Light Use Efficiency and productivity of 16 genotypes of *eucalyptus* along a 6-year rotation in Brazil

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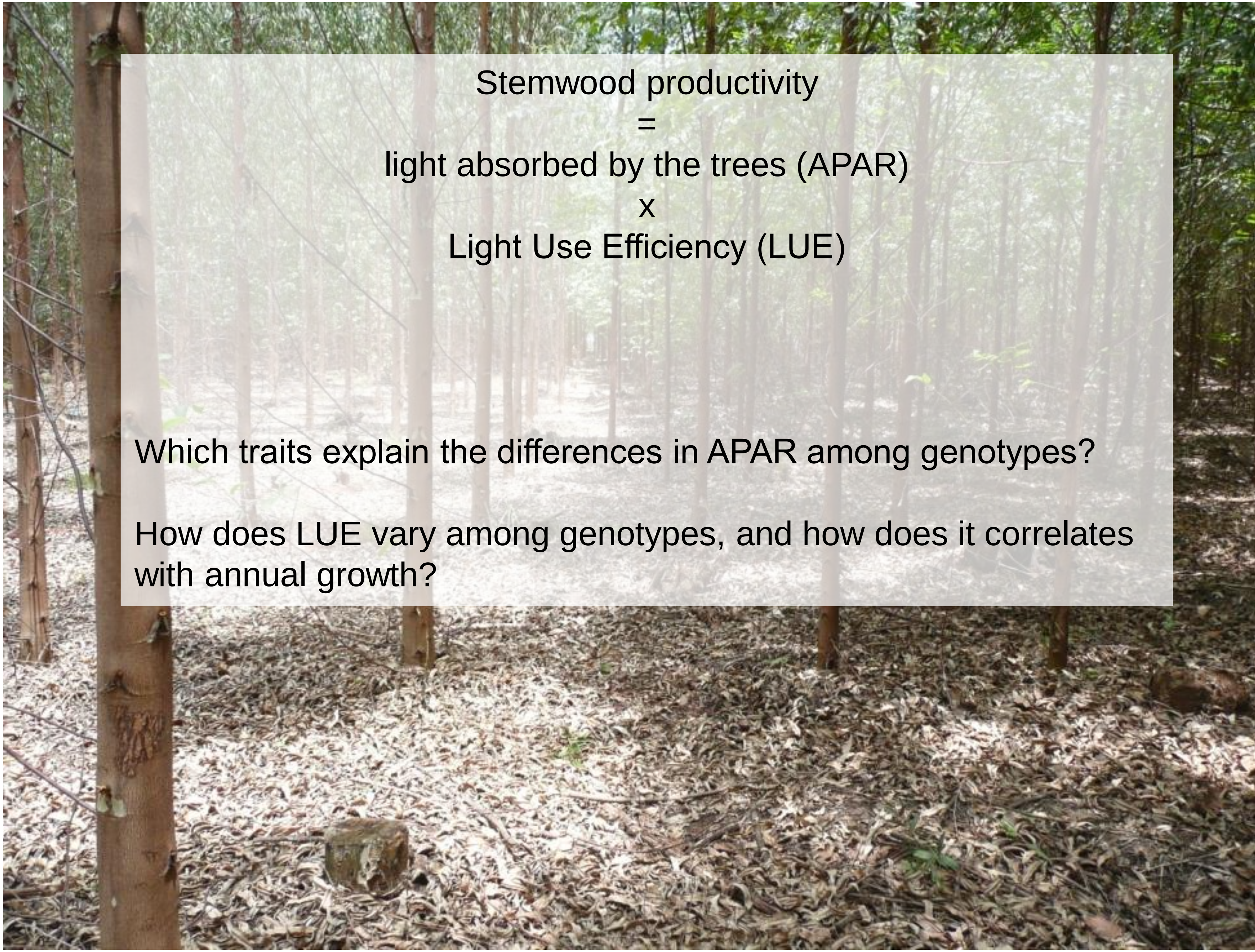
EUCFLUX project (2008-2016)

IUFRO Curritiba 2019



Stemwood productivity
=
light absorbed by the trees (APAR)
x
Light Use Efficiency (LUE)

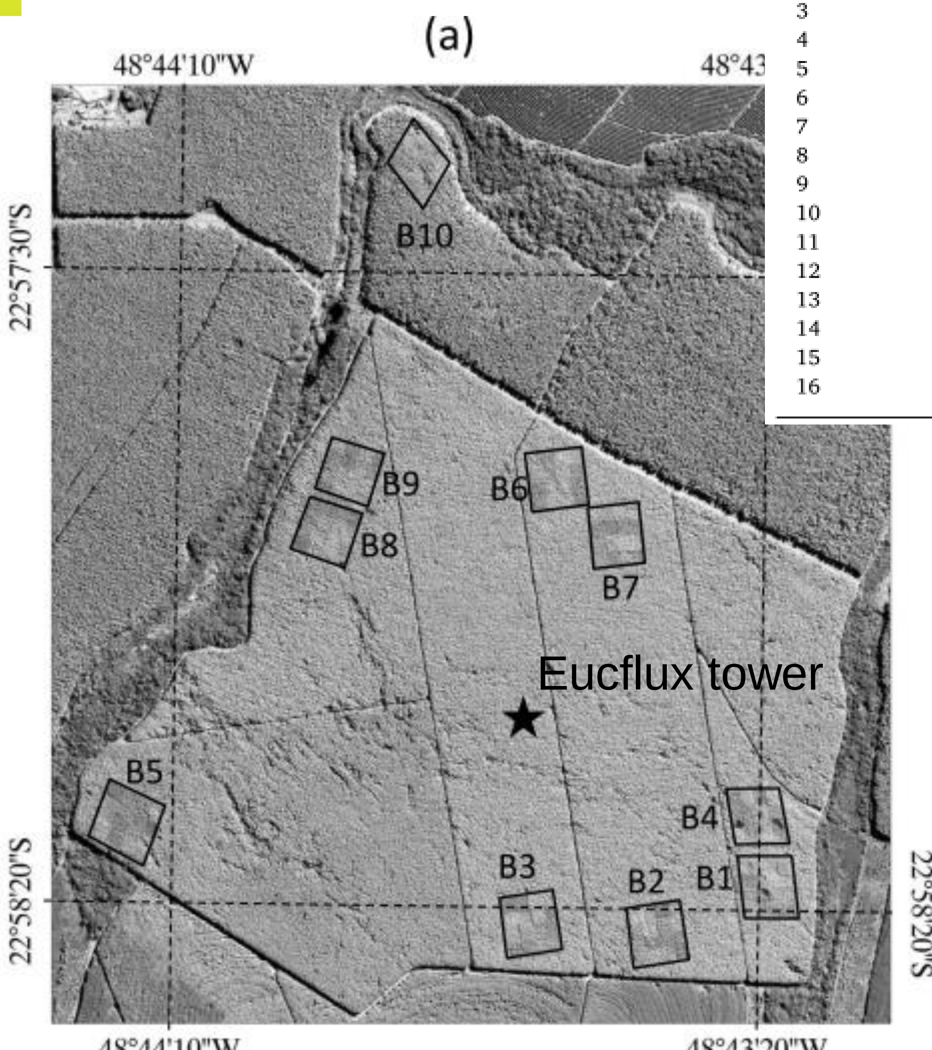
Which traits explain the differences in APAR among genotypes?

How does LUE vary among genotypes, and how does it correlates with annual growth?

Experiment

16 clones, highly productives in their respectives origins => expected high production variability when planted in the same area

Genotype	Species	Propagation	State of origin	Climate
1	*E. grandis*	Seed	SP	Cfa
2	*E. grandis*	Seed	SP	Cfa
3	*E. grandis* × *E. urophylla*	Clone	SP	Cwa
4	*E. grandis* × *E. urophylla*	Clone	SP	Cfa
5	*E. grandis* × *E. urophylla*	Clone	SP	Cwa
6	*E. grandis* × *E. urophylla*	Clone	ES	Aw
7	*E. grandis* × *E. urophylla*	Clone	MG	Cwa
8	*E. grandis* × *E. urophylla*	Clone	MG	Aw
9	*E. grandis* × *E. urophylla*	Clone	BA	Am
10	*E. grandis* × *E. urophylla*	Clone	SP	Cfa
11	*E. grandis* × *E. urophylla*	Clone	SP	Cfa
12	*E. urophylla* × *sp*	Clone	MG	Cwb
13	*E. grandis* × *E. urophylla*	Clone	MG	Cwb
14	*E. saligna*	Clone	RS	Cfa
15	*E. grandis*	Clone	SP	Cfa
16	*E. grandis* × *E. camaldulensis*	Clone	BA	As



10 repetitions (blocks)
16 plots (genotypes) per blocks
1 plot = 12 lines of 16 trees (3x2 m)

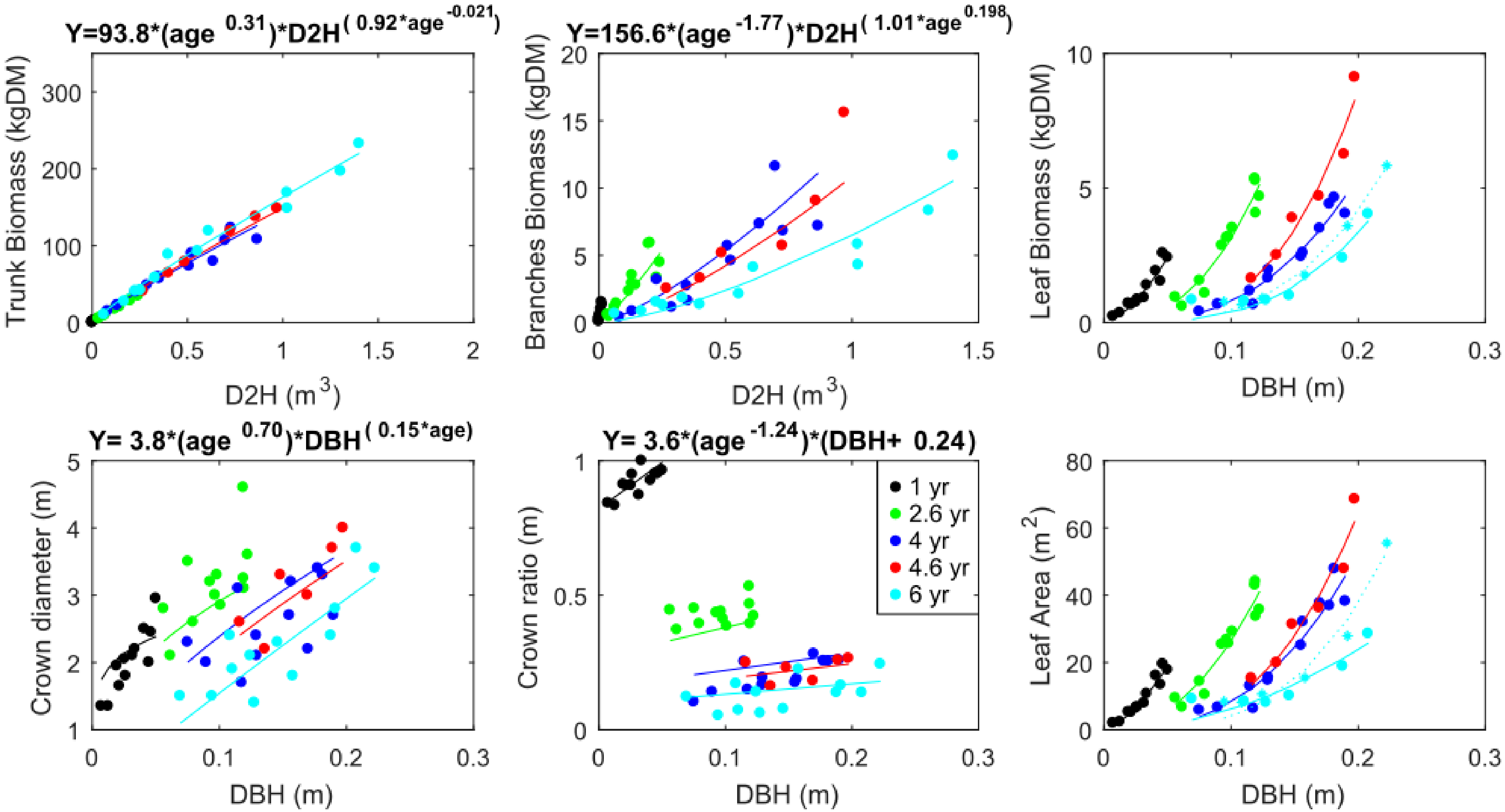
100 central trees analysed (avoid border effects)

Measurements

Date	age (years)	DBH	H	DBH border t.	Biomass	Leaf angles	SPAD	Leaf Refl/Tran	LAI-2000
03/11/2009	0								
17/05/2010	0.53	X	X						
03/11/2010	1.00	X	X		X	X	X	X	
01/06/2011	1.58	X	X						
01/01/2012	2.16	X	X						
01/06/2012	2.58			X	X	X			
01/07/2012	2.66	X	X						
15/01/2013	3.20	X	X						
15/07/2013	3.70	X	X						
15/11/2013	4.04				X	X			
15/02/2014	4.29	X	X						
15/06/2014	4.62								X
23/06/2014	4.64	X	X	X	X	X	X		
31/10/2014	5.00	X	X						
15/02/2015	5.28	X	X						
15/07/2015	5.70	X	X						
15/11/2015	6.03				X	X	X	X	
15/01/2016	6.20	X	X						

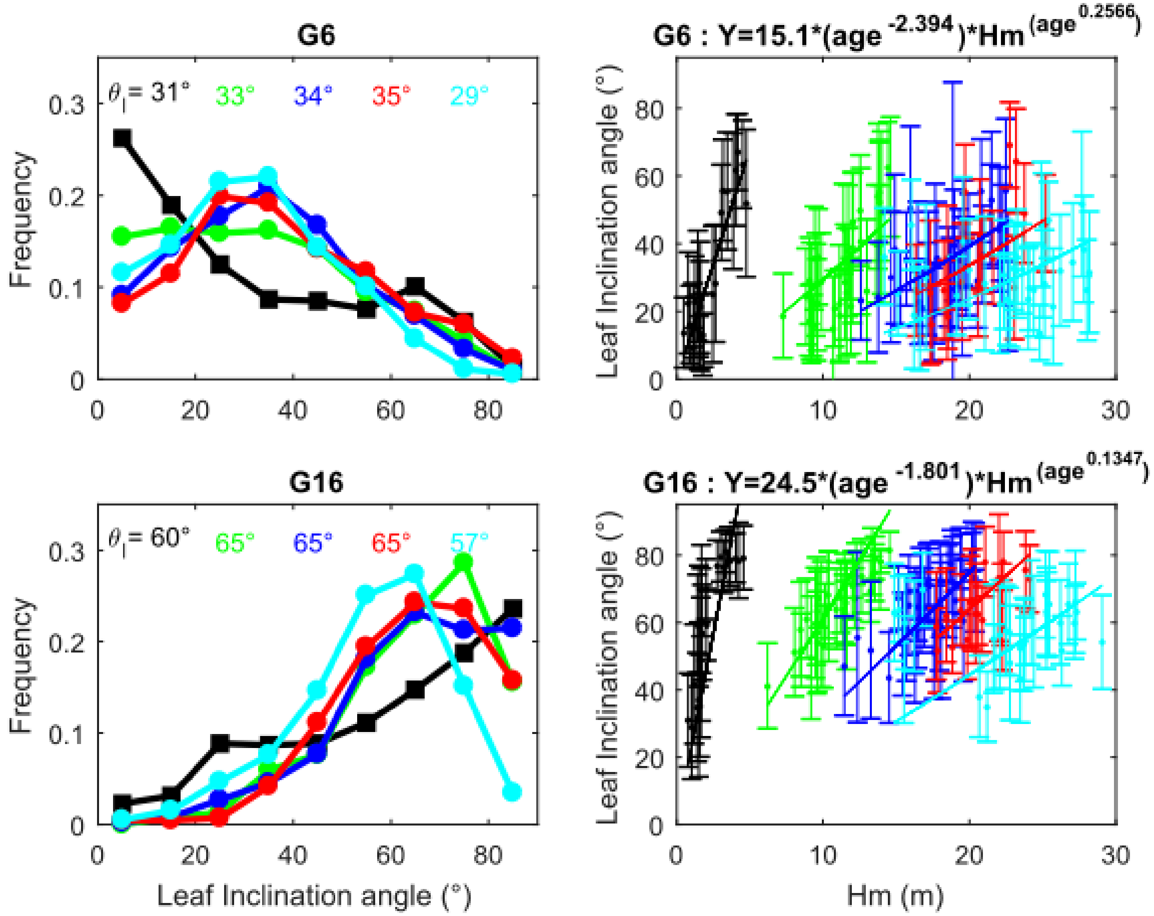
Measurements

Ex: clone 14



Measurements

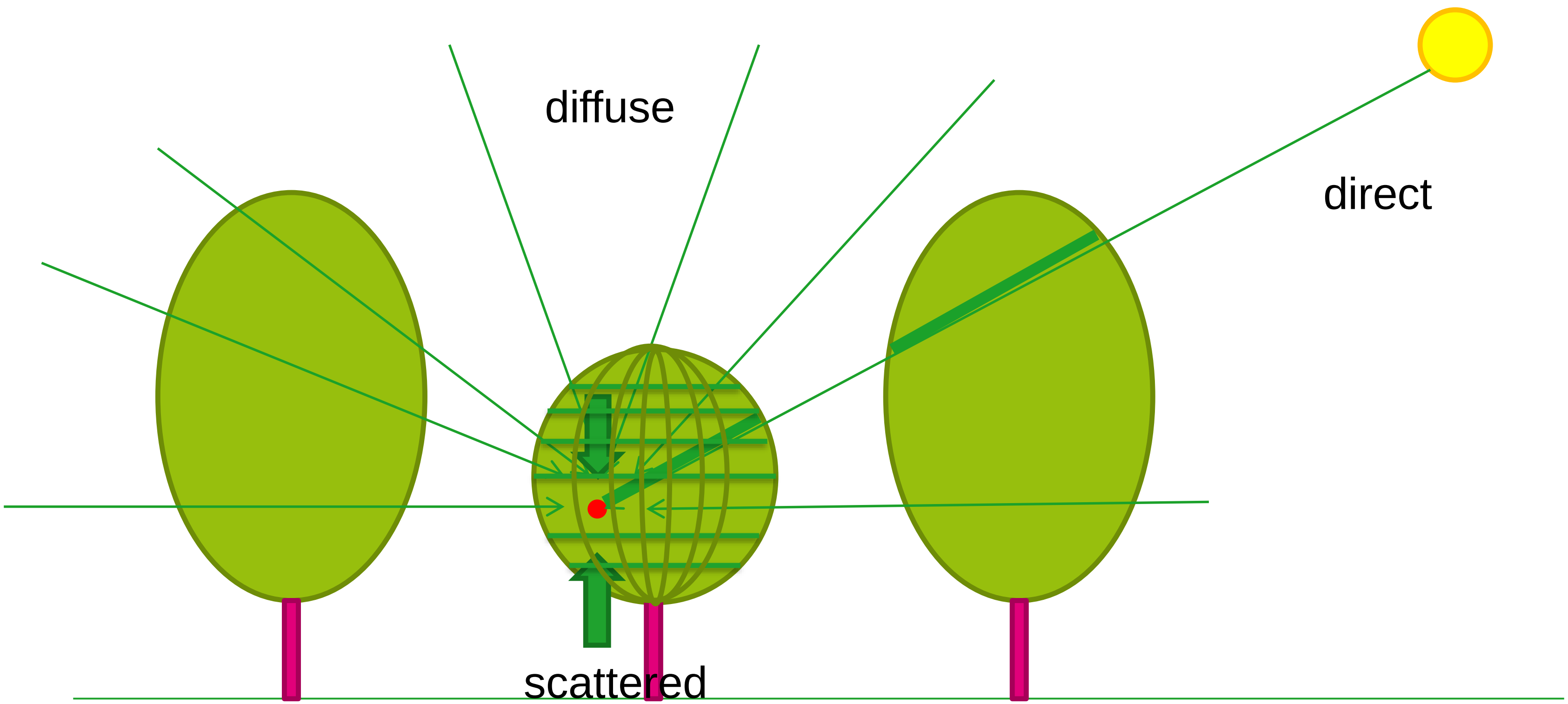
Ex: clone 14



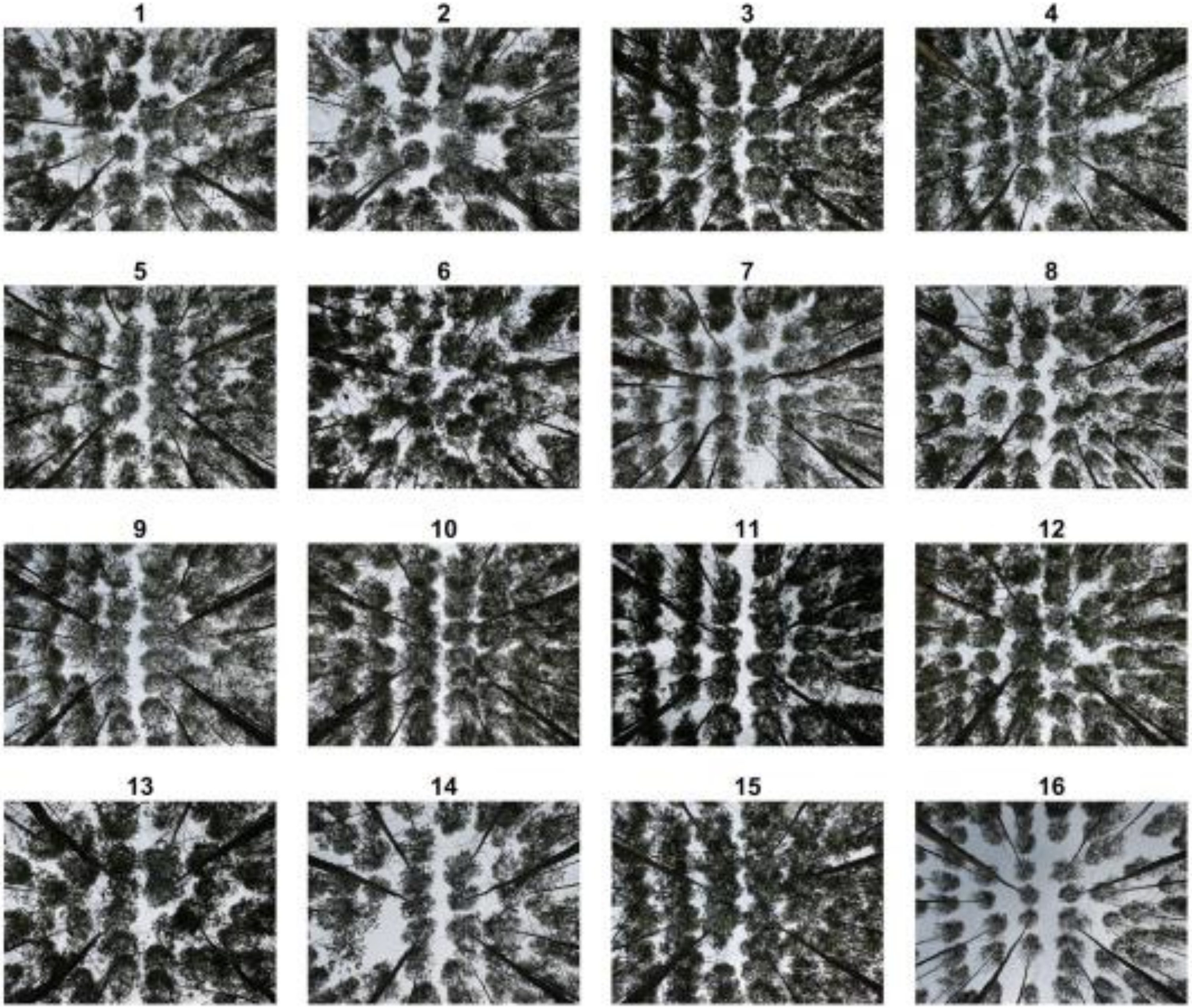
Modelling

MAESPA model (Wang and Jarvis 1990, Duursma and Medlyn 2012)

- 3D representation of each tree of the clonal test
- Measurements of the main foliage characteristics
- Interpolation for the rotation
- Simulations of APAR for each tree
- Comparison with LAI-2000 measurements for validation



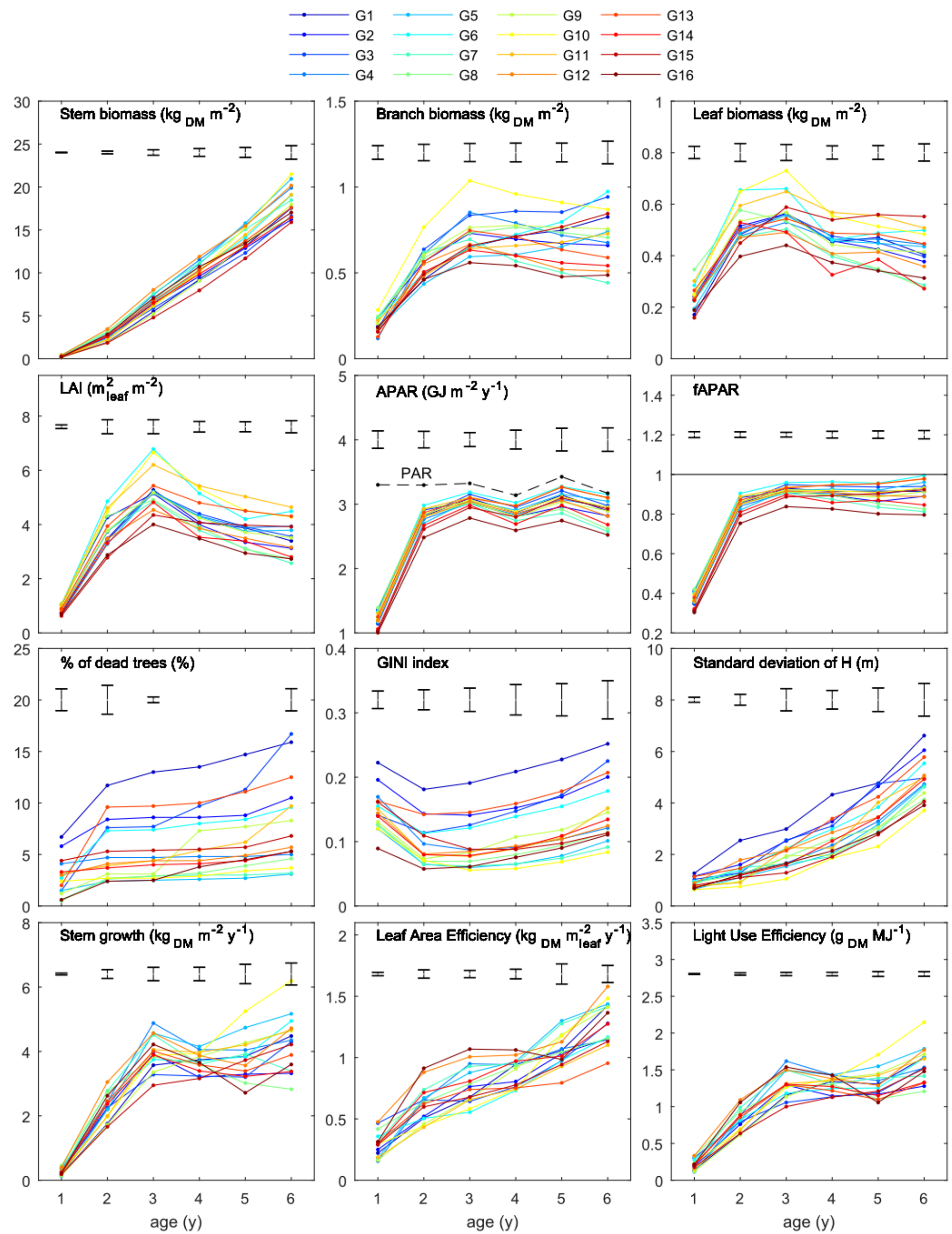
Results

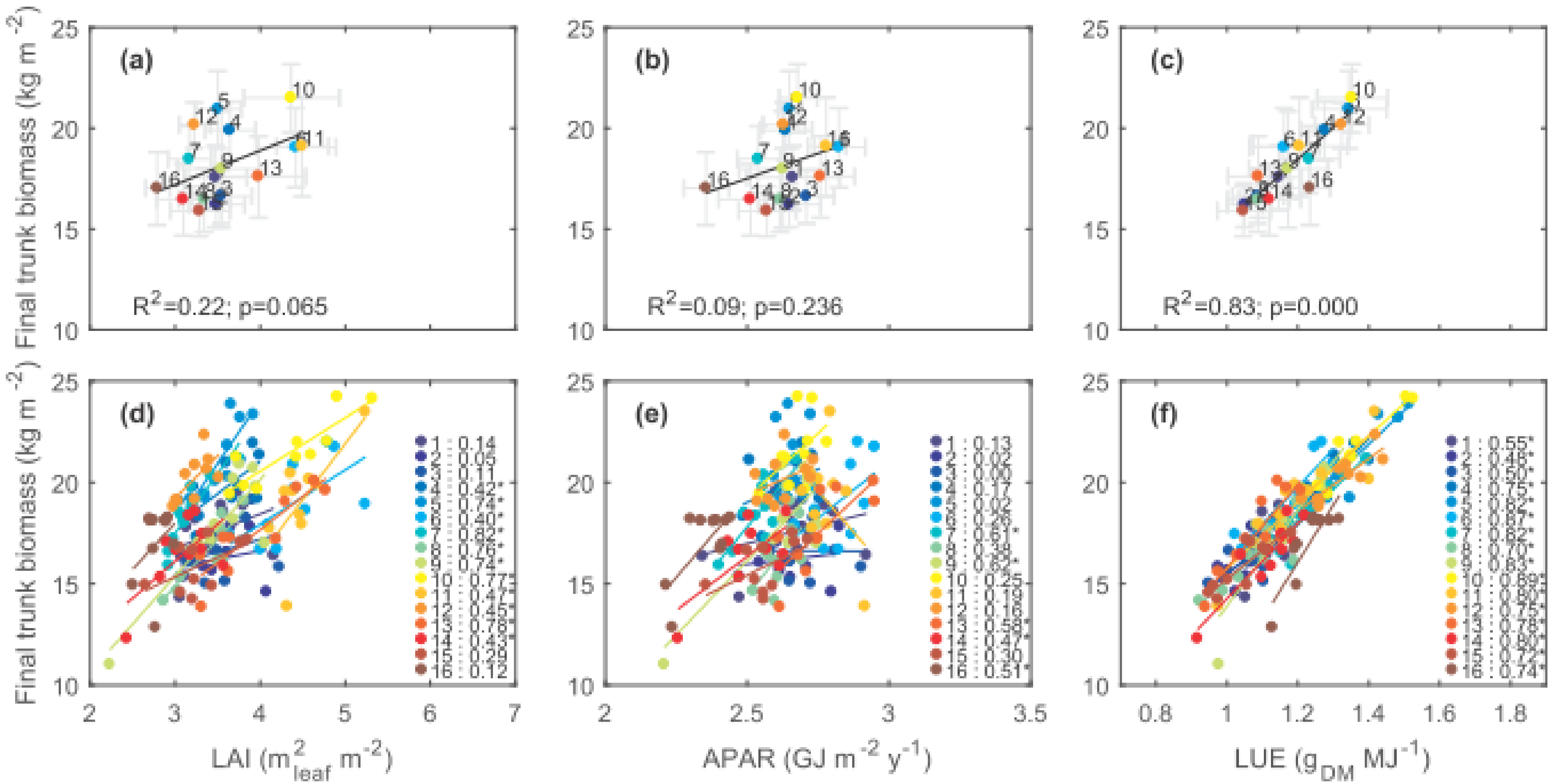


Results

High variability of production, LAI, fAPAR and LUE

Increase of LUE during the rotation

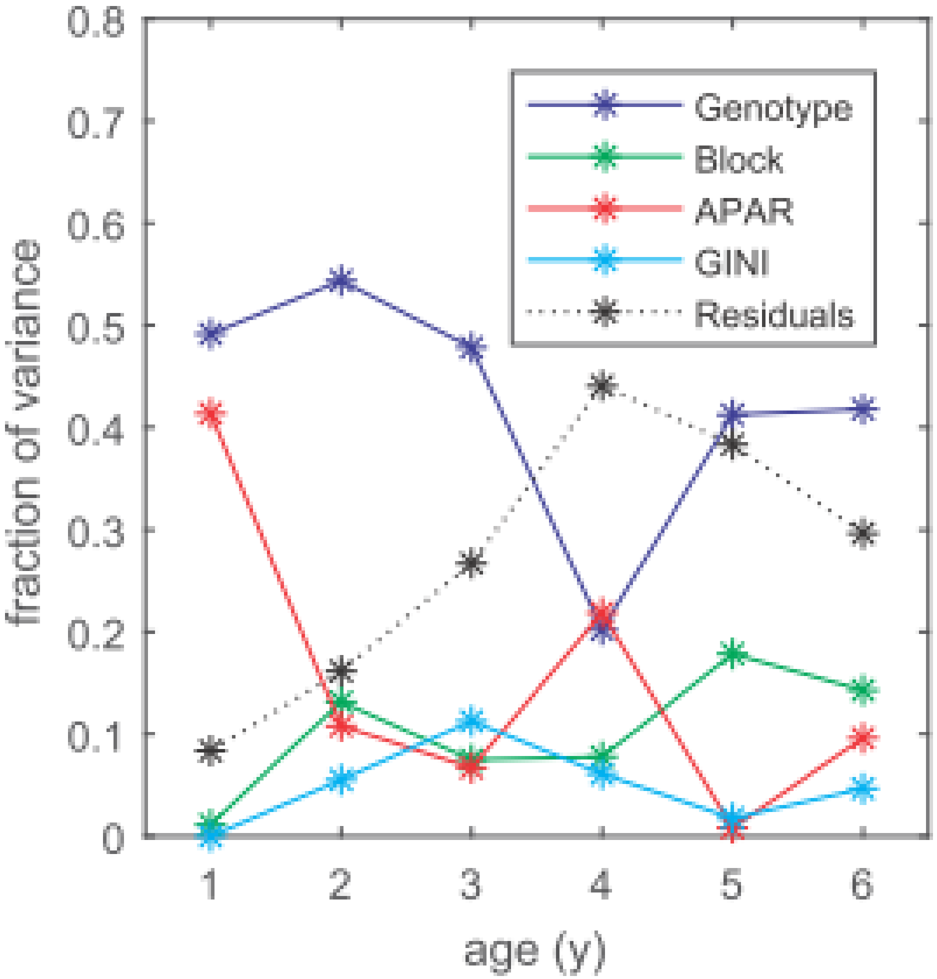




On a rotatinon-length basis, final trunk biomass is well correlated to LUE on an intra- and inter-genotype basis

Results

Plot-scale productivity is explained by:



As expected, genotype is the main effect, then APAR the first year

GINI (heterogeneity) and other block effects explains part of the remaining variability

End of the rotation: other factors (allocation, water limitation, etc.)

Results

Genotype productivity is explained by final years LUE

Correlation of final stem biomass with :	**R2**
LUE year 1	n.s.
LUE year 2	n.s.
LUE year 3	n.s.
LUE year 4	0.45 ($p<0.01$)
LUE year 5	0.64 ($p<0.01$)
LUE year 6	0.61 ($p<0.01$)

Conclusions

Differences between genotypes productivity :

Major influences of factors/limitations other than APAR for wood produced at harvest date (included in the “LUE” term)

Factors controlling stemwood production at the end of the rotation are highly important to explain final biomass between genotypes

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LA RECHERCHE AGRONOMIQUE
POUR LE DÉVELOPPEMENT

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Thank you !

EUCFLUX project (2008-2016)

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