Resin Flow in Pfynwald

What causes the differences in resin flow?

Master thesis of Crest Simeon, student ETH Environ. Sc.

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1. Methods

Resin Flow

- 100 trees, selection on a gradient of crown transparency and equal numbers of irrigated/ control
- 13mm hole through bark and phloem to expose xylem
- Resin collection with specialized sampler in 15ml centrifuge tubes
- 24h collection duration
- Weighed to the nearest 0.001 g
- 2x Sampling, April and August

Methods

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Methods

Dendrochronology

- 41 trees, selection in 4 groups
  - Irrigated, high resin flow
  - Irrigated, low resin flow
  - Control, high resin flow
  - Control, low resin flow
- 2 cores (South and North) at 50-100 cm above ground
- Tree ring measurements at WSL Dendrolab
- Sapwood, marked in the field for later measuring

3. Statistical Analysis

Model

- **Linear mixed effects model LMM**
  - R version 3.1.1, Package lme4, function lmer

→ lmm.RF <- lmer(sqrt(RF) ~ (CT14 + Vit + Mistl) * Treat + DBH09 + DCT1 + regCoef11yr + Date + comp + X + Y + (1|Team) + (1|Tree), data=d.RF)

Variables

- **Response variable**
  - Resin flow
- **Predictors**
  - Treatment: Irrigated/Control
  - Crown transparency in 2014
  - Crown transparency trend over past 1 and 11 years (regression coefficient)
  - Tree vitality: derived from basal area growth between 2003 and 2009
  - Date: April/August
  - Mistletoe
  - Location of tree: X/Y coordinates
  - Competition: sum of basal area of neighboring trees within 3.5m radius
- **Predictors-Random Effects**
  - Tree number
  - Plot (correlates highly with tree number)
  - Team (the groups that collected the resin, several groups per sample date)

5. Results

Analysis of Variance Table

	Df	Sum Sq	Mean Sq	F value
CT14	1	0.21248	0.21248	1.5028
Vit	1	0.03307	0.03307	0.2339
Mistl	3	0.35998	0.11999	0.8487
Treat	1	0.12149	0.12149	0.8593
DBH09	1	0.27611	0.27611	1.9528
DCT1	1	0.00278	0.00278	0.0196
regCoef11yr	1	0.19073	0.19073	1.3490
Date	1	1.70218	1.70218	12.0391
comp	1	0.00843	0.00843	0.0596
X	1	0.21808	0.21808	1.5424
Y	1	0.17384	0.17384	1.2295
CT14:Treat	1	0.07958	0.07958	0.5629
Vit:Treat	1	0.00246	0.00246	0.0174
Mistl:Treat	3	0.32286	0.10762	0.7612

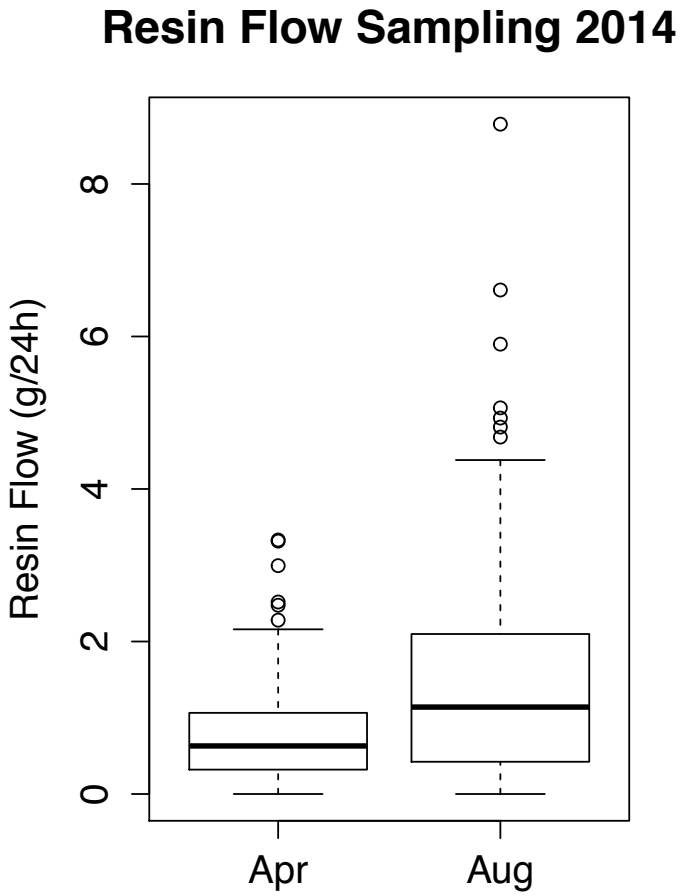
	Df	AIC	LRT	Pr(Chi)	
<none>		299.44			
DBH09	1	299.10	1.6609	0.197484	
DCT1	1	297.49	0.0503	0.822498	
regCoef11yr	1	298.92	1.4807	0.223667	
Date	1	305.92	8.4717	0.003607	**
comp	1	297.50	0.0553	0.814109	
X	1	299.49	2.0489	0.152314	
Y	1	298.36	0.9214	0.337105	
CT14:Treat	1	298.78	1.3352	0.247875	
Vit:Treat	1	297.48	0.0344	0.852952	
Mistl:Treat	3	296.13	2.6910	0.441762	

Results

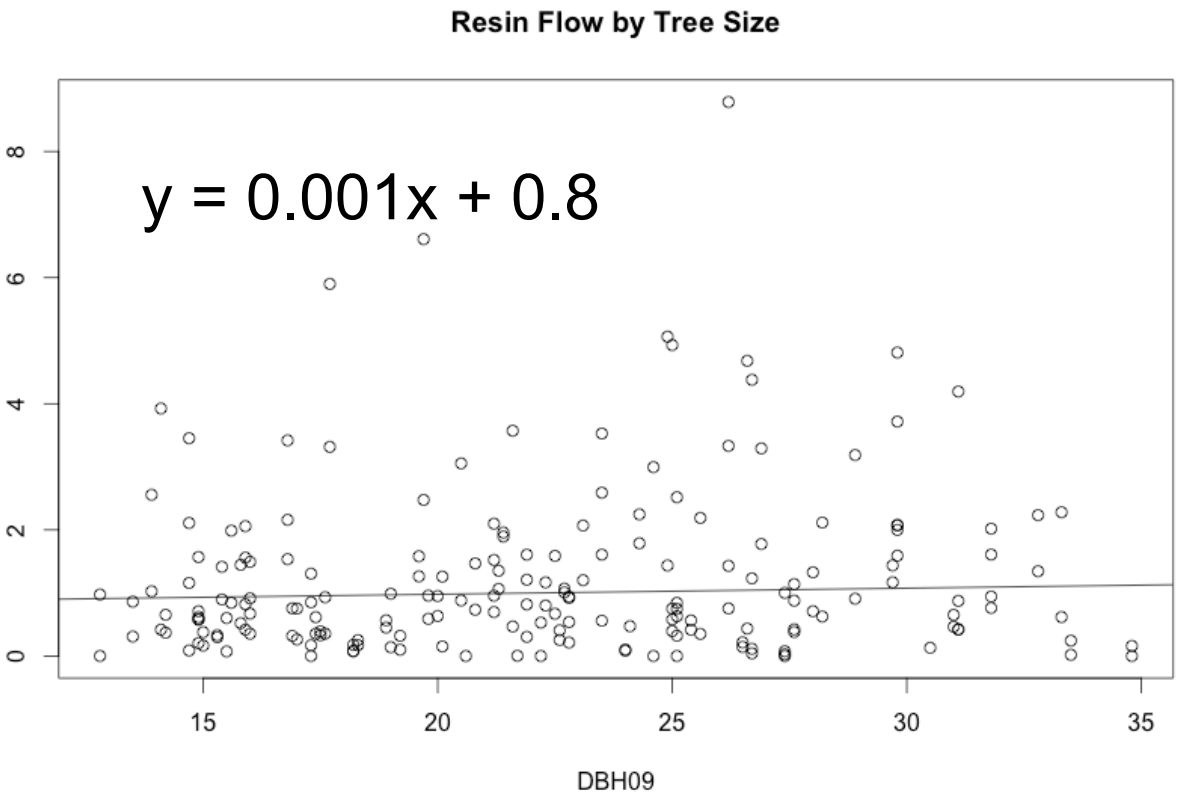
Resin Flow

2x Resin flow sampling

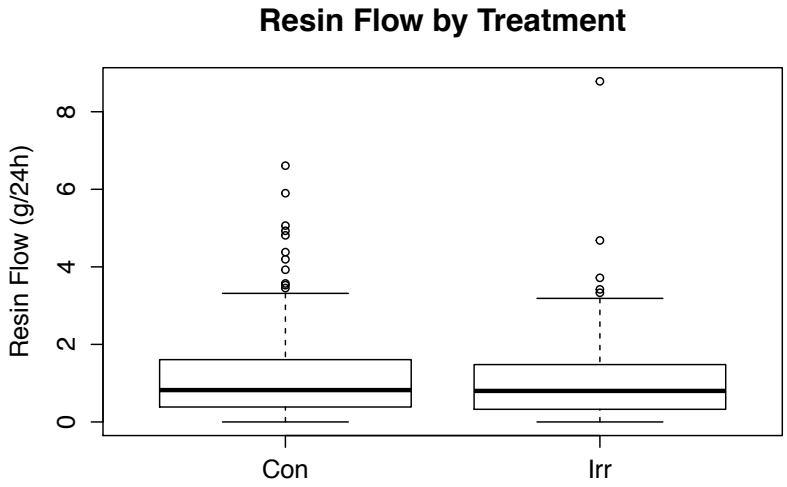
- Apr: n=101
  - mean±SD=0.84±0.75
  - min=0, max=3.33
- Aug: n=97
  - mean±SD=1.61±1.63
  - min=0, max=8.78

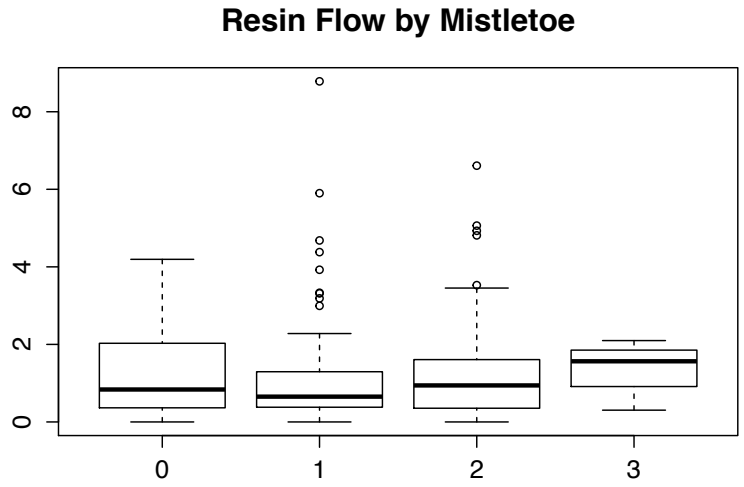


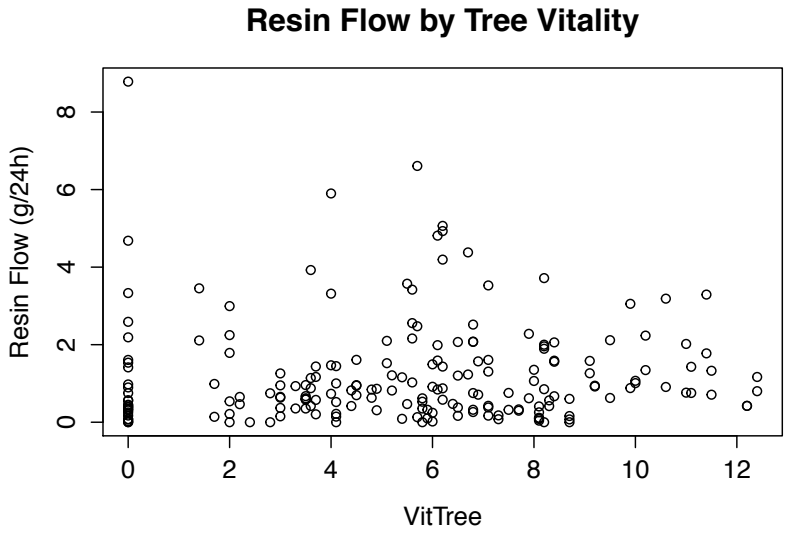
Results

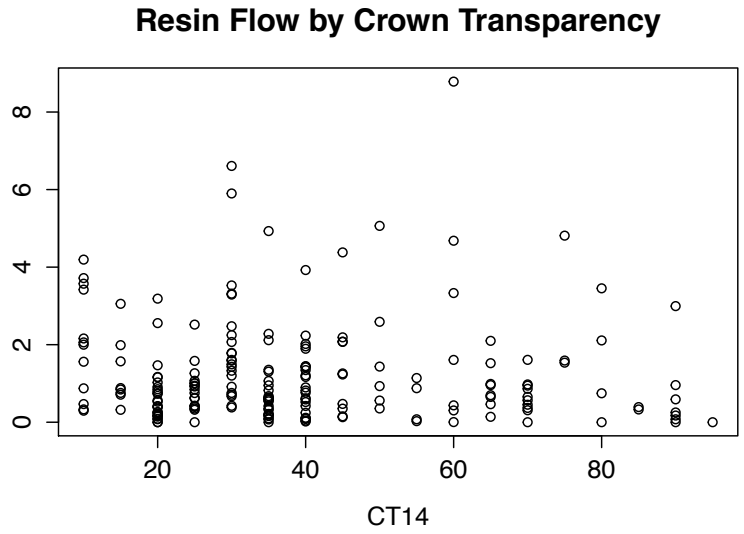


Results


Resin Flow by Treatment
Resin Flow (g/24h)
0
2
4
6
8
Con
Irr


Resin Flow by Mistletoe
0
2
4
6
8
0
1
2
3


Resin Flow by Tree Vitality
Resin Flow (g/24h)
0
2
4
6
8
0
2
4
6
8
10
12
VitTree


Resin Flow by Crown Transparency
0
2
4
6
8
20
40
60
80
CT14

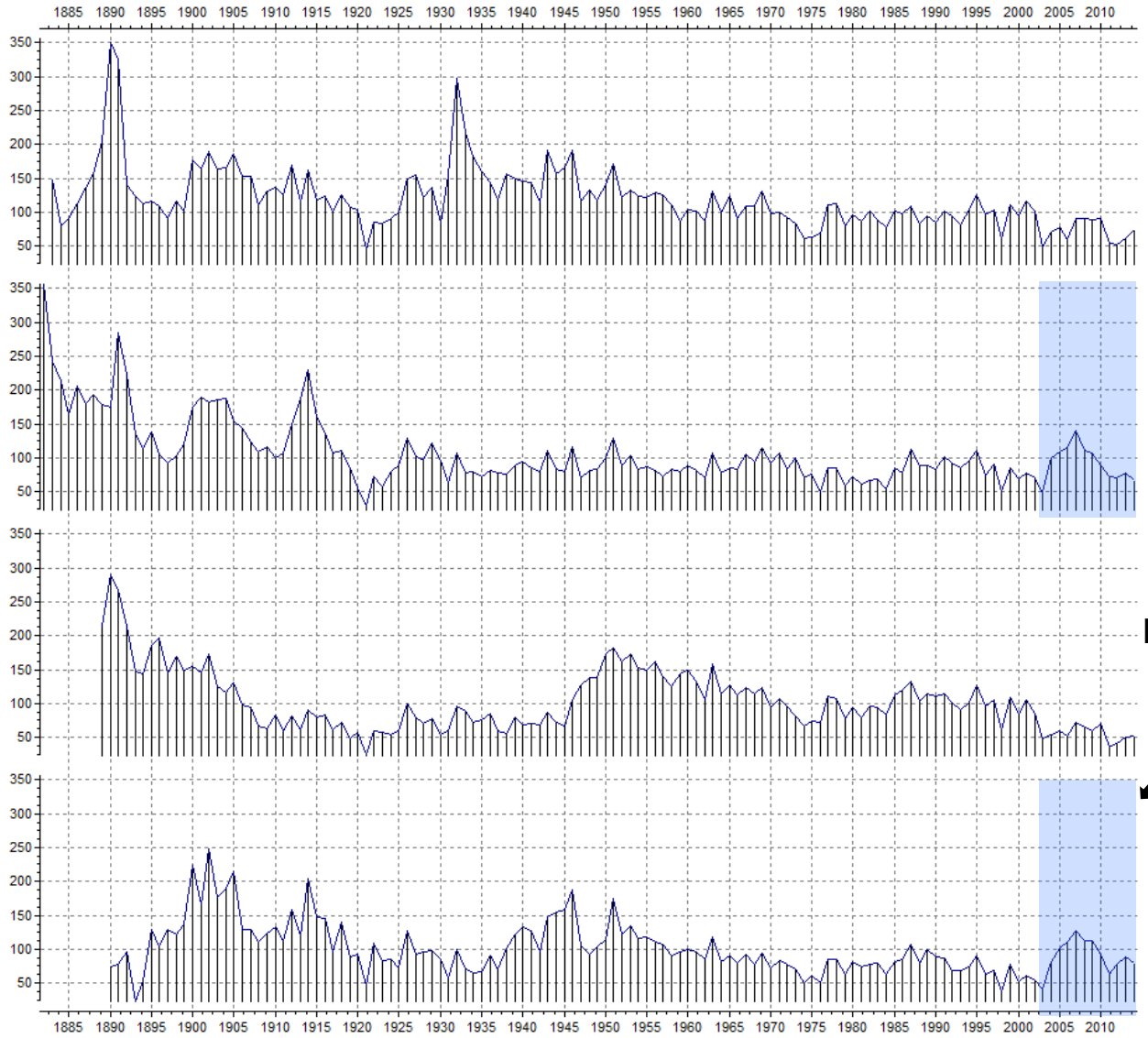
Results

Control, low resin

Irrigated, low resin

Control, high resin

Irrigated, high resin



Irrigation

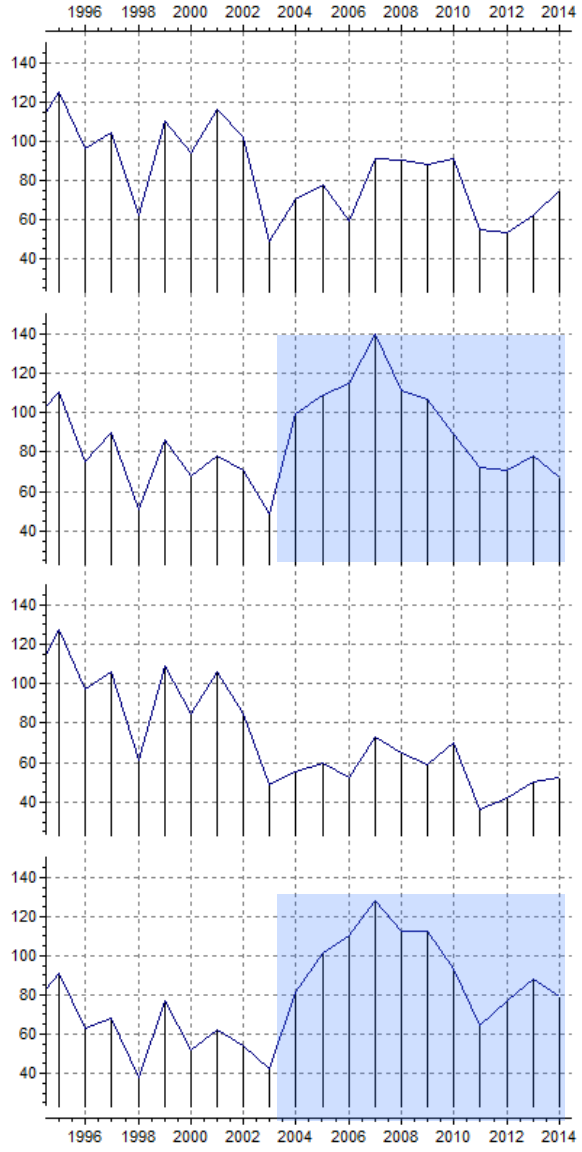
Results

Control, low resin

Irrigated, low resin

Control, high resin

Irrigated, high resin



6. Conclusions

- Non of the environmental or tree physiological factors have a clear influence on the resin flow
- Date is the only factor showing a significant influence
  - Date is a proxy for the climatic condition (mainly temp.) of the sampling day and other factors not accounted for
- Other studies have found minimal correlation between resin flow and DBH, tree age, competition

Thank You

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