinmachnow, Germany

²AgroParisTech, UMR 211 INRA-AgroParisTech, BP 01, 78850, Thiverval-Grignon, France

³Institute for Crop and Soil Science, Julius Kühn Institute, Bundesallee 58, 38116 Brunswick, Germany

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Motivation



- The need of developing robust AF-DSS to simulate complex interactions of crop and tree growth across seasons
- Hi-sAFe, a new 3D process-based model offering a comprehensive framework, but still has some limitations
- Hybridizing Hi-sAFe with machine learning techniques may help overcome these limitations

Current limitations



Limited Research and Data

Complex Interactions

Model Limitations

The conceptual approach to solve them

 Using AF diverse dataset from Wendhausen (old and ongoing)

✓Parameterizing Hi-sAFe 3D model for AF and MC

 ✓ Integrate ML with Hi-sAFe 3D model (hybridization)



The hybridization approach





Why hybridization?



✓ Filling the missing data

✓ Simplifying Hi-sAFe Model optimization and Outputs

✓Hybridization can bridge the gaps in Hi-sAFe's current limitations

✓ Developing microclimate model

Why microclimate model?



- Improved accuracy by capturing fine-scale environmental variations
- Consider the effect of humidity and wind reductions (Hi-sAFe limitation)
- ✓Validate Hi-sAFe microclimate observations (Moisture, ET…)

 The potential of generating microclimate variables from macroclimate stations

The specific challenges



 Collecting high quality and real time AF, MC and microclimate dataset

✓ Complexity of parameterization

✓Integration of Advanced Monitoring Technologies

Data is the bottleneck, thus we are very interested to engage with AFS experts and potentially utilize their datasets for improving our AFS models

The progress (ongoing AF experiments)



- Parameterizing Hi-sAFe using old and limited dataset from Wendhausen
- Designing and initiating a new AF experiment in Wendhausen
- Installing microclimate sensors at different spaces from tree
- ✓Analyzing real-time dataset from climate sensors









Microclimate Results



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Effects of hourly time, distance and wind

Air Temperature at Specific Times





Soil moisture over time





Effect of Wind Type and Distance



Pair Plot of Weather and Soil Variables by Wind Type

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300	and interest	al data	Corr: 0.145***	Corr: 0.041	Corr: 0.356***	Corr: -0.084*	Corr: 0.160***	Corr: -0.144***	* Corr: 0.330***	Corr: -0.164***		
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### Any Questions

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