

# Are air quality related ecosystem services of European tree species adequately represented in current models?

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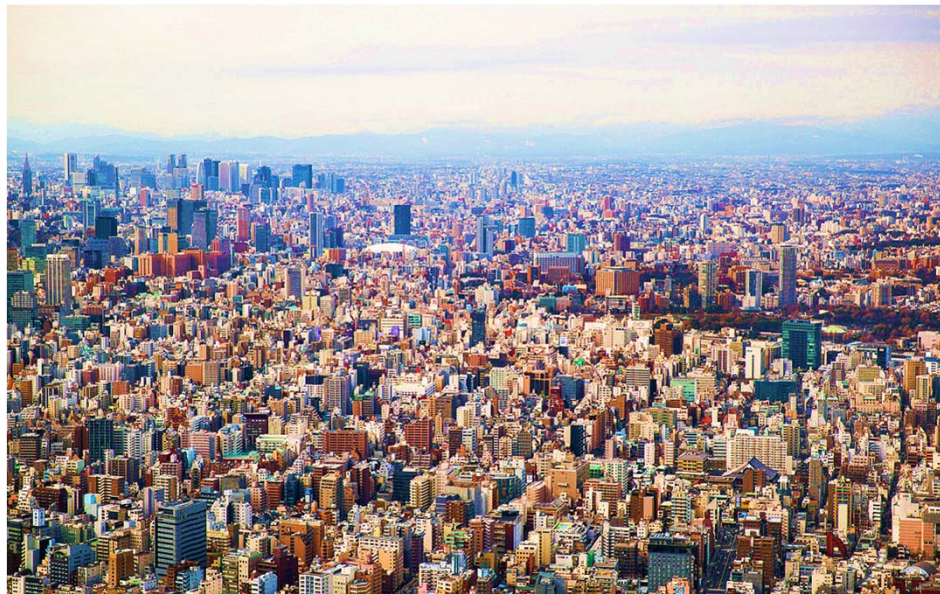


## Preliminary modelling of air pollution mitigation using the i-Tree model



# Why is it important to think about mitigation?

- Climate change (increasing temperature)
- Increasing urbanization  
(increasing susceptibility + increasing temperature)
- Energy transformation (changing pollution regime)



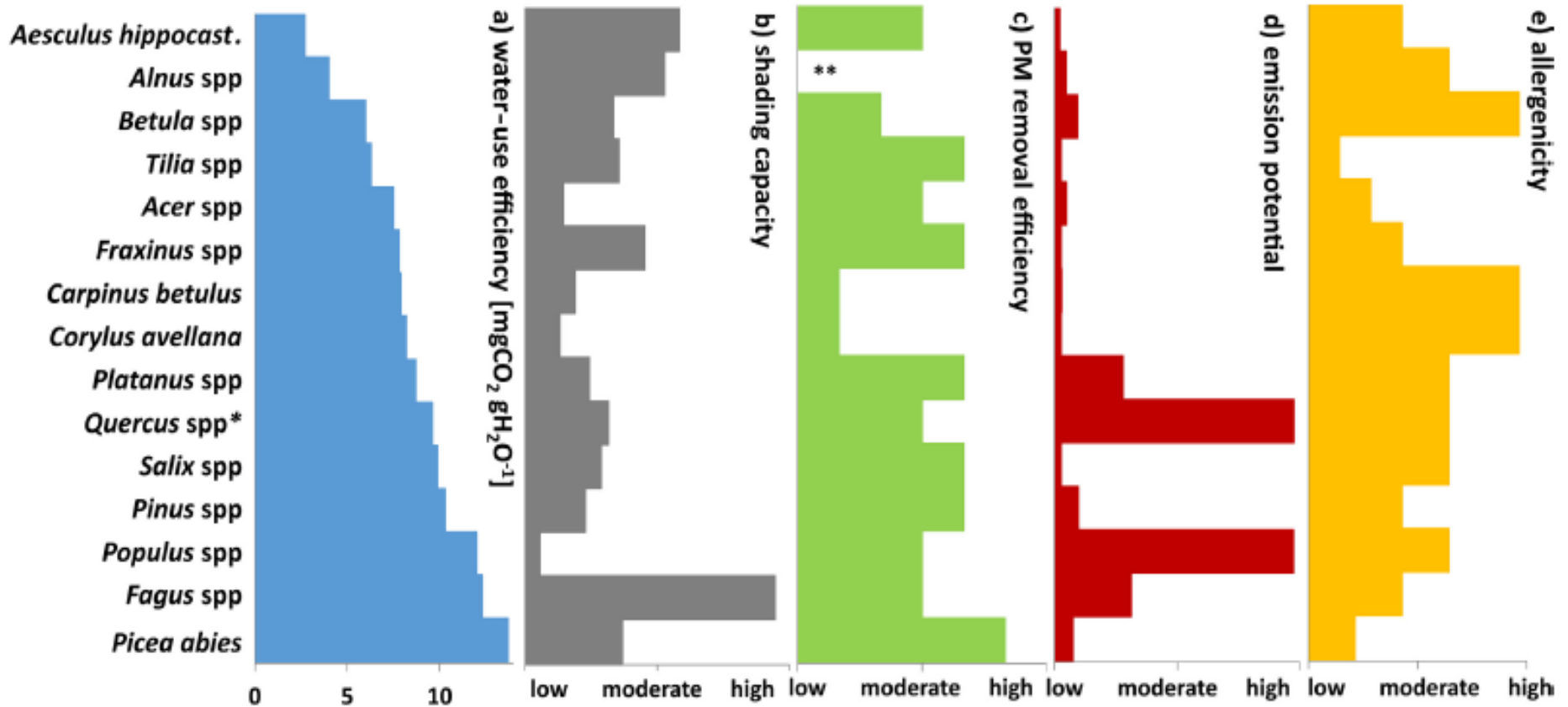
# Why could green infrastructure be a solution?

- Decreases temperature
- Decreases susceptibilities
- Removes pollution , ....

**...BUT...**



# ... this depends on tree species properties!



\* Only deciduous oaks considered, \*\* no data available

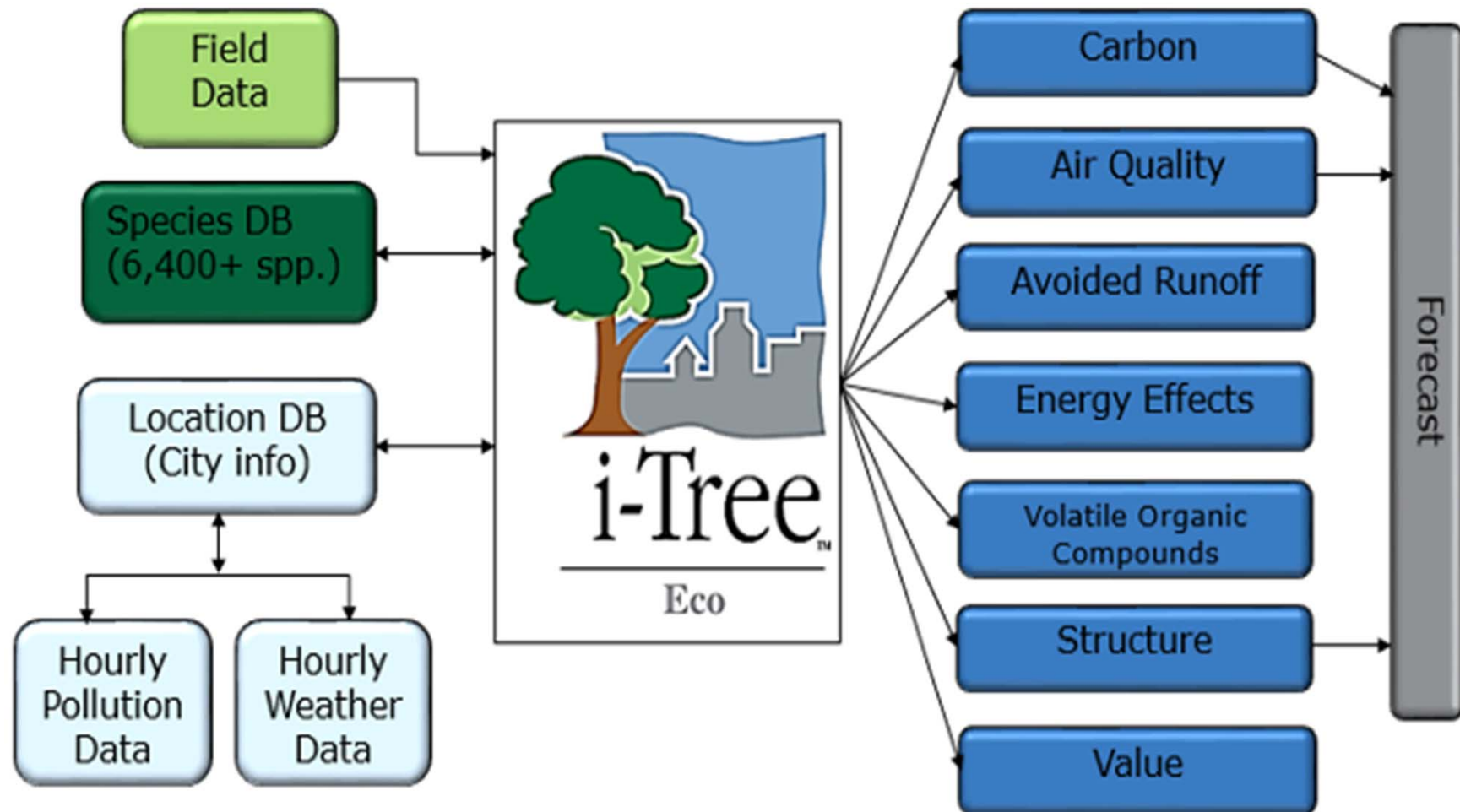
Grote et al., 2016 (FEE)

# A Case Study to invest tree impacts: green2clean

## Munich, Germany



# Methodology: The i-TREE model



# Test Subject: Englischer Garten

TREE SPECIES and DIMENSIONS:  
(position, stem diameter, height, crown size, ...)

SCENARIOS:

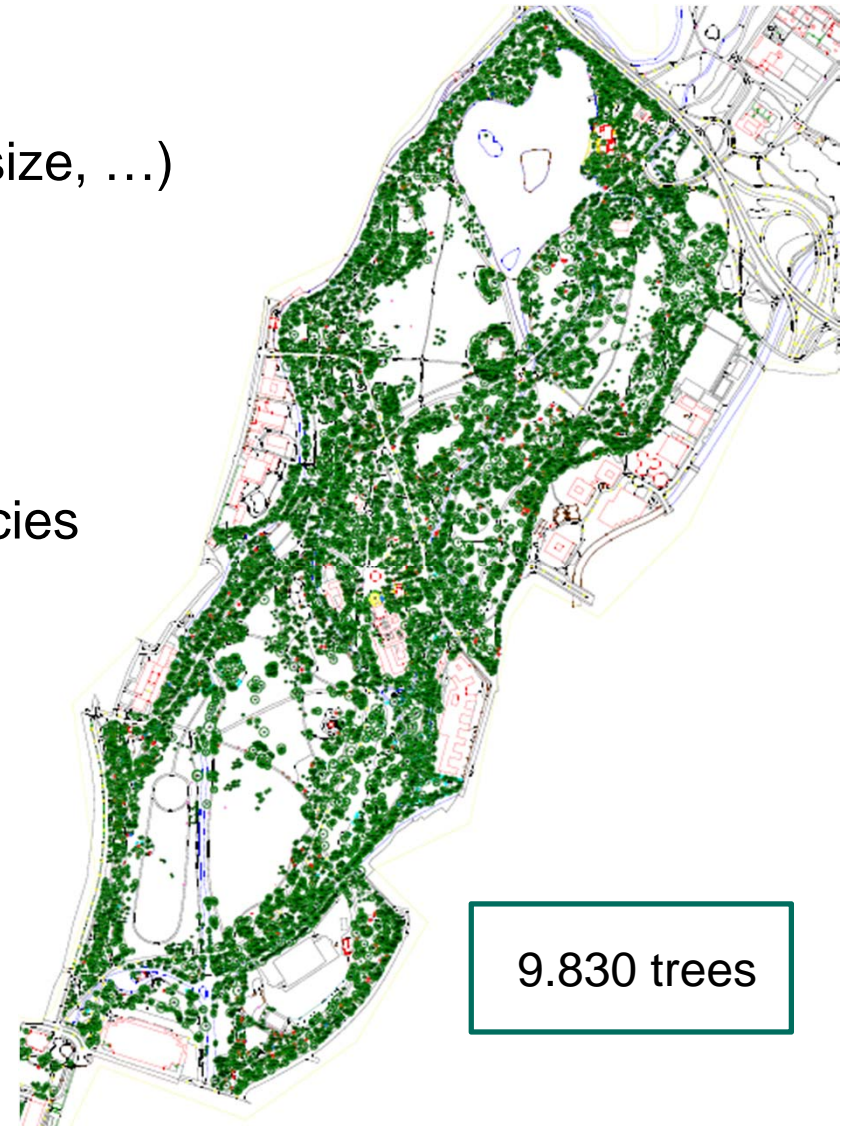
ACT: Actual Inventory

HIS: High Isoprene emitters species

HMT: High monoterpene emitters species

METEOREOLOGICAL STATION:  
Landsberg, Germany, year 212

POLLUTANTS DATA:  
Boston, US, year 2012



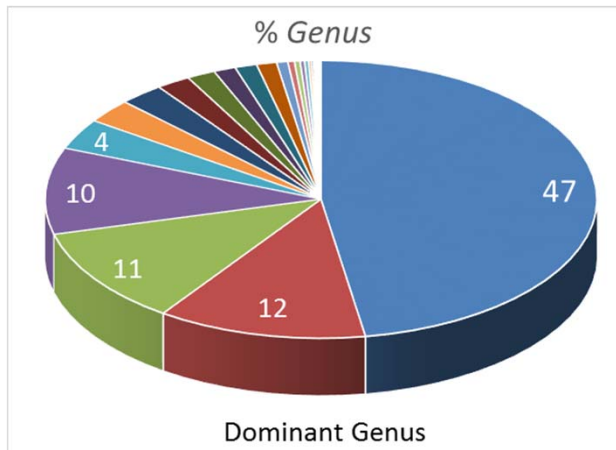


# Scenarios of Species Composition

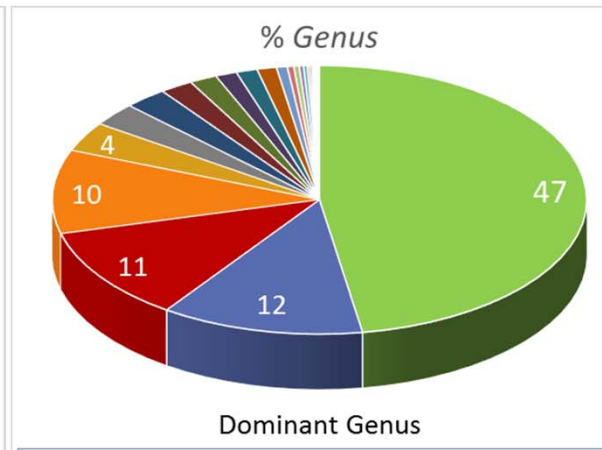
ACT

HIS

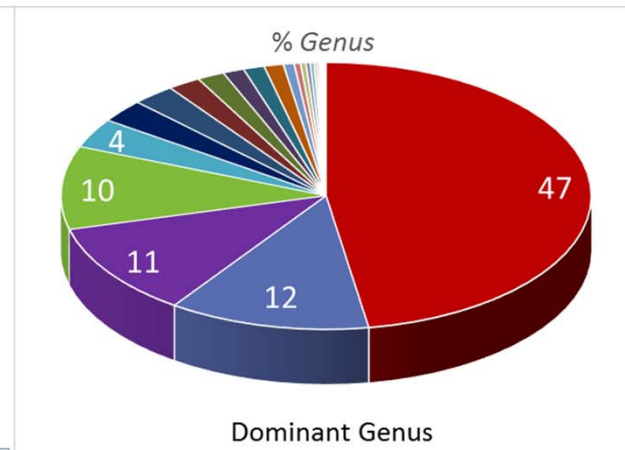
HMT



*Acer, Fagus, Tilia,  
Fraxinus, Carpinus*

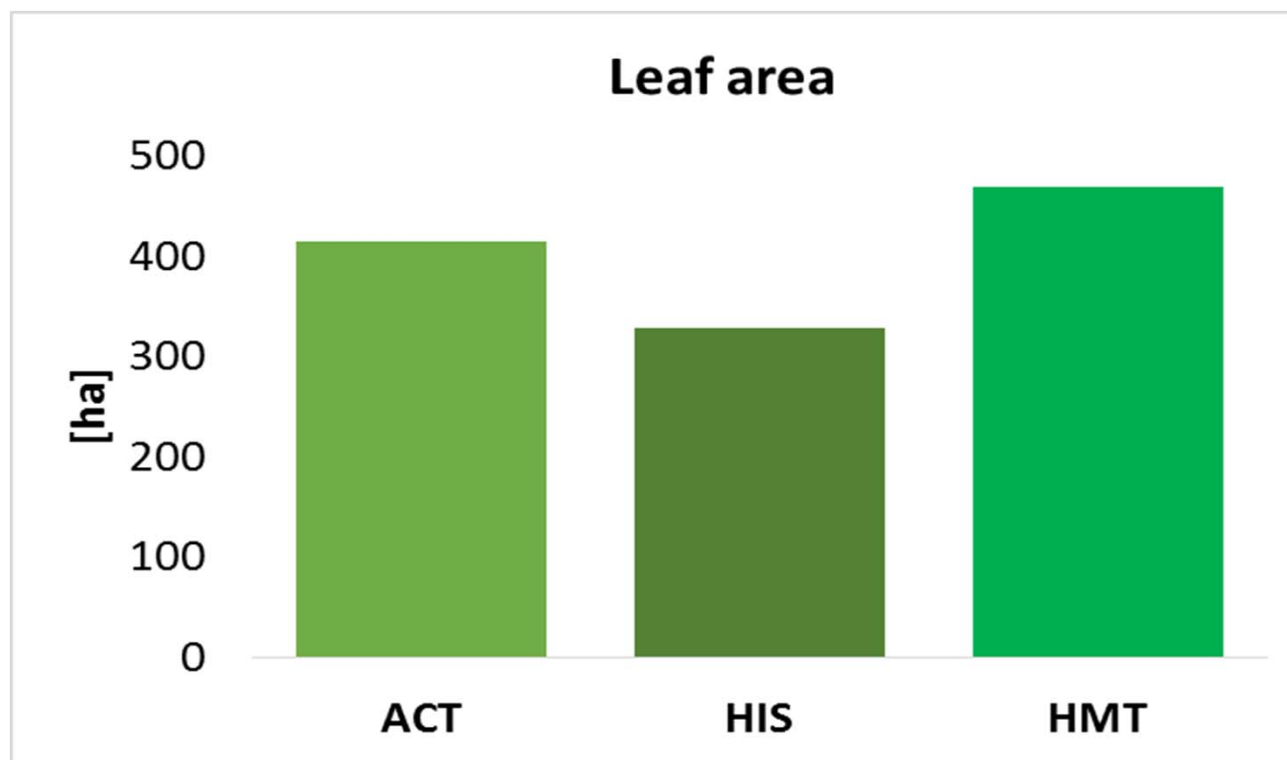


*Quercus, Robinia,  
Platanus, Populus, Salix*



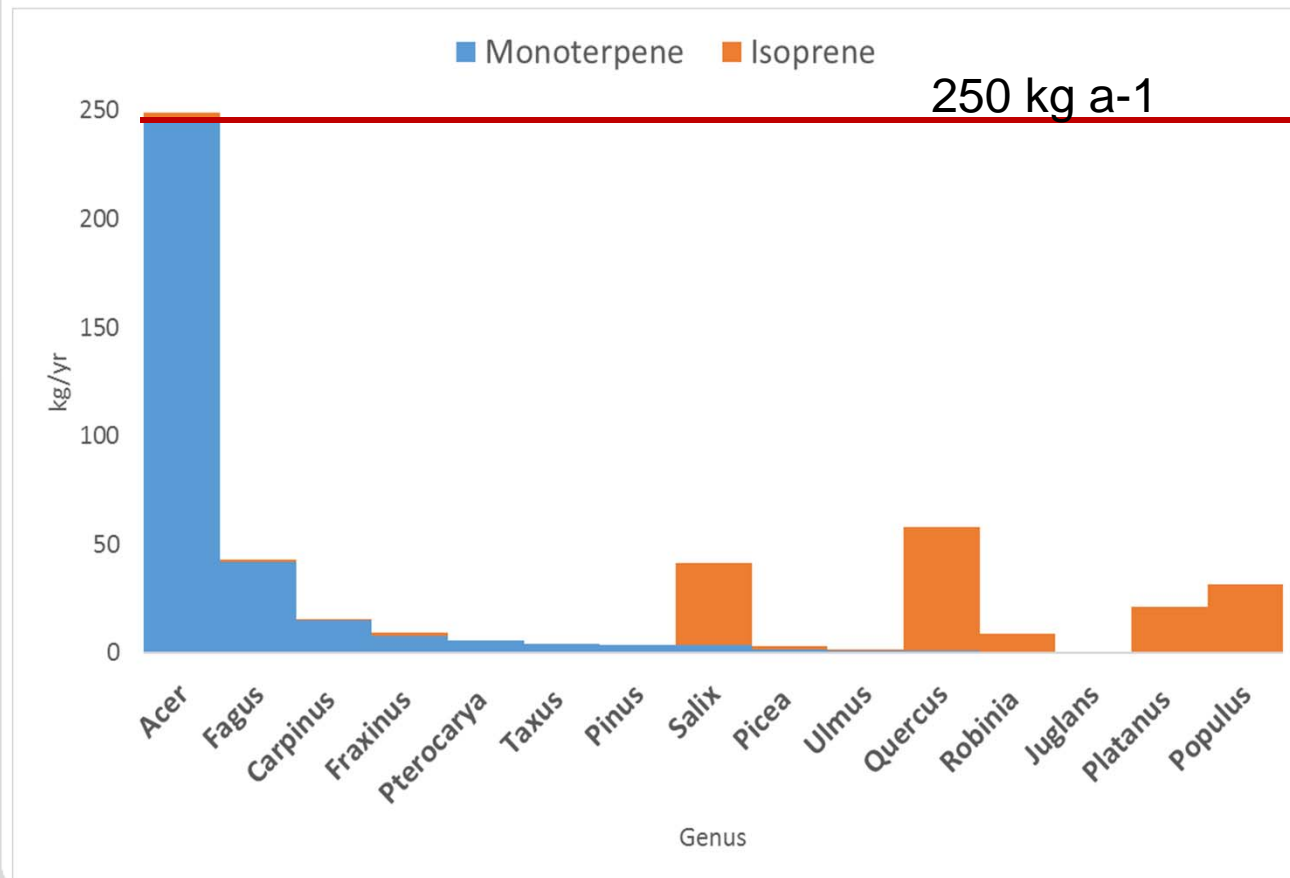
*Picea, Juglans, Magnolia,  
Pinus, Ginkgo*

# Scenario Effects: Leaf Area



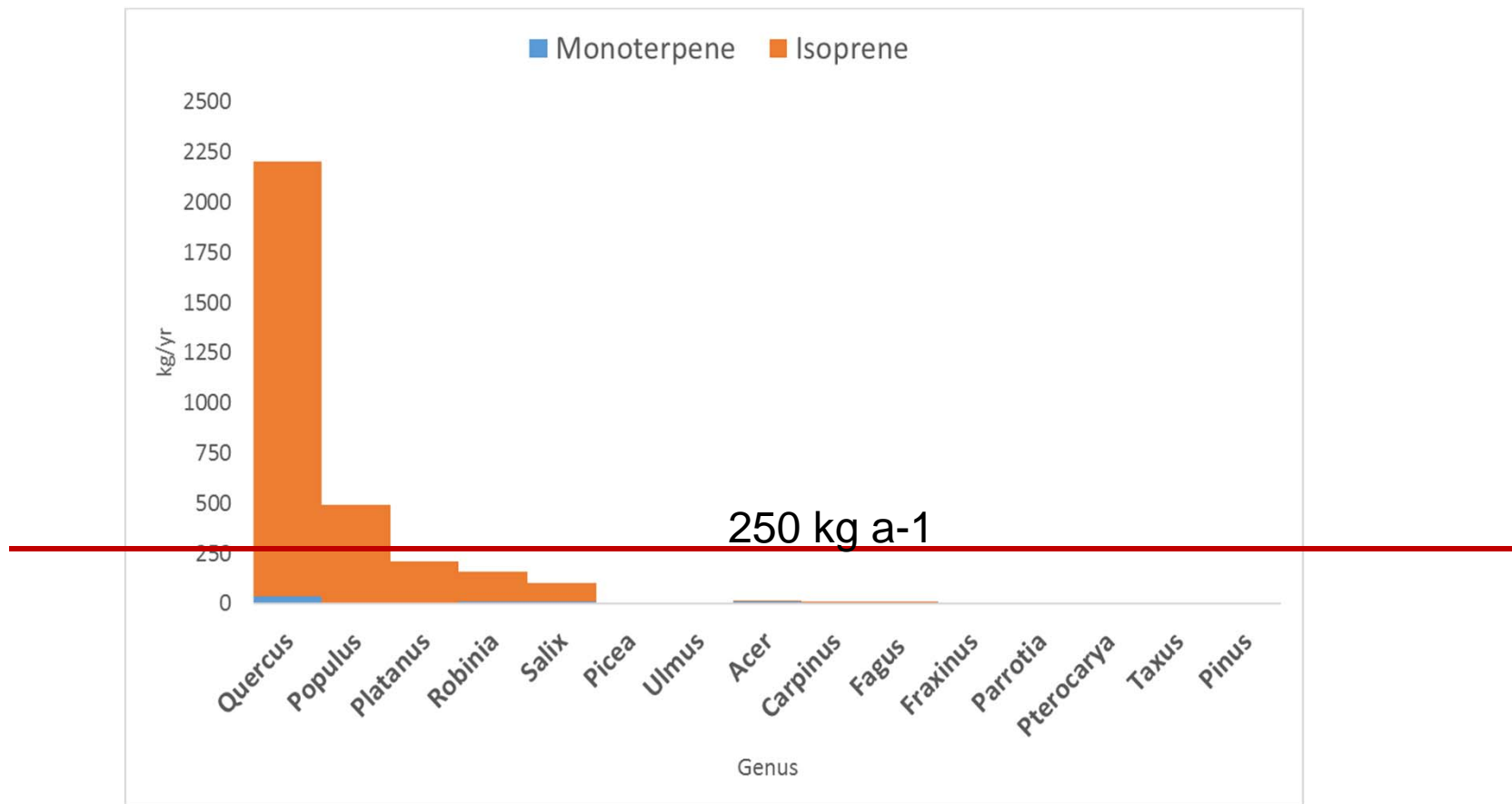
# Scenario Results: Emission

ACT



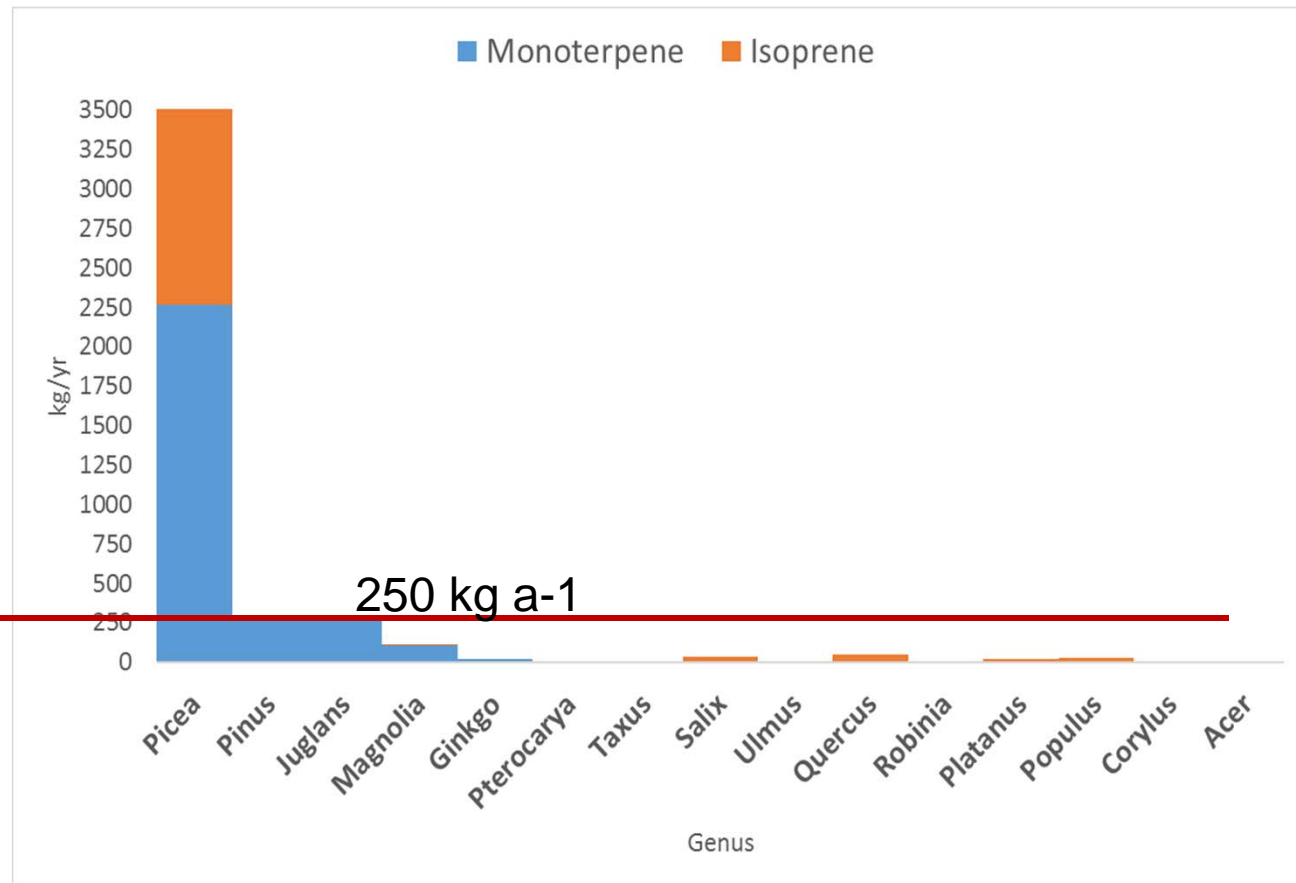
# Scenario Results: Emission

HIS



# Scenario Results: Emission

HMT



# Scenario Results: Potential effects on ozone

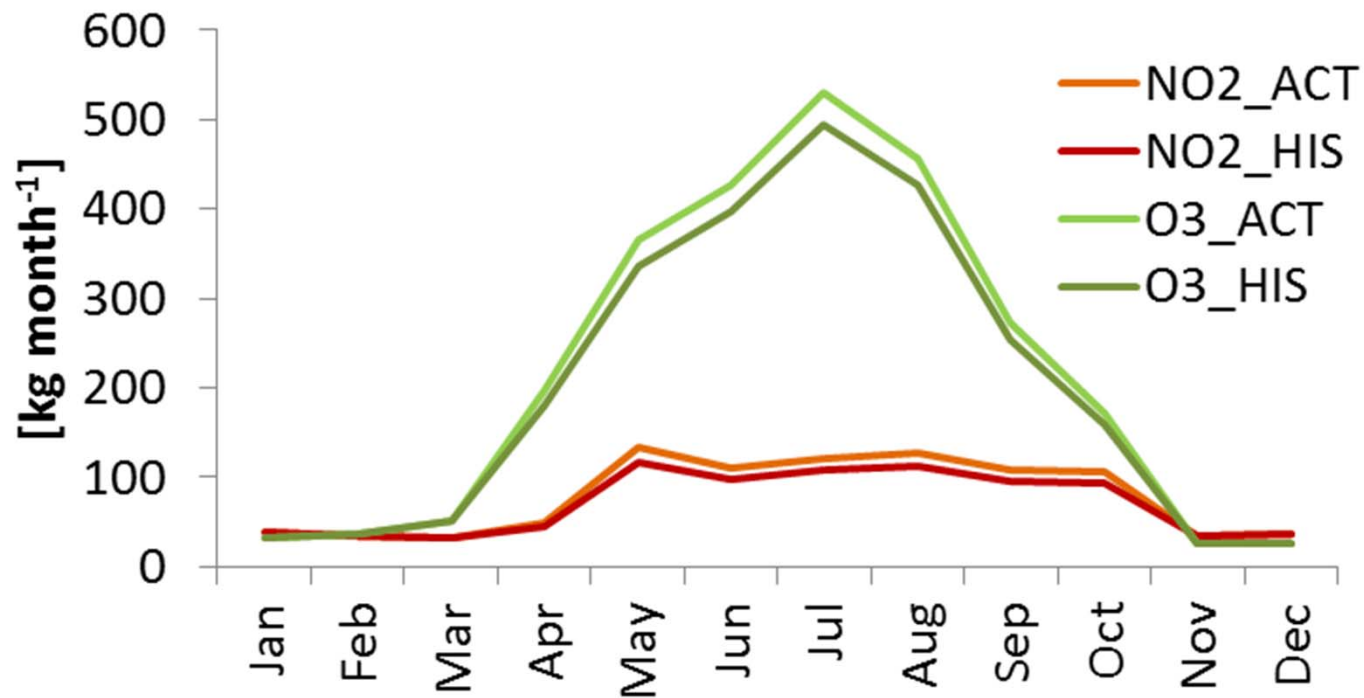
	ISO [kg a-1]	MONO [kg a-1]	OFP* [kg a-1]
ACT	161	335	2742
HIS	3107	98	28646
HMT	1410	2956	24065

\*Ozone forming potential according to Benjamin and Winer, 1998 (AE)

... and now to something completely different...

# Scenario Effects: Air Pollution Removal

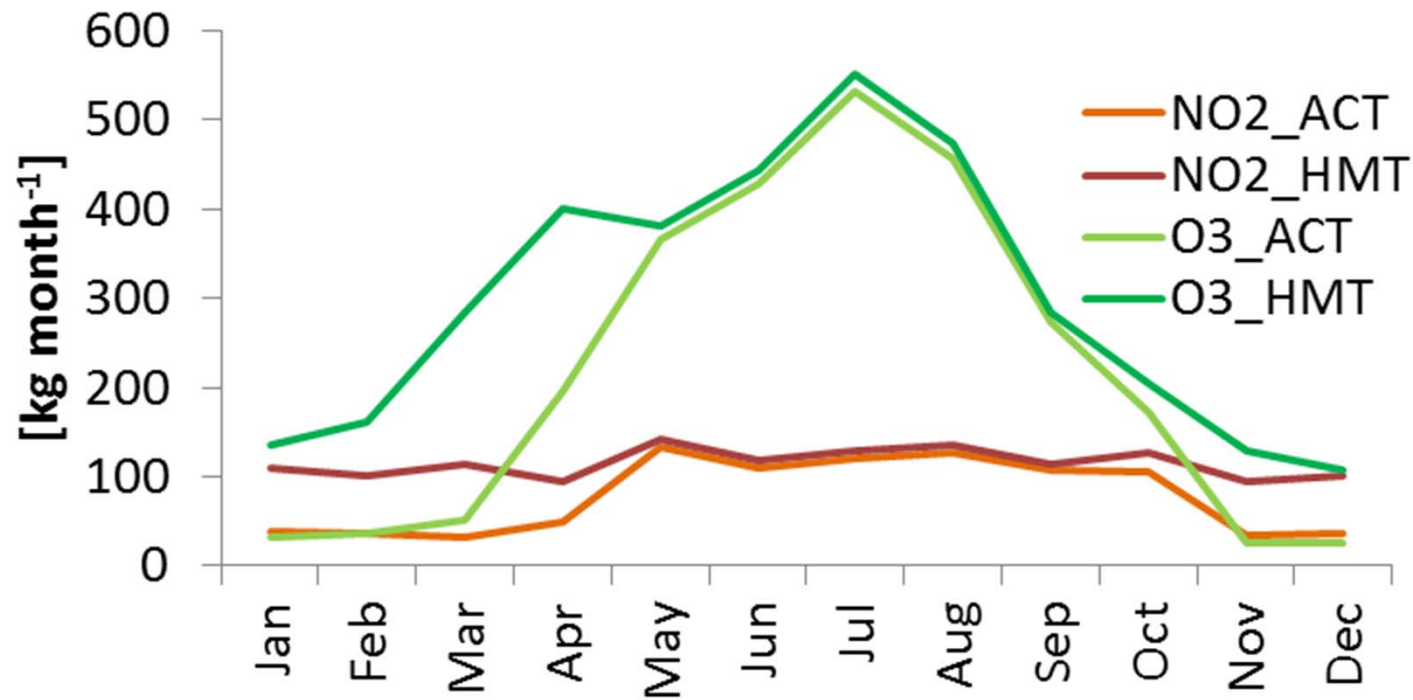
## High Isoprene vs. Actual



	O <sub>3</sub> [kg a <sup>-1</sup> ]	NO <sub>2</sub> [kg a <sup>-1</sup> ]
<b>ACT</b>	<b>2594</b>	<b>930</b>
<b>HIS</b>	<b>2417</b>	<b>846</b>

# Scenario Results: Air Pollution Removal

## High Monoterpene vs. Actual



	O <sub>3</sub> [kg a <sup>-1</sup> ]	NO <sub>2</sub> [kg a <sup>-1</sup> ]
<b>ACT</b>	<b>2594</b>	<b>930</b>
<b>HMT</b>	<b>3553</b>	<b>1378</b>

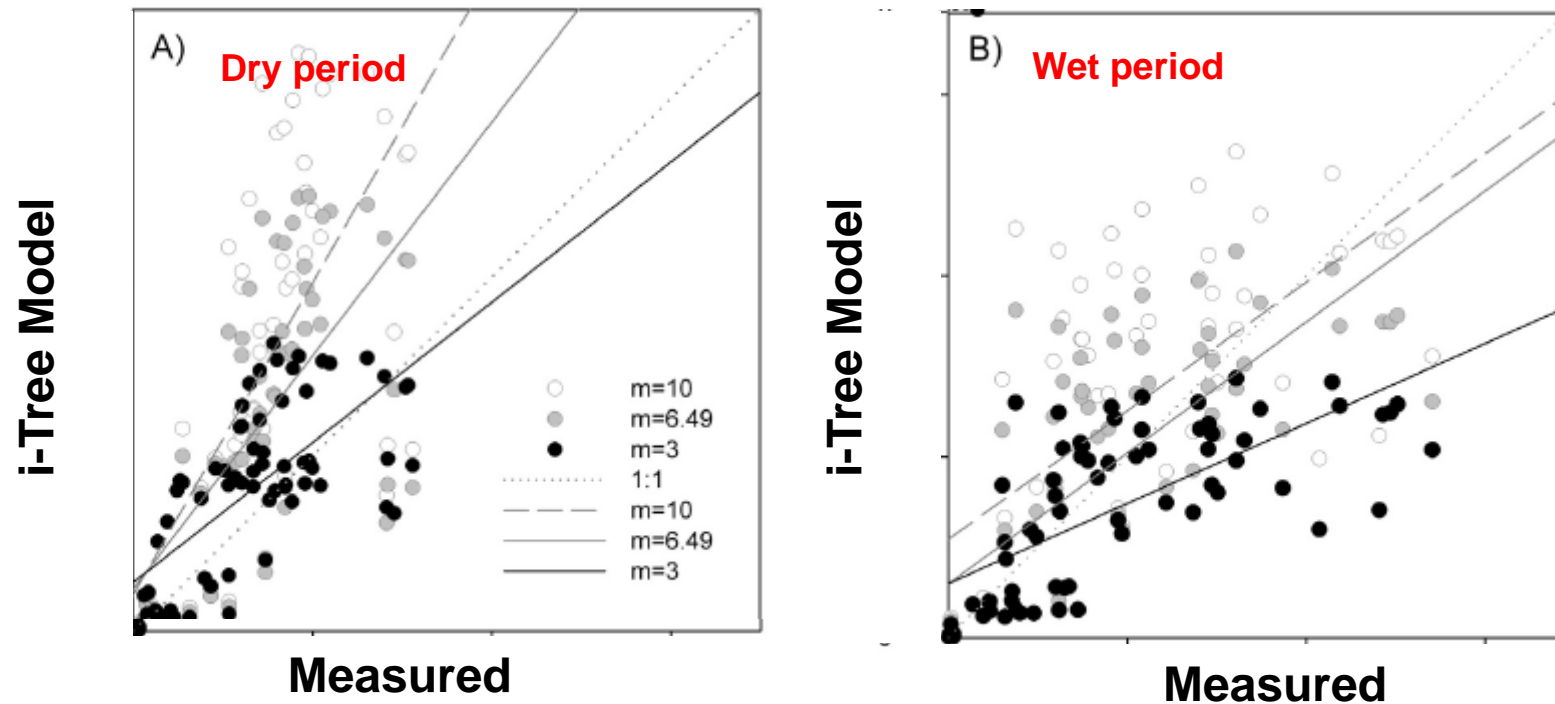


# Uncertainties

**MANY!!**

# Uncertainties: Deposition and Drought

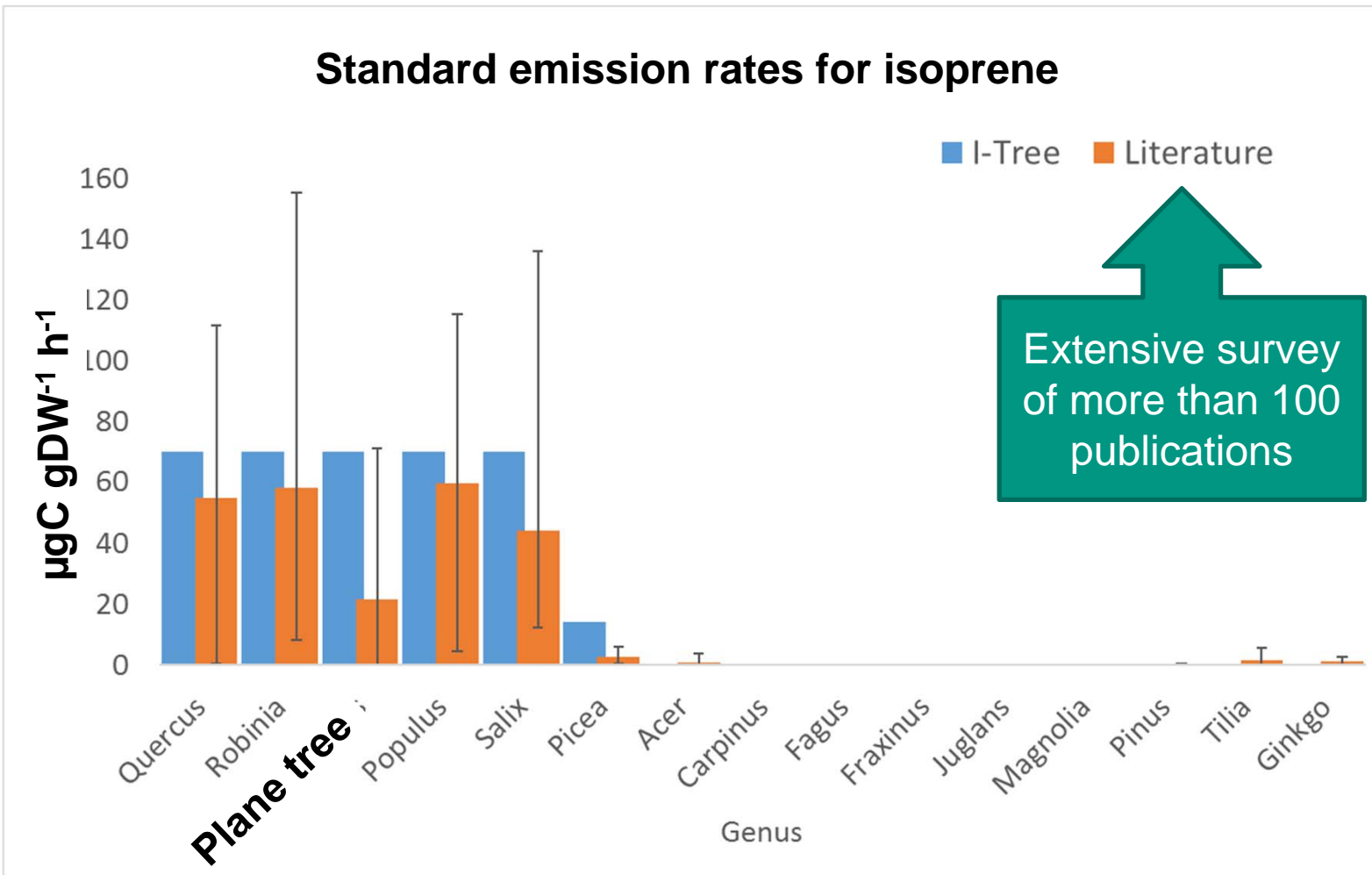
Deposition of ozone during a year in a peri-urban region of Rome.



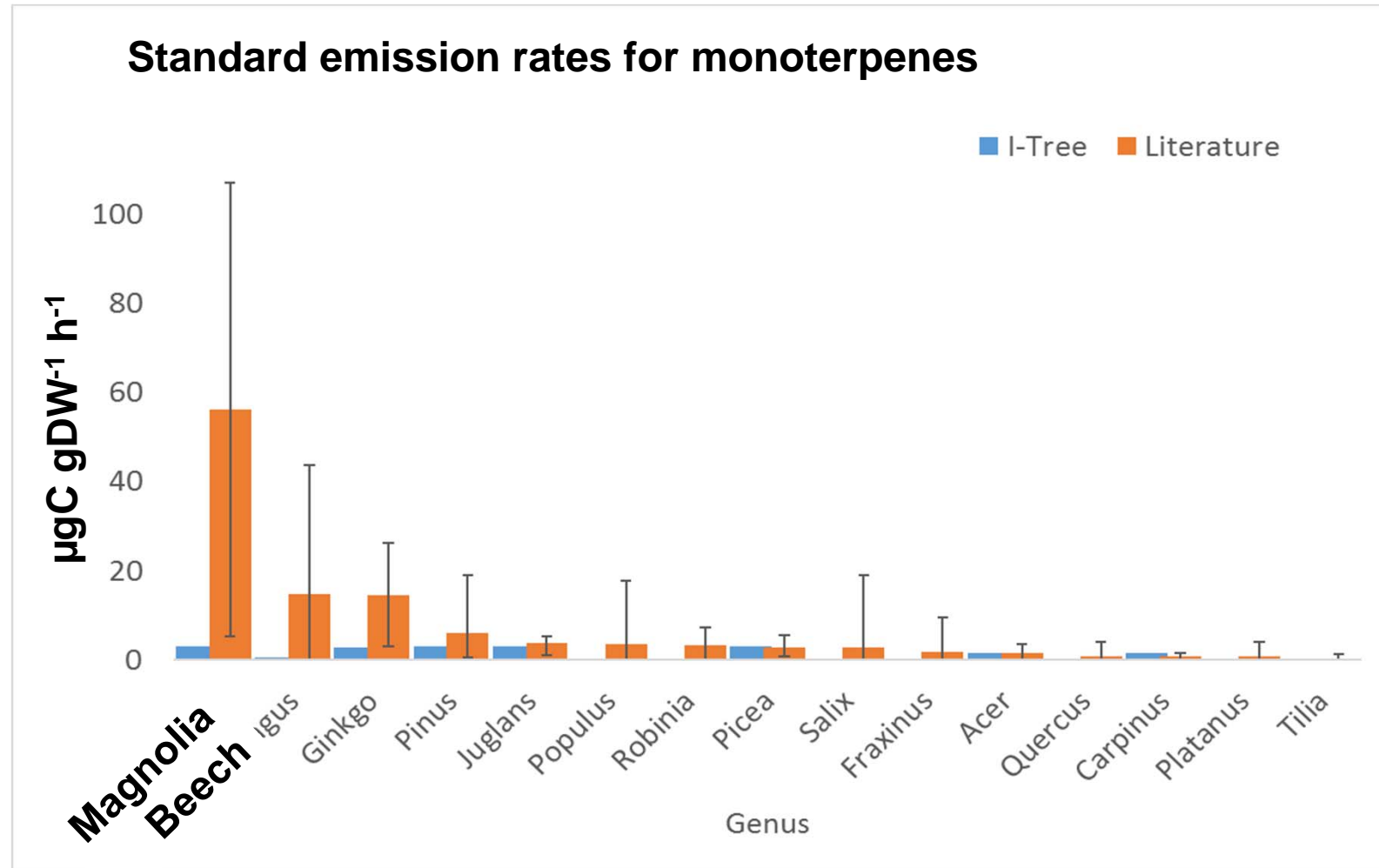
Morani et al., 2014 (EP)

# Uncertainties: BVOC emissions

## Standard emission rates for isoprene



# Uncertainties: BVOC emissions



## Conclusion

- **Under current conditions, air pollution removal of Englischer Garten trees is considerable.**
- **Using high BVOC emitting tree species is likely to trigger ozone in a magnitude similar to ozone deposition.**
- **Considerable uncertainty exists in estimating deposition as well as emission effects with the i-Tree model.**

Going on towards larger challenges...

Munich



Berlin

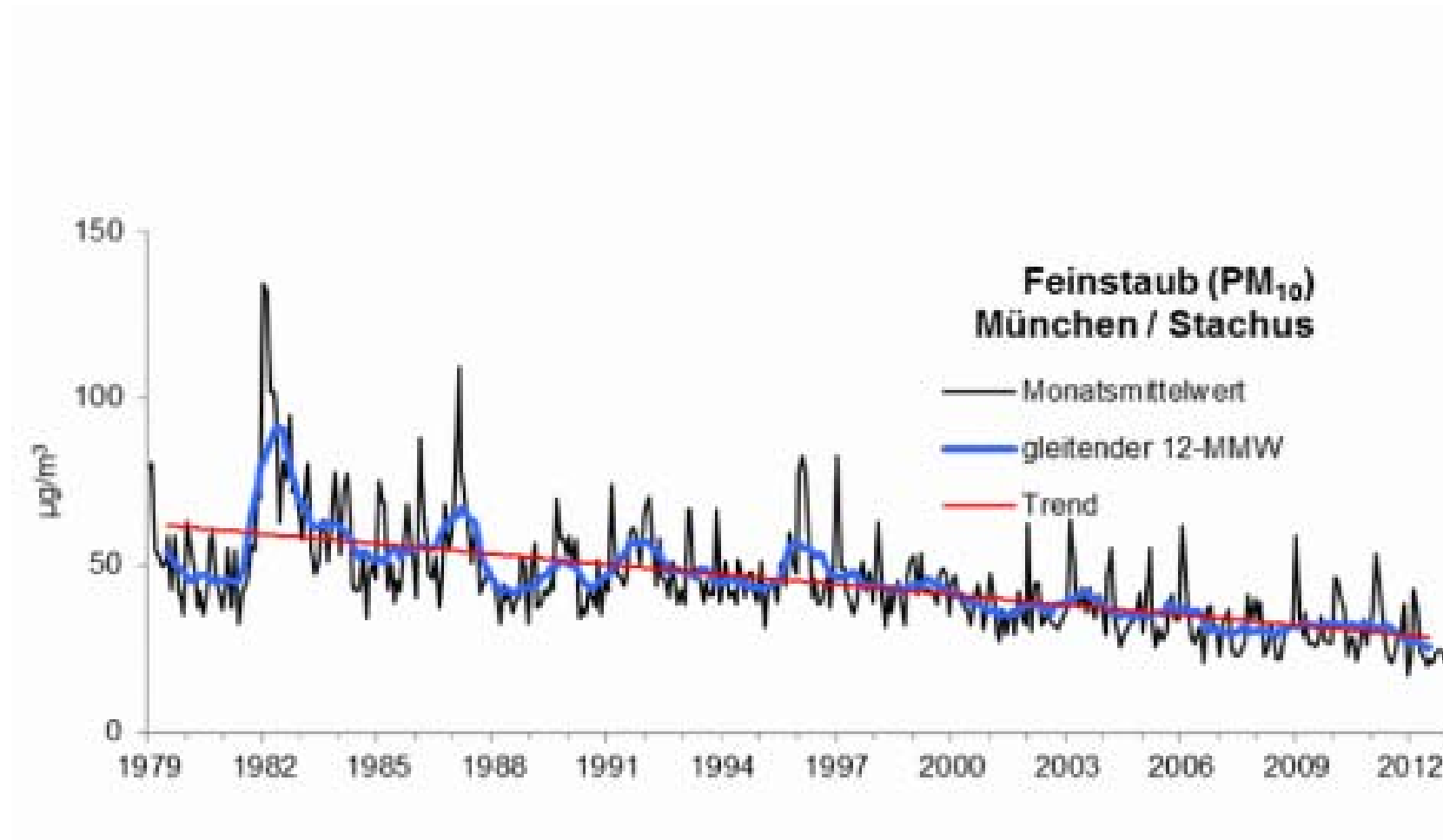


Rome

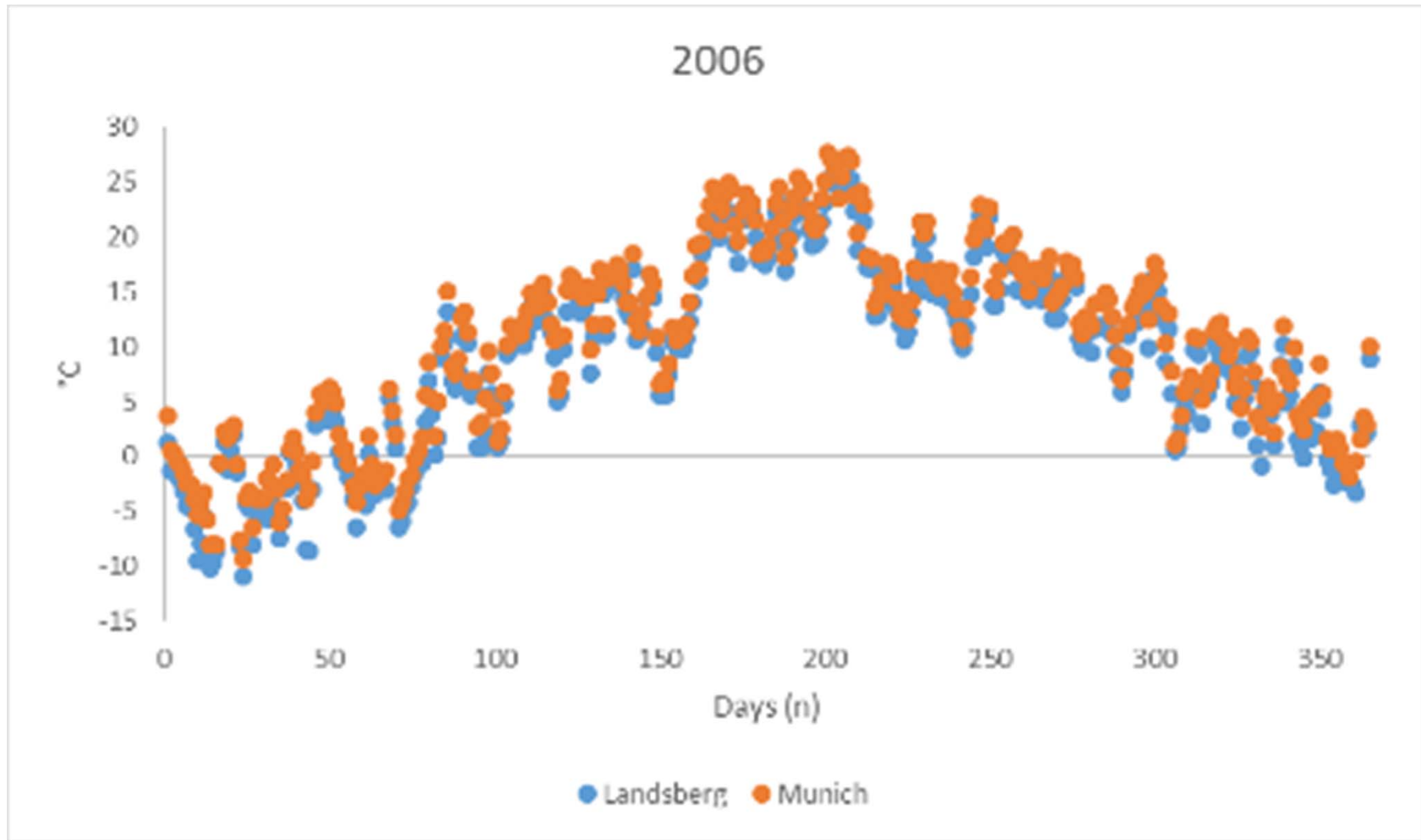


**THANKS FOR YOUR ATTENTION**

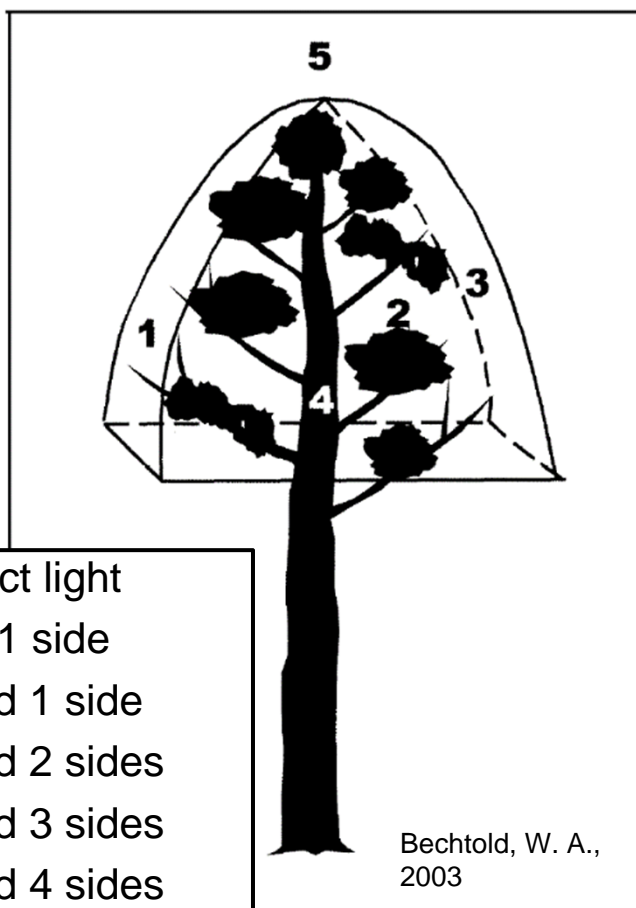




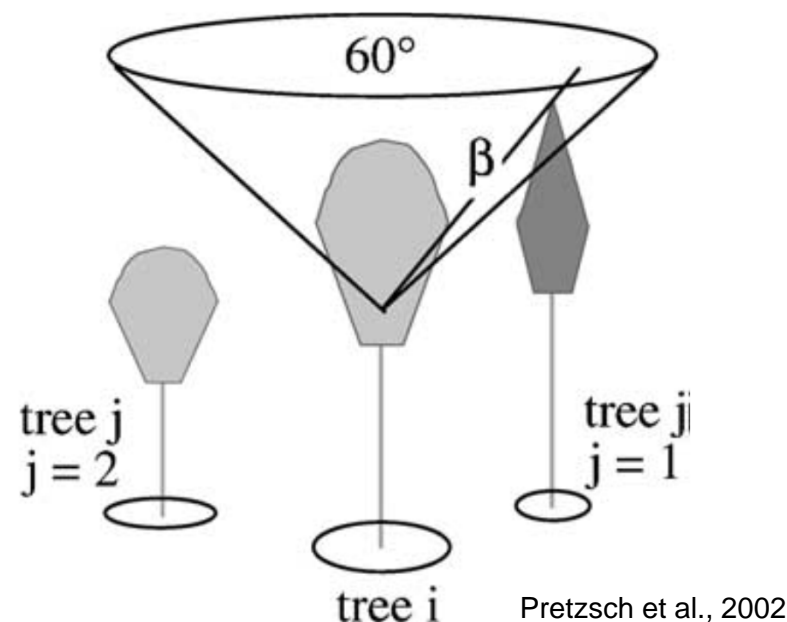




# Crown light exposure



## TUM - Chair of Forest Growth and Yield Science



- Tree position and dendrometric data
- SILVA Model
- Competition index