Rubber tree ecophysiology and Climate Change

What do we know?

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Rubber ecophysiology and future climate

• What will the climate be in the main rubber producing areas?  Y/N

• What will be the effects of higher T° on C assimilation?  N

• What will be the effects of higher T° on tree growth?  N

• What will be the effects of higher T° on latex production?  N

• Adaptation of rubber trees to water stress?  Y/N

  almost nothing
What will the climate be in the main rubber producing areas?

Probable Global Climate scenarios are rather well-known

- But need to be downscalled to every local NR area
- Methodologies are available
- Good forecasts in some areas
- Need to be generalized or updated

Y/N

What will be the effects of higher T° on C assimilation?

- Some knowledge at leaf scale (Kositsup et al 2010)

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We can predict photosynthetic parameters at future temperatures.
What will be the effects of higher $T^\circ$ on C assimilation?

But a long way to predict whole tree C assimilation and plantation primary production (GPP)!

PS parameters x stomatal conductance x whole tree canopy x phenology....

Because higher VPD?

Shorter leaf lifespan?
What will be the effects of higher $T^\circ$ on C assimilation?

The way forward: upscaling flux measurements

Rubber Flux Tower at Chachoengsao
http://asiaflux.net

Primary Production

Evapo-transpiration

Water Use Efficiency
What will be the effects of higher $T^\circ$ on C assimilation?

The way forward: modelling

Example
MAESPA Model

Simulation of water and CO$_2$ fluxes at tree and plot scale
What will be the effects of higher $T^\circ$ on C assimilation?

The way forward: modelling

Example LUCIA Model

Presented by S Blagodatsky in Session 2
What about growth and latex production?

Biomass will be directly linked to C assimilation but growth/yield partitioning depends on C allocation.
What about growth and latex production?

Direct effects of higher $T^\circ$ on latex yield?

- Negative for latex flow?
- Day/night differences?

Greater diurnal temperature difference, an overlooked but important climatic driver of rubber yield
Yu Haiying et al. 2014. INDUSTRIAL CROPS AND PRODUCTS 62: 14-21

A key research topic will be the interactions between climate change and low tapping frequencies
Socio-economic x climate issue.
Adaptation of rubber trees to water stress?

- More knowledge from the numerous studies of adaptation to drier conditions in marginal areas, particularly in India and NE Thailand
- Recent findings show a promising clonal variability in response to water stress

"Growth and Hydraulic" (GRHYD) project:
Bases of rubber clones adaptation to water constraints in immature period
Adaptation of rubber trees to water stress?

- Important to untangle soil drought from atmospheric drought
- Strong regulation of transpiration with high VPD, even if water is available in soil.

Strong over-estimation of water use in many studies and models.

From Isarangkool et al 2011 (mature trees RRIM600)

Relationship between tree transpiration and reference evapotranspiration (ET0) in a well-watered period (REW > 0.5) with ET0 ≤ 2.2 mm day⁻¹ (open circle), a well-watered period when ET0 was higher than >2.2 mm day⁻¹ (closed circle), others drought periods (REW< 0.5).
Conclusion

• Little knowledge and huge gaps
• Potential risk of adverse effects of CC on growth, survival and yield
• Intensive research efforts to be promoted

Improving the ecophysiological functions in integrative models could be a relevant cooperative project for the network.