



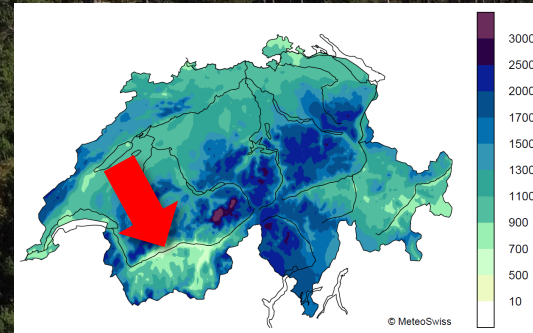
A research institute
of the ETH Domain

Welcometo the 6th Pfynwald Workshop 2024

The Long-term Experimental Research Platform Pfynwald



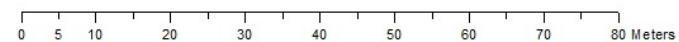
- Natural, even aged, xeric Scots pine forest in the Rhone Valley
- 876 *Pinus sylvestris* trees/ha
- Natural precipitation < 600 mm/year
- Since 2003 irrigation (+ 600 mm/year)
- Since 2014 irrigation stop on 1/3 of each irrigated plot



Plot design



-  Control (600 mm)
-  Irrigation (+ 600 mm, since 2003)
-  Irrigation-Stop (since 2014)
-  9 measurement scaffolds





*28 June 1961 , † 31 October 2012

Phyton (Austria) Special issue: "APGC 2004"	Vol. 45	Fasc. 4	(153)-(156)	1.10.2005
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The Decline of *Pinus sylvestris* L. Forests in the Swiss Rhone Valley - a Result of Drought Stress?

By

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Key words: Scots pine, climate warming, drought stress, tree mortality, biome shift.

Summary

DOBBERTIN M., MAYER P., WOHLGEMUTH T., FELDMEYER-CHRISTE E., GRAF U., ZIMMERMANN N.E. & RIGLING A. 2005. The decline of *Pinus sylvestris* L. in the Swiss Rhone valley – a result of drought stress? – *Phyton* (Horn, Austria) 45 (4): (153)-(156).

In Scots pine forests in the inner valleys of the European Alps high mortality of unknown causes has recently been observed. In 2002-2003 we assessed forests in the Swiss Rhone valley on a systematic grid ranging in altitude between 440 m and 1550 m a.s.l. We tested if mortality rates since the National Forest Inventory (NFI) in 1983/85 differed between species, geographic regions, altitudinal ranges or potential drought stress (extrapolated difference between annual precipitation (P) and modeled potential evapotranspiration (PET) for the period 1961-90). We also correlated annual pine mortality for a local long-term forest research site (LWF) with climatic data. At the LWF site 59% of the pines died between 1996 and 2004. Annual mortality rates varied substantially between years and were highest following the drought years 1998 and 2003. Mortality related best to P-PET of the prior summer (May – August). Pine mortality on NFI plots was higher than elsewhere in Switzerland, while mortality of other species was not. Below 1100 m a.s.l. mortality rates of pines, but not of other species, were higher than above. We found a significant negative relationship between mortality rates and P-PET in pines, but not in the other species. Therefore, we postulate that drought stress triggers the observed pine decline.

Introduction

Scots pine (*Pinus sylvestris* L.) forests occur naturally in the inner valleys of the European Alps near the southern limit of the species range. Extraordinarily high tree mortality of Scots pine has recently been observed in several of these in-

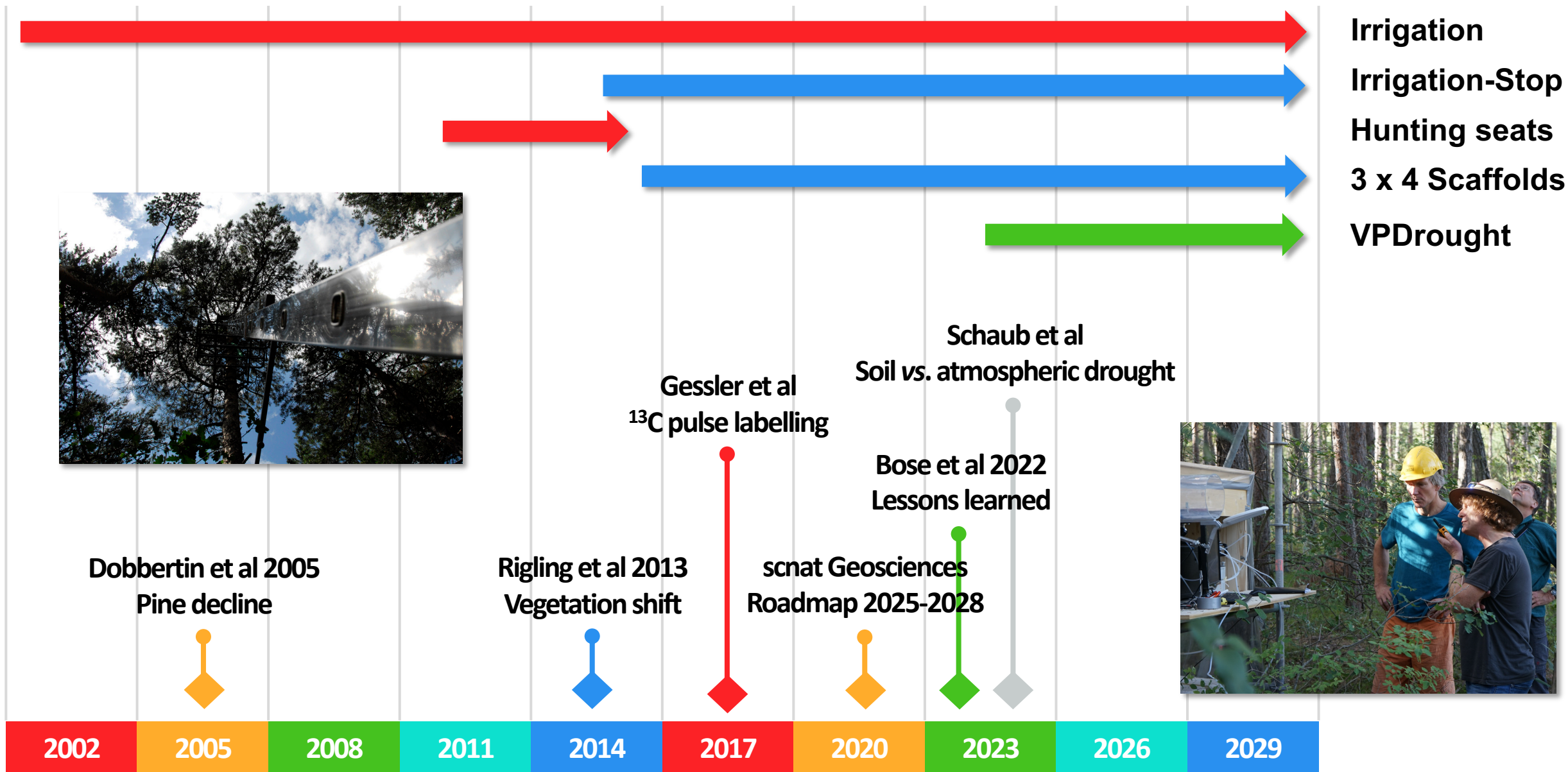
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2005-2010 (7/55 ISI publications)



2020-2024 (24/55 ISI publications)



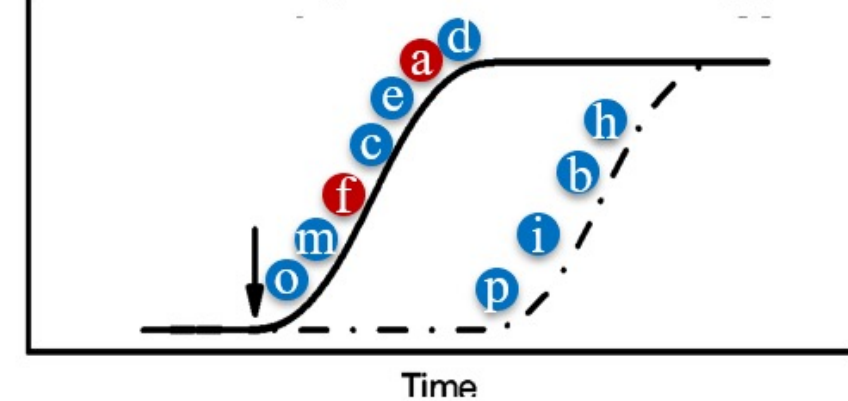


Tree vs. ecosystem response

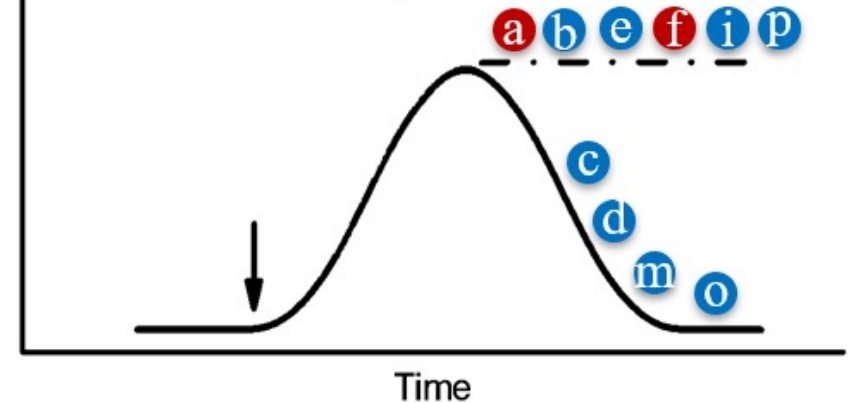
Tree-level responses	Ecosystem-level responses
a Crown transparency ^P ↓	i <i>Tomicus</i> abundance* ↓
b Tree survival ^P ↑	k <i>Pinus</i> , <i>Quercus</i> & Shrubs' sapling abundance ↑
c Needle length ^P ↑	l Litter decomposition* ↑
d Shoot length ^P ↑	m Fungal fruit bodies ↑
e Radial growth ^P ↑	n Soil organic matter (SOM) stocks* ↑
f Tree ring $\delta^{13}C$ ^P ↓	o Soil moisture ↑
g NSC insoluble ^P ↓	p Stand basal area ↑
h Fine root biomass ^P ↑	q Litterfall* ↑
i Leaf area index ^P ↑	

Response patterns

Start of the responses: Immediate vs. lagged

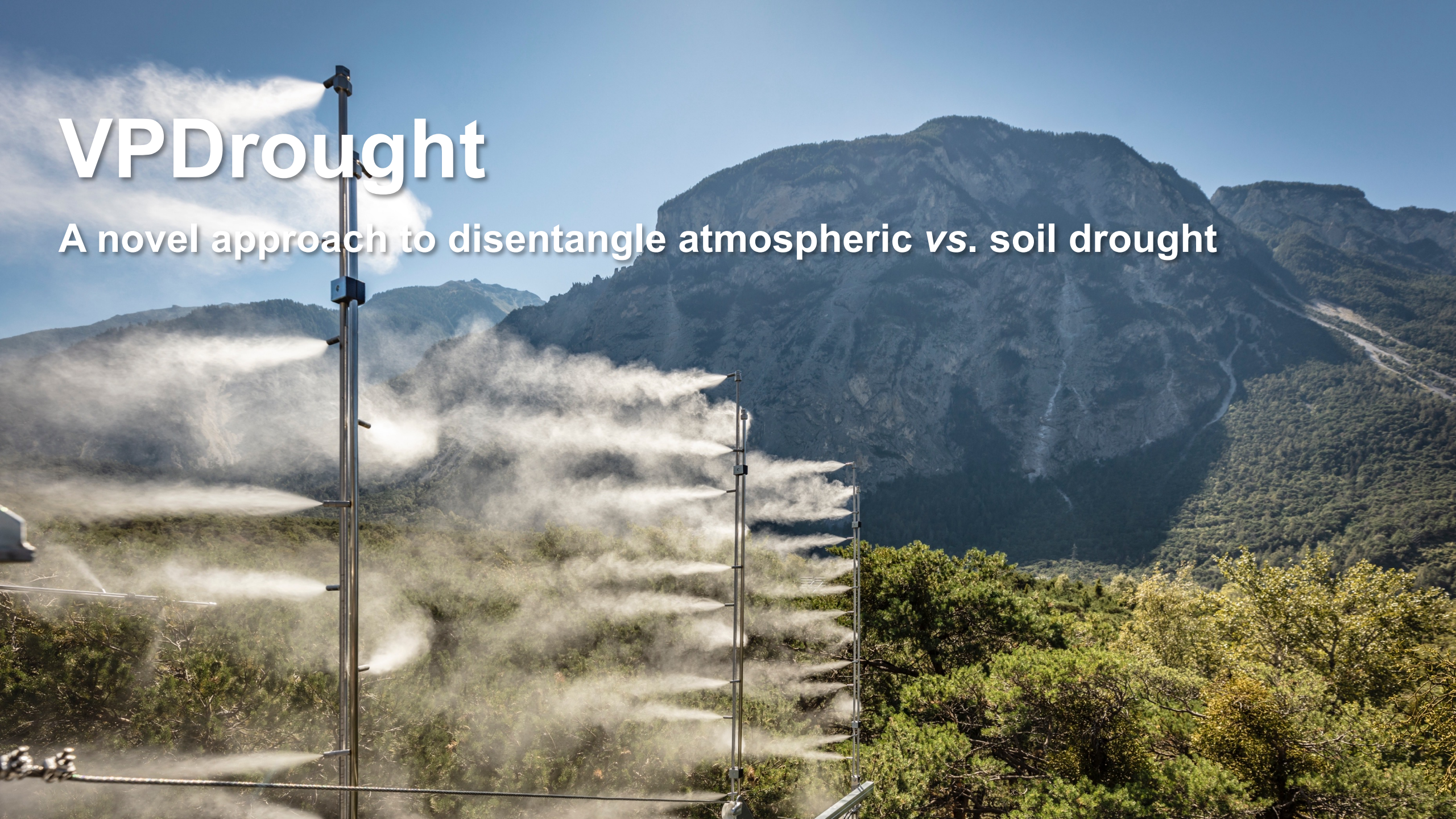


Duration of the responses: Transient vs. persisting



VPDrought

A novel approach to disentangle atmospheric vs. soil drought



Program of the 6th Pfywald Workshop, Englersaal, WSL Birmensdorf, 7 March 2024

Time	Titel	Presenter
9:00	Welcome & Intro	marcus.schaub@wsl.ch
9:10	Hölstein - a Forest without Rain	ansgar.kahmen@unibas.ch
9:30	VPDrought in a Nutshell – a Novel Approach to Disentangle Atmospheric and Soil Drought	marcus.schaub@wsl.ch
9:50	VPDrought - from Alpine Pumping to Climatic Canopy Gradients	stefan.hunziker@wsl.ch
10:10	From the Forest to Figures: The Lifecycle of Pfywald's Data	volodymyr.trotsiuk@wsl.ch
10:30	Coffee break	
10:50	Insights from Geophysical Imaging of the Below Ground and Tree Trunks in Pfywald	alexis.shakas@erdw.ethz.ch
11:10	Short and Long-Term Responses of Soil CO ₂ Effluxes under Drought	luisa.minich@wsl.ch
11:30	Twenty Years of Irrigation Acclimation is Driven by Denser Canopies in <i>Pinus sylvestris</i>	alice.gauthey@epfl.ch
11:50	Lunch break (tables reserved)	
13:00	Radial Stem Growth and Tree Water Deficit	roman.zweifel@wsl.ch
13:20	Plant Hydraulic Adjustments to Varying VPD and Soil Moisture: Model Predictions	andrea.carminati@usys.ethz.ch
13:40	Microwave Radiometry of Vegetated Land	yiwen.zhou@wsl.ch
14:00	Predicting Ecosystem Productivity and Transpiration Using an Optimality-based Theory of Photosynthesis and Hydraulics	jaideep.joshi@unibe.ch
14:20	Coffee break	
14:40	Tree-ring Isotopes Indicate Acclimation	valentina.vitali@wsl.ch
15:00	InSitu Isotope Measurements and Isotope Fractionation	marco.lehmann@wsl.ch
15:20	Defoliation, Metabolites and Beyond	arthur.gessler@wsl.ch
15:40	3D Tree - An Alternative Visualization Approach for Complex Data	manuel.luck@wsl.ch
16:00	Wrap up & Apéro	



Universität
Basel

Forschungsareal «Swiss Canopy Crane II»

Den Wald der Zukunft erforschen

Bäume brauchen Wasser

Wenn Bäume Kohlendioxid aus der Luft für die Photosynthese aufnehmen, entweicht aus ihren Blättern eine grosse Menge an Wasser. Hochgerechnet auf einen ganzen Wald können Bäume an einem Tag bis zu 30'000 Liter Wasser pro Hektar verdunsten.



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Wasser und Klimawandel

Der Anstieg von Kohlendioxid in der Atmosphäre führt nicht nur zu steigenden Temperaturen. Modelle sagen auch voraus, dass es in der Schweiz im Sommer in Zukunft 20 – 30% weniger regnen wird und Dürreperioden zunehmen werden.

Wie reagiert der Wald auf den Klimawandel?

Gibt es Baumarten, die besonders resistent gegenüber solchen Dürreperioden sind? Können sich Bäume an zunehmende Trockenheit anpassen? Und was bedeuten diese Veränderung für die komplexen ökologischen Prozesse, die in einem Wald stattfinden?

Diese Fragen will die Universität Basel gemeinsam mit Partnern auf dem Forschungsareal «Swiss Canopy Crane II» klären. Hierzu wurde der Wald seit 2018 mit einer grossen Anzahl Sensoren ausgestattet. Sieben grosse Regenreduktionsdächer unter den Bäumen simulieren zukünftige Dürreperioden. Ein «Waldkran» ermöglicht den Forschenden die Auswirkungen der simulierten Dürre auf die verschiedenen Baumarten direkt in den Baumkronen zu untersuchen.



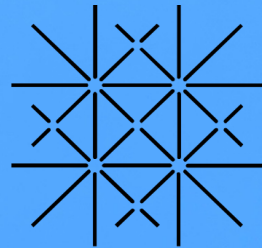
Partner und Unterstützung:



Amt für Wald beider Basel



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