

# Zustandsmonitoring von Streuobstwiesen mit Unmanned Aerial Vehicles (UAV) – die Auswirkungen von Dürreereignissen auf unterschiedliche Obstbaumarten in Baden-Württemberg

## AK Fernerkundung - Session 2: Remote Sensing Science

Tamara Schober



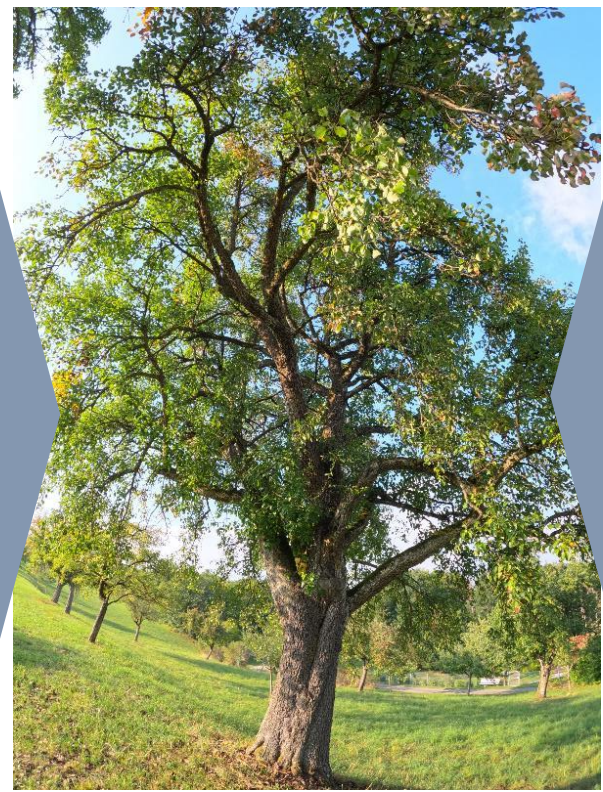


# Introduction (1/3)

## management difficulties



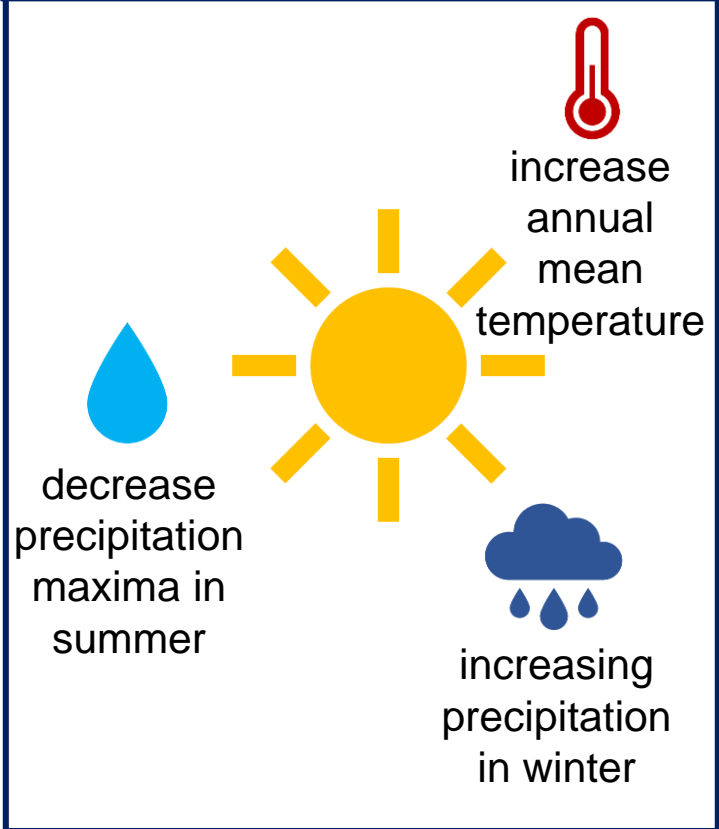
Economic profitability  
Interest in use



drastic decline  
orchard meadow  
stands

Change in site  
conditions

## climate change



Baden-Wuerttemberg  
- **2/3** since 1950s

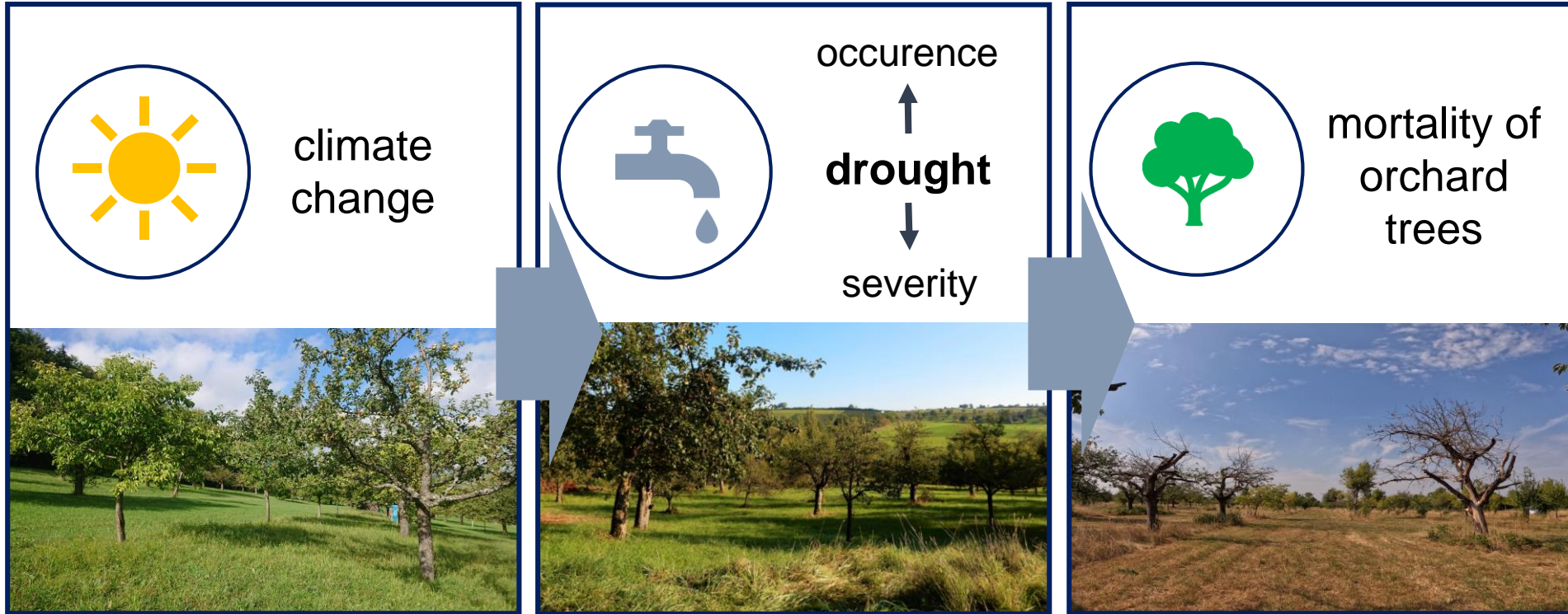
**80%** not adequately managed





# Introduction (2/3)

## Objective



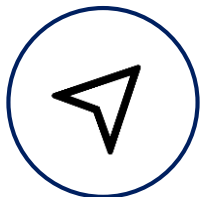
sensitivity to insect damage



increased spread of parasites (Mistletoe)



sensitivity to illnesses



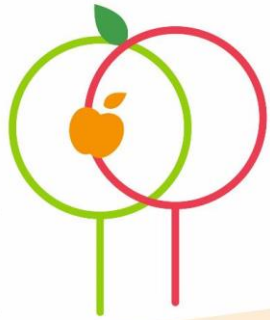
...describe and evaluate the impact of drought on orchards





# Introduction (3/3)

Research Project



# STIK

Streuobstwiesen im Klimawandel

founded by BADEN-WÜRTTEMBERG STIFTUNG



information/  
data basis



analyses



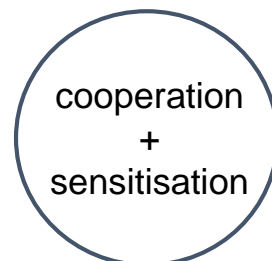
Strategy  
development

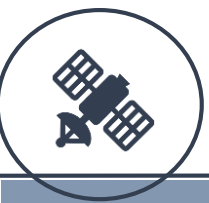


knowledge  
transfer



transfer





# Material & Methods (1/5)

Study area

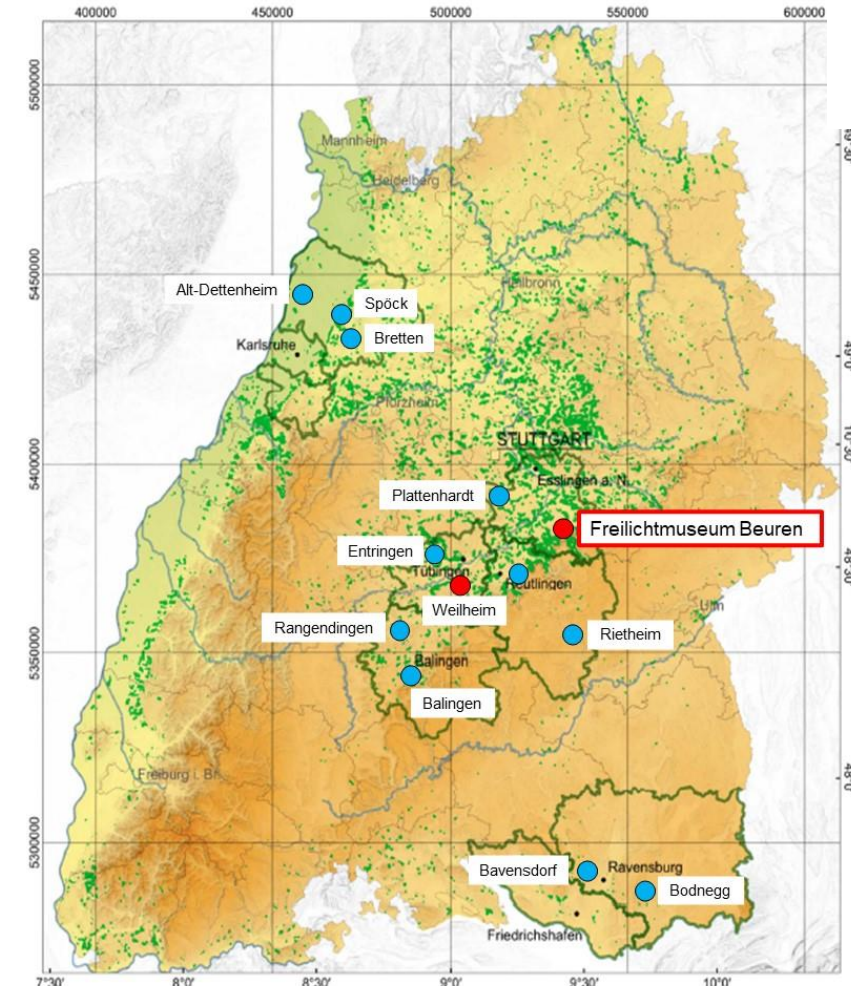
## Freilichtmuseum Beuren



area: 11 ha



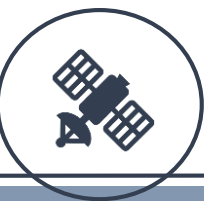
about 1,100 trees



- Intensive study area  
→ drone flight every 4 weeks within vegetation period
- Study area  
→ drone flight two times (leafless and leafy tree condition)

5





# Material & Methods (2/5)



6

## Workflow

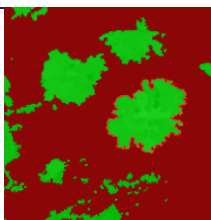
drone flight



Structure from motion



individual treecrown delineation



UAV data

## Planet

## Sentinel 2

2016 - 2021

cloud cover < 5%

108 images

78 images

NDVI images

treecrown - NDVI layer

Remote sensing data

## DWD station

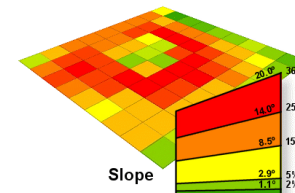
2016 - 2021

statistical analysis

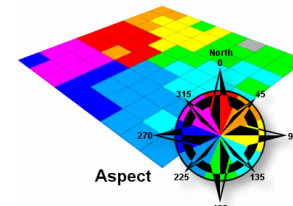
climate data

## variables

Elevation



Slope



Aspect

Site data

## field mapping

apple

pear

chestnut

cherry



mirabelle

nut

spearling

plum

tree species





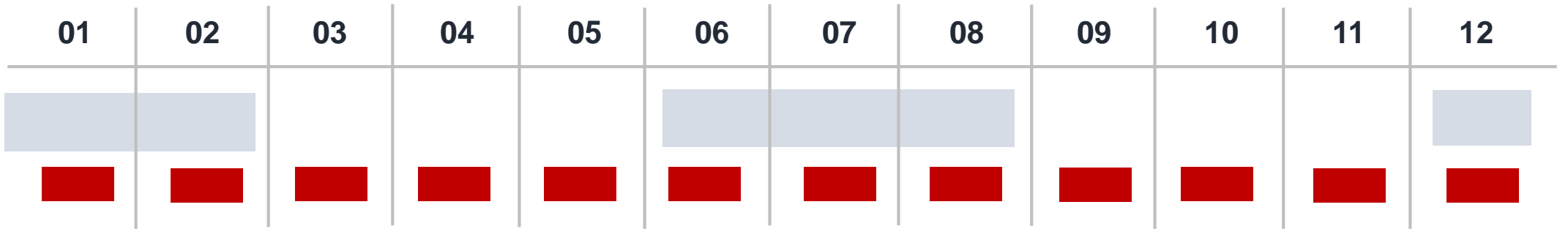
# Material & Methods (3/5)

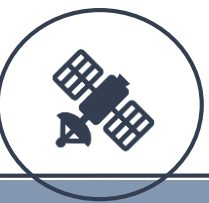
UAV data

phenological development



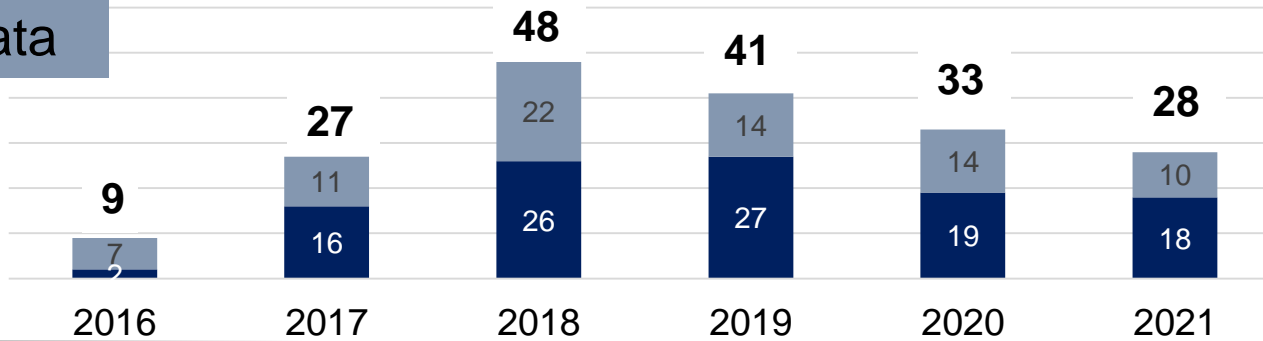
time of the UAV flight





# Material & Methods (4/5)

remote sensing data

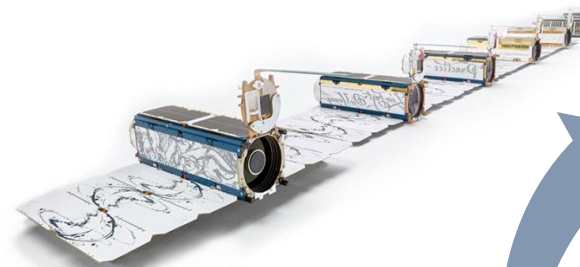


8

Planet



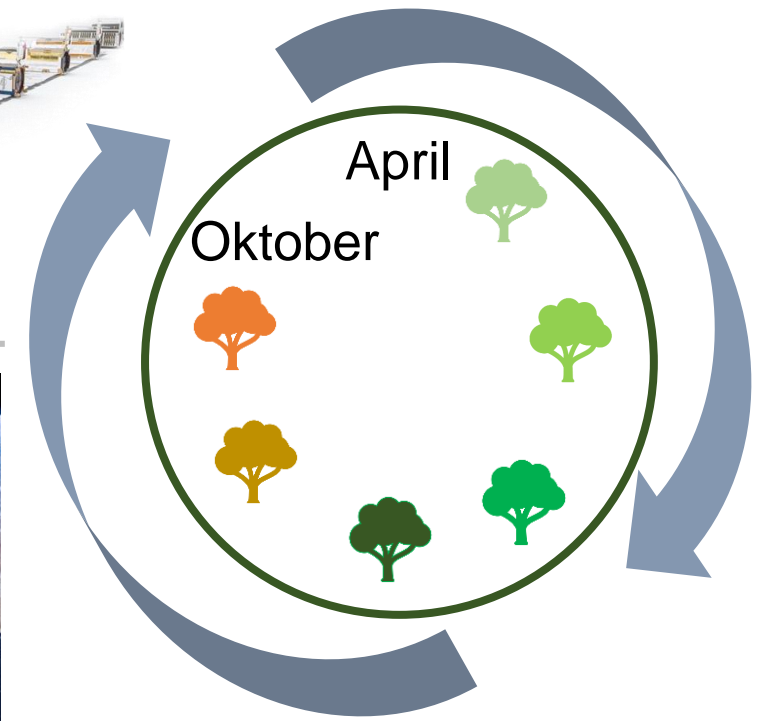
- 3 meters
- 108 images (2016 – 2021)
- 4 bands



Sentinel 2



- 10 - 20 Meter
- 78 images (2016 – 2021)
- 13 bands







# Material & Methods (5/5)

climate data

NDVI



dead plant



unhealthy plant



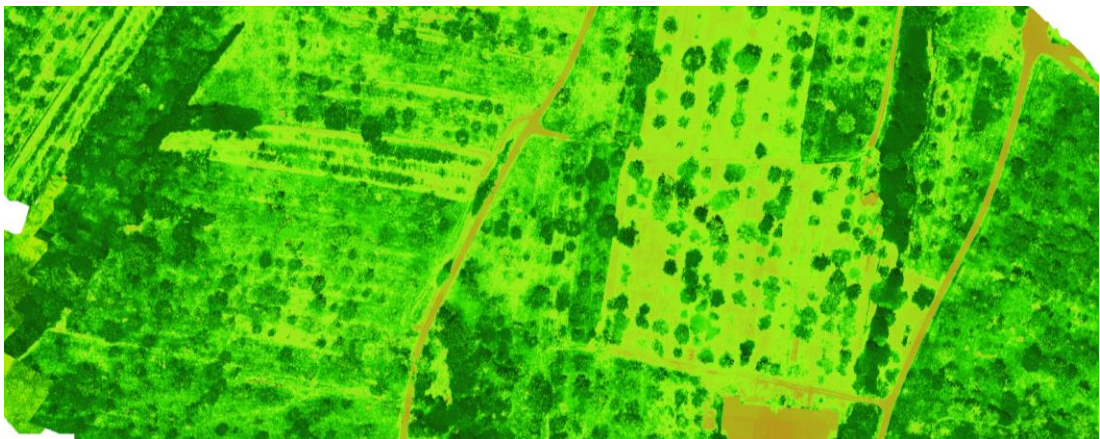
moderately healthy plant



healthy plant

-1

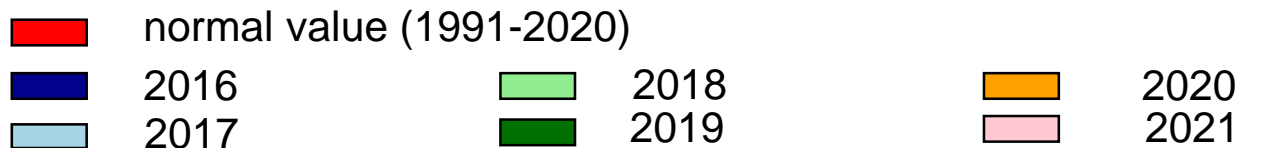
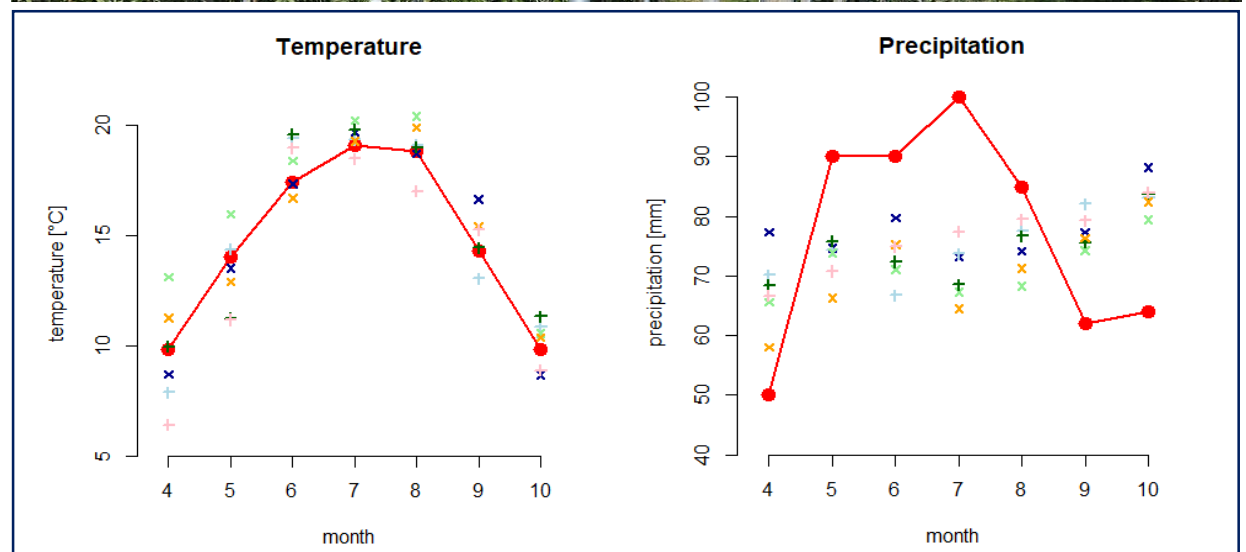
1



Notzingen  
325 m

DWD

9

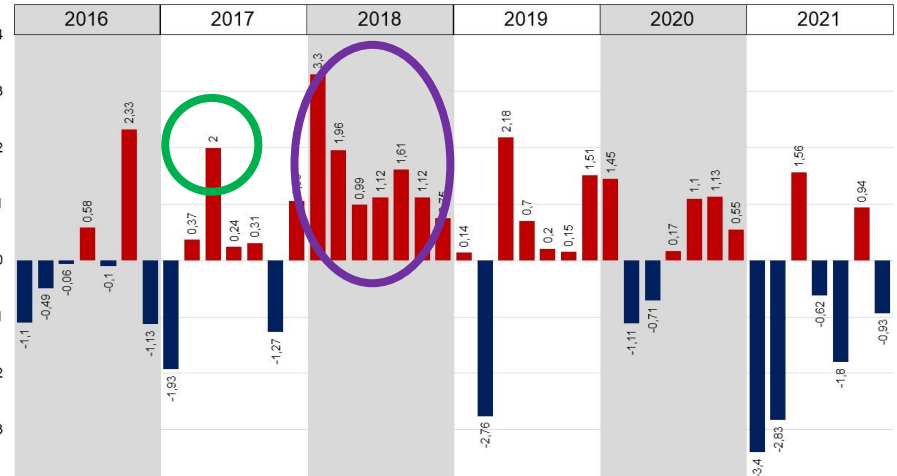




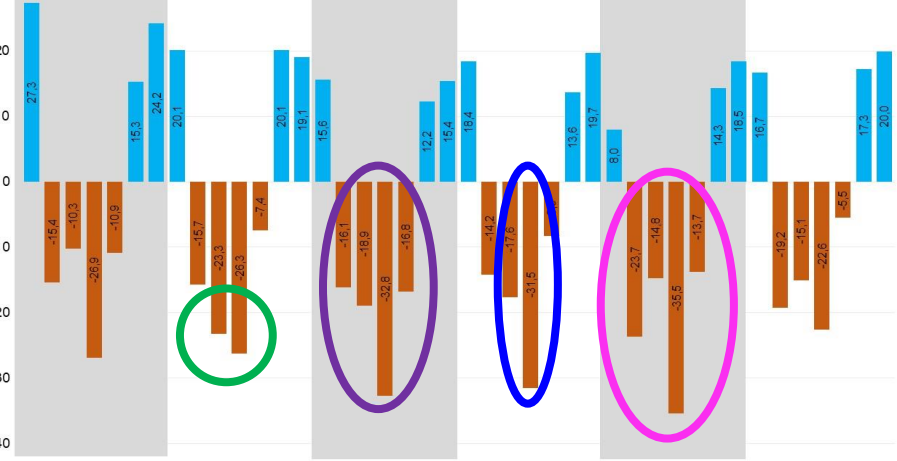
# Results (1/4)

climate data

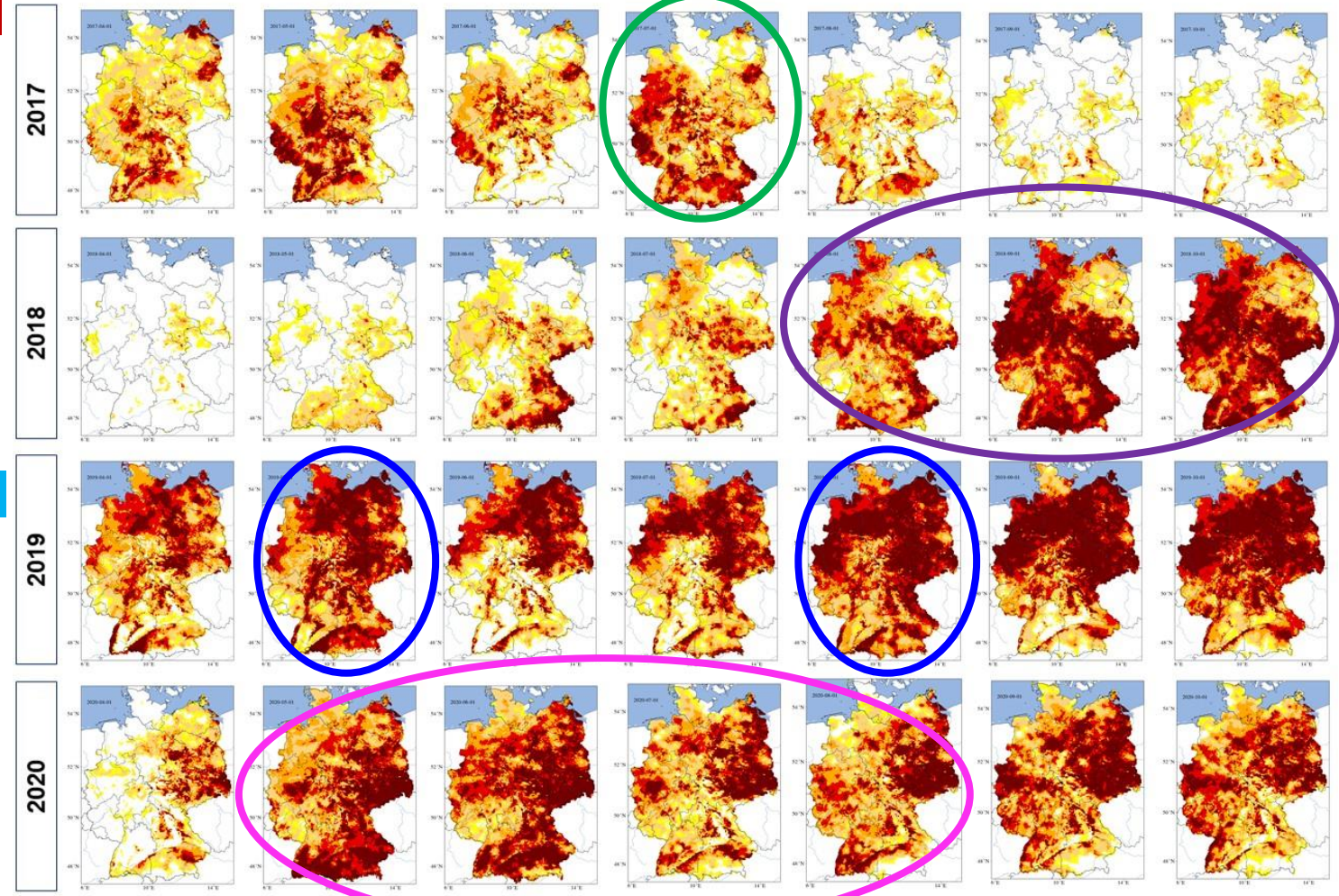
temperature



precipitation



April    May    June    July    August    September    Oktober



10



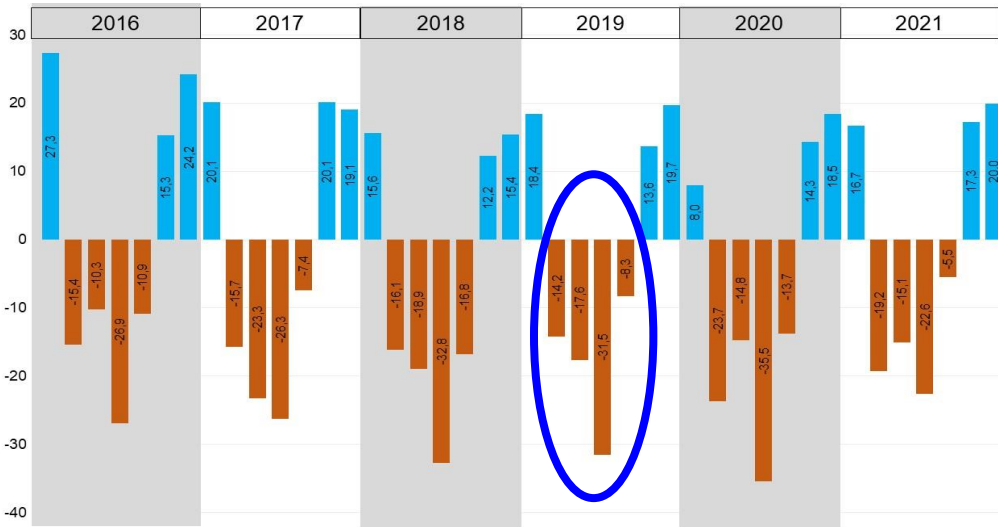
UFZ 2022



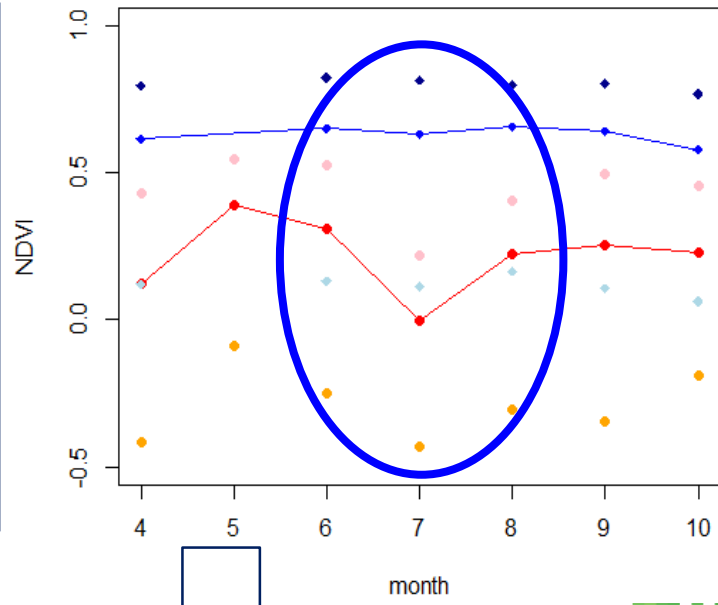
# Results (2/4)



11

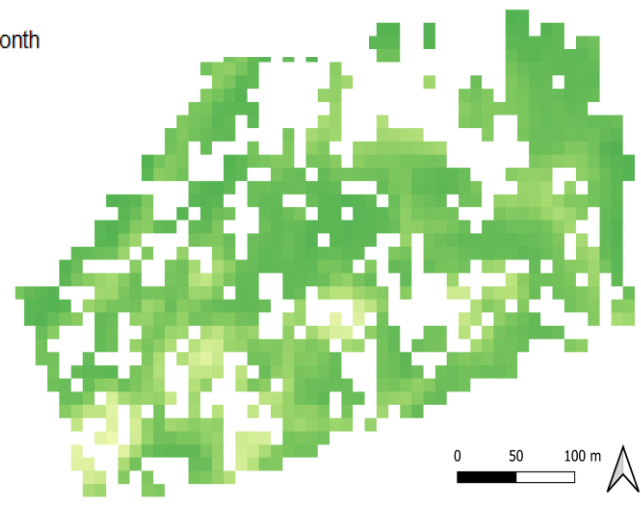
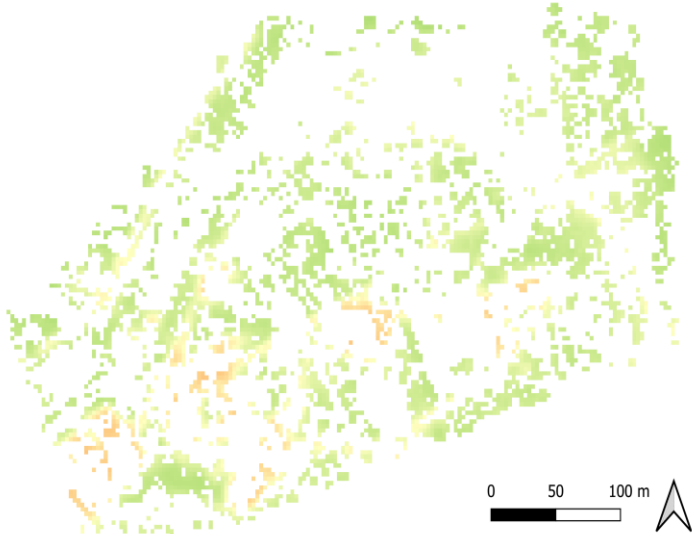


2019



Sentinel

Planet

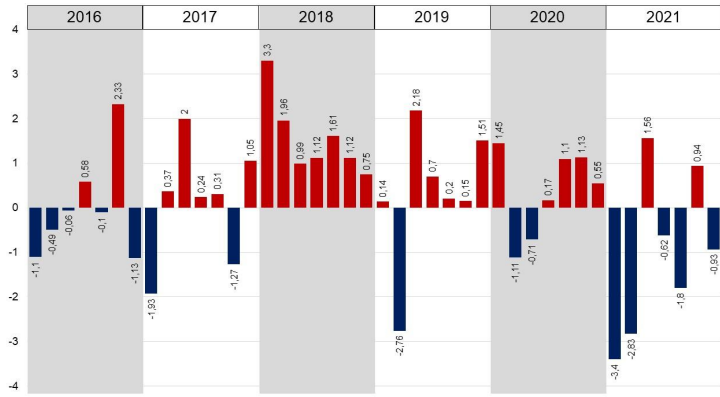




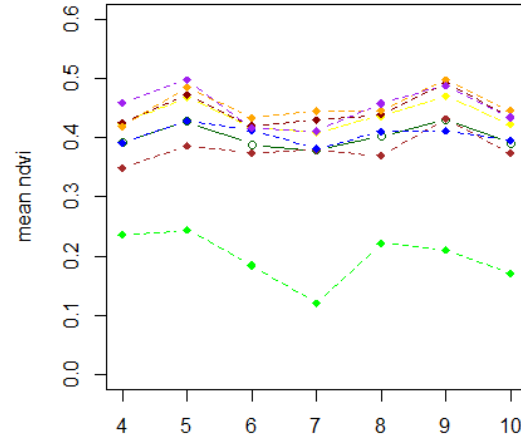
# Results (3/4)



12

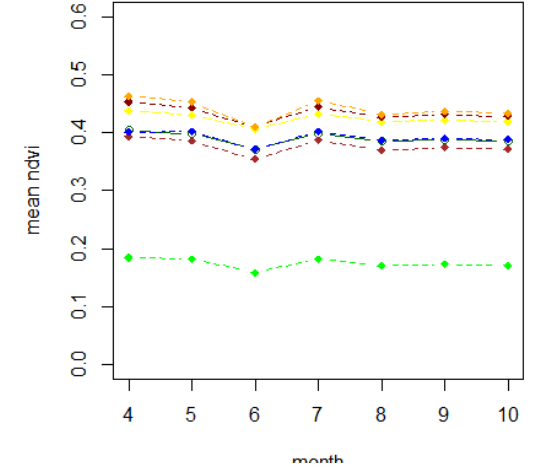


2017

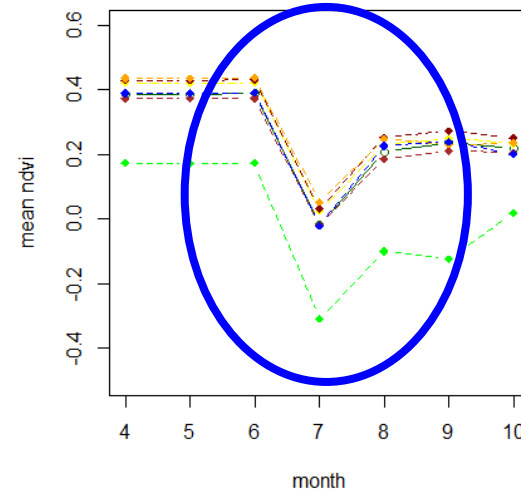


- apple
- pear
- chestnut
- cherry
- mirabelle
- nut
- spearlign plum

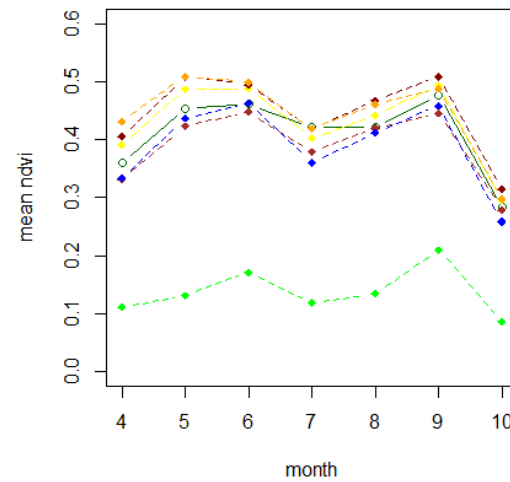
2018



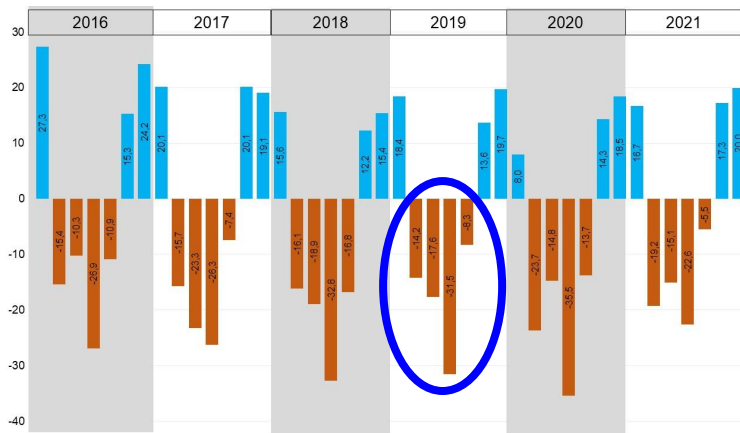
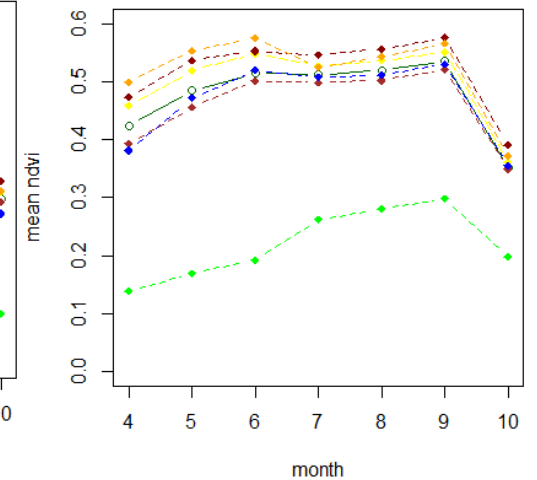
2019



2020



2021

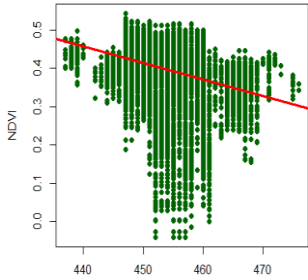




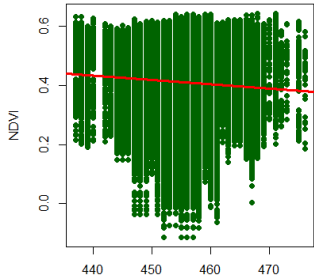
# Results (4/4)

## elevation

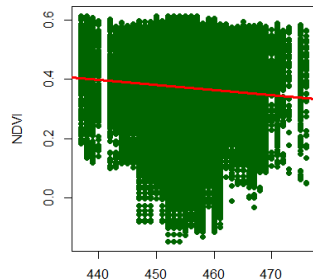
NDVI and elevation in 2016 (Planet)



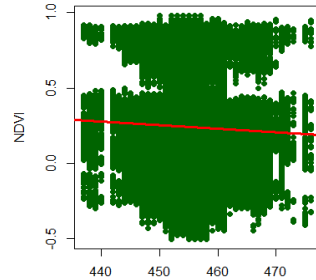
NDVI and elevation in 2017 (Planet)



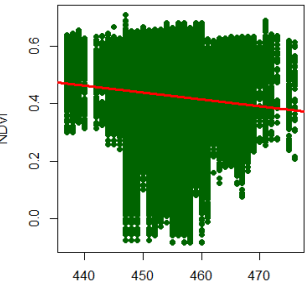
NDVI and elevation in 2018 (Planet)



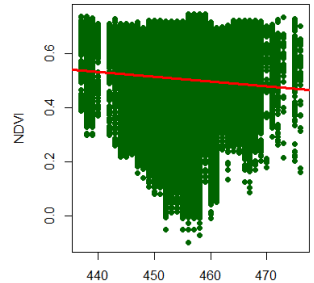
NDVI and elevation in 2019 (Planet)



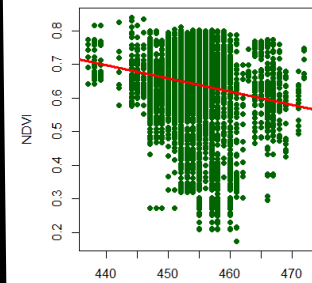
NDVI and elevation in 2020 (Planet)



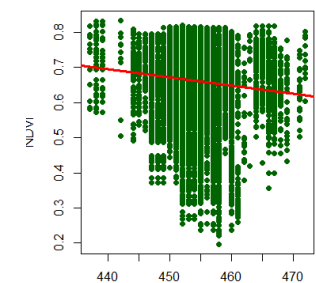
NDVI and elevation in 2021 (Planet)



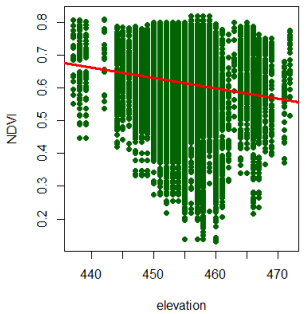
NDVI and elevation in 2016 (Sentinel)



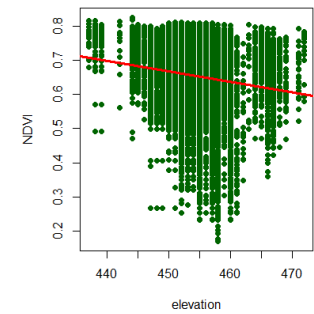
NDVI and elevation in 2017 (Sentinel)



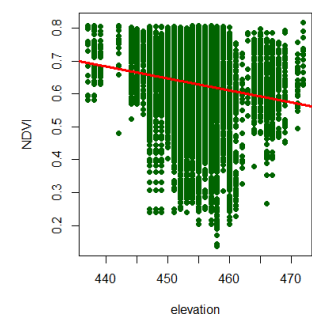
NDVI and elevation in 2018 (Sentinel)



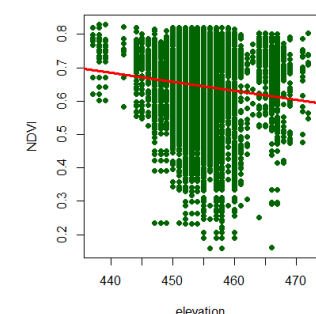
NDVI and elevation in 2019 (Sentinel)



NDVI and elevation in 2020 (Sentinel)



NDVI and elevation in 2021 (Sentinel)



year	sensor	correlation elevation ndvi	correlation slope ndvi
2016	Planet	- 0.23909110	- 0.2585497
2017	Planet	- 0.06160331	- 0.2070326
2018	Planet	- 0.07205291	- 0.1585606
2019	Planet	- 0.03332481	- 0.0641901
2020	Planet	- 0.09633628	- 0.2182964
2021	Planet	- 0.06910174	- 0.1753293
2016	Sentinel	- 0.17362800	- 0.2086212
2017	Sentinel	- 0.09959393	- 0.2345347
2018	Sentinel	- 0.12994670	- 0.1530774
2019	Sentinel	- 0.14129330	- 0.1707441
2020	Sentinel	- 0.15345960	- 0.2411638
2021	Sentinel	- 0.11250470	- 0.1578976





# Summary & Outlook



Climate change represents great challenge for orchard meadows → Adaptations necessary



drought pattern at NDVI of individual trees closely related to temperature and precipitation



comparison with other sites in relation to elevation, slope, aspect, soil and geology of the project



methods for estimation and monitoring of drought stress in orchard stands



## contact

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