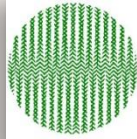




WARSAW UNIVERSITY  
OF LIFE SCIENCES  
- SGGW



INRA

Institut National de la Recherche Agronomique



HNE  
Eberswalde

Hochschule für nachhaltige Entwicklung

# Effects of Tree Species Mixture on Crown Characteristics: A Case Study with Sessile Oak

Research Project  
Forest Information Technology

Leona Julia Griebisch



# Index

Overview

Methodology

Results

Discussion

Reference





Fig. 1: private

Field study in France:  
Silvicultural strategies in mixed and  
pure stands [Sessile oak (*Quercus petraea* Liebl.) and  
Scots pine (*Pinus sylvestris* L.)]:

1. Reducing density to limit water stress
2. Favoring mixed stands for maintaining the productivity concerning the resistance and resilience against disturbance

### Two hypotheses:

1. Sessile oak crown plasticity is higher in mixed stands compared to pure stands
2. Mixed stands have larger crowns and projected areas in mixed stands compared to pure stands



## Advantage of mixed stands (coniferus with deciduous trees)

- More productive and resilient
- Positive effect on light-use efficiency
- Conifers might profit from higher light and water availability during the early spring season

## Importance of crown volume

- Tree crown is related to growth



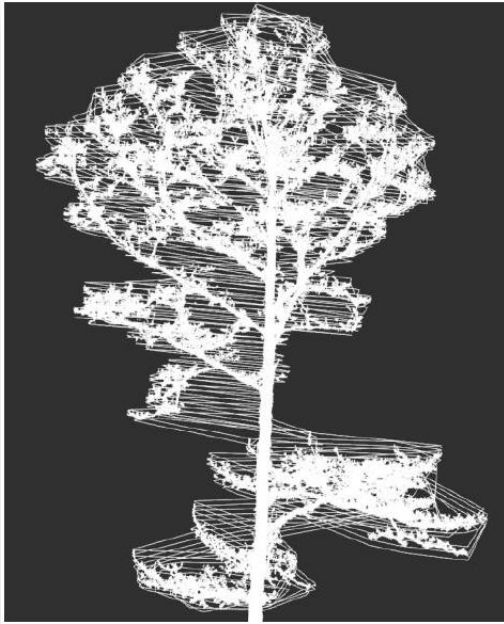


Fig. 2: CompuTree

### Technical instruments:

-TLS FARO Focus3D X130

### Software:

-Faro Scene  
-Polyworks  
-CompuTree  
-R

### Crown parameters:

-Volume (with and without epicormic shoots)  
-Length  
-Skewness  
-Kurtosis  
-Projected area

### Given stand parameters:

-RDI of 0.7 (conservative, radius 10 m)  
-Stand basal area (radius 10 m)



Overview

Methodology

Results

Discussion



Fig. 3-6: all four different scans

Fig. 7: derived 3D model

All figures: FaroScene



Model	Formular
1	$Y = a + b \cdot \text{DBH}$
2	$Y = a + b \cdot \text{DBH}^2$
3	$\log(Y) = a + b \cdot \log(\text{DBH}^2)$

Model	Formular
3.1	$\log(Y) = a + b \cdot \log(\text{DBH}^2) + c \cdot \log(\text{BA})$
3.2	$\log(Y) = a + b \cdot \log(\text{DBH}^2) + c \cdot \log(\text{RDI})$
3.4	$\log(Y) = a + b \cdot \log(\text{DBH}^2) + c \cdot \log(H)$
3.5	$\log(Y) = a + b \cdot \log(\text{DBH}^2) + c \cdot \log(\text{CL})$
3.6	$\log(Y) = a + b \cdot \log(\text{DBH}^2) + c \cdot \log(\text{RDI}) + d \cdot \log(H) + e \cdot \log(\text{CL})$

### Final equation:

$$\log(Y) = a + b \cdot \log(\text{DBH}^2) + c \cdot \log(\text{RDI}) + d \cdot \log(H) + e \cdot \log(\text{CL})$$



Overview

Methodology

Results

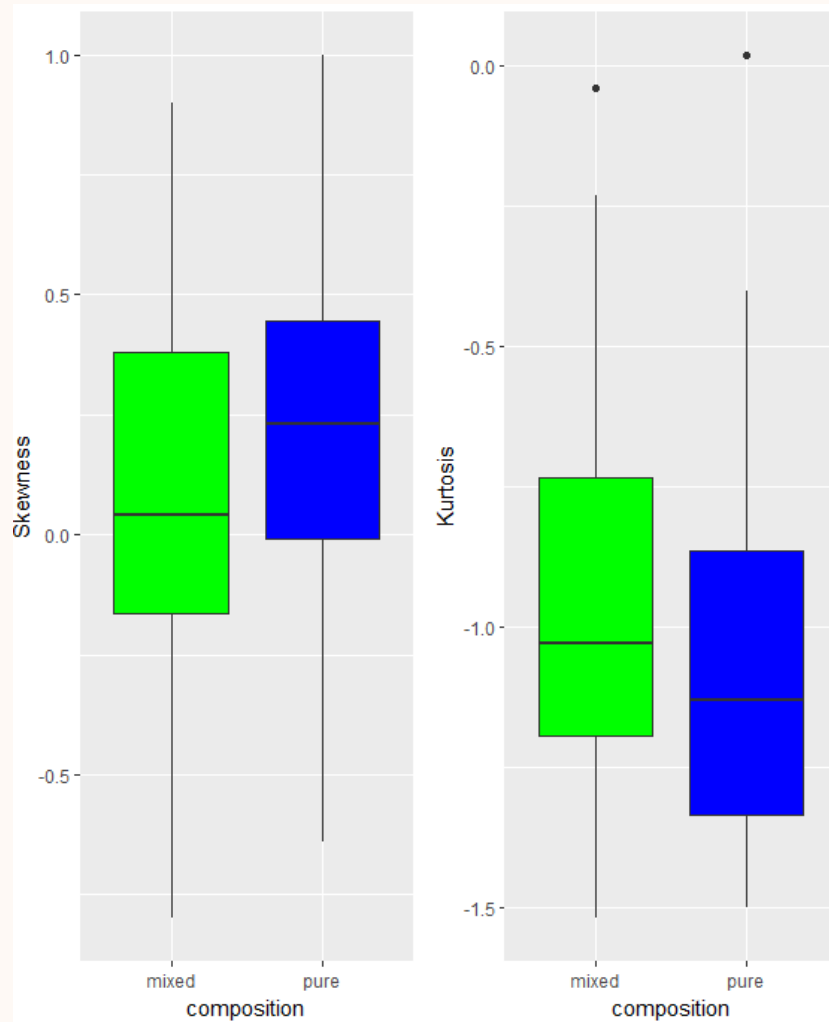
Discussion

**Tab. 1: Tree parameters of trees in pure and mixed stands with conservative density**

	H (m)	Crown Volume	DBH (cm)	CL (cm)	BA (ha)
<b>mixed</b>	18.26 (12.39 - 21.98)	128.7 (17.24- 392.95)	24.2 (12.0 - 37.7)	11.75 (6.97 - 17.39)	28.94 (19.89- 42.54)
<b>pure</b>	18.98 (13.38 - 23.27)	89.682 (5.80 - 263.94)	22.95 (12.40 - 30.80)	9.83 (6.77 - 14.15)	25.66 (15.43- 40.03)







**Variations in crown metrics in mixed and pure stands**

Fig.8: R Studio

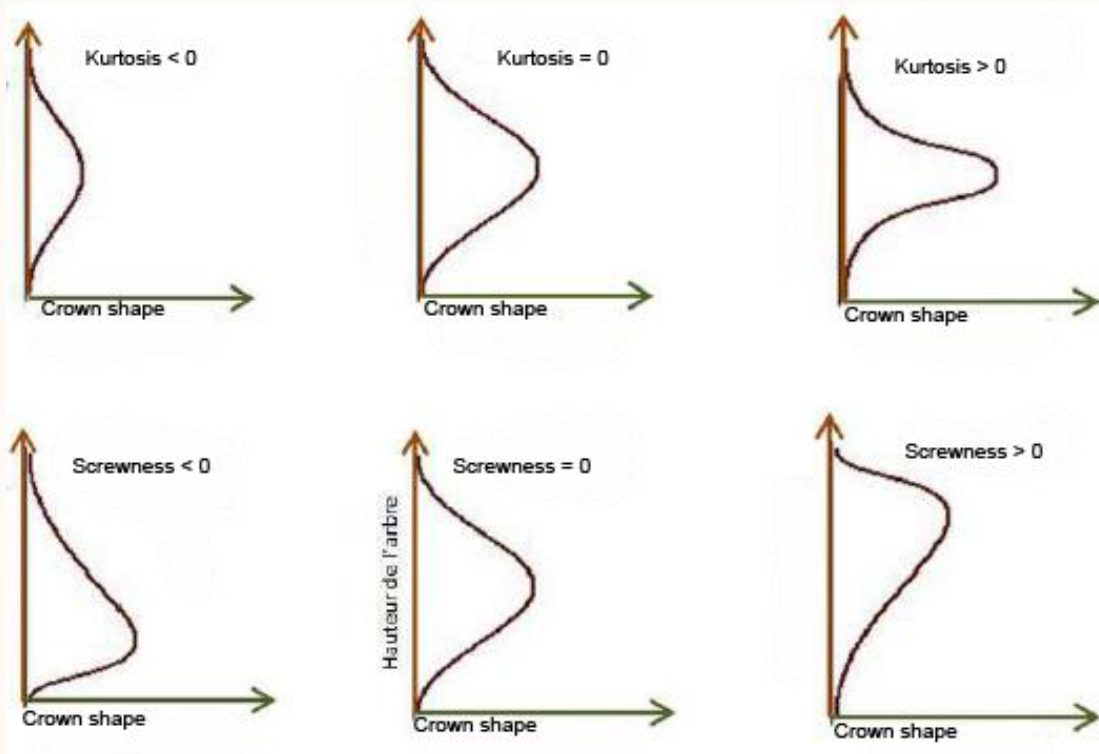


Overview

Methodology

Results

Discussion



## Crown shape according to values of Kurtosis and Skewness

Fig.9: Potiron 2016

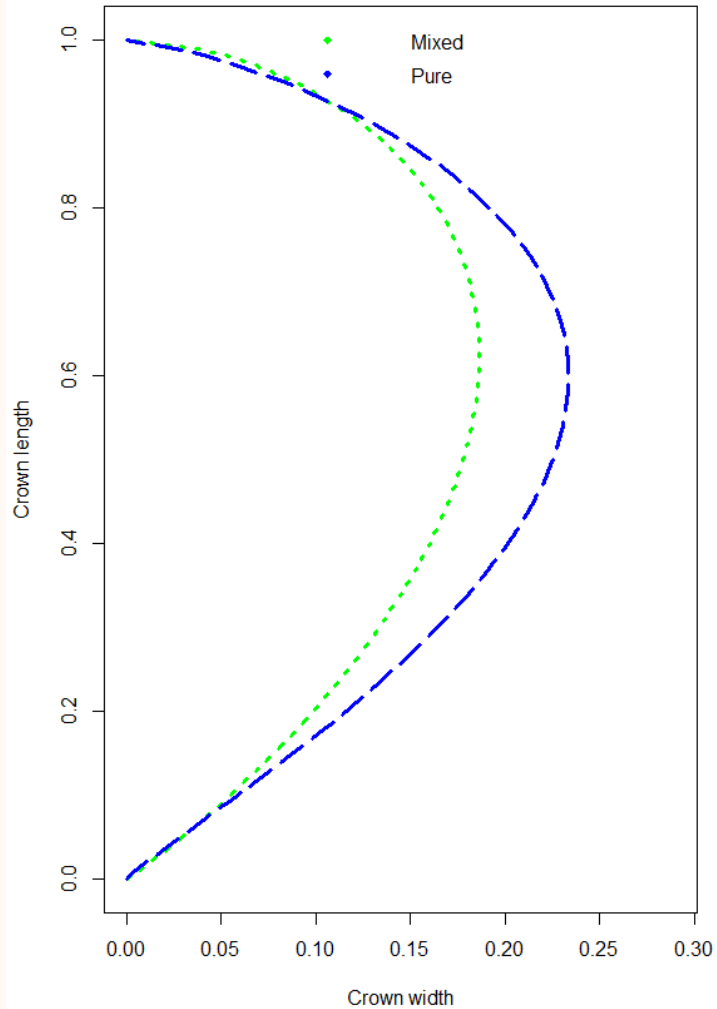


Overview

Methodology

Results

Discussion



Crown plasticity in  
pure and mixed  
stands

Fig.10: R Studio

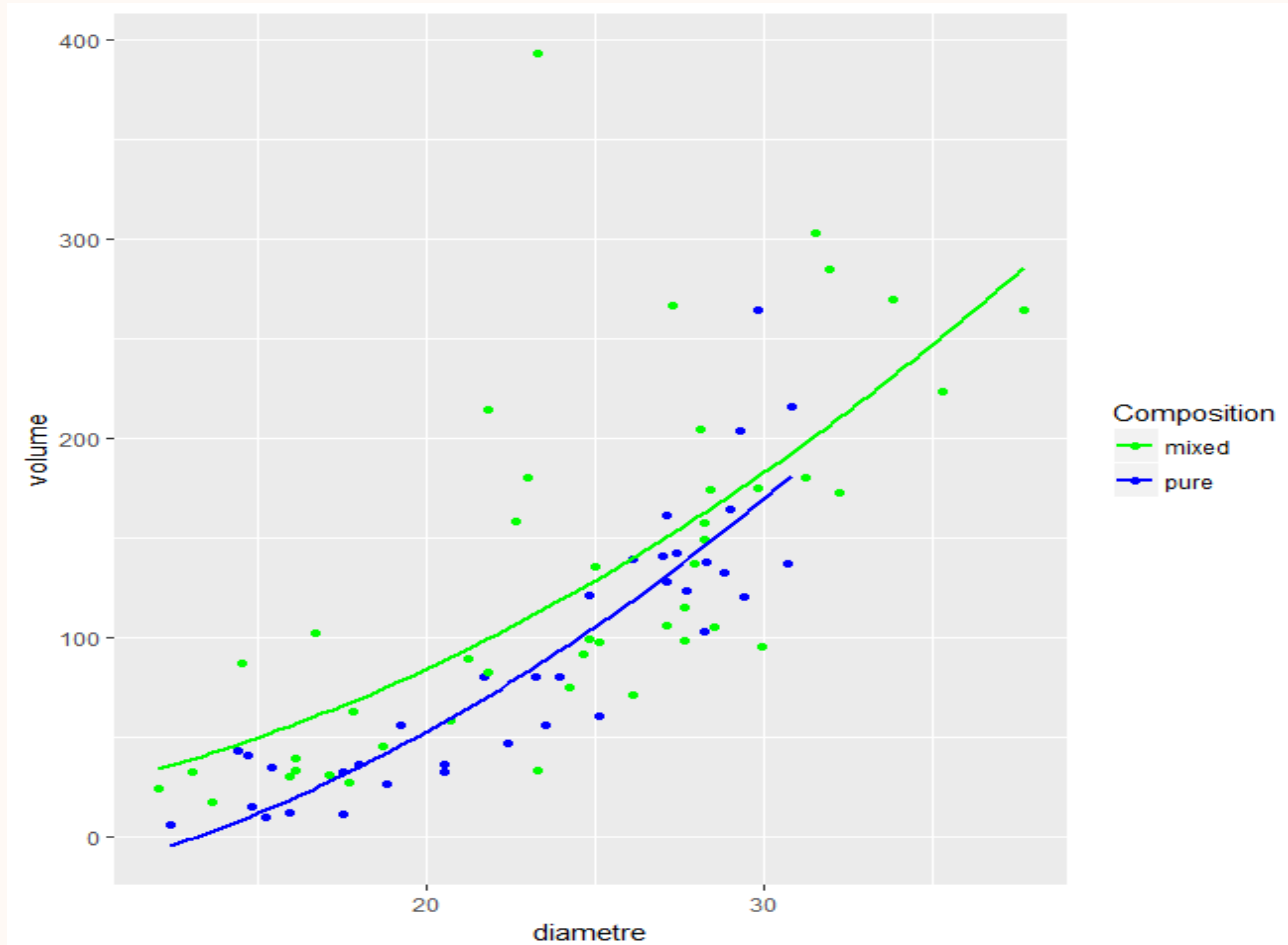


Overview

Methodology

Results

Discussion



**Effect of diameter on crown volume of pure and mixed stands in conservative Silviculture**

Fig.11: R Studio



Overview

Methodology

Results

Discussion

**Tab. 2: Estimates and standard error (in brackets) for the variables of the best models (with lower AIC) for crown volume and coherent factors**

	DBH (cm)	H (m)	CL (m)	RDI	AIC	
<b>Mixed</b>	Crown Length	0.28 (0.07)***			-11.07	
	Crown volume	1.85 (0.24)***	3.93 (0.75)***	1.21 (0.28)***	1.01 (0.45)	4.83
	Projected Area	1.31 (0.26)***	3.08 (0.66)**	0.66 (0 0.30)*	1.05 (0.55)	9.67
<b>Pure</b>	Crown Length	0.28 (0.06)***		-0.06 (0.30)	-15.63	
	Projected Area	1.24 (0.18)***	2.25 (0.68)**	0.63 (0.63)	17.81	
	Crown volume	1.85 (0.22)***	3.03 (0.85)**	1.14 (0.52)*	30.23	

**p value**

\*\*\* 0.001

\*\* 0.01

\* 0.05



Overview

Methodology

Results

Discussion

- Significant relationship between crown volume and DBH which is higher in mixed stands
- In mixed stands crown length had a significant effect on volume
- Mixed stands have larger crowns and projected area in mixed stands compared to pure stands
- Horizontal extension in mixed compositions was higher

***Next steps (objective of Master's thesis)***

Focus on comparing the differences observed in a conservative silviculture to a more dynamic silviculture with reduced density.



## Reference

Gribsch (2016): Effects on mixture on crown characteristics: a case study with sessile oak; Research Project

Potiron (2016): Influence de la densité du peuplement et du mélange sur la morphologie des houppiers de Chêne

