



Characterisation of microclimatic indicators in coffee production systems under varying biophysical contexts and its relation to fungal coffee diseases

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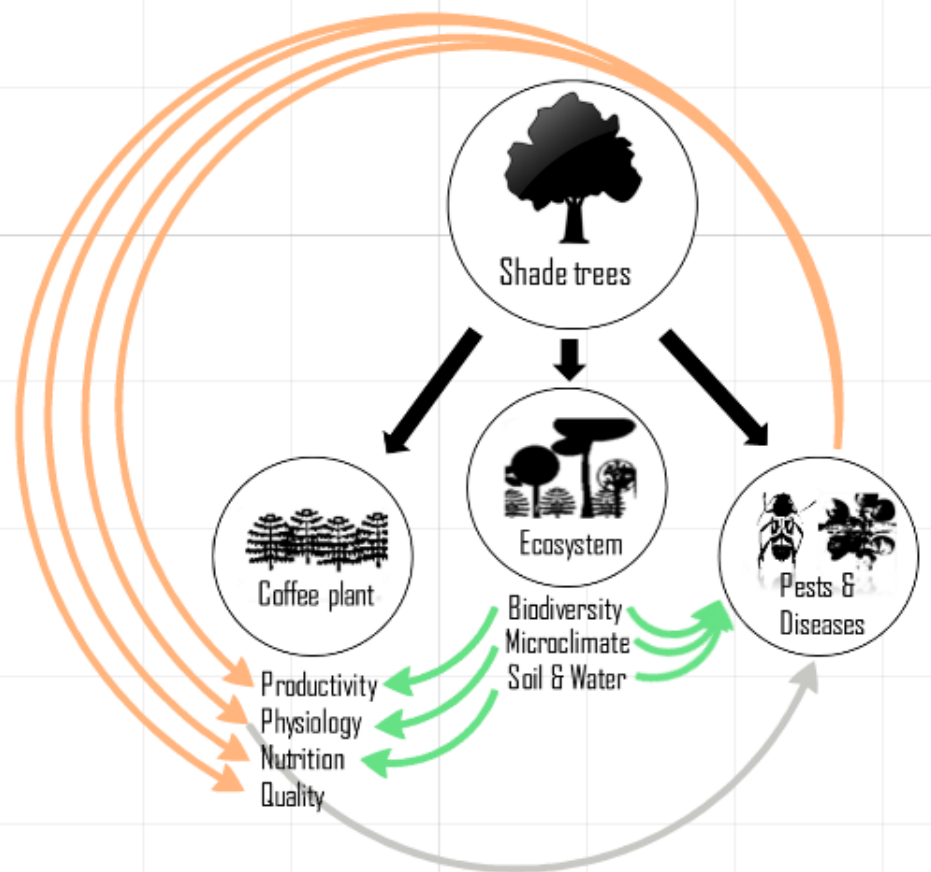
Kunming, Nov.16th



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The coffee & shade debate

- Understanding shade effects on coffee pests and diseases has been a challenge because:



→ Its complex. Direct, interactive, indirect effects

→ Space & time dependence

→ Focus on few factor → 1 response

→ Tools to evaluate networks of causal relationships?

The complexity of the system, including spatiotemporal variations, should be addressed in a framework describing direct, indirect & interactive effects.

Example: Environment, shading systems, microclimate & CLR

Research questions

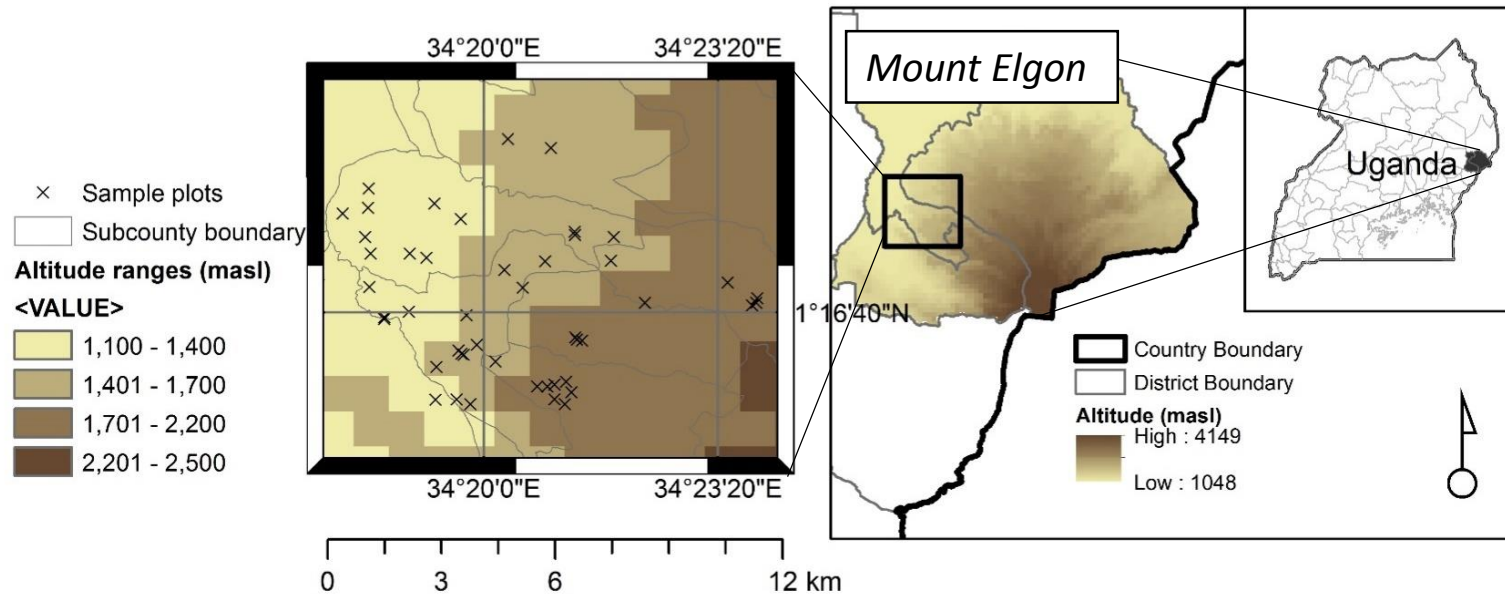
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- How are spatiotemporal variations in microclimate and CLR characterized?

2

- What are the indications for the underlying causal relationships of system? Are effects direct, indirect or interactively?

Study Area & Sampling Design



- 49 sample plots
- Altitudinal gradient (1100 – 2300 m)
- 3 coffee production systems
- CLR monitoring (6 weekly) and microclimate recordings (Temp, RH, hourly) over one growing season (15/16)

CB = Coffee Banana system
 CO = Coffee Open system
 CT = Coffee Tree system

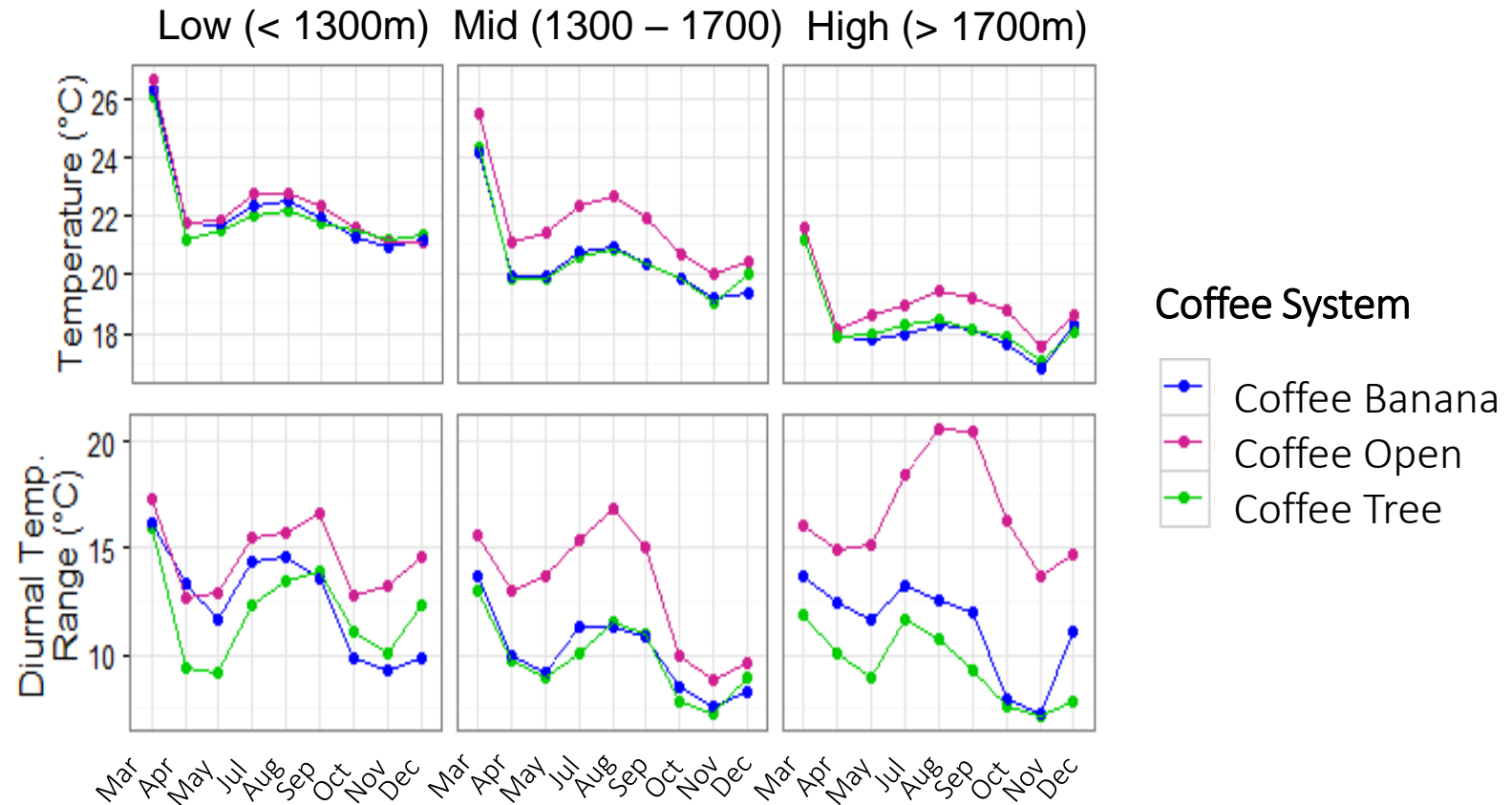
Research questions

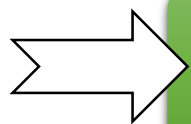
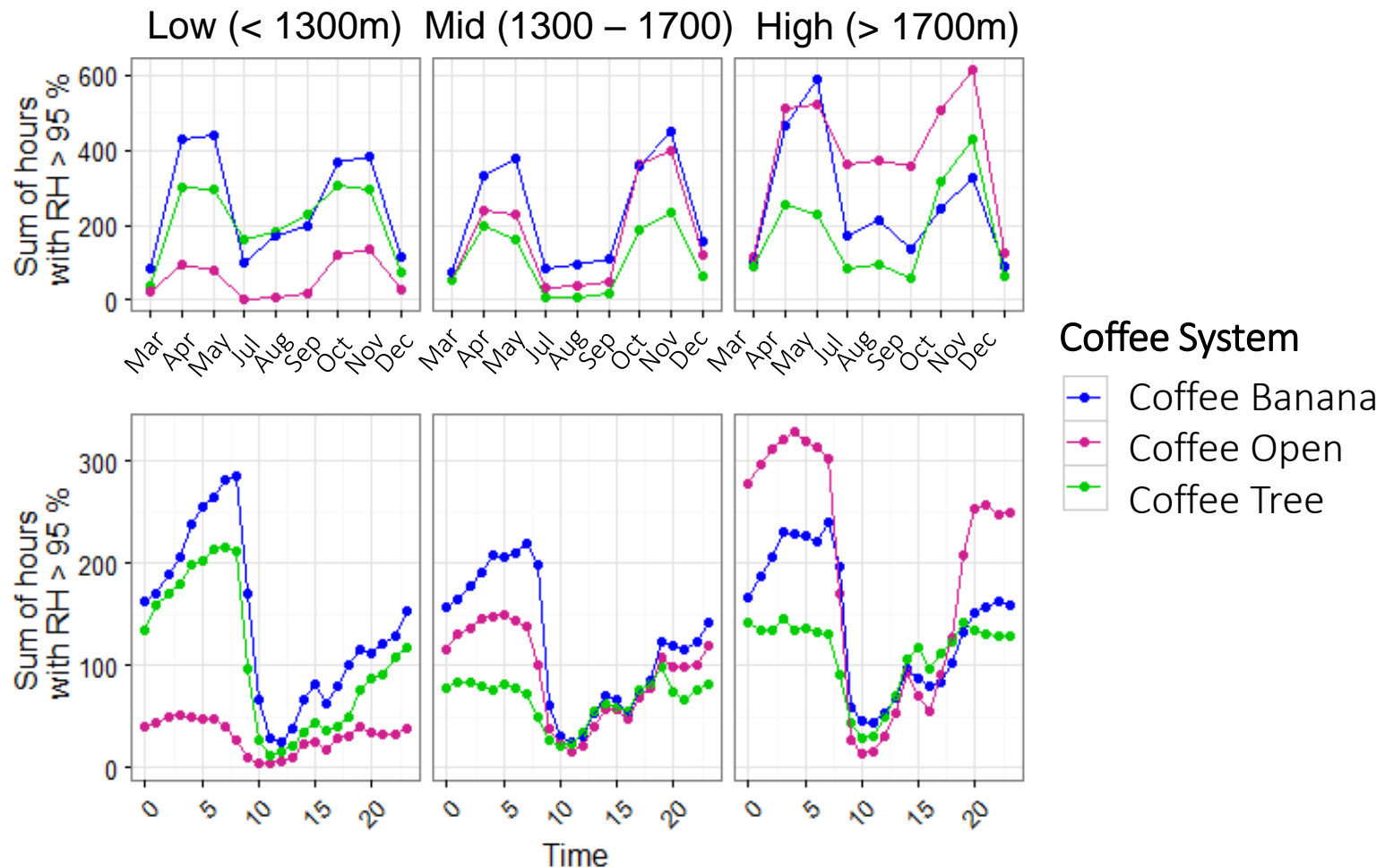
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- Selection of microclimatic indicators important in explaining CLR variability: → Literature and Sparse partial least square (sPLS)
- Analysis of spatiotemporal variations in microclimate and CLR: → Graphical analysis

2

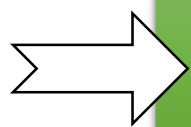
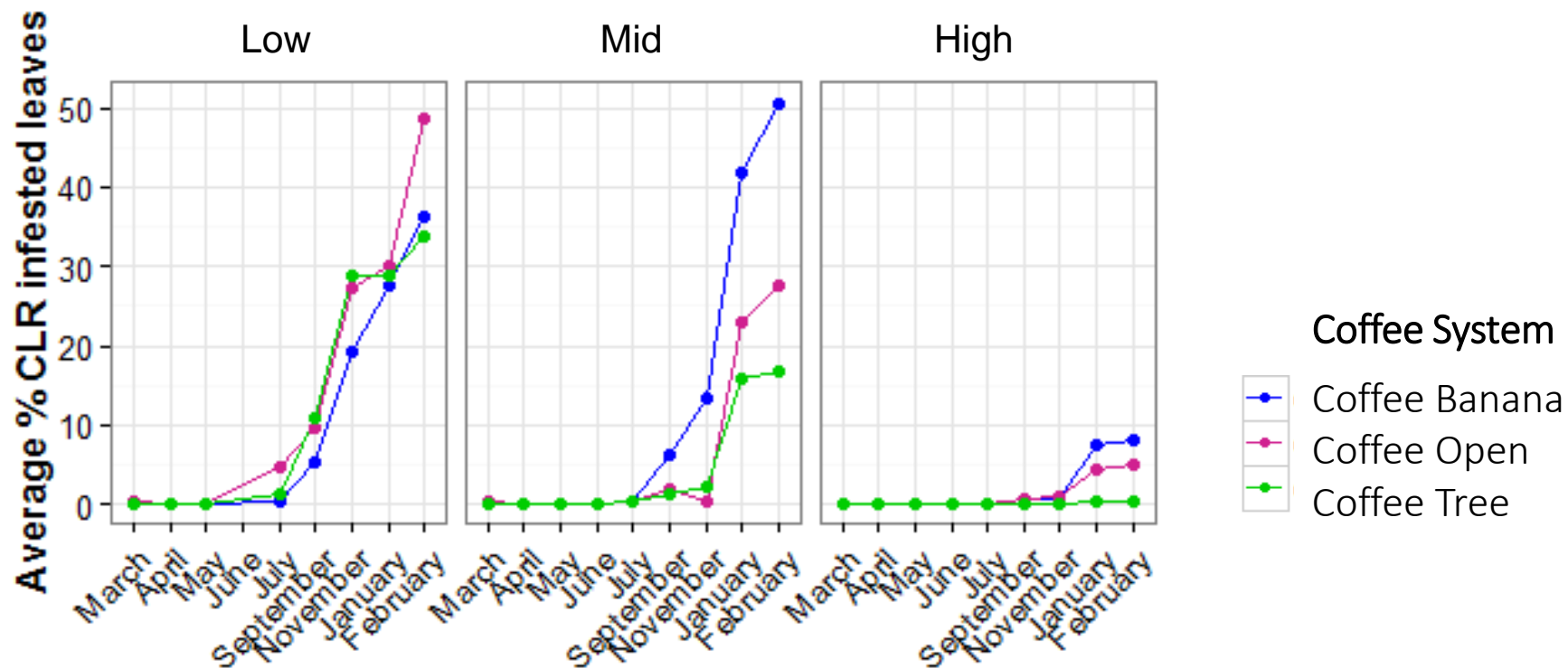
- To estimate direct and indirect effects of altitude and coffee production system on microclimate and CLR: → Piecewise structural equation model





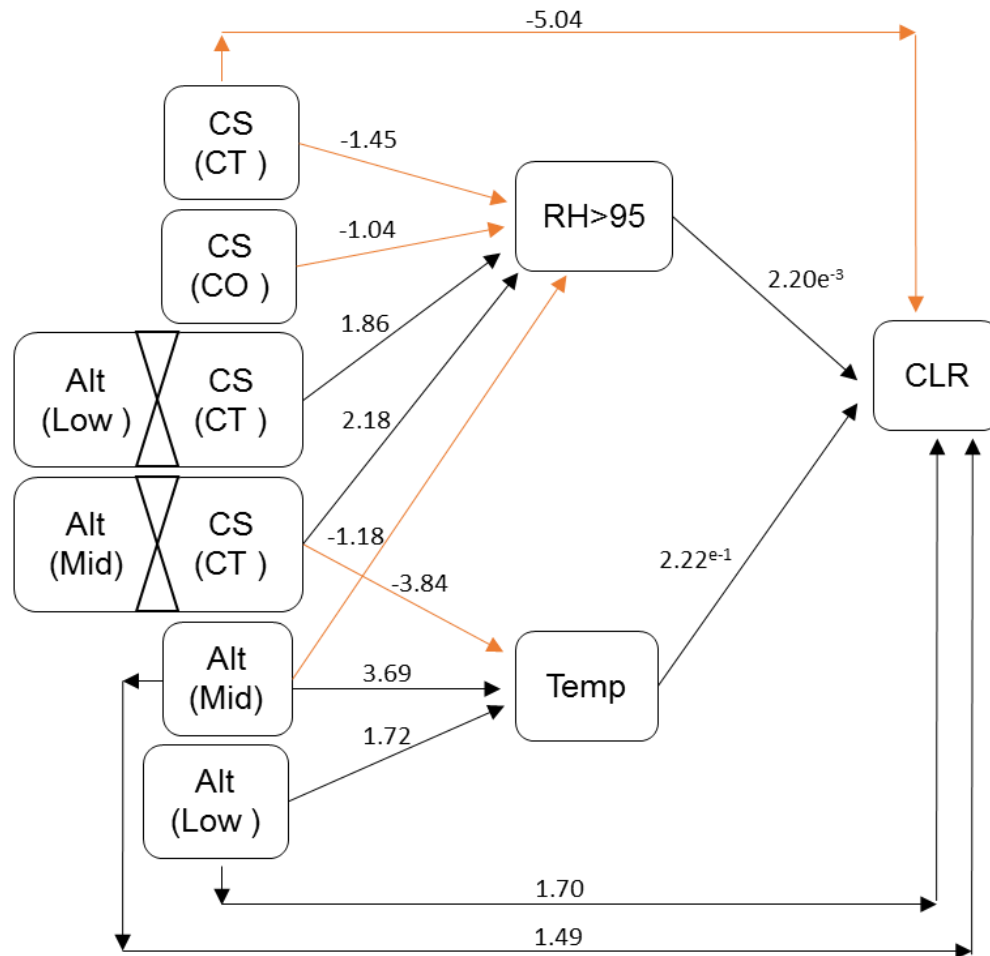
Environment (altitude) and coffee system affect seasonal and daily pattern microclimate

Spatiotemporal variations in CLR



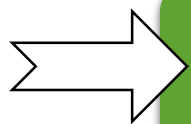
Environment (altitude) and coffee system affect seasonal pattern of CLR

Piecewise structural equation model



CS = Coffee System, CT = Coffee Tree, CO = Coffee Open, RH>95 = The accumulated number of hours with the RH > 95 % (May / June), Temp = Average temperature (May / June)

Shipley's test of d-separation was used to estimate the overall fit of the model (chi-squared test on the Fisher's C statistic = $p > .05$, Fisher's C, AIC = 65.85).



Effects of the environment and production system on CLR are directly or indirectly mediated by microclimate.

- Spatiotemporal variations in microclimate: There are no consistent altitude or system effects
- E.g. At high altitudes, highest humidity was found in unshaded systems (Vapor pressure deficit? Energy balance?)
- “Relative humidity and leaf wetness are increased in shaded systems” ???
- Spatiotemporal variation in microclimate affects spatiotemporal CLR development
- Structural equation modelling is a useful framework to describe interaction networks and causal relationships of agroecosystems



Thank you for
your attention

Acknowledgements

Technical assistance

Wilberforce Wodada (IITA)

David Mukasa, (IITA)

Funding

BMZ

CCAFS

Claussen-Simon-Stiftung

Organizing committee of



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