How to continue 50 years of monitoring and develop new methods for forest ecology

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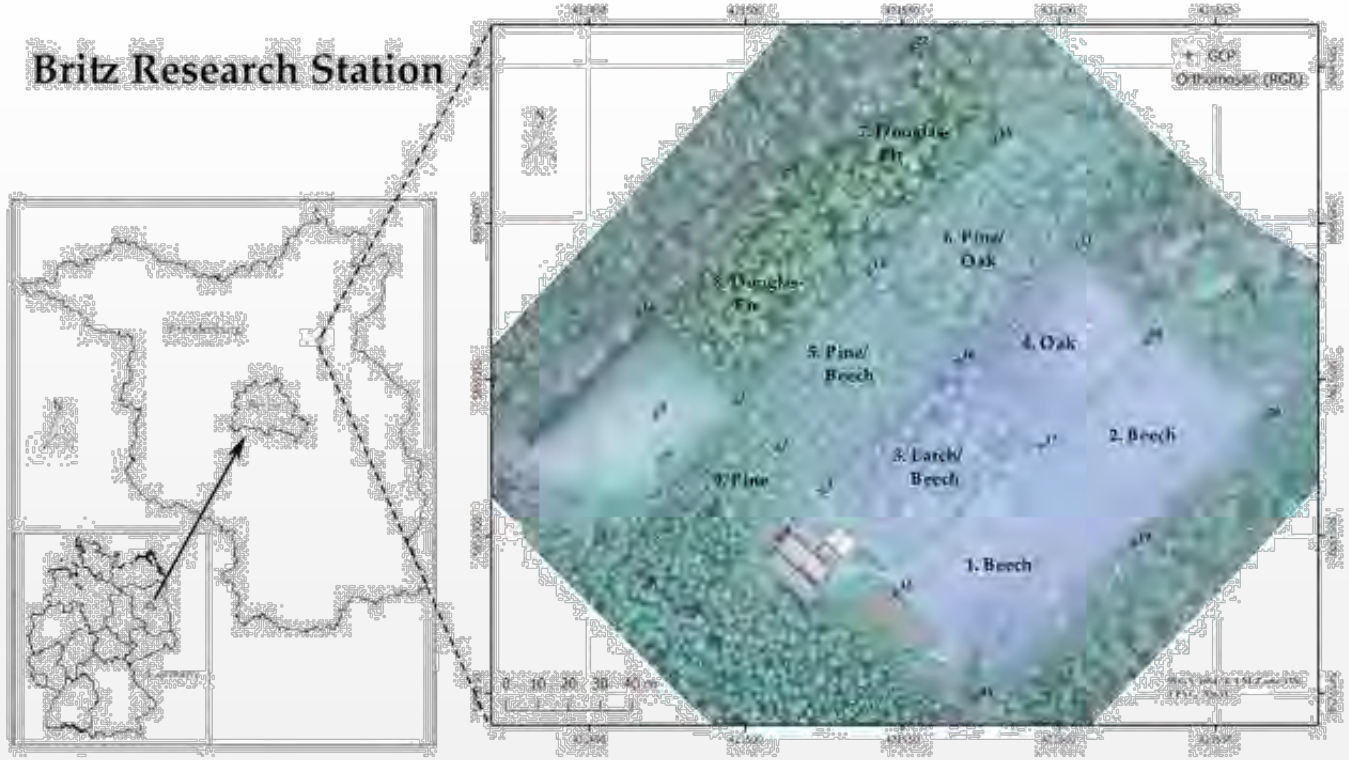
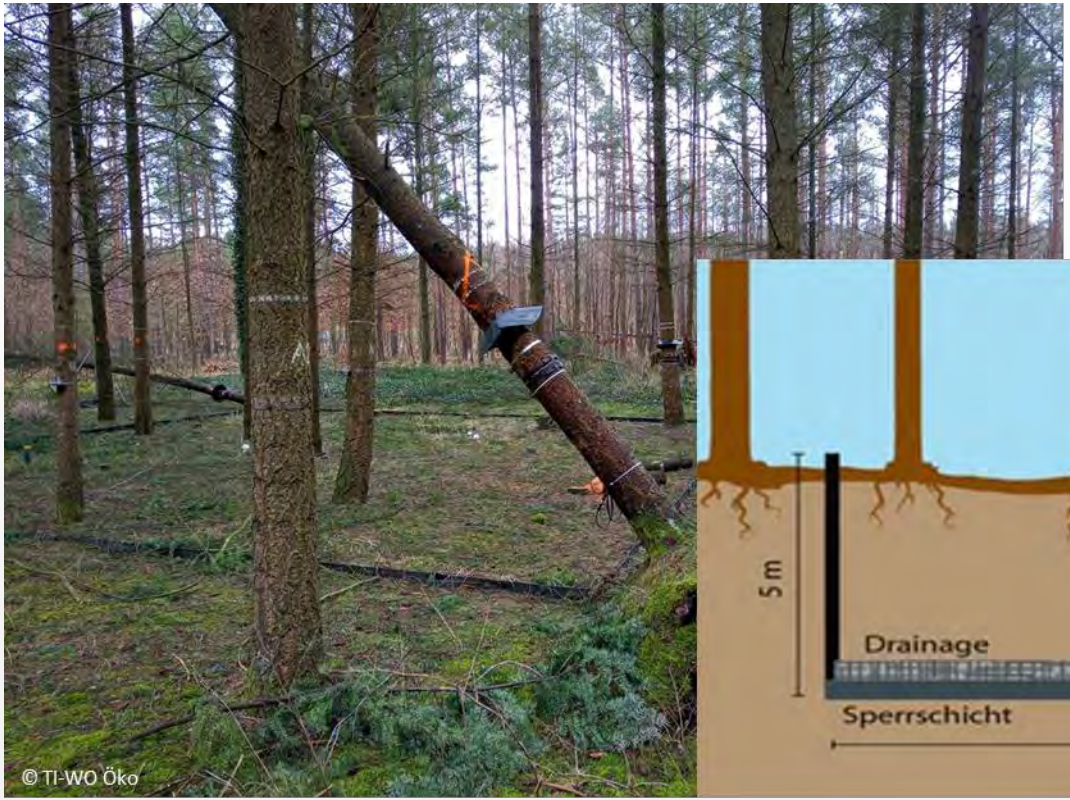
Location

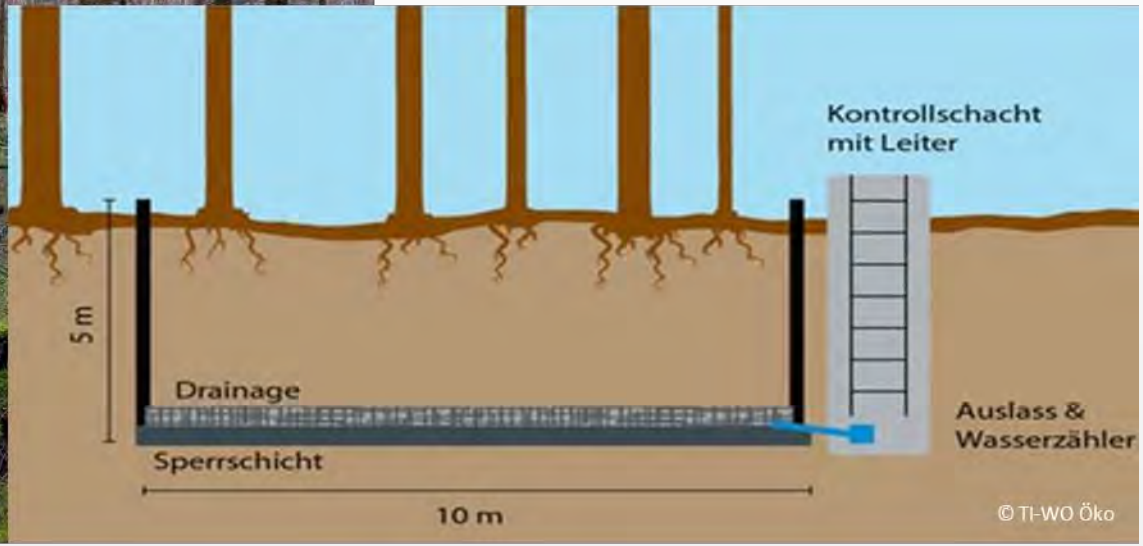


Krause et al 2019: DOI: 10.3390/rs11070758

Tree species

9 large-scale Lysimeters





1978- 1998

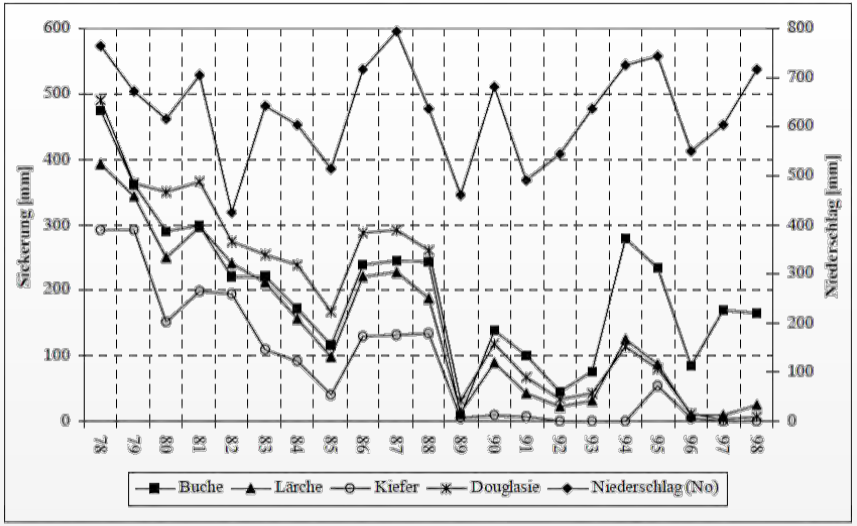
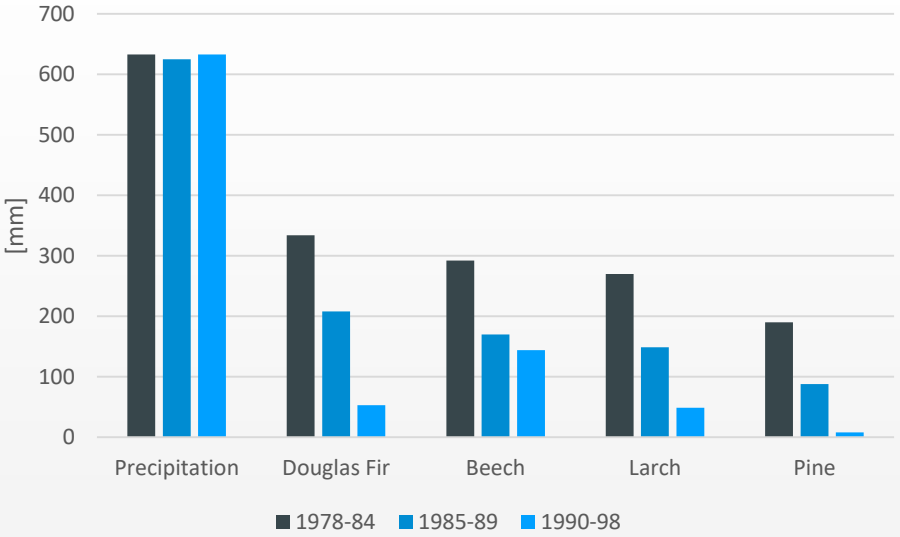


Abbildung 2: **Jahresniederschlag No und -sickerung D 1978 bis 1998 auf der Lysimeterstation Britz**

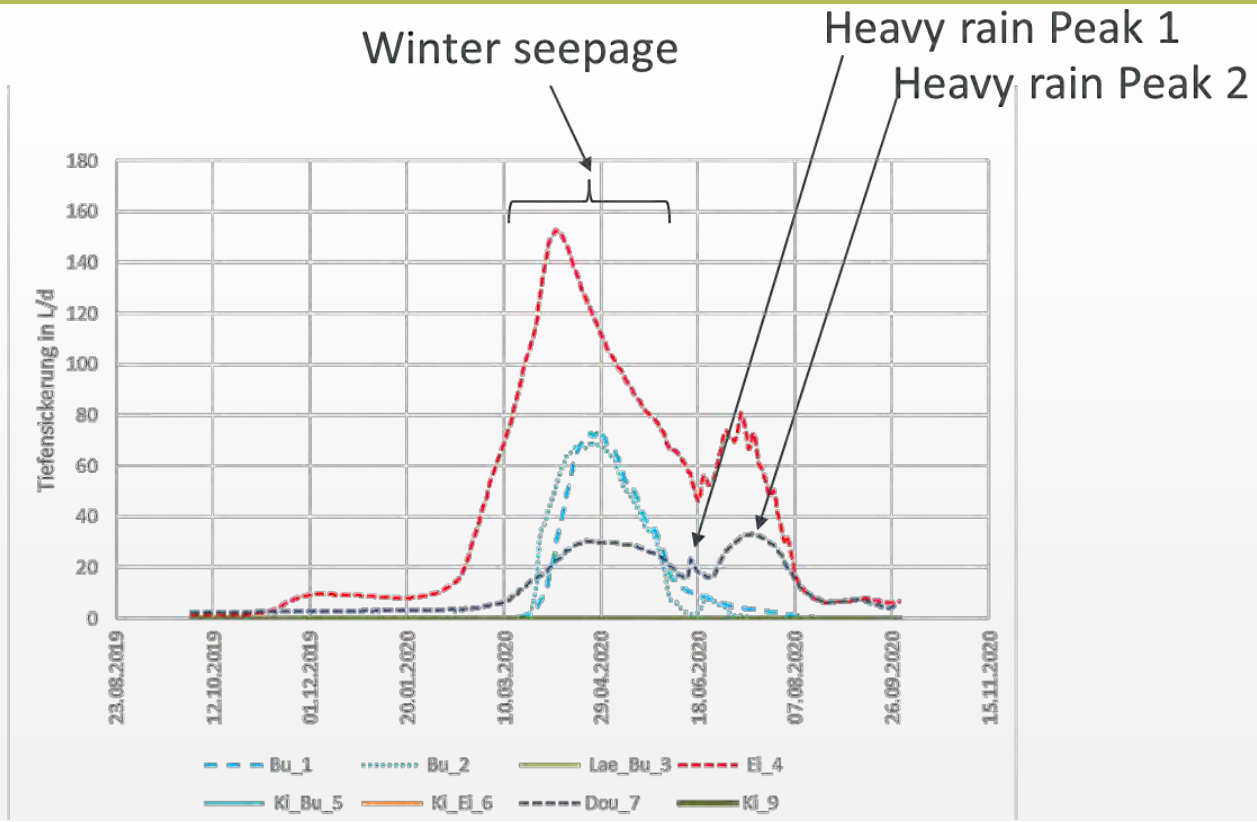


Müller, J. (30). 30 Jahre forsthydrologische Forschung auf der Großlysimeteranlage in Britz-Zielstellung und Ergebnisse. na.

9 large-scale lysimeters

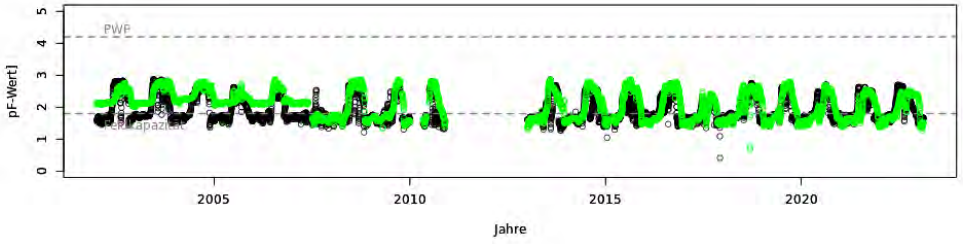
Year	Precipitation [mm]	Seepage [mm]						
		Beech (1974)	Pine (1974) & beech (2000)	Pine (1974) & oak (2000)	Pine (1974)	Larch (1974) & beech(2000)	Douglas fir (1974)	Oak (2000)
Mean	655	71	12	16	9	25	68	251
2010	836	81	1	2	0	81	88	561
2011	714	182	62	120	63	118	136	421
2012	689	135	5	29	14	27	100	522
2013	666	119	0	12	13	7	134	265
2014	678	22	0	3	0	0	21	142
2015	571	23	0	2	0	0	27	173
2016	536	25	0	0	0	0	29	135
2017	838	38	0	0	0	0	41	185
2018	554	121	7	25	15	21	119	219
2019	660	0	0	0	0	0	16	75
2020	638	37	0	0	0	0	49	164
2021	712	85	67	14	16	54	121	257
2022	425	63	12	1	1	18	5	143

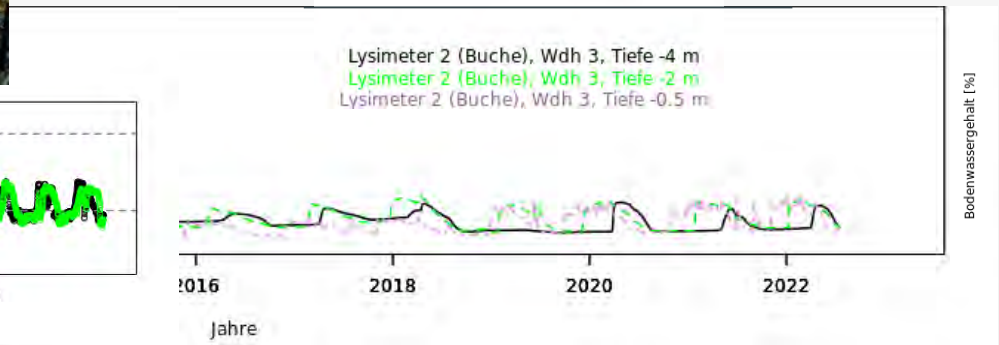
9 large-scale lysimeters



Focus since 1972 on hydrology

- Soil water content down to 4,6m (FDR sensors)
- Three repititions in every depth
- Matric potential to 2m depth (tensiometer)

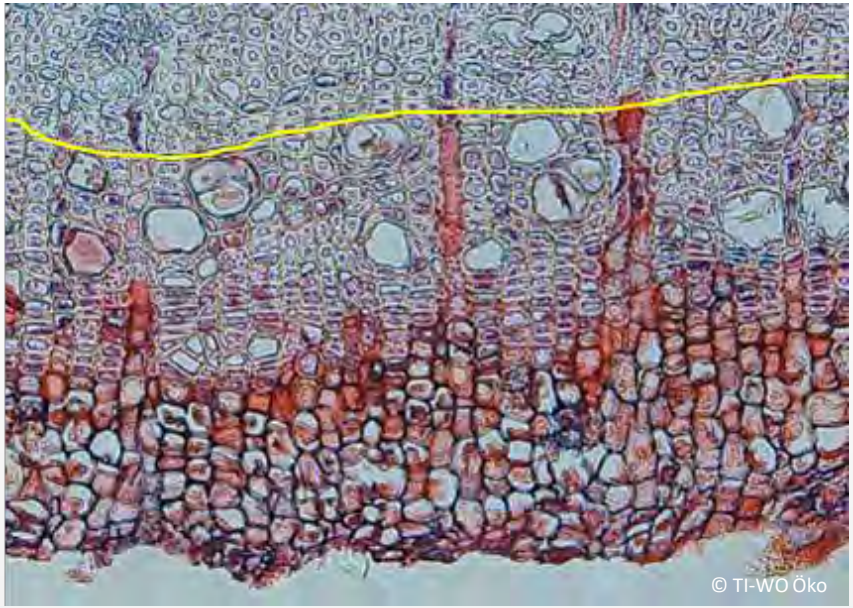




Parameters according to Level II manuals

- Litterfall
- Tree height
- Diameter (inventory, manual and automatic dendrometers)
- Meteorology (open field, pine, beech)
- Precipitation (open field, all species)
- LAI
- Phenology (ground, UAV, pheno cameras)
- Soil moisture

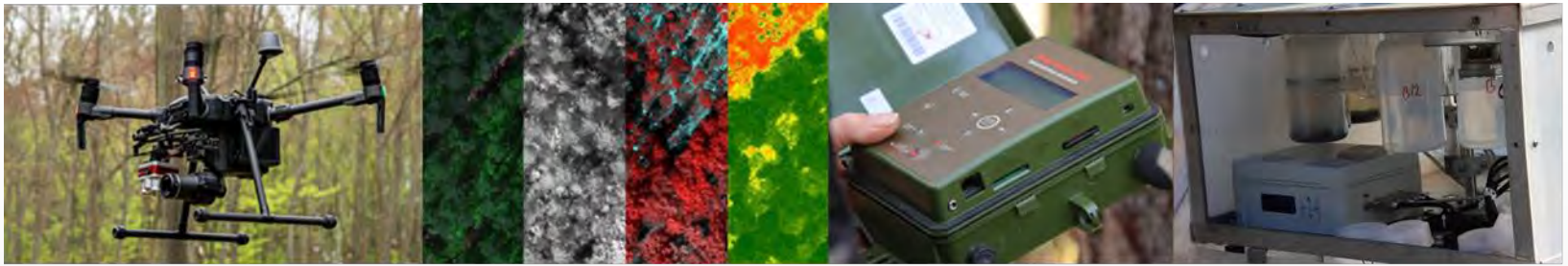
Detecting extremes



frost ring in beech (taken 25 May 2018), yellow line: ring boundary, red oval: messy cells with none, small, and damaged vessels

Late frost damage on oak

New methods



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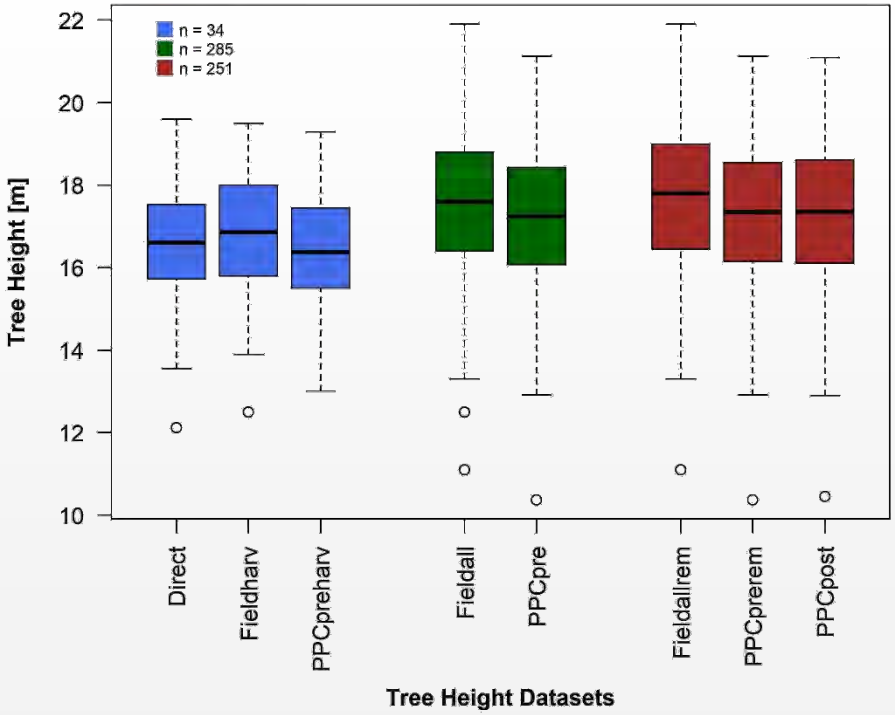
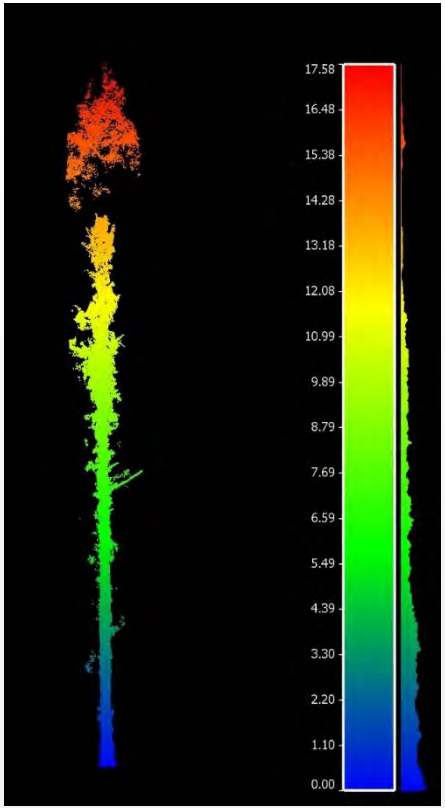
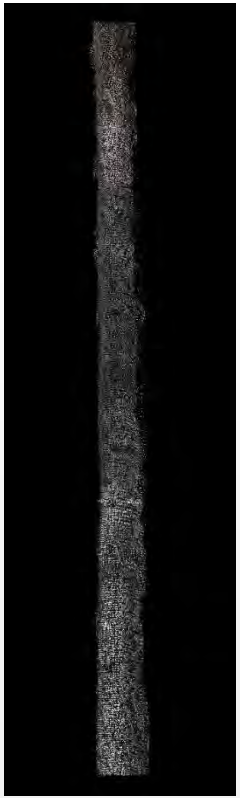
Tree volume by UAV

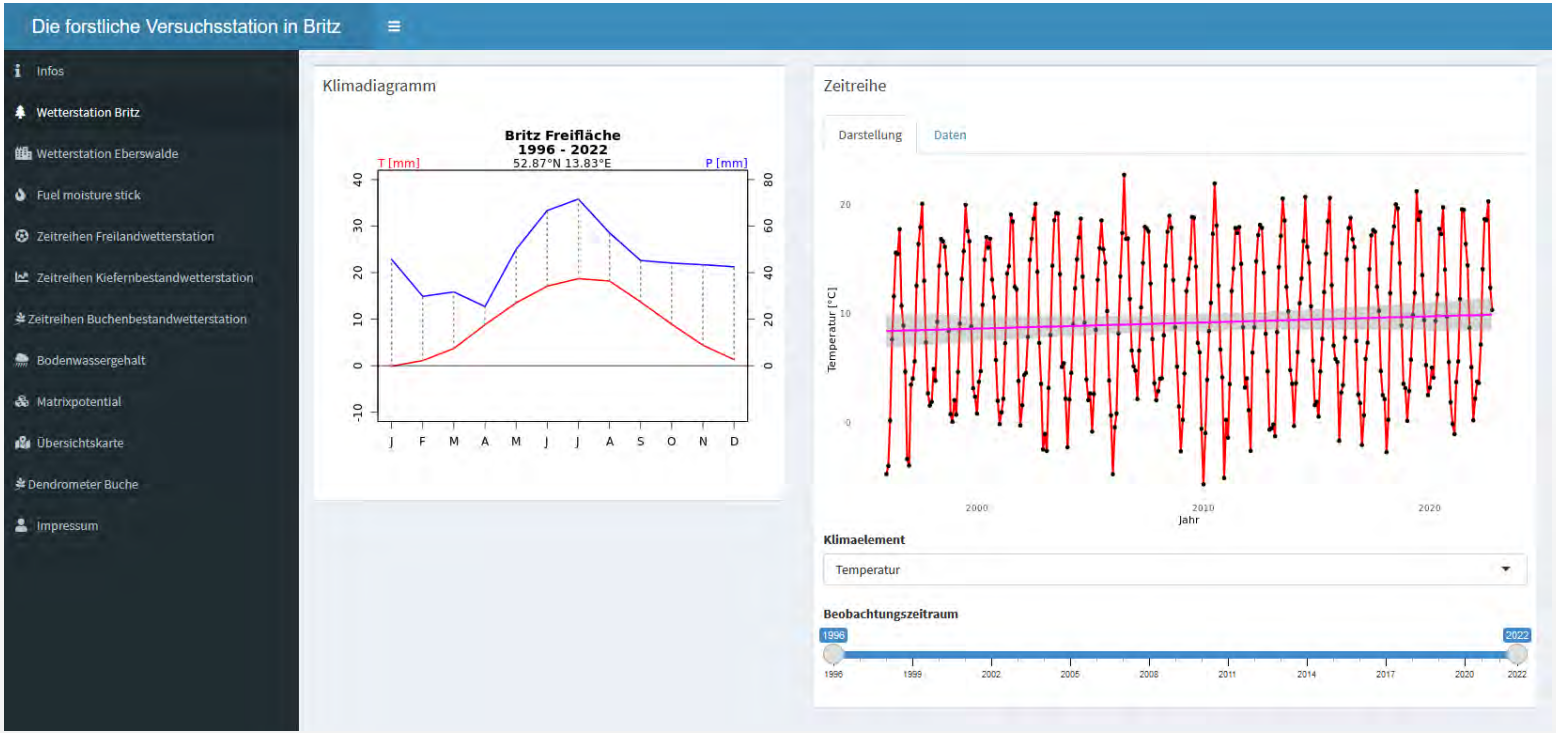






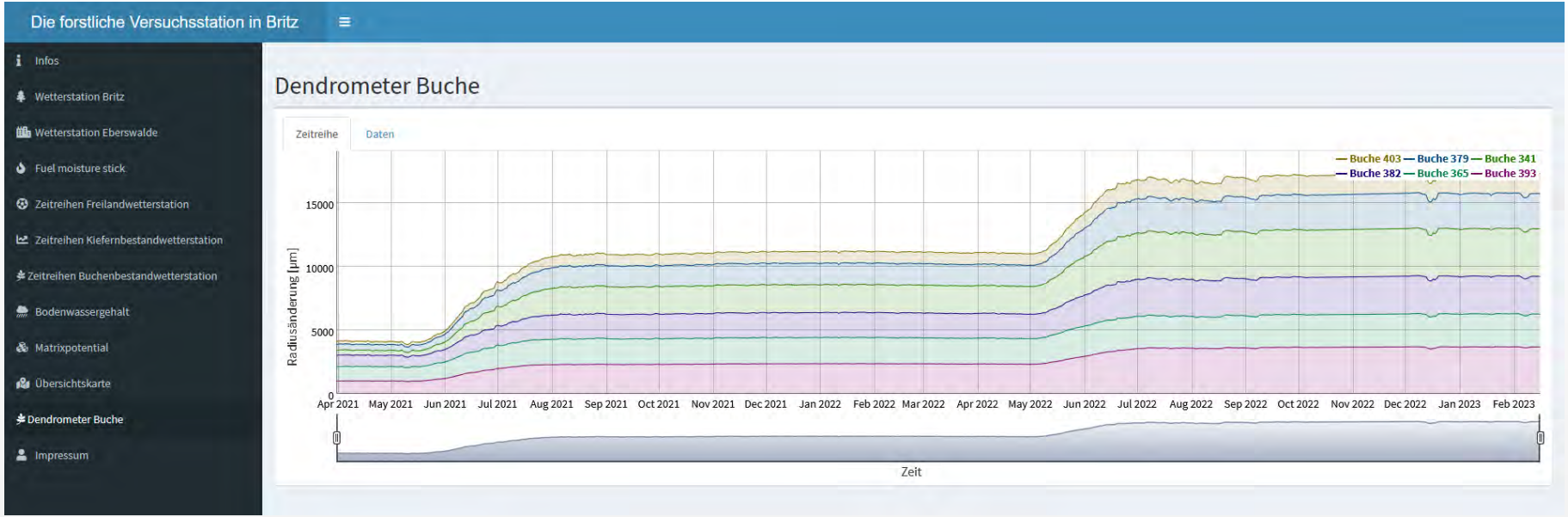
Krause, S., Sanders, T. G., Mund, J. P., & Greve, K. (2019). UAV-based photogrammetric tree height measurement for intensive forest monitoring. Remote sensing, 11(7), 758.

Meteorology



https://wo-apps.thuenen.de/apps/britz/

Dendrometer



https://wo-apps.thuenen.de/apps/britz/

Phenology

Documentation of the six phases of beech in the manual on phenological ground assessment

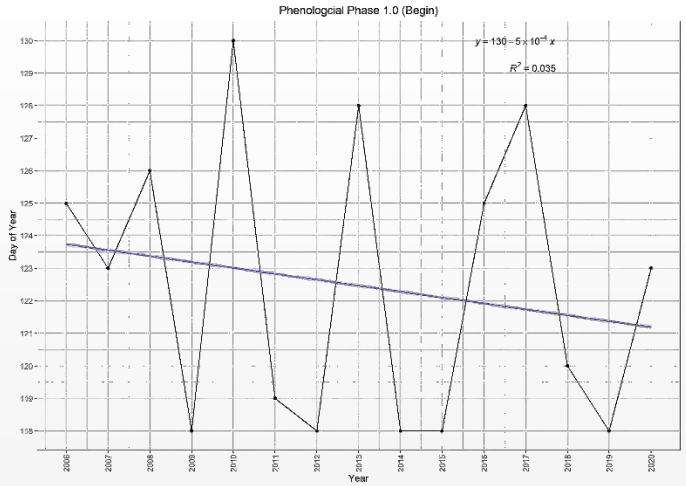
Krause, S. H., & Sanders, T. G. (2022). European Beech Spring Phenological Phase Prediction with UAV-derived Multispectral Indices and Machine Learning Regression. bioRxiv, 2022-12.

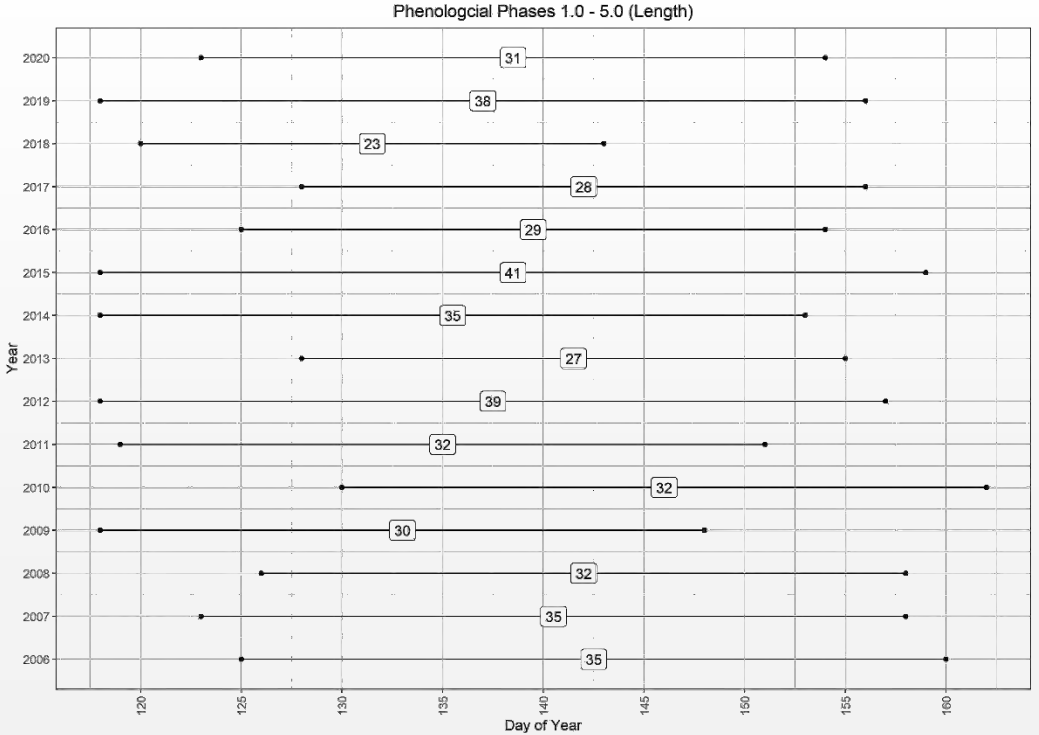
… with UAV and 3D models

- Compare to weekly ground observations
- Assess differences between individual trees
- Reach a higher temporal resolution

Krause, S. H., & Sanders, T. G. (2022). European Beech Spring Phenological Phase Prediction with UAV-derived Multispectral Indices and Machine Learning Regression. bioRxiv, 2022-12.

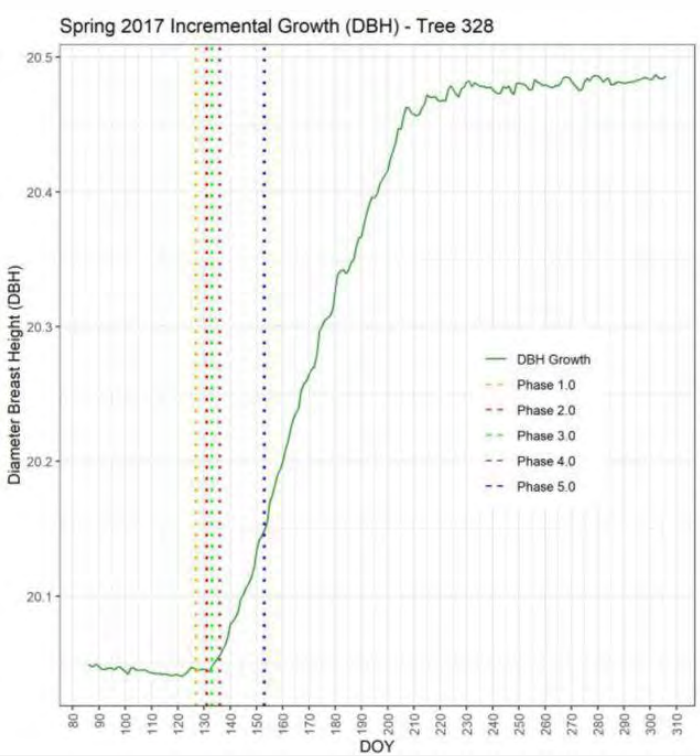
Phenology and machine learning

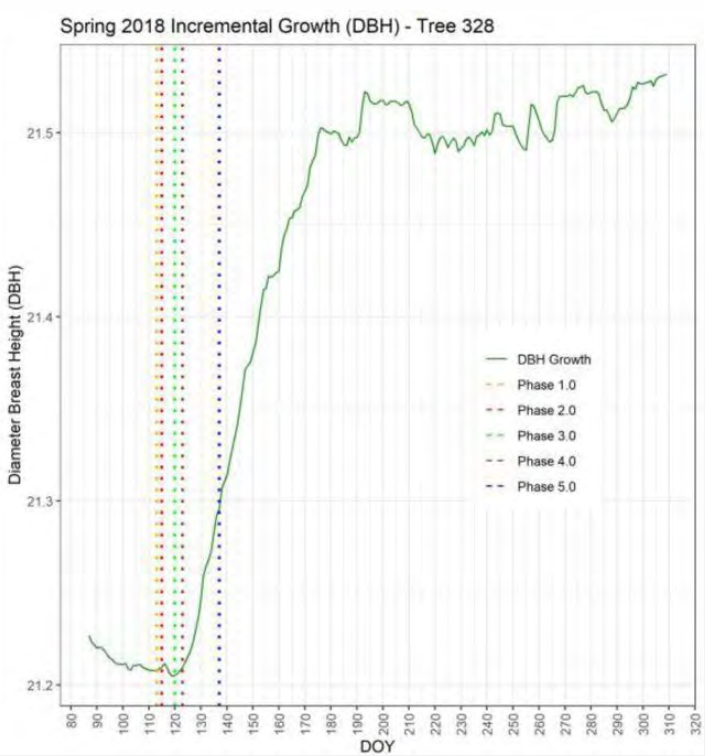




Krause, S. H., & Sanders, T. G. (2022). European Beech Spring Phenological Phase Prediction with UAV-derived Multispectral Indices and Machine Learning Regression. bioRxiv, 2022-12.

Dendrometer and phenology



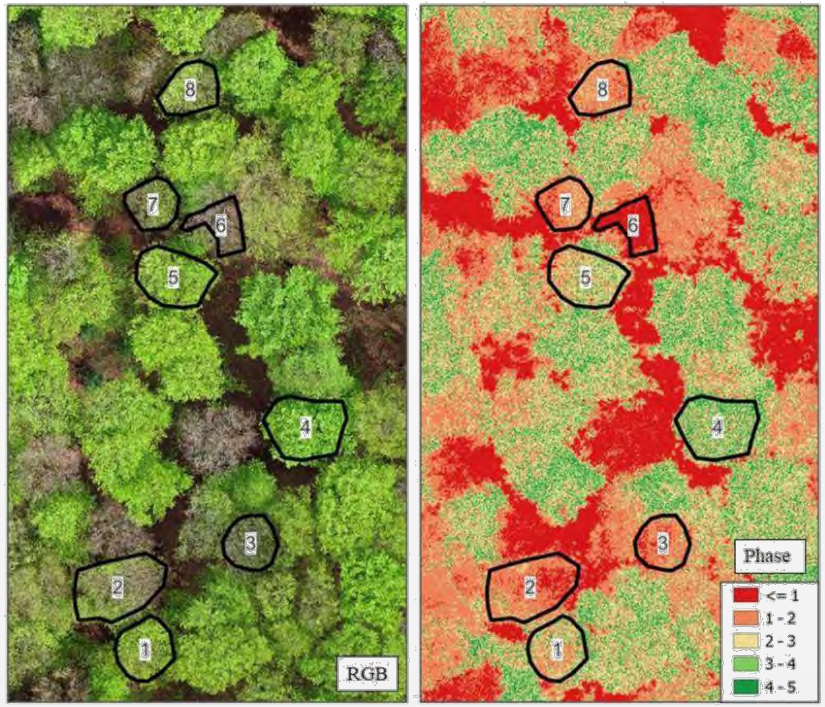


Krause, S. H., & Sanders, T. G. (2022). European Beech Spring Phenological Phase Prediction with UAV-derived Multispectral Indices and Machine Learning Regression. bioRxiv, 2022-12.

UAV assessment with phase prediction

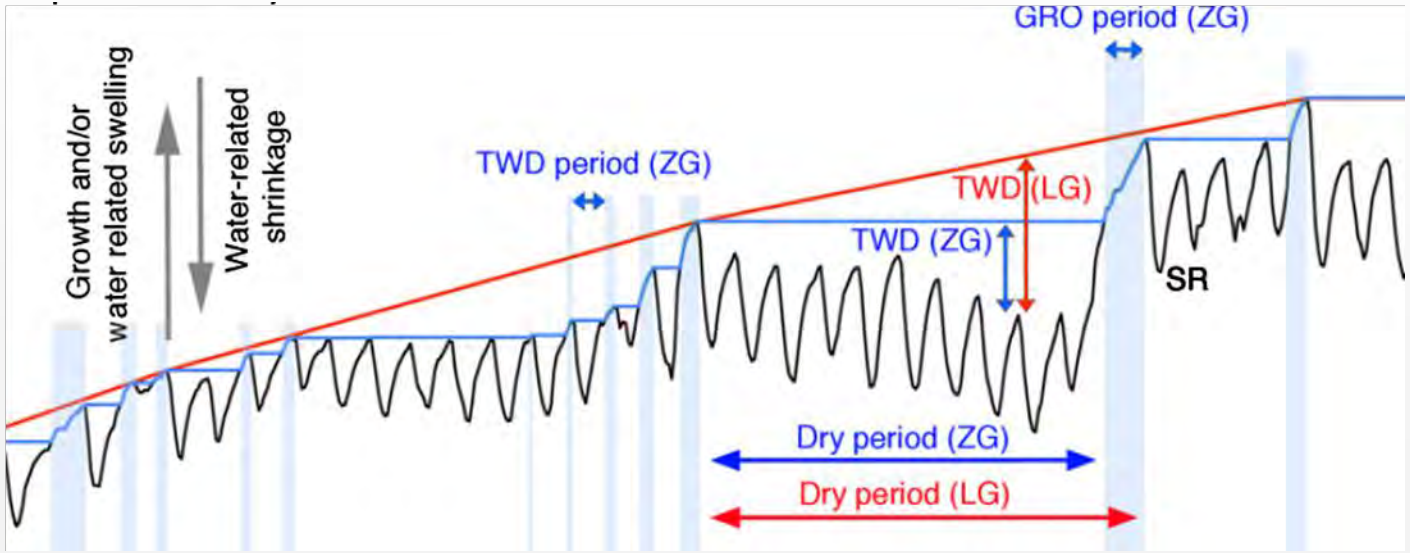
Sensor: RGB Zenmuse X7
Location: Black Forest (< 70 years)
Date: 2022-04-25
DOY : 115
Model: bf-gcc-19-20

Tree ID	ML Phase	Phase	Difference
1	2.4	2.5	-0.1
2	1.4	1.5	-0.1
3	1.5	1.3	0.2
4	3.2	3.8	-0.6
5	2.6	3.0	-0.4
6	0.8	0.9	-0.1
7	1.6	1.5	0.1
8	1.8	2.7	-0.9
RMSE	**MAE**	**R^2**	**Mean Dif.**
0.43	**0.32**	**0.02**	**-0.25**



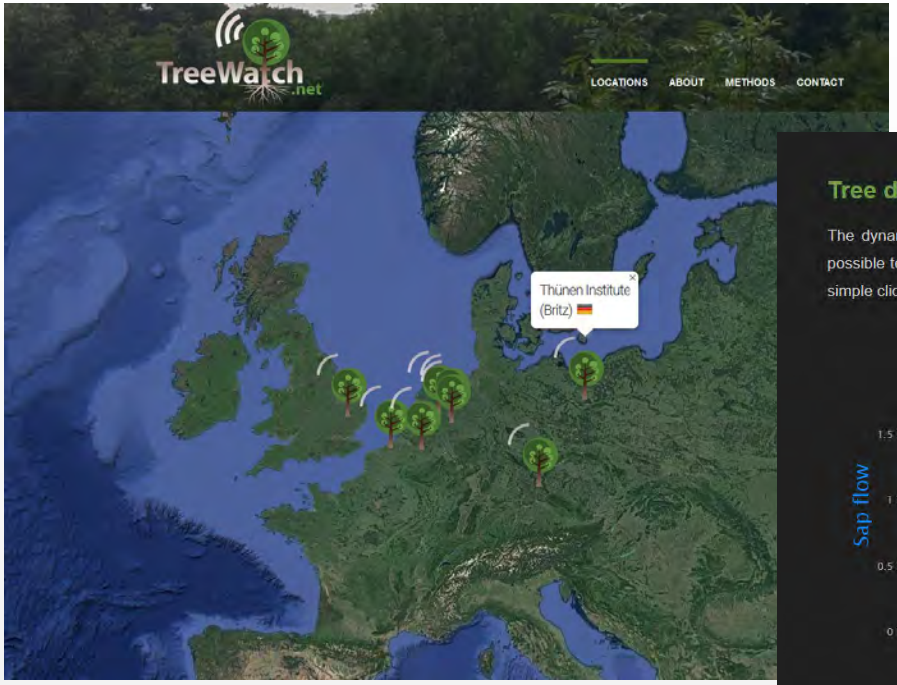
Krause, S. H., & Sanders, T. G. (2022). European Beech Spring Phenological Phase Prediction with UAV-derived Multispectral Indices and Machine Learning Regression. bioRxiv, 2022-12.

Tree water deficit



Krause, S., & Sanders, T. G. (2022). Mapping Tree Water Deficit with UAV Thermal Imaging and Meteorological Data.

TreeWatch



https://treewatch.net/thunen-institute-forest-ecosystems/

Cooperations

- Spore trap (Ammod, Uni Kassel/ Museum König)
- Malais and picture trap (Ammod, Uni Kassel/ Museum König)
- Klinsecta
- Particulate matter on leaves (Uni Bonn)

AMMOD

Always open to share our playground!

2023

Alle Bilder © TI-WO Öko

- Regular LAI measurements
- ICOS eddy covariance flux-station
- Comparison of various dendrometer types
- Become an LTER-site

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