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German Centre for Integrative Biodiversity Research (iDiv)
Halle-Jena-Leipzig



Flowering and leaf phenology are more variable and stronger associated to traits in herbaceous compared to tree species

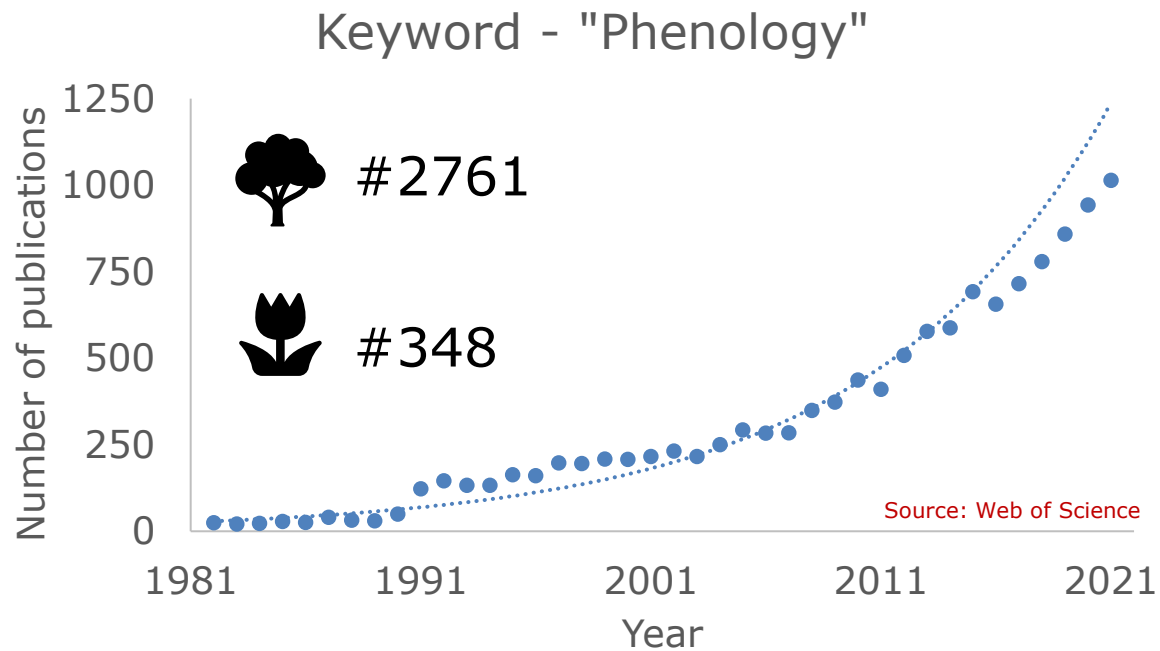
Sophie Horbach, **Robert Rauschkolb**, Christine Römermann
Phenology at the crossroads 2022



FRIEDRICH-SCHILLER-
UNIVERSITÄT
JENA

iDiv is a research centre of the
DFG Deutsche
Forschungsgemeinschaft

Phenology research – Fingerprints of climate change



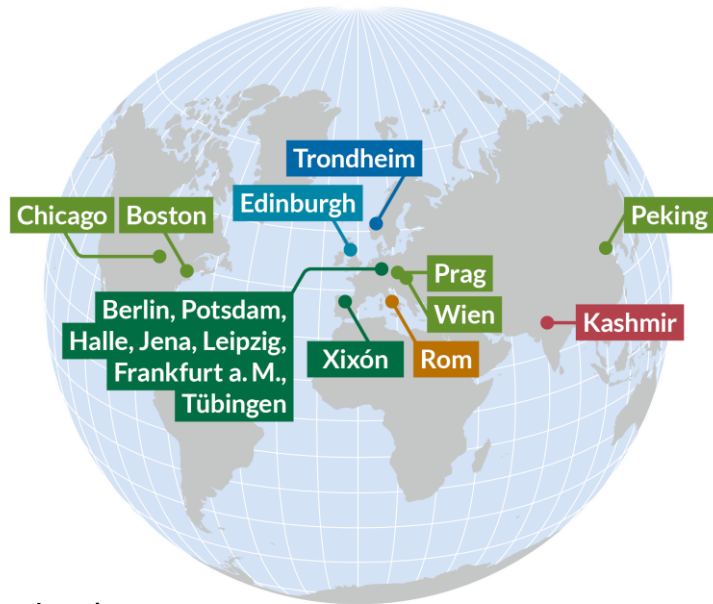
So far many studies focused on ...

- trees, shrubs or crops
- early and „easy to measure“ stages

but

- ~85% of species of temperate ecosystems are non-woody
- studies on entire life cycle of plants are needed to forecast future growth periods

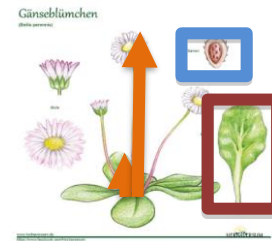
The PhenObs initiative – Phenology research in botanical gardens



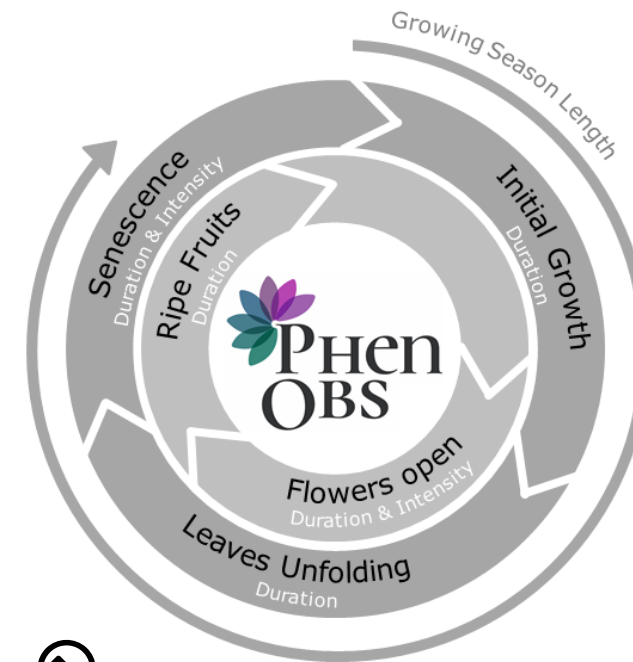
Locations

Overview of botanical gardens in their bioclimatic zone.

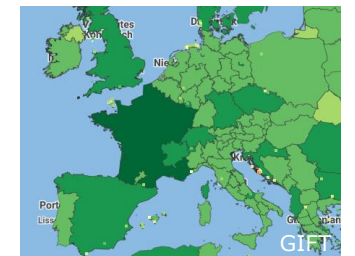
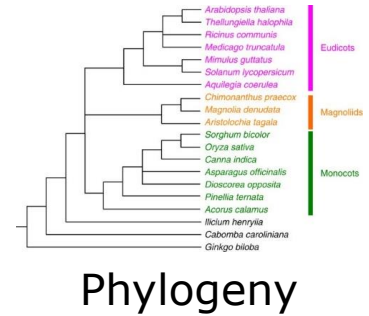
- boreal, oceanic
- temperate, hyperoceanic
- temperate, continental
- temperate, oceanic
- mediterranean, oceanic
- submediterranean



Functional traits



Environmental conditions



Distributional range

Study design – Comparing trees and herbaceous species



- 21 and 19 species
- March – September 2021
- Weekly records of phenological stages
- 7 functional traits

Vegetative stages



Sophie Horbach

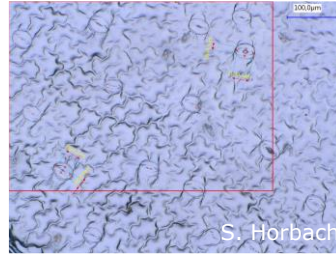
Generative stages



Study design – Comparing trees and herbaceous species



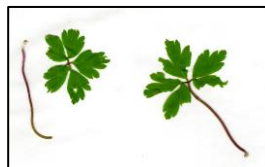
- 21 and 19 species
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Stomatal size + density

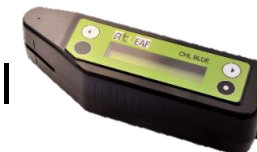


Plant height + leafthickness



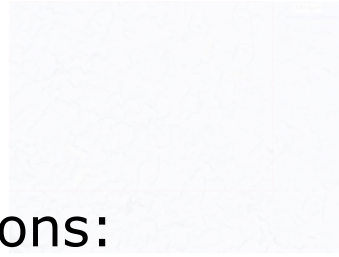
SLA + LDMC

Chlorophyll



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Study design – Comparing trees and herbaceous species



Stomatal size + density

Research questions:

- 21 and 19 species
 - March – September 2021
 - Weekly records of phenological stages
 - 7 functional traits
- 1) Do herbaceous and woody species in the botanical garden Jena differ in their phenology patterns?
 - 2) Which functional traits are the most important factors to explain interspecific differences in phenological stages and are these trait-phenology relationships consistent across herbaceous and woody species?



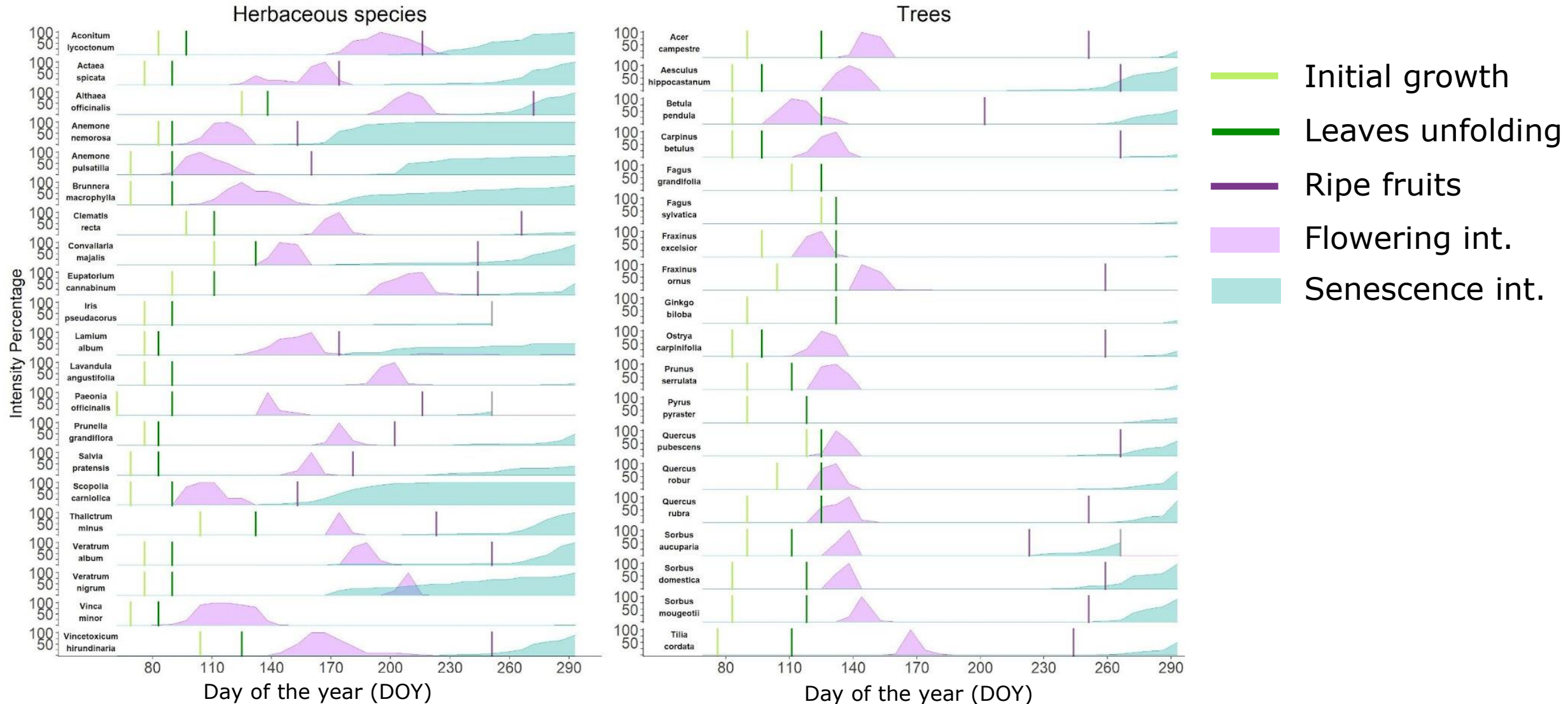
LDMC

Chlorophyll





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Results – Differences in phenological patterns



Results – Differences in phenological patterns

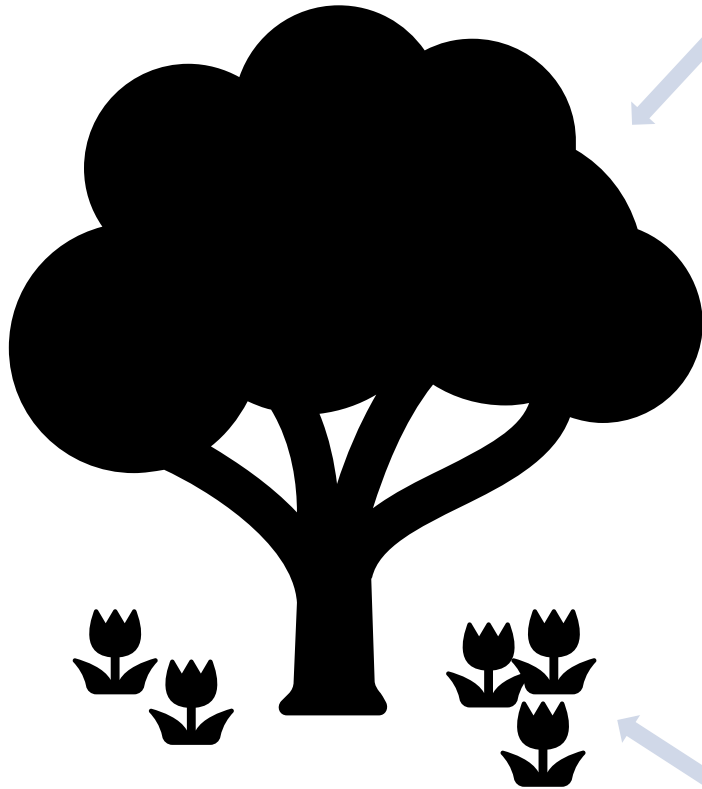
Phenological stage	Coefficient of variation 	Coefficient of variation 
Initial Growth	CV = 0.28	CV = 0.13
Leaves unfolding	CV = 0.18	CV = 0.10
Start of senescence	CV = 0.19	CV = 0
First open flower	CV = 0.26	CV = 0.11
Peak flowering	CV = 0.21	CV = 0.09
Flowering duration	CV = 0.76	CV = 0.40
First ripe fruit	CV = 0.21	CV = 0.08



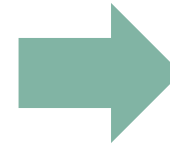
- Phenological stages in herbaceous species are less synchronized
- Time between start of growing and flowering is longer in herbaceous species (63 days vs. 17 days)

Discussion – Differences in phenological patterns

More storage organs



More competition



- Decoupling of vegetative and generative growth in trees



- Different pollination modes



- Herbaceous species use more niches

Results – Phenology trait associations



Vegetative height



Relationships with all phenological stages

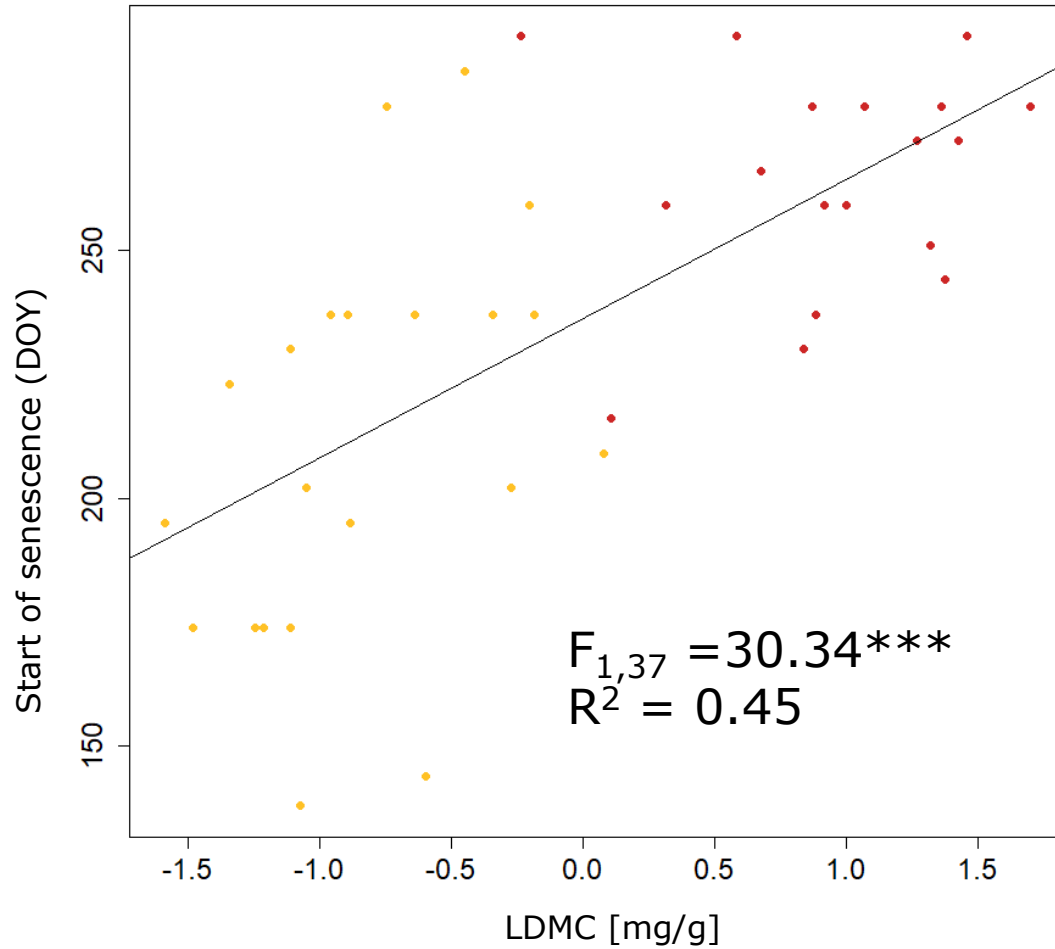


Leaf dry matter content



Relationships with 5 of 7 phenological stages

Results – Phenology trait associations



Positive relationship
between LDMC and start
of senescence



LDMC

Senescence

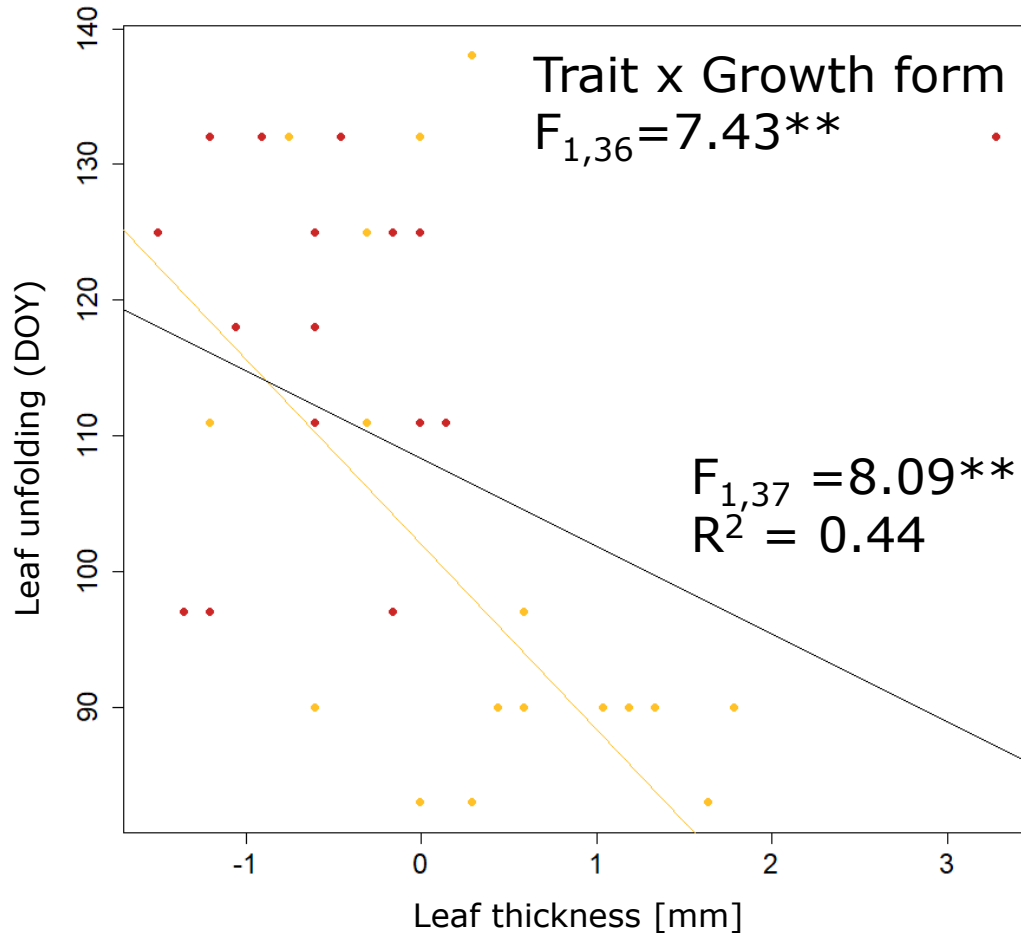
<



LDMC

Senescence

Results – Phenology trait associations



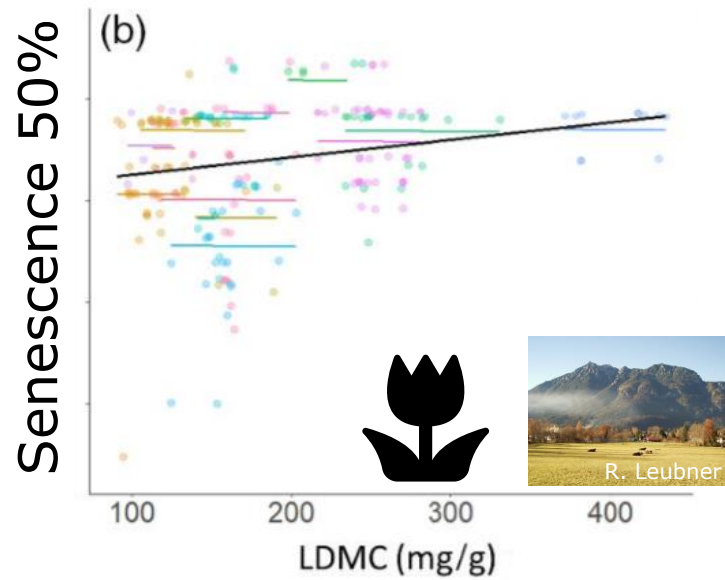
Negative relationship
between leaf thickness
and leaf unfolding



???

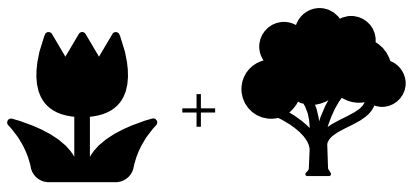
All sig. trait:Growth form
interactions showed
associations for the
herbaceous species

Discussion - Phenology trait associations

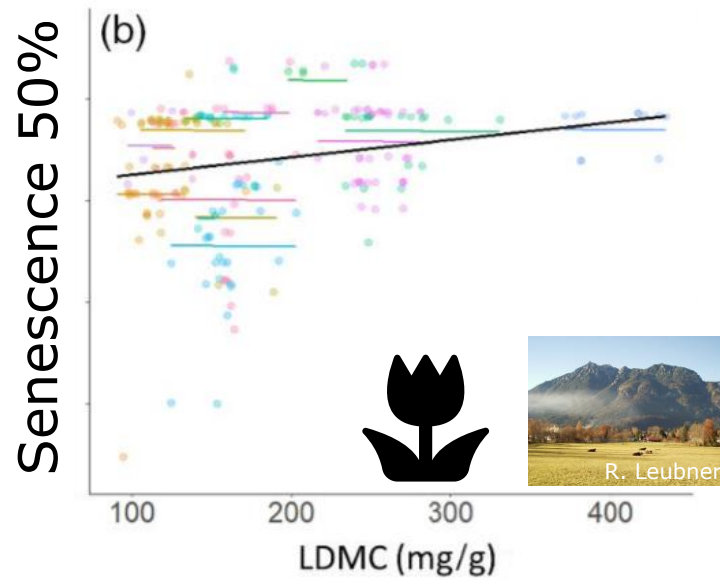


Bucher & Römerrmann 2021

➔ We confirmed results from field studies

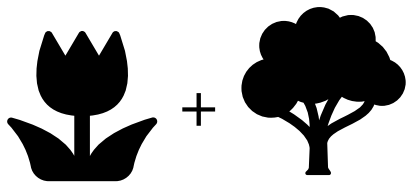


Discussion - Phenology trait associations

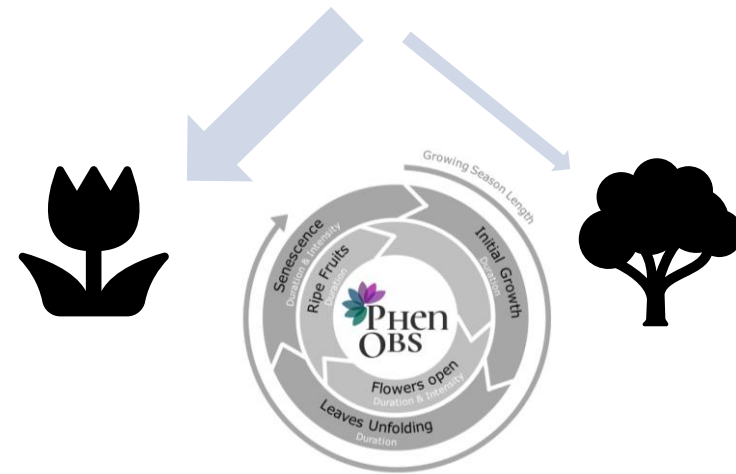


Bucher & Römermann 2021

➔ We confirmed results from field studies



Functional traits

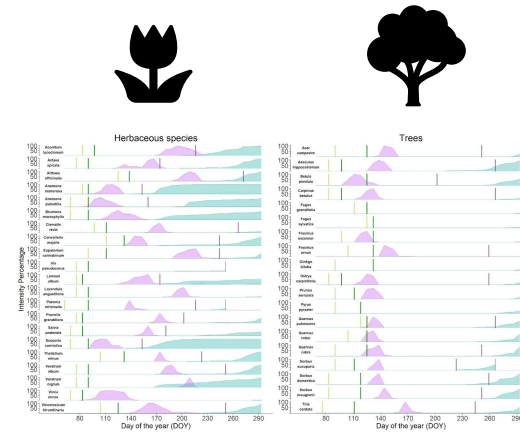


➔ Measured functional traits are more important in herbaceous species compared to trees to predict phenological stages

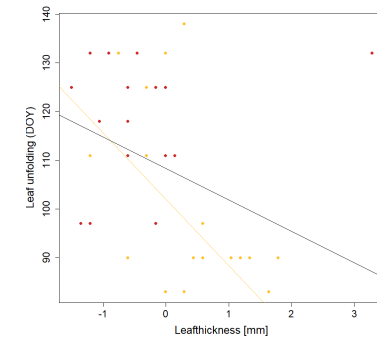
Summary



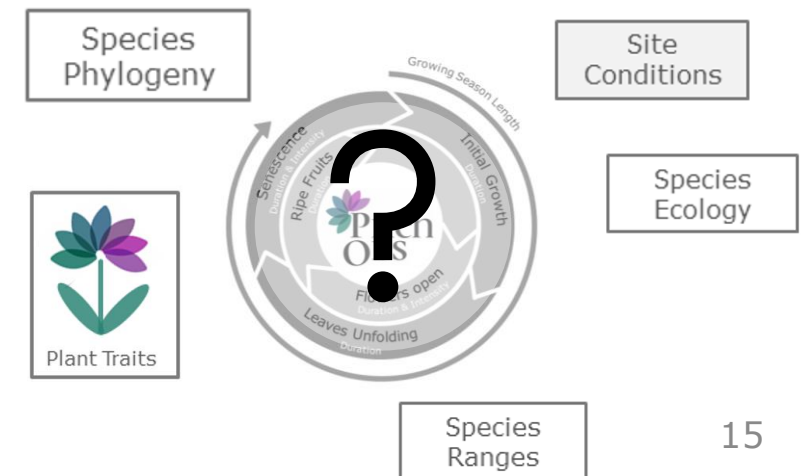
Phenology patterns differ between growth-forms



The linkage between traits and phenology is stronger in herbaceous species



Let's get on with phenology research!



Thanks to...



Working Group
Biodiversity of plants
FSU Jena

Funded by



Deutsche
Forschungsgemeinschaft

German Research Foundation



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German Centre for Integrative
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Halle-Jena-Leipzig



**Phen
OBS**

Botanical Gardens as a
Global Phenological
Observation Network

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@R_Rauschkolb



Thank you for listening!