TERRECO 2010 WORKSHOP
Dr. Hans-Frisch Straße 1, Bayreuth
12 APR. 2010

2010 work plan

Estimation of stand level gas exchange fluxes

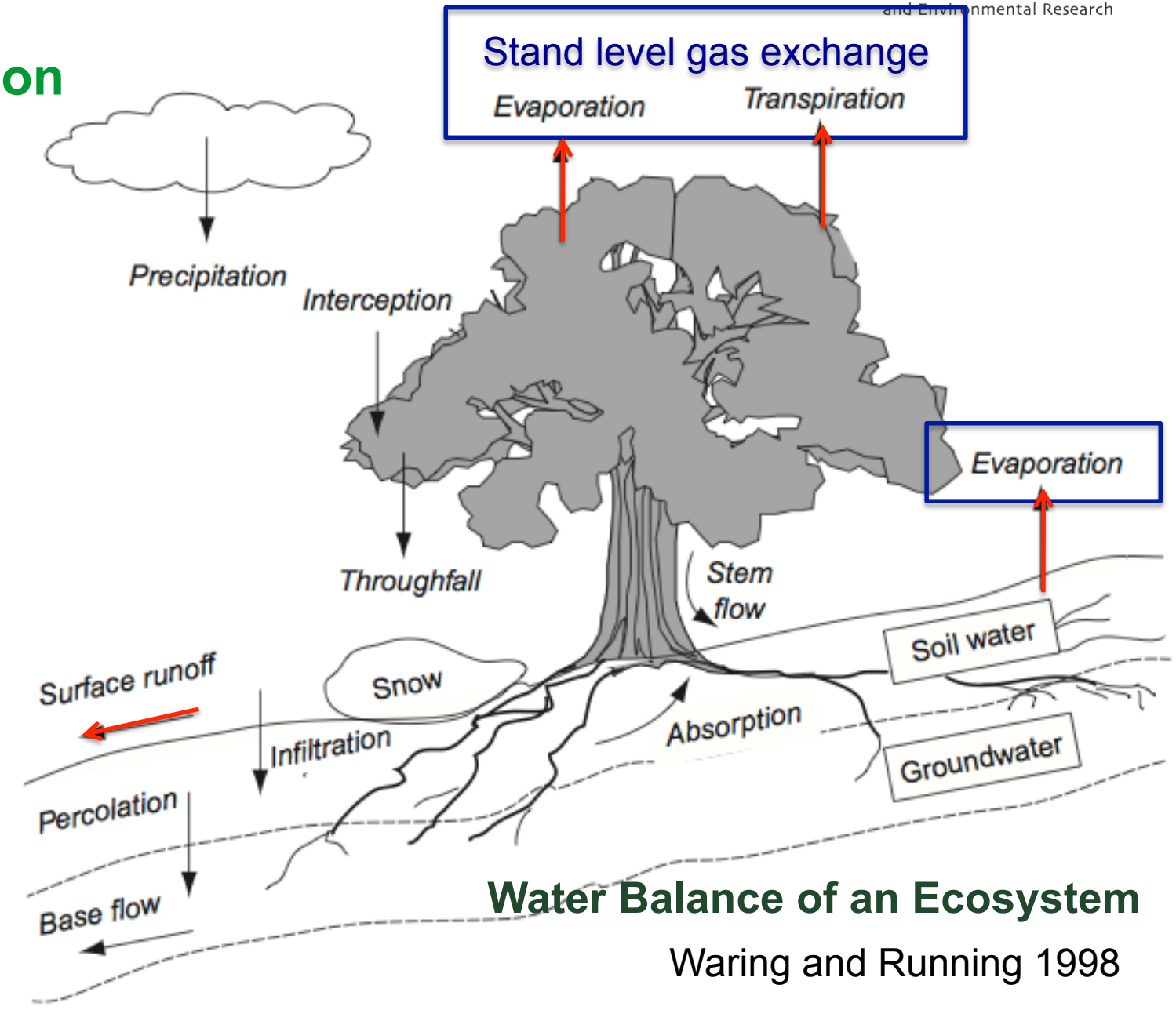
E. Jung and P. Zhao

Water use by forests in Haean Catchment

Sap flow measurements in South Korea, 2010

Eun-Young Jung and Dennis Otieno
Dept. of Plant Ecology

Introduction



Water Balance of an Ecosystem

Waring and Running 1998

Introduction

How much water is used by forests in Haean catchment?

Different Elevation

Different Forest Structure

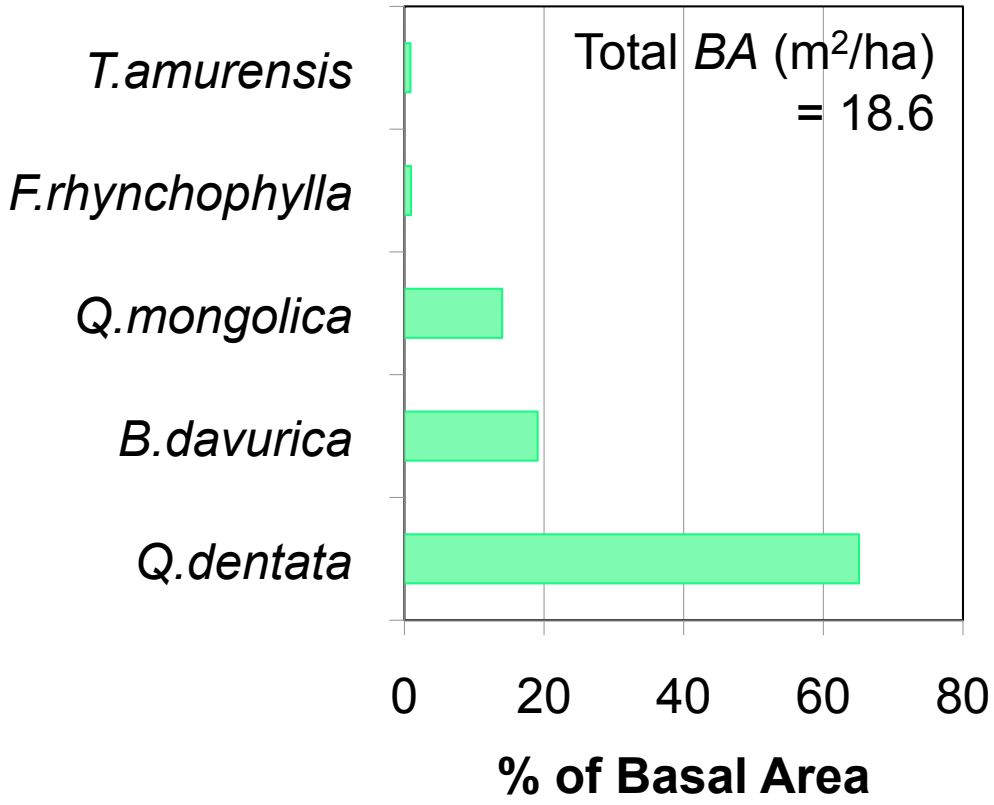
Different Meteorological Condition

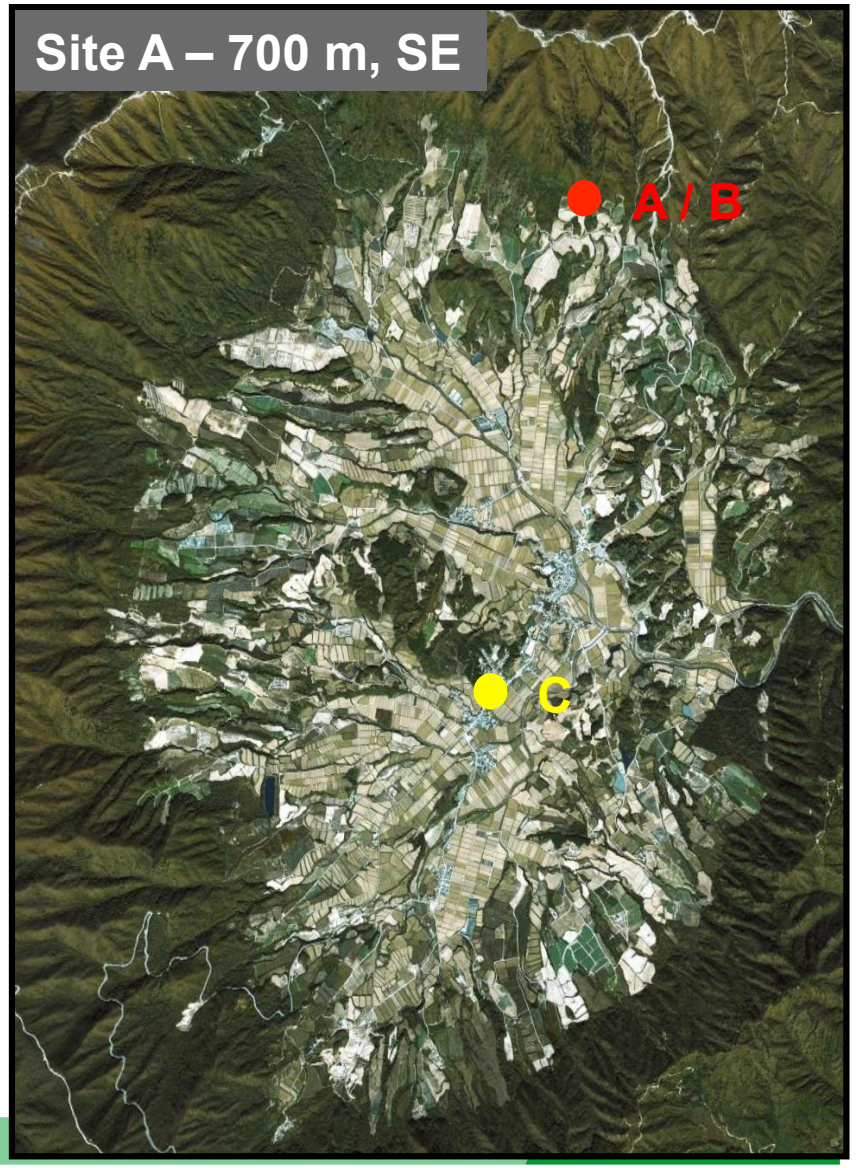
Different Species Composition

Different On/Off Set

➔ **Estimate Stand Transpiration!**

2009 Result
Elevation, Forest Structure, Species Composition





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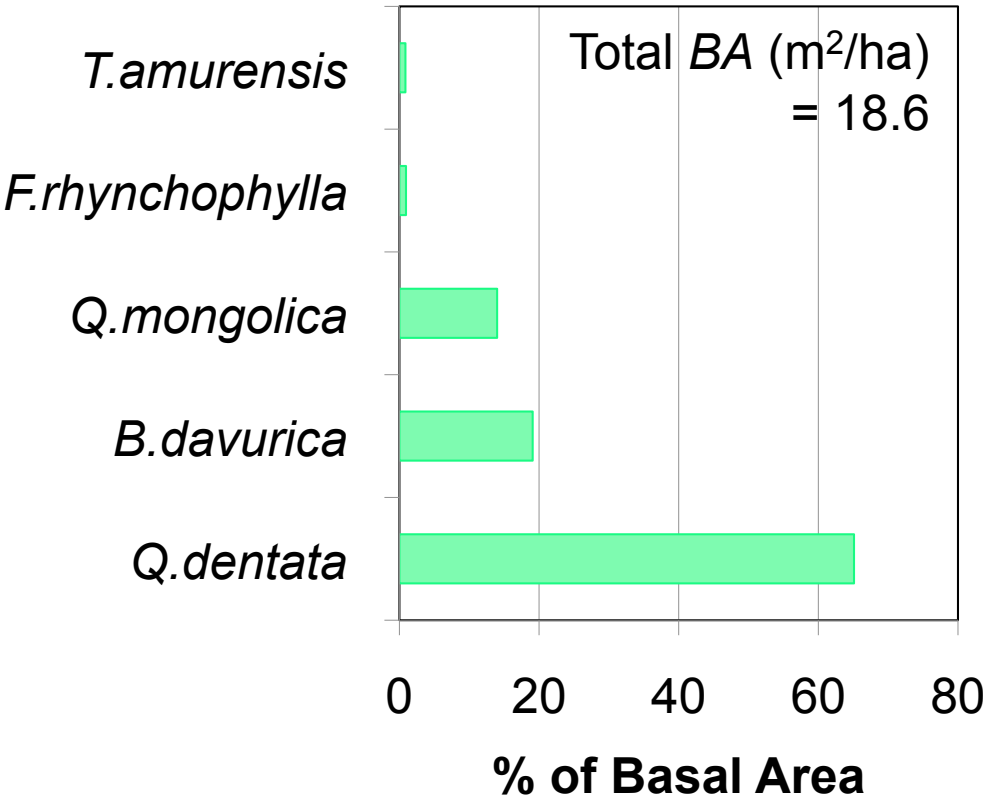

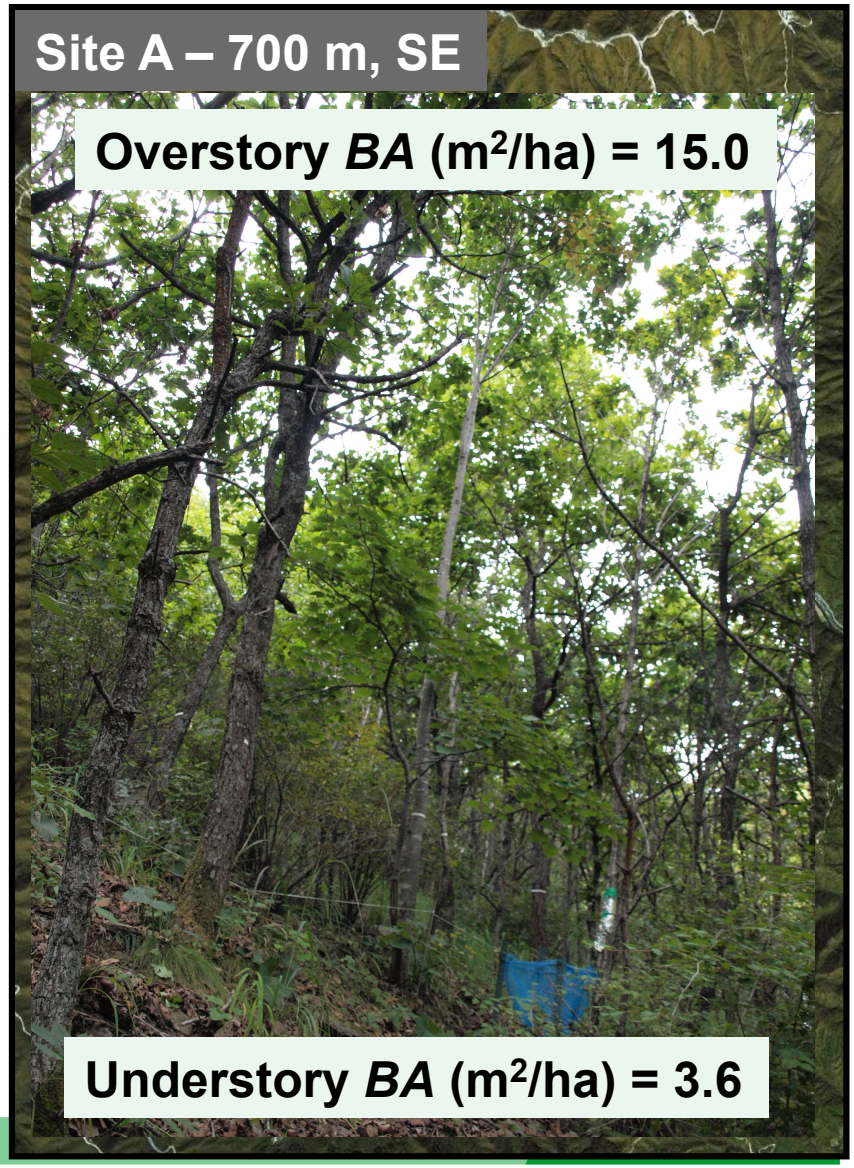

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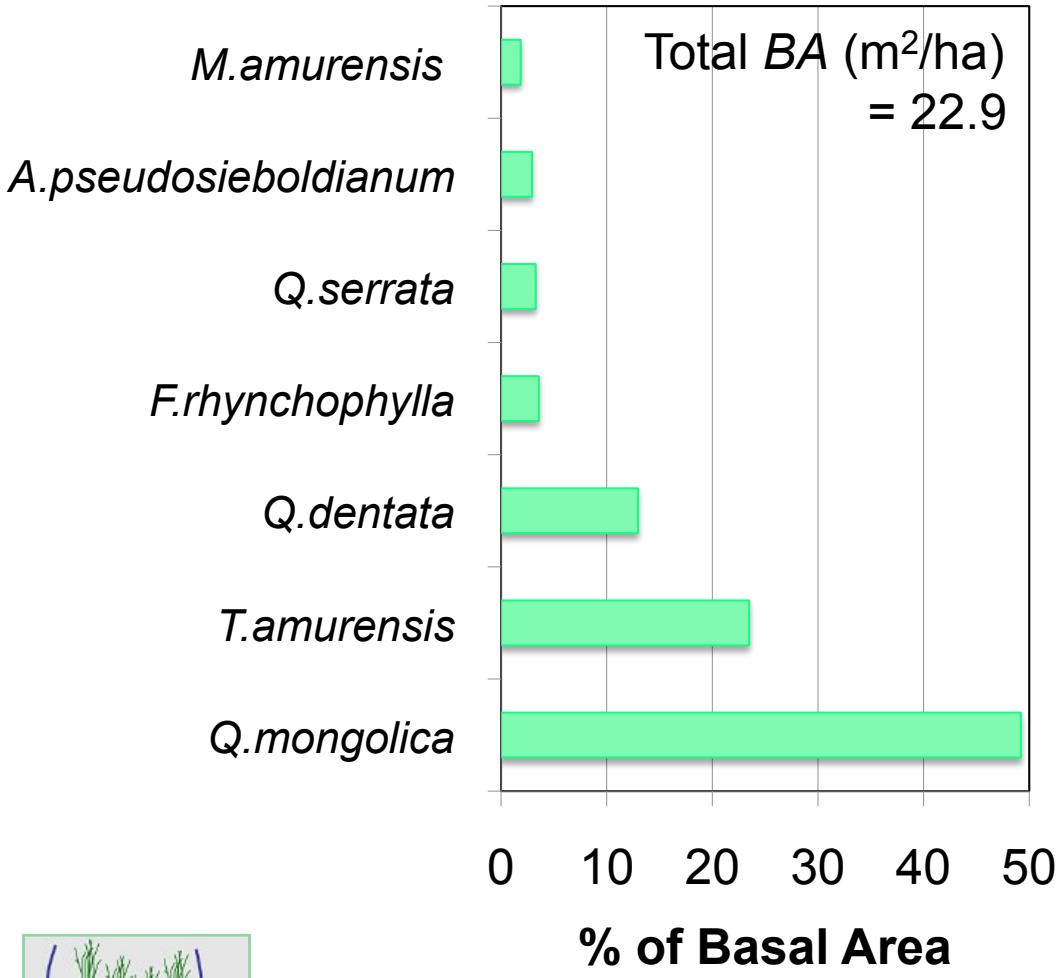

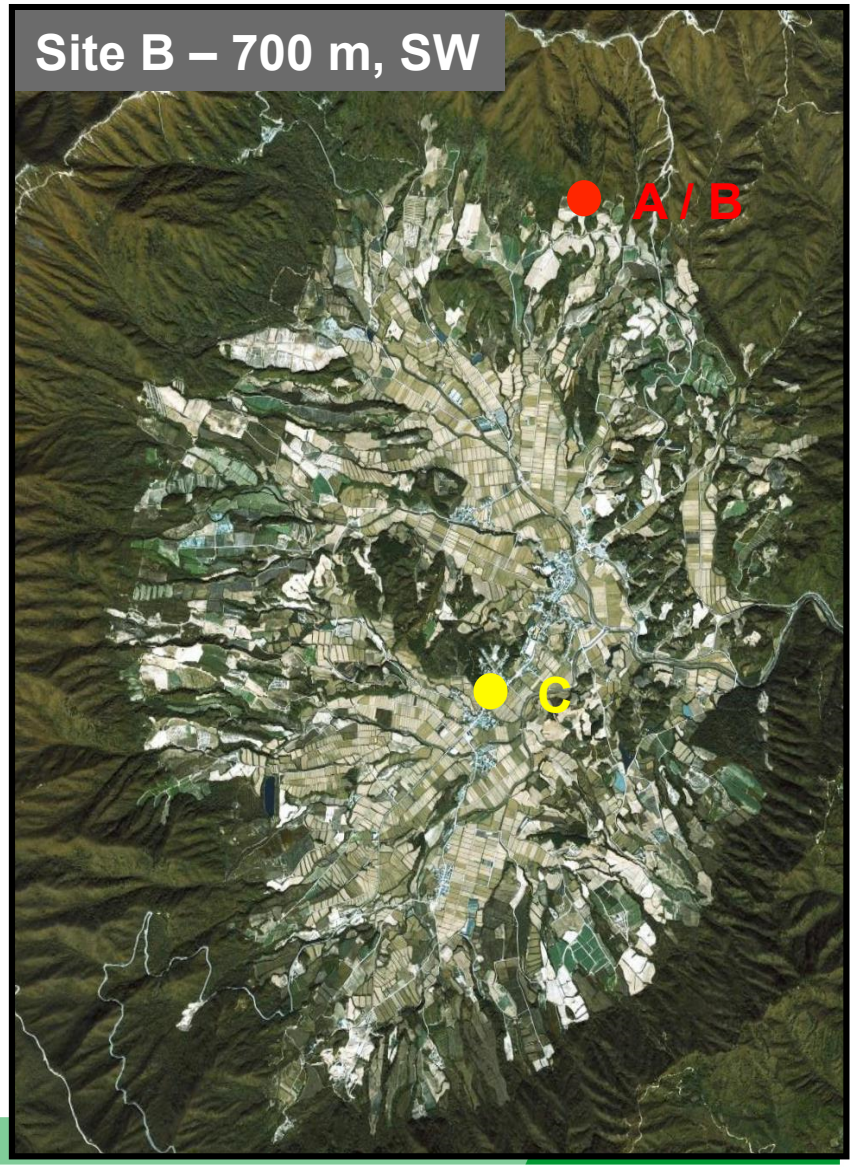

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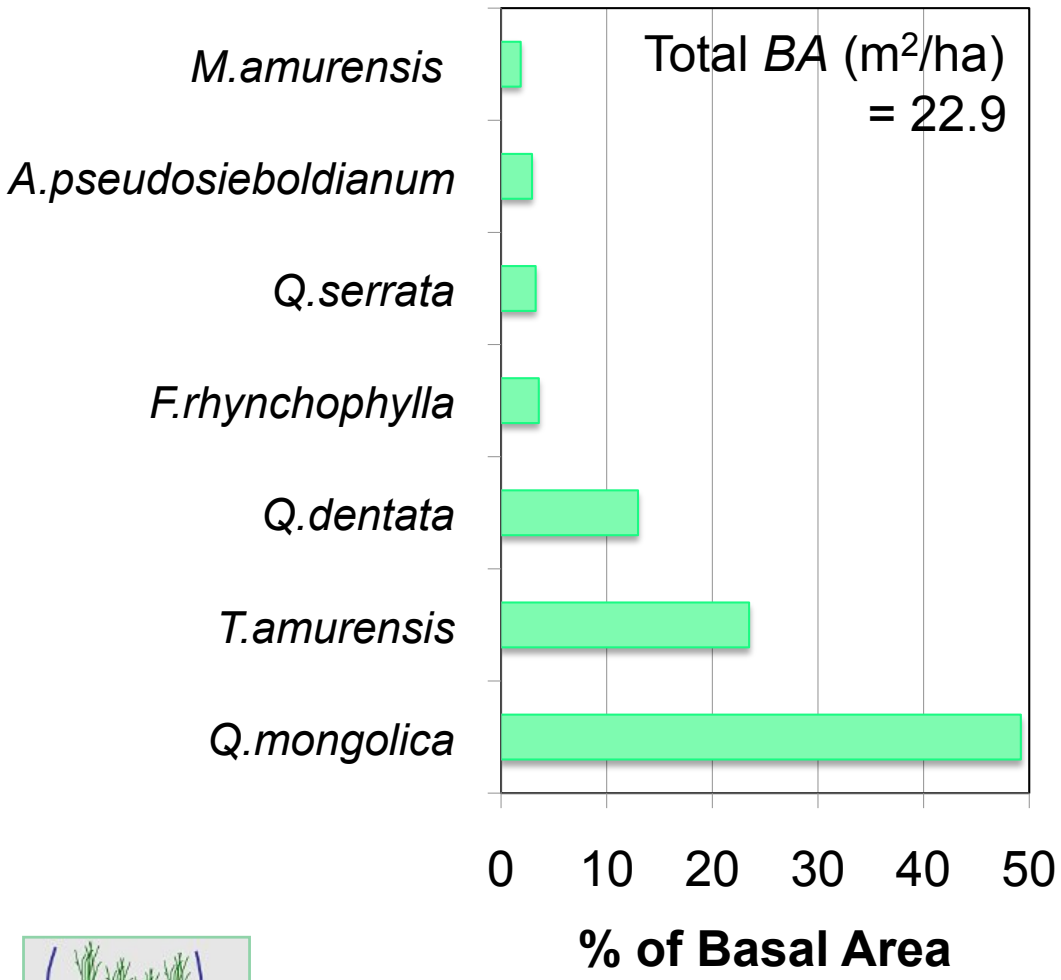

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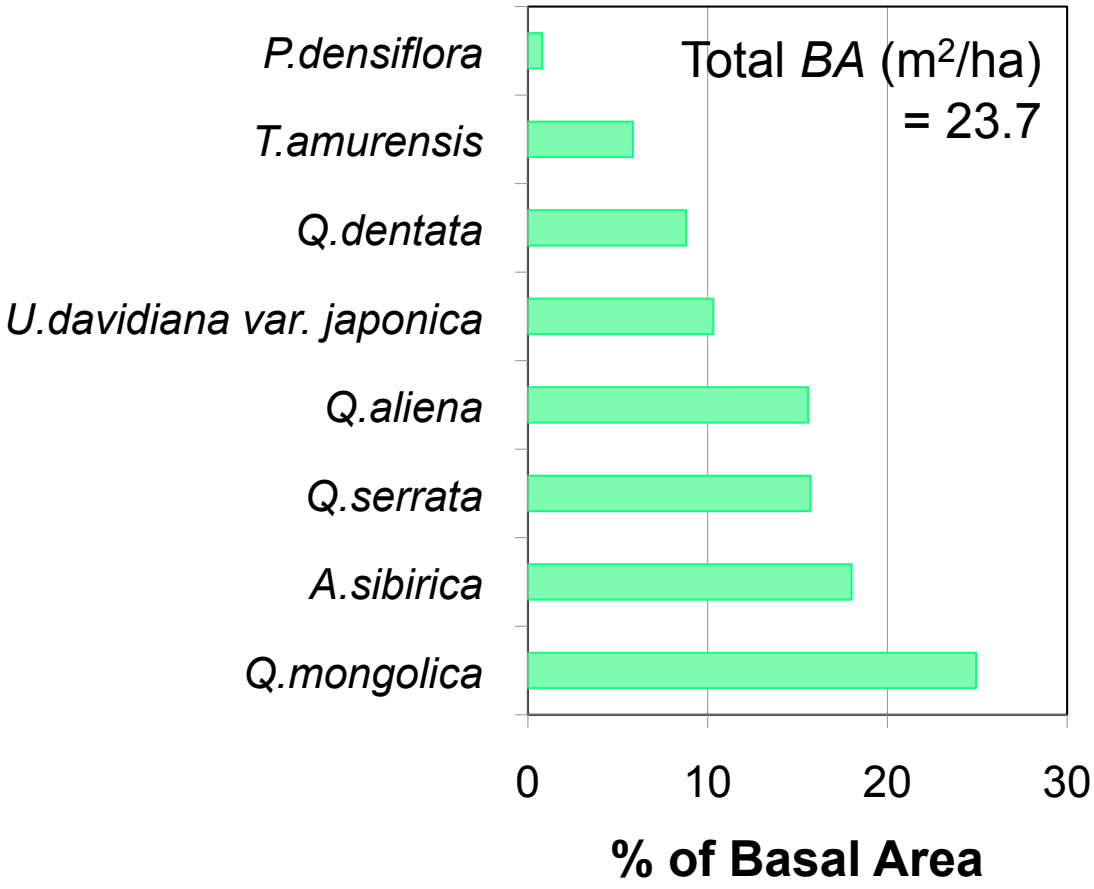

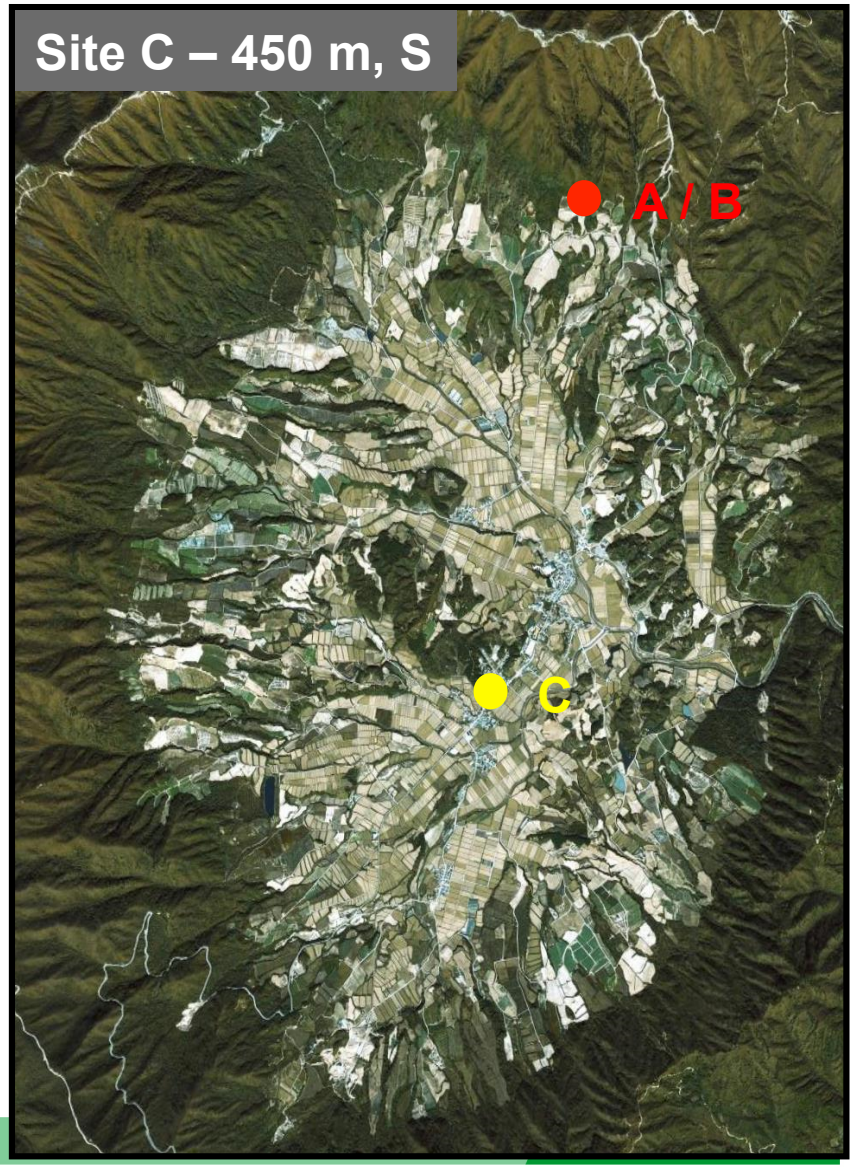

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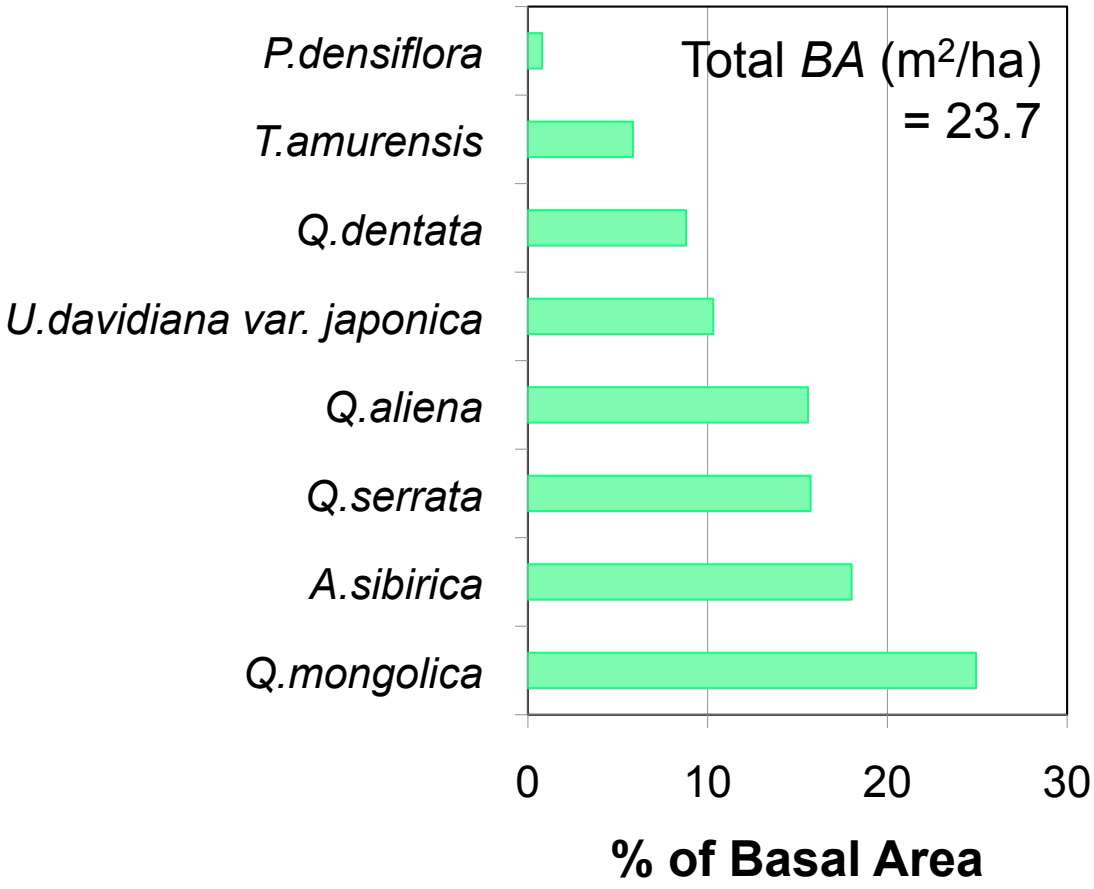

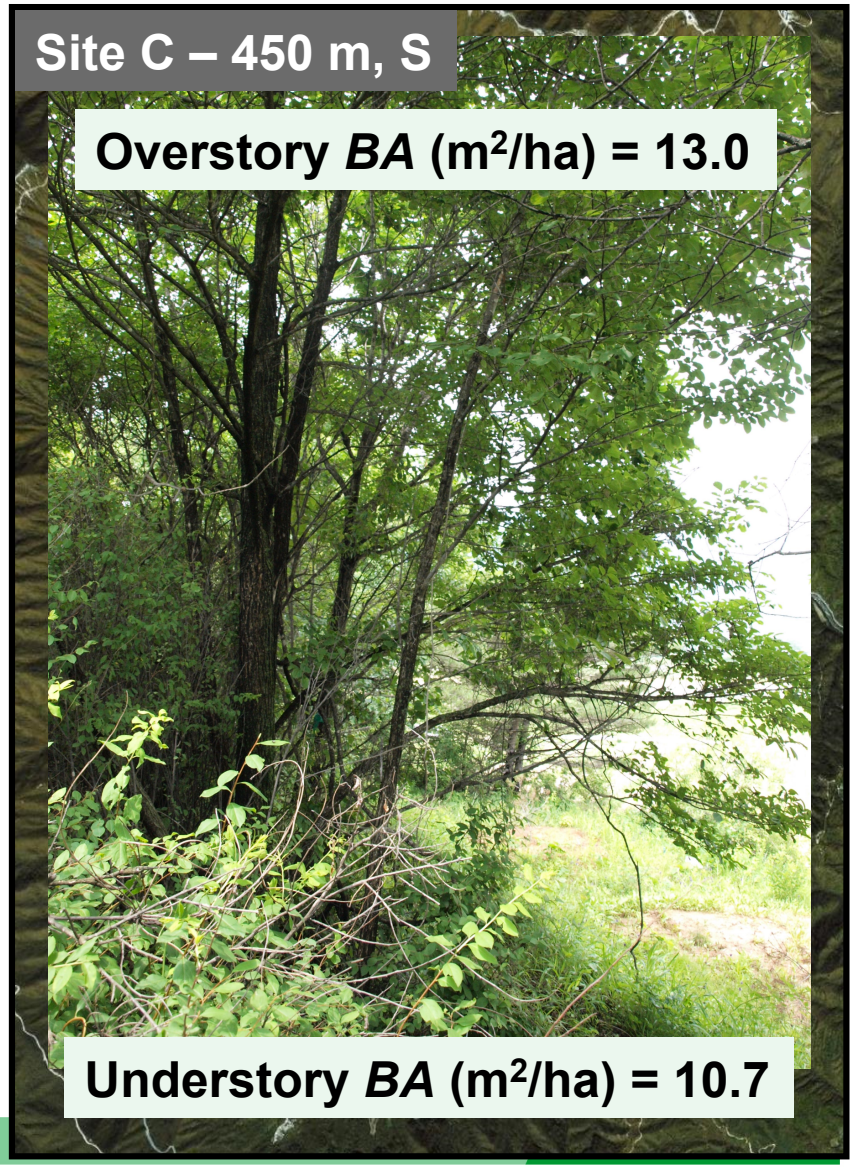

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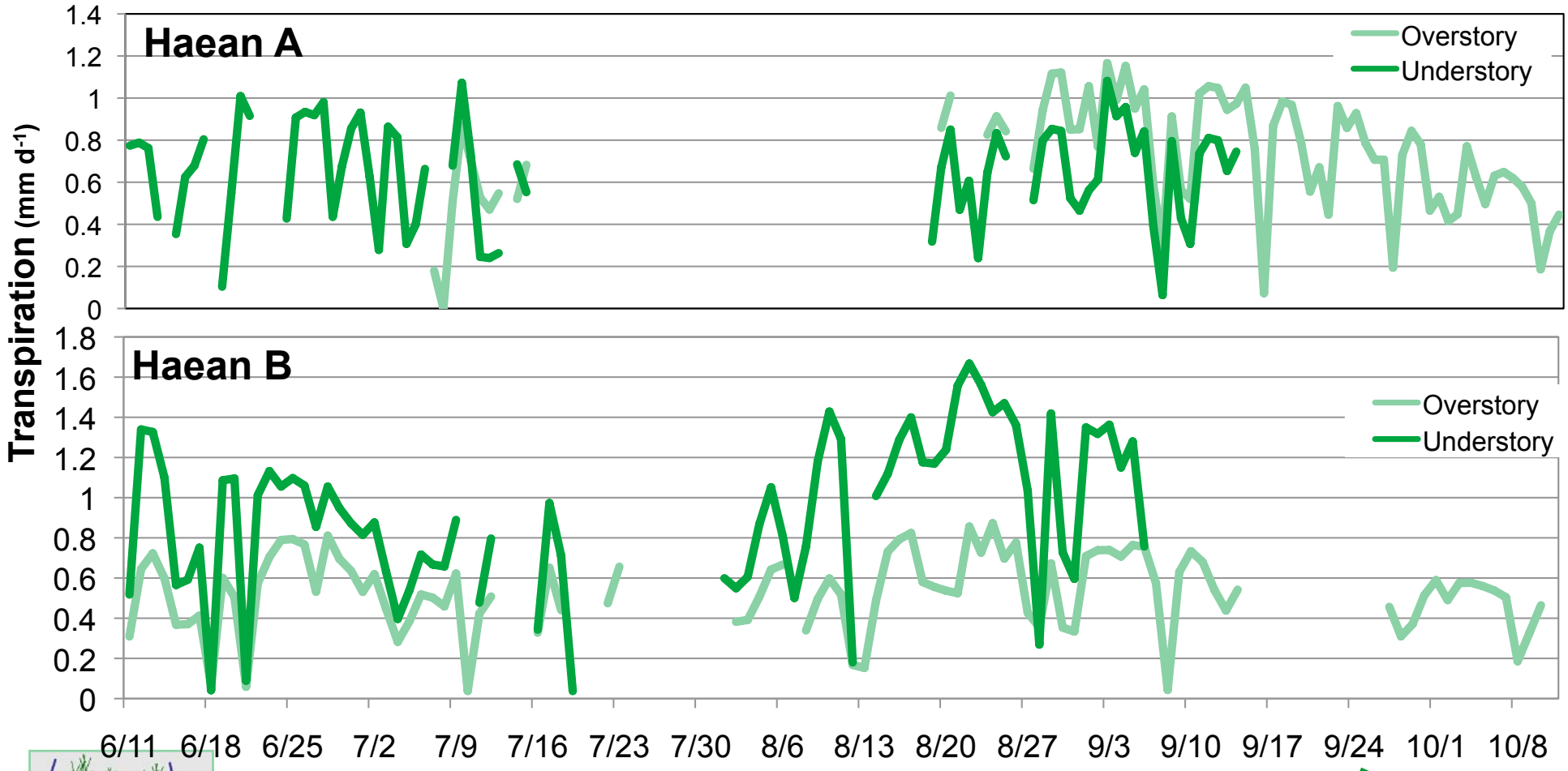
2009 Result
Stand Transpiration



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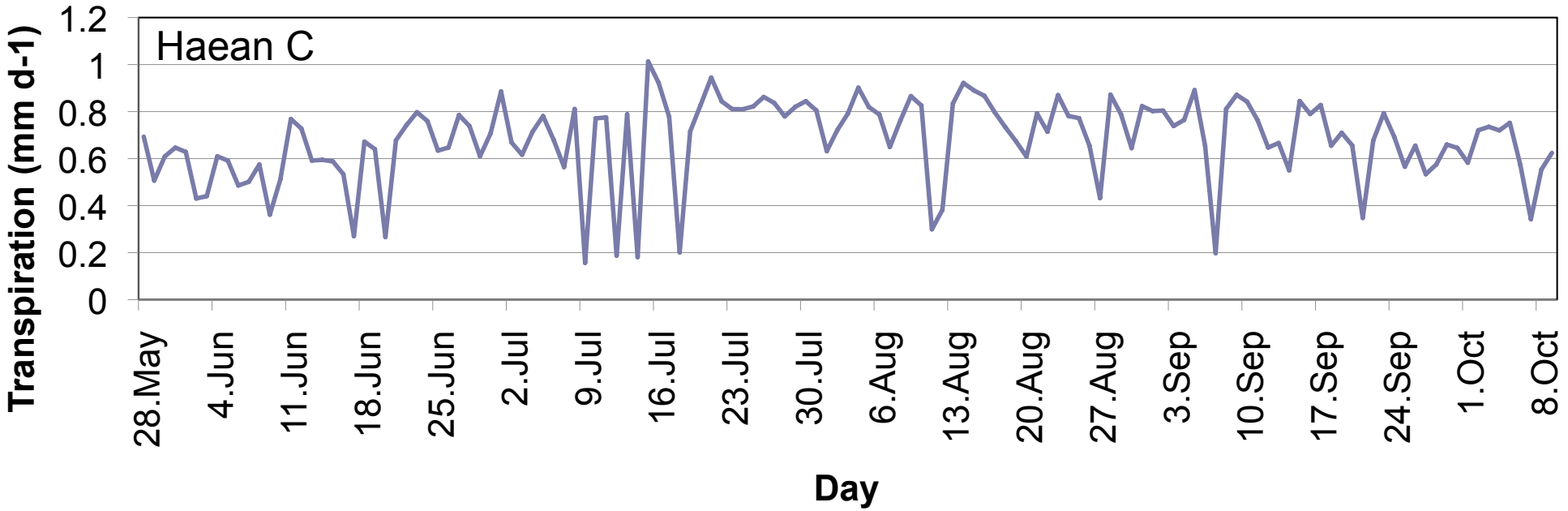


Correct over-estimation of understory transpiration!

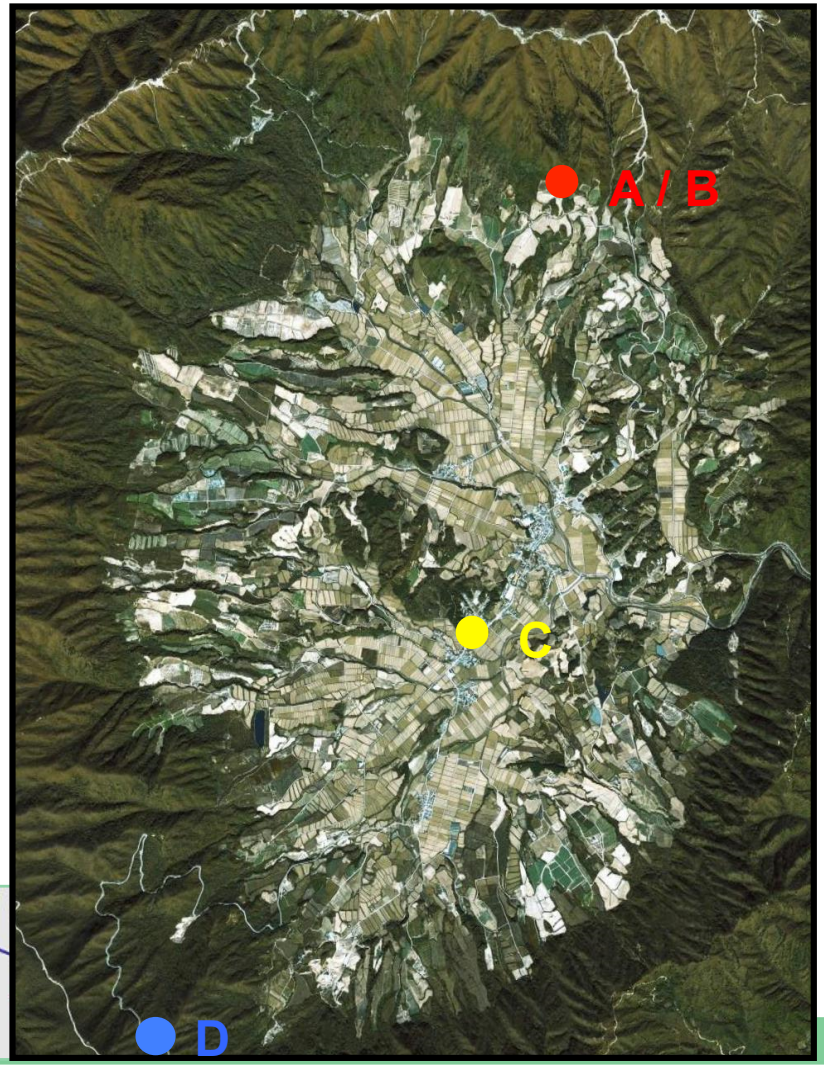
Add measurements to interpret forest stand transpiration of Haean catchment

No more data gaps!

2010 Work Plan

1. Sap flow measurements

Quantify tree water use by over- and under-story species



2 different **sap flow methods**

- Thermal Dissipation Probes

  (**TDP**, Granier 1987)

➔ *Overstory (DBH > 10 cm)*

- Stem Heat Balance

  (**SHB**, Sakuratani 1981)

➔ *Understory (DBH < 10 cm)*

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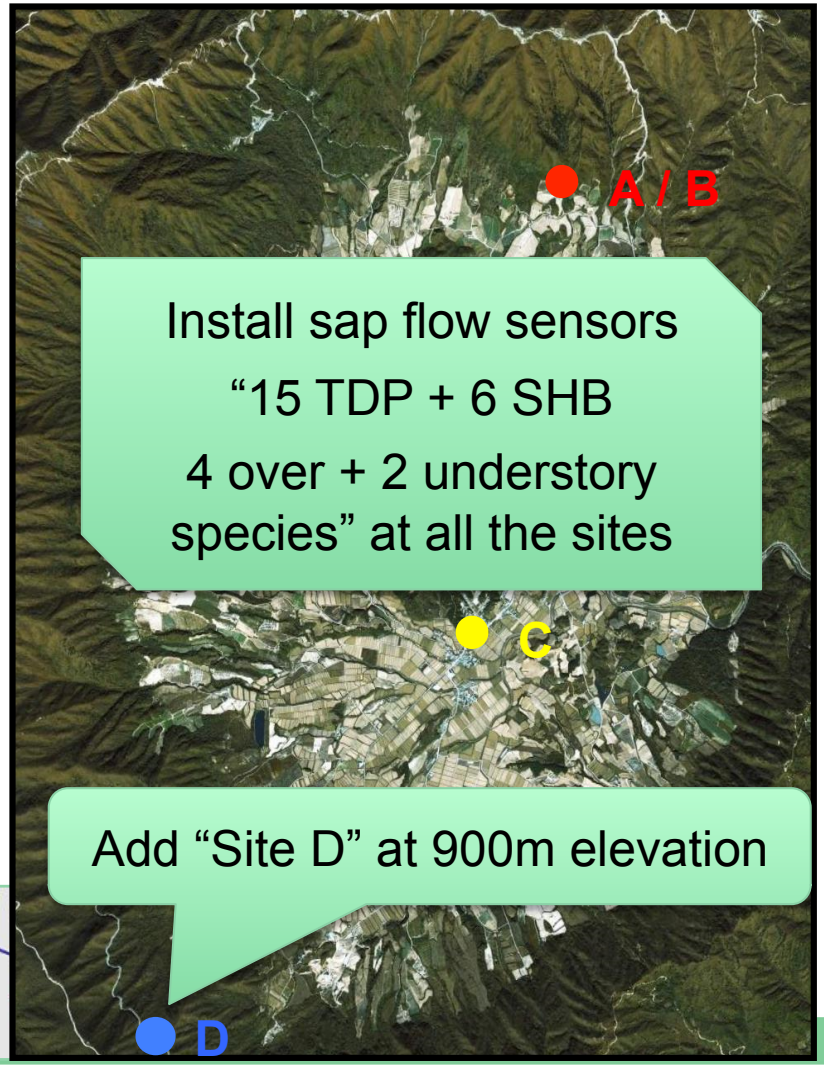

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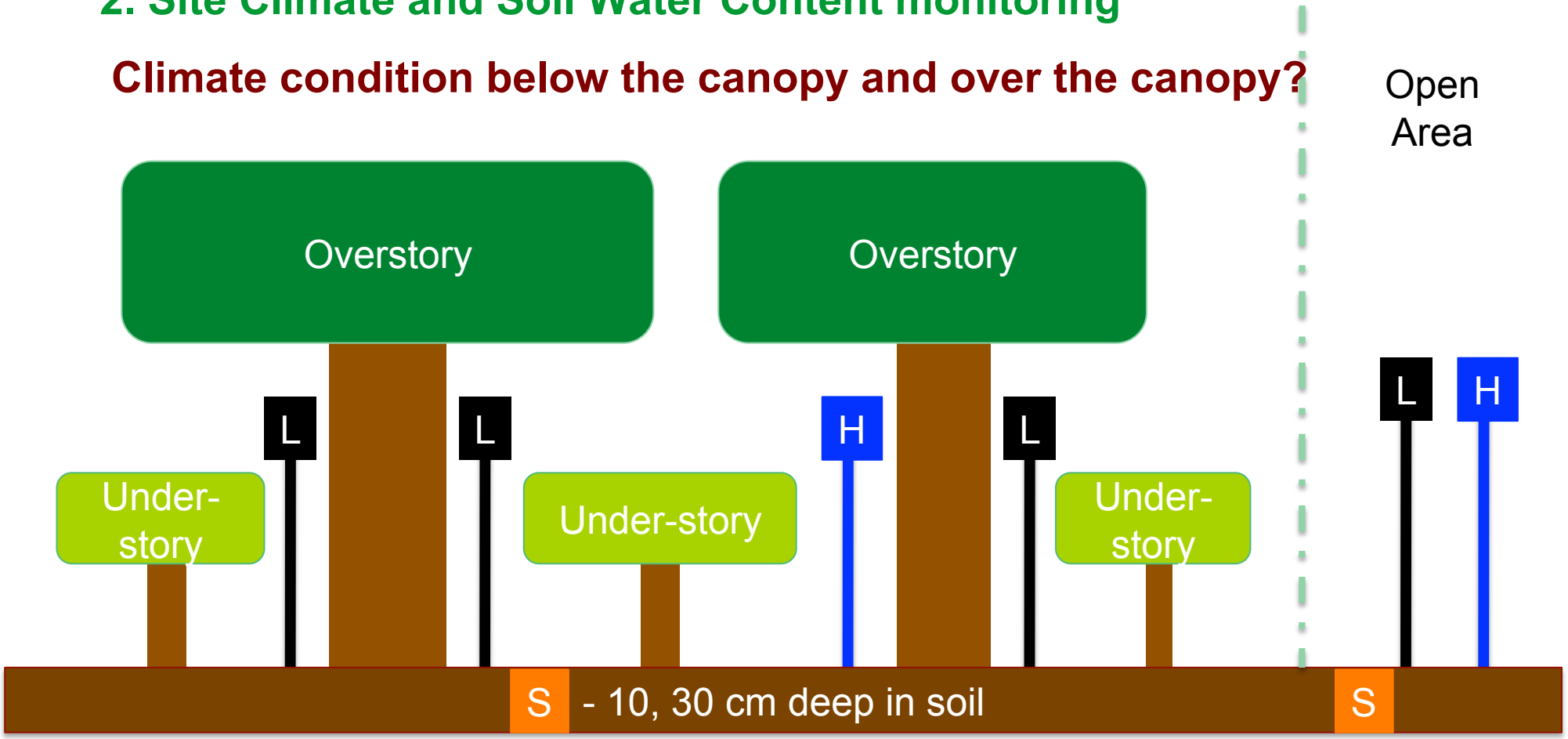
2010 Work Plan

2. Site Climate and Soil Water Content monitoring

Climate condition below the canopy and over the canopy?



L Light sensors – PAR (Licor), photodiodes, HOBO

H Humidity + Temperature sensors – Funky

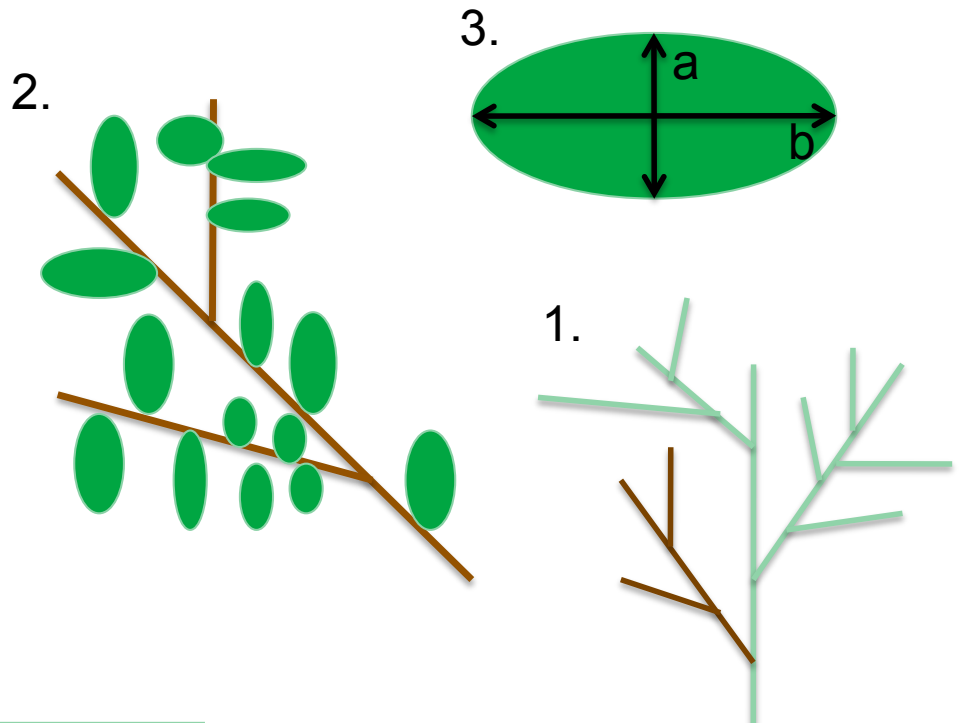
S Soil moisture sensors – Ech$_2$o (Decagon Device)

2010 Work Plan
3. Leaf Area Measurements

How leaf area changes along the seasons?

Leaf Seasonality Observation

(Nasahara *et al*. 2008)



5 Litter Traps at each sites

1. Select sample shoots
2. Count number of the leaves on the shoot
3. Measure width and length of 20 randomly selected leaves

2010 Work Plan
4. Leaf Transpiration and Leaf Water Potential

What are the species-specific characteristics of water use?

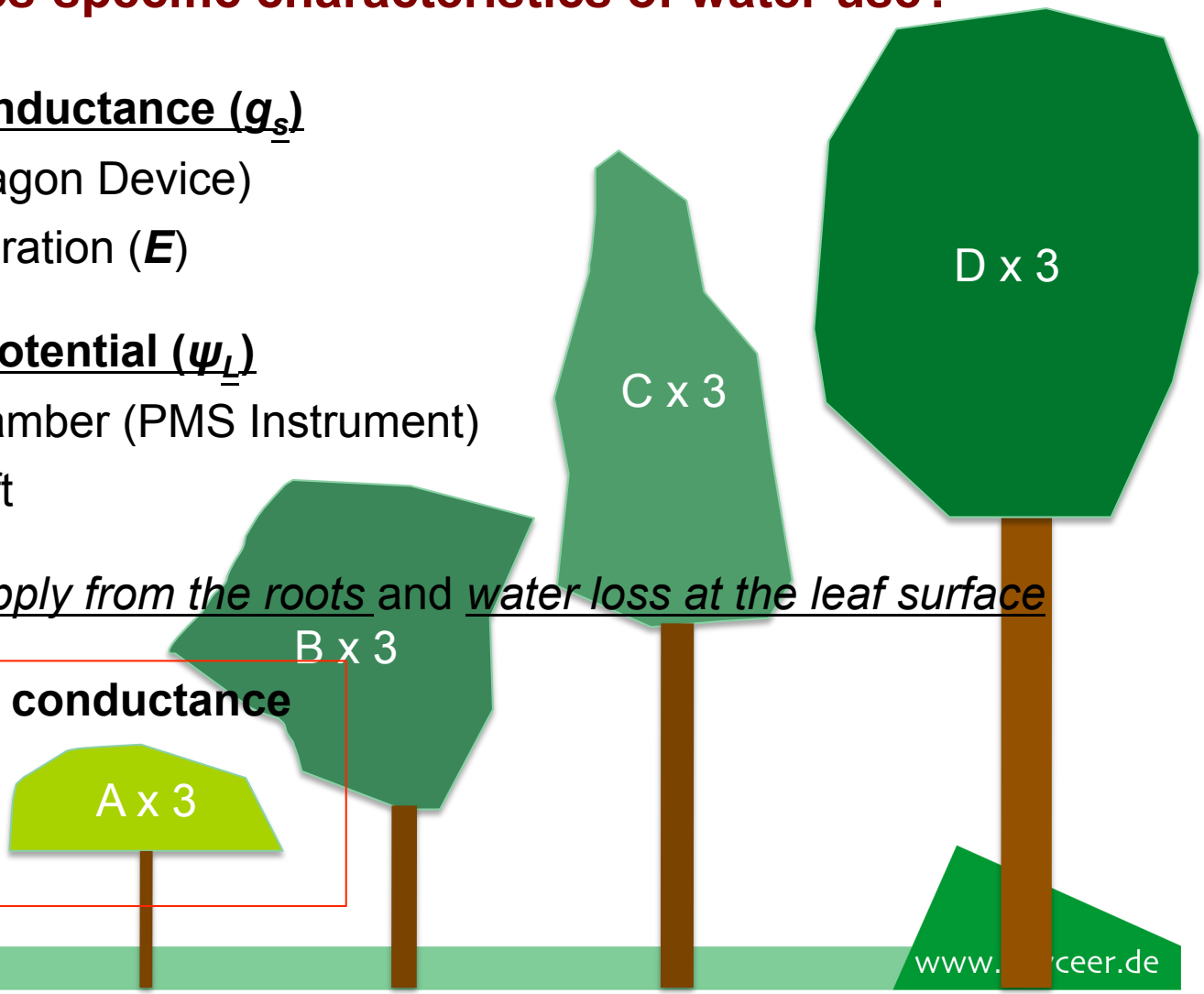
Measure **Stomatal Conductance (g_s)**
- Leaf Porometer (Decagon Device)
- Examine Leaf Transpiration (***E***)

Measure **Leaf Water Potential (ψ_L)**
- Potable Pressure Chamber (PMS Instrument)
- Examine Hydraulic Lift

To understand *water supply from the roots* and *water loss at the leaf surface*

Specific leaf hydraulic conductance
= $E / (\psi_{pd} - \psi_L)$

Otieno *et al*. 2005

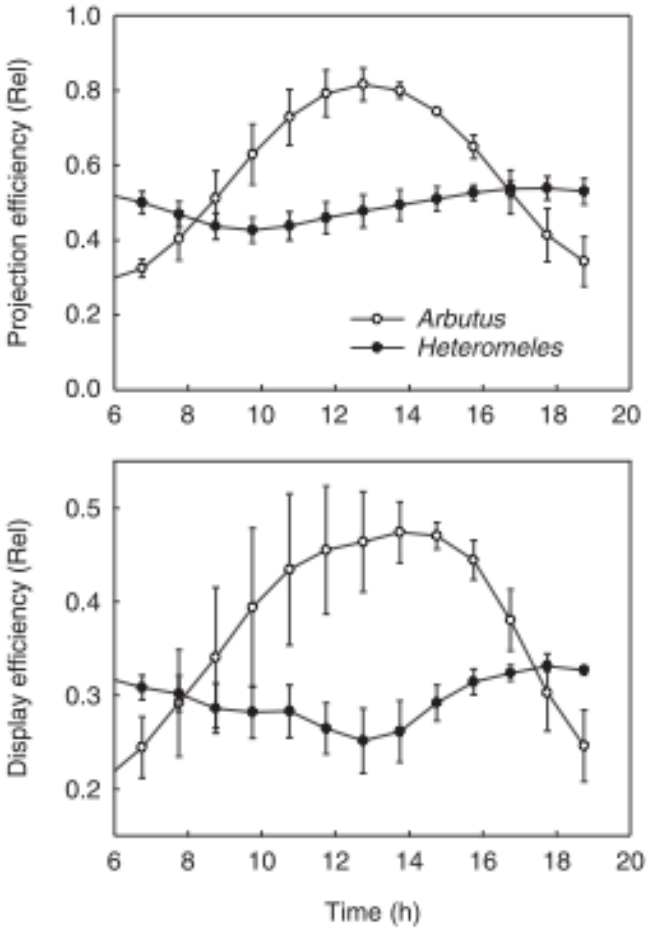


2010 Work Plan

5. Crown Architecture Modeling (Y-Plant, Pearcy and Yang 1996)

Achieve better understanding of species-specific water use

➔ Light-capture efficiencies of different species?



smaller, steeply angled leaves (mean = 72°)

Heteromeles

relatively large horizontal leaves

Arbutus

Pearcy *et al*. 2005

Arbutus projects and displays more of its leaf area towards the sun than does *Heteromeles*.

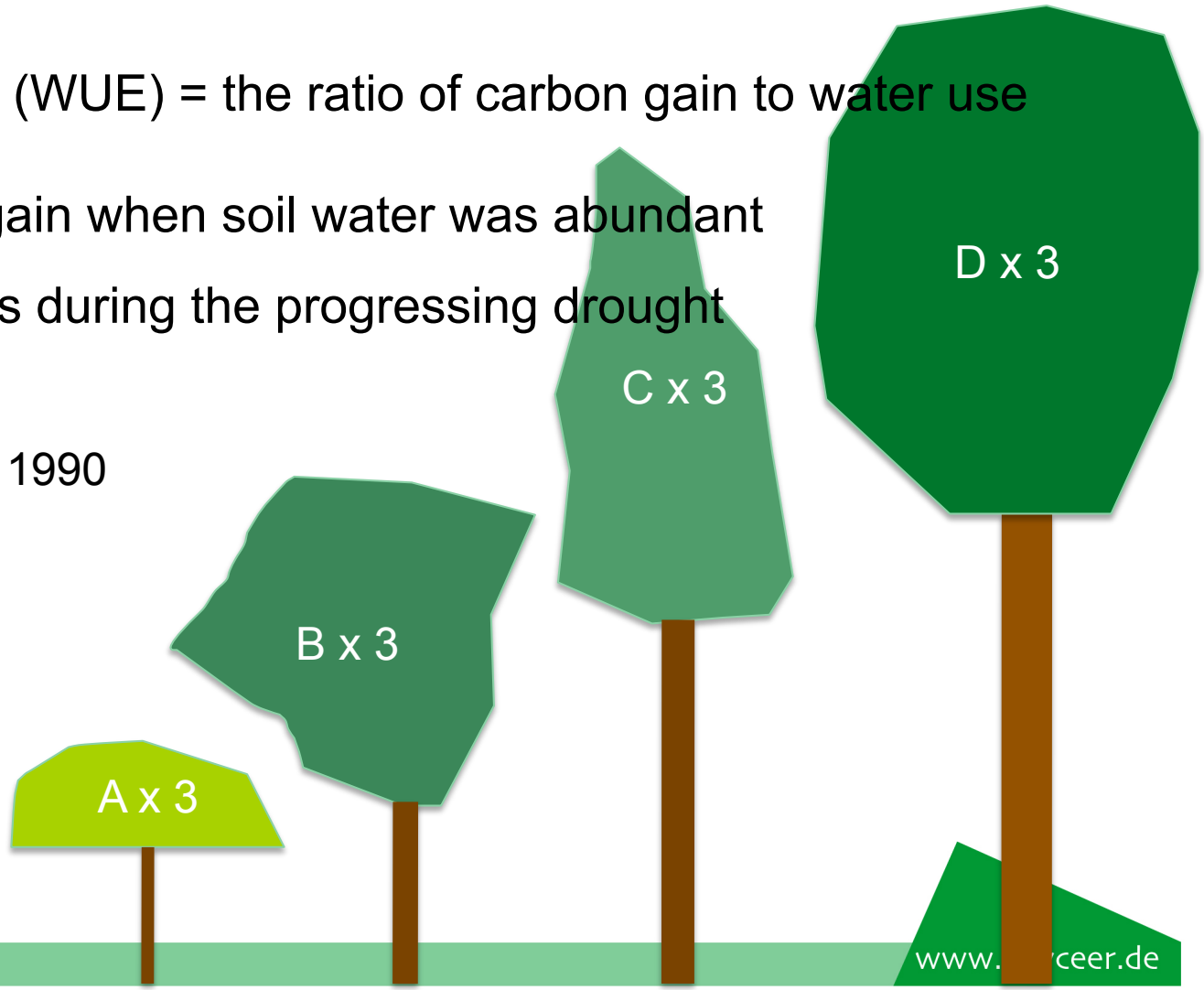
2010 Work Plan
6. Carbon Isotope Discrimination ($\delta^{13}C$)

Water use efficiency before / after Monsoon?

Water Use Efficiency (WUE) = the ratio of carbon gain to water use

- Maximize carbon gain when soil water was abundant
- Minimize water loss during the progressing drought

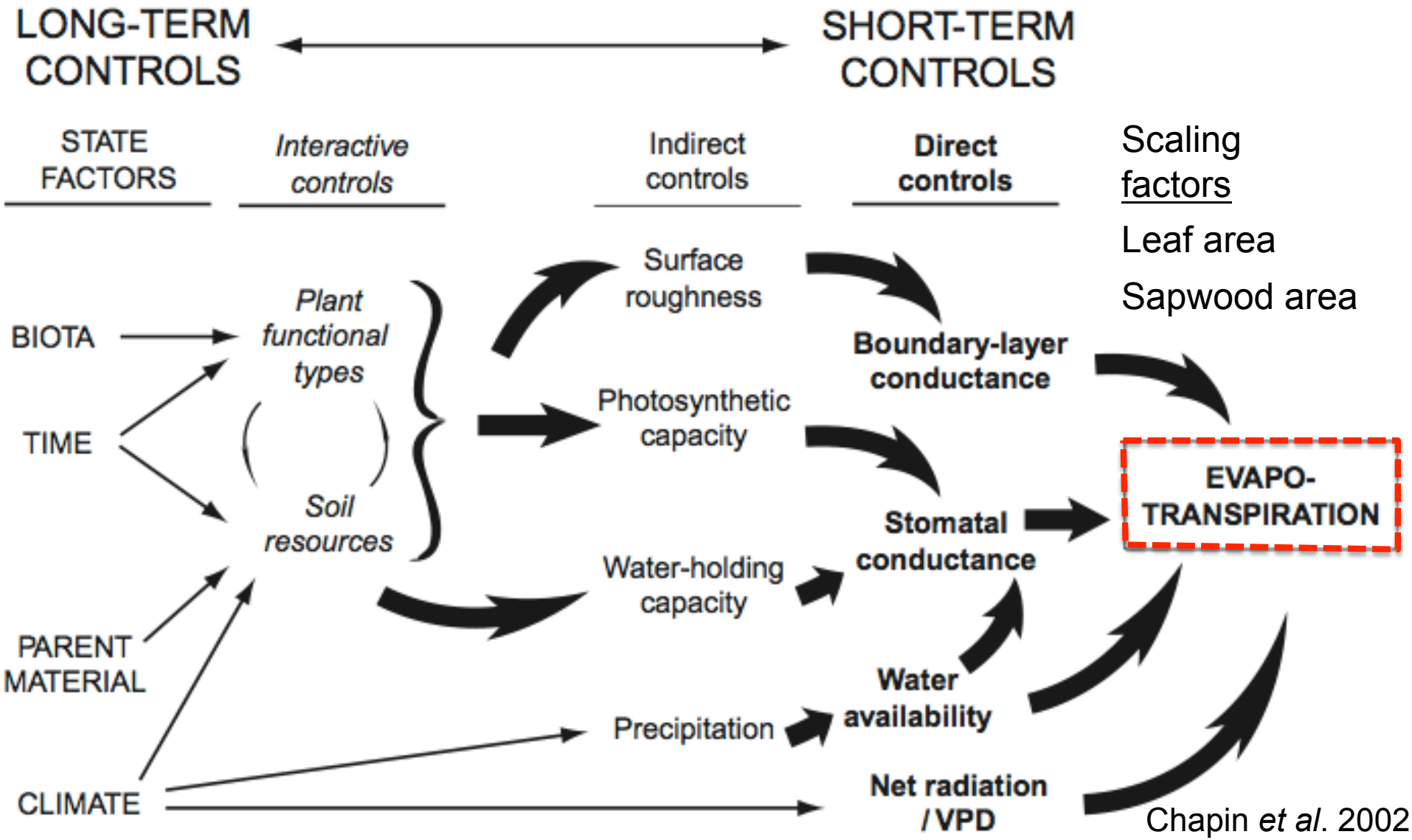
Tieszman and Archer 1990



2010 Work Plan
Time Schedule

APR	MAY	JUN	JUL	AUG	SEP	OCT
D	Haean, KoreaIN		Deutschland - Data Analysis - Practical course	XXIII IUFRO	Haean, Korea	
	1. Leaf Area				1. Leaf Area / Litter Traps	
	2. Somatal Conductance				2. Somatal Conductance	
	3. Leaf Water Potential				3. Leaf Water Potential	
	4. Carbon Isotope				4. Carbon Isotope	
	5. Vegetation Map (Site D)		6. Crown Architecture Modeling (Y-Plant)			
	7. Sap flow measurements					
	8. Site Climate and Soil Water Contents Monitoring					

Summary



Scaling factors

Leaf area

Sapwood area

Chapin *et al*. 2002

References

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Granier, A. 1987. Evaluation of transpiration in a Douglas-fir stand bymeans of sap flow measurements. Tree Physiol 3:309–319.

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Thank you!