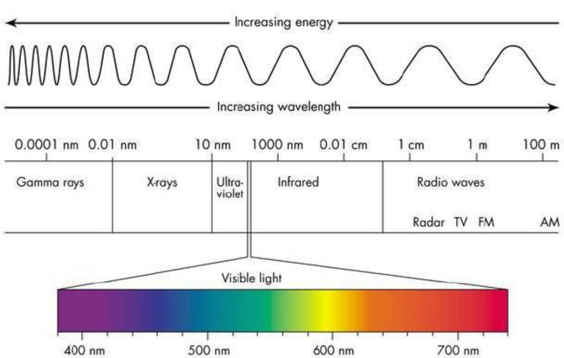
Imperial College London

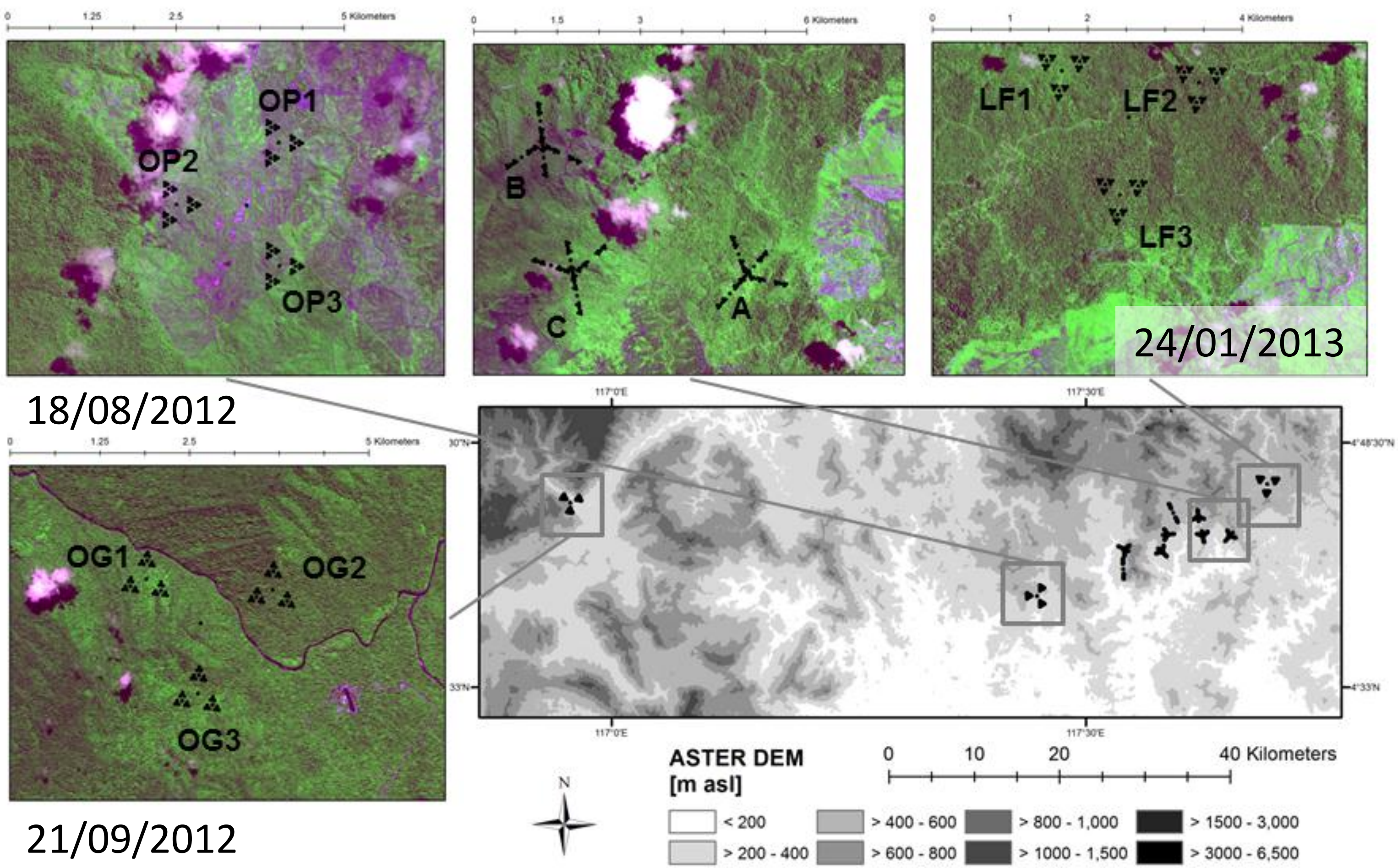
Science@SAFE 2014

Forest degradation from above forest canopies

Marion Pfeifer[1], Robert Ewers[1]

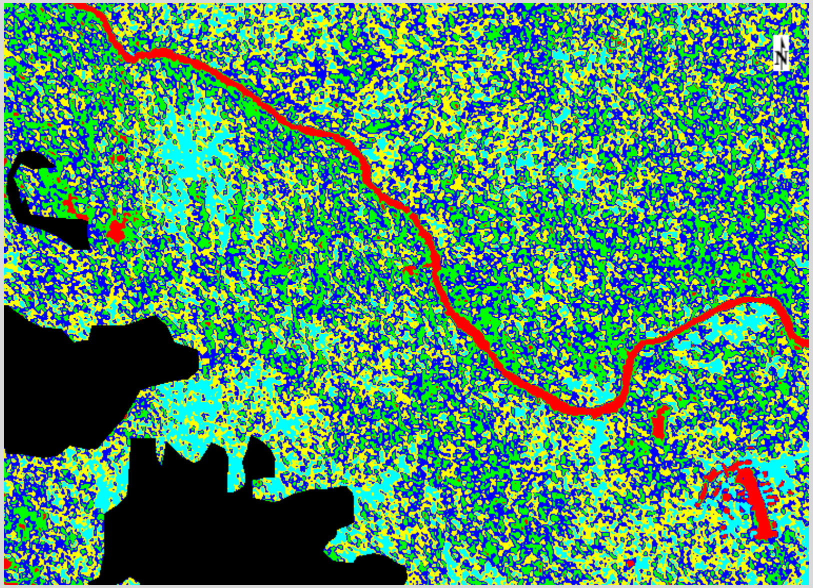


RapidEye at SAFE provided by ESA and BlackEye



Linking plot attributes to spectral data measured from above canopies

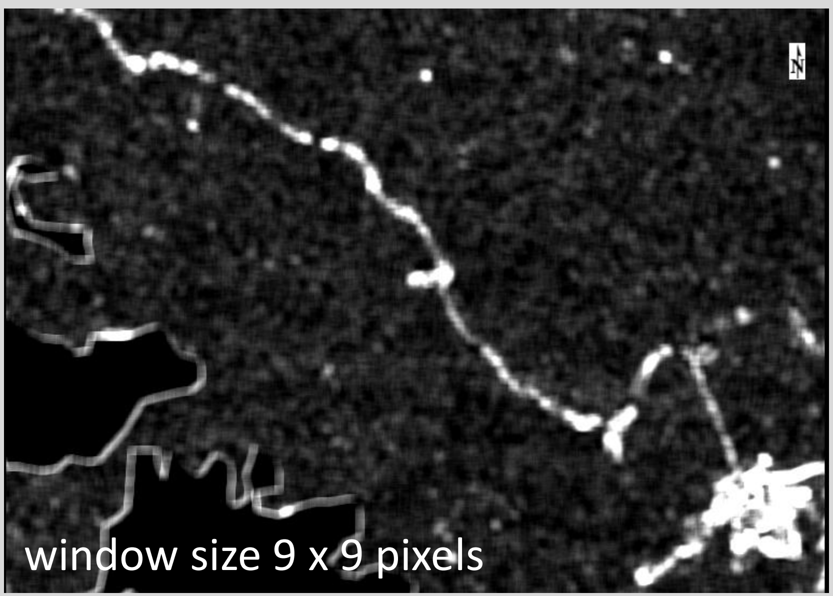
Unsupervised classification

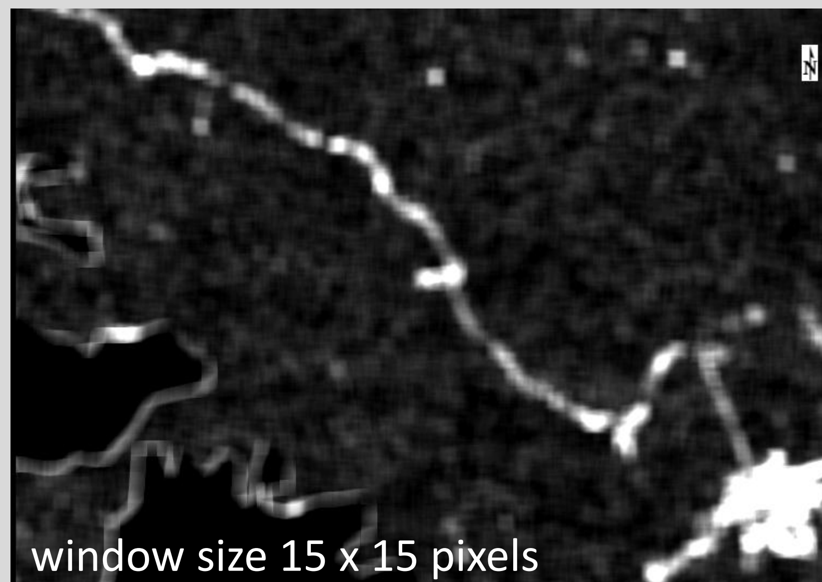


NDVI

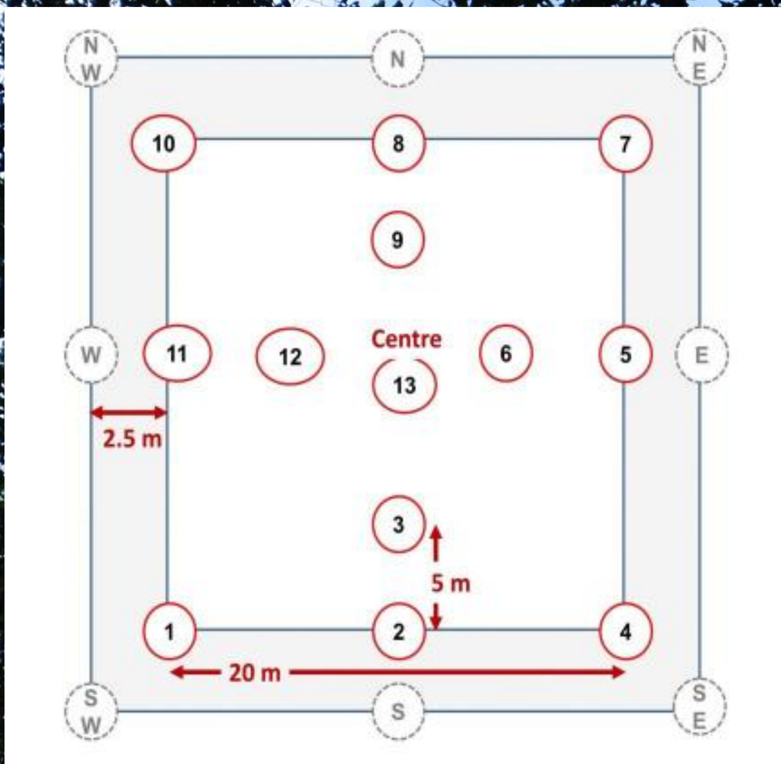
Linking plot attributes to texture data derived from spectral data measured from above canopies

Dissimilarity band 3, offset =1, varying window sizes





Mapping forest attributes



N = 193 (AGB), N = 203 (LAI)

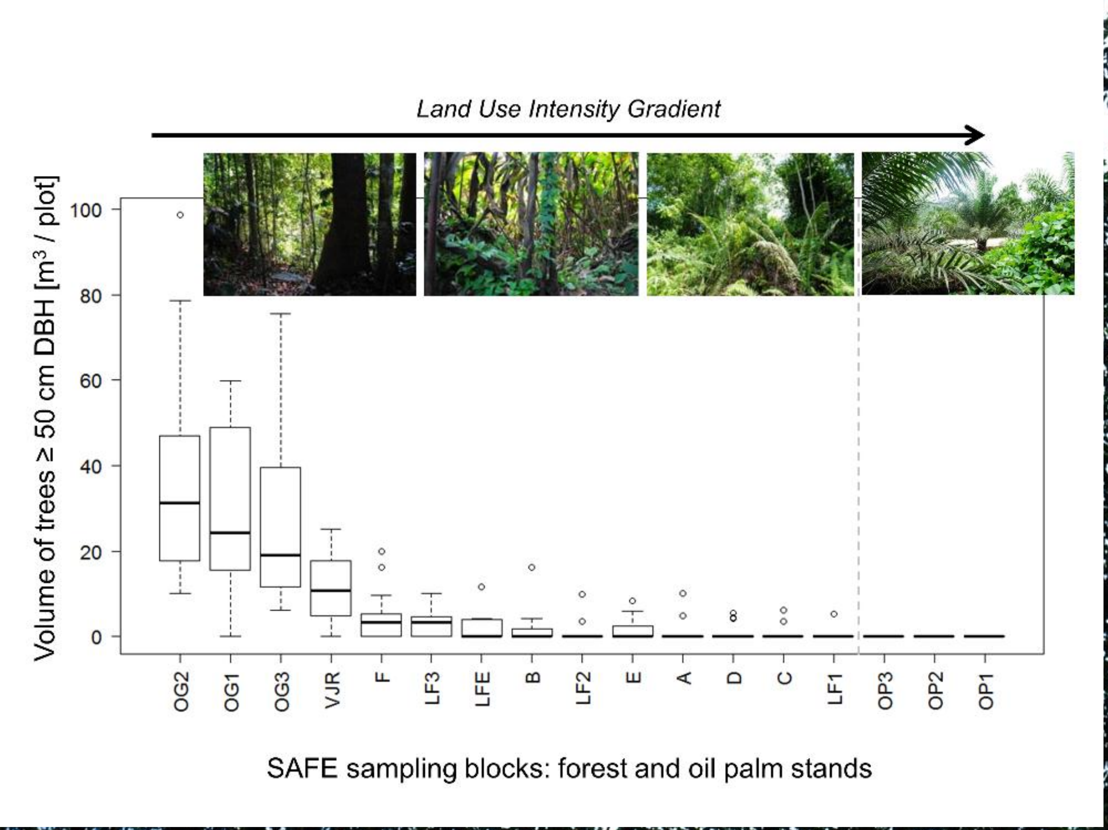
Leaf Area Index, fCover

Using hemispherical photography

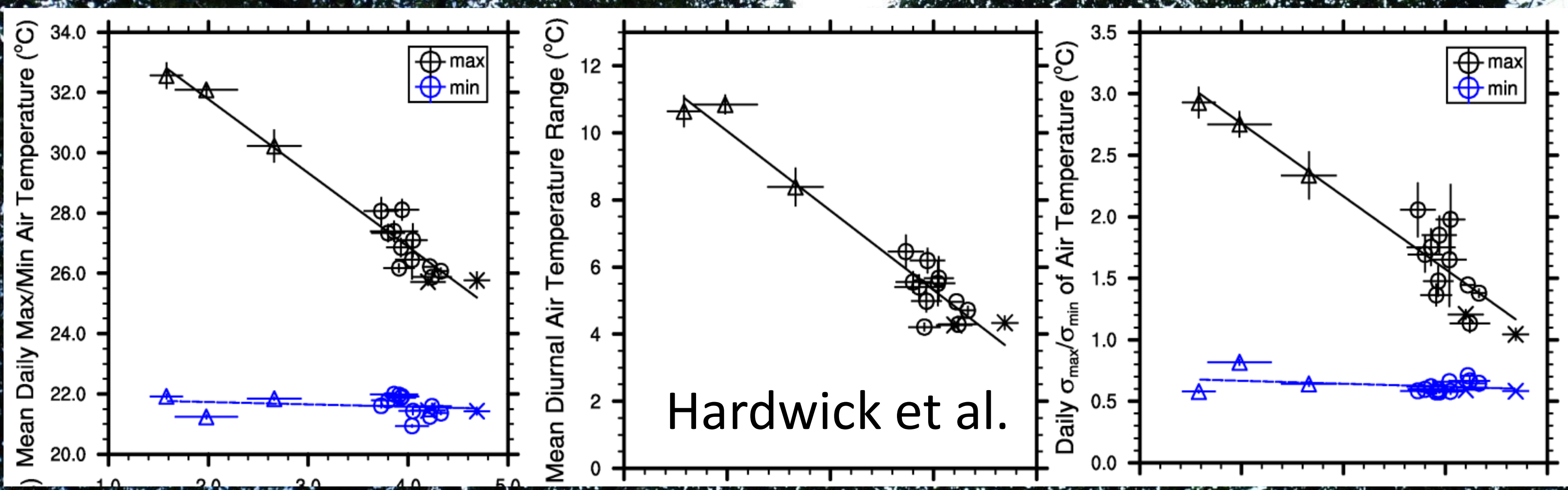
Aboveground biomass, AGB_{live}

AGB_Chave_wet: global
AGB_Chave_moist: global
AGB_Niiyama_2010: Malaysia
AGB_Kenzo_2009: Sabah
AGB_Basuki_2009: East Kalimantan

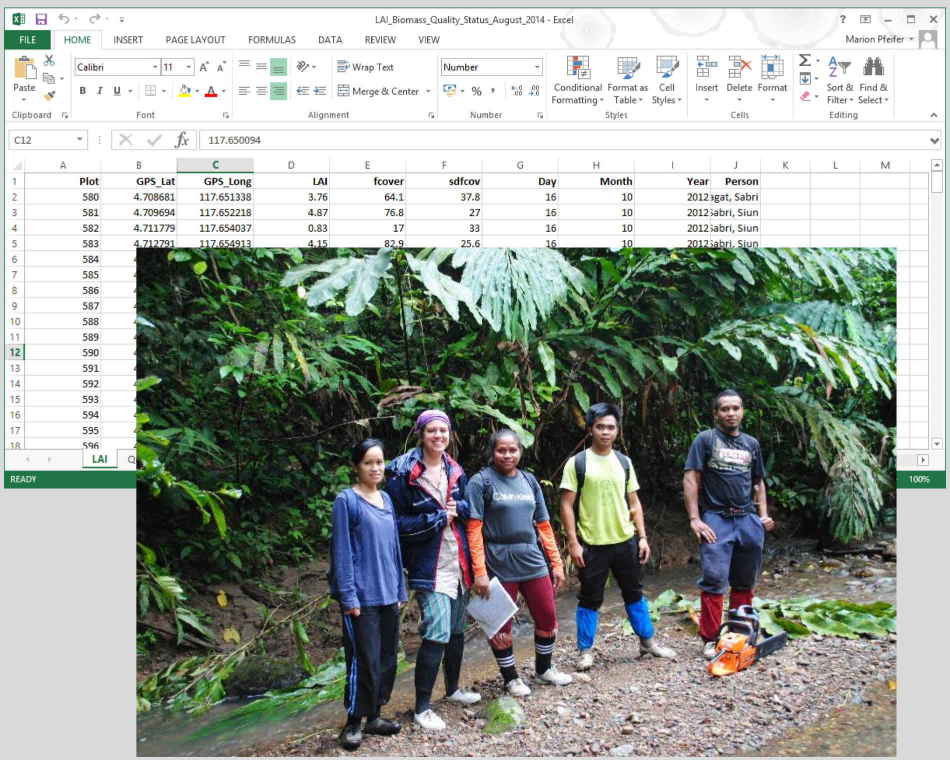
- **Biomass** (AGB$_{live}$) declines significantly with increasing land degradation at SAFE



- **Biomass** (AGB$_{live}$) declines significantly with increasing land degradation at SAFE
- **LAI** varies within and among forest stands and is clearly linked to microclimate



Data distributed for SAFE analyses:
LAI_Biomass_Quality_Status_August_2014.xls

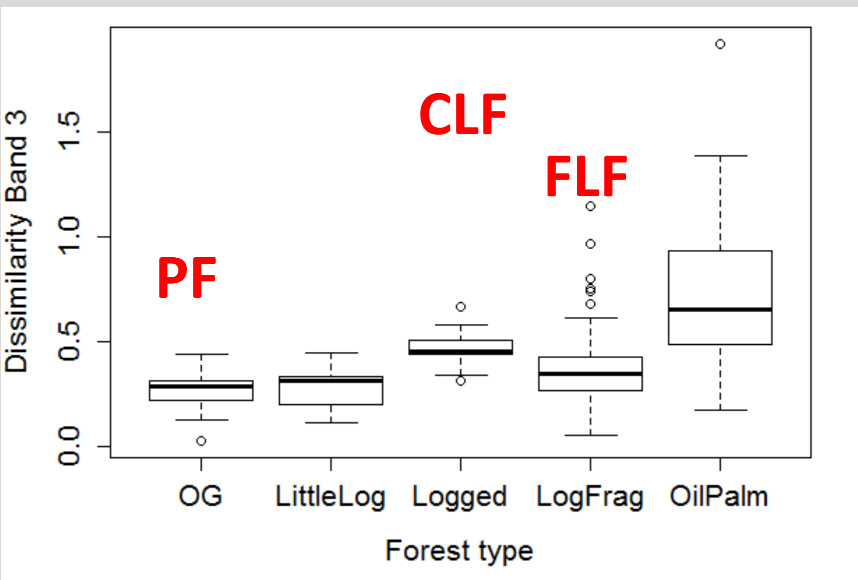


Thanks to the SAFE RAs:
Maria, Ika, Opong, …….

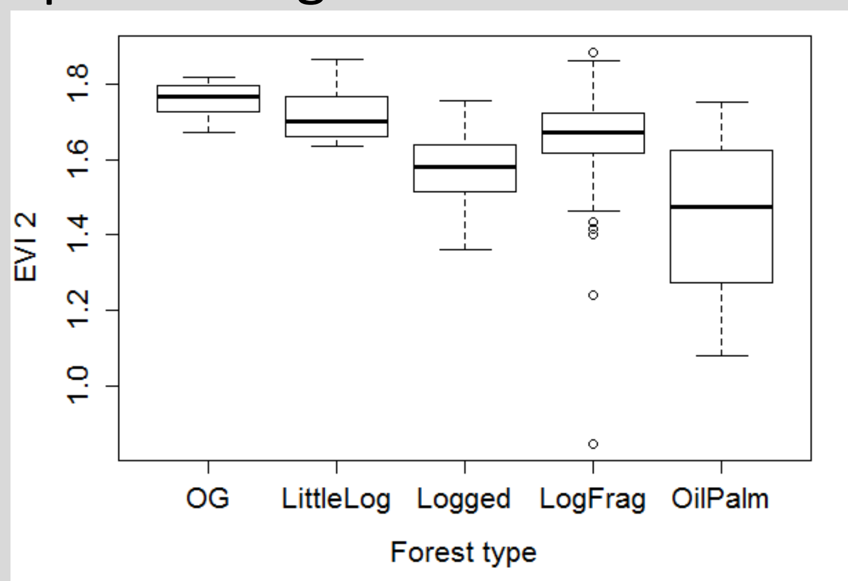
Grouping forest plots into four classes: pristine (OG), slightly logged (LittleLog), logged (Logged), heavily logged (LogFrag); and grouping plots in oil palm stands (OilPalm)

Earth Observation derived measures

Texture dissimilarity



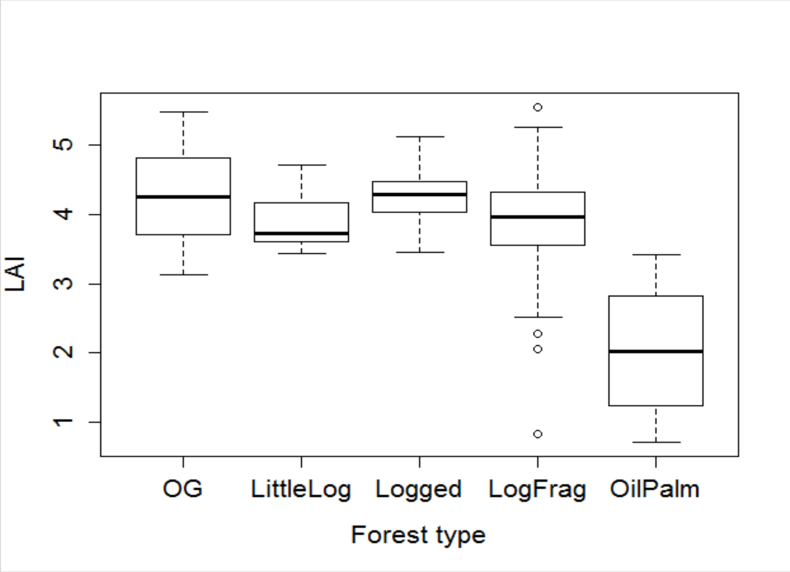
Spectral vegetation index



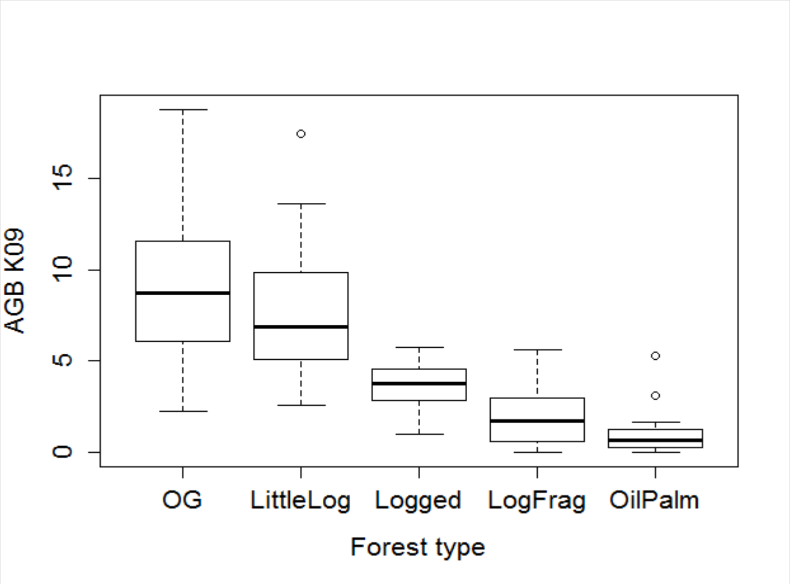
LAI, N = 191 (LFE plots are in the clouds), AGB, N = 185

Field derived measures

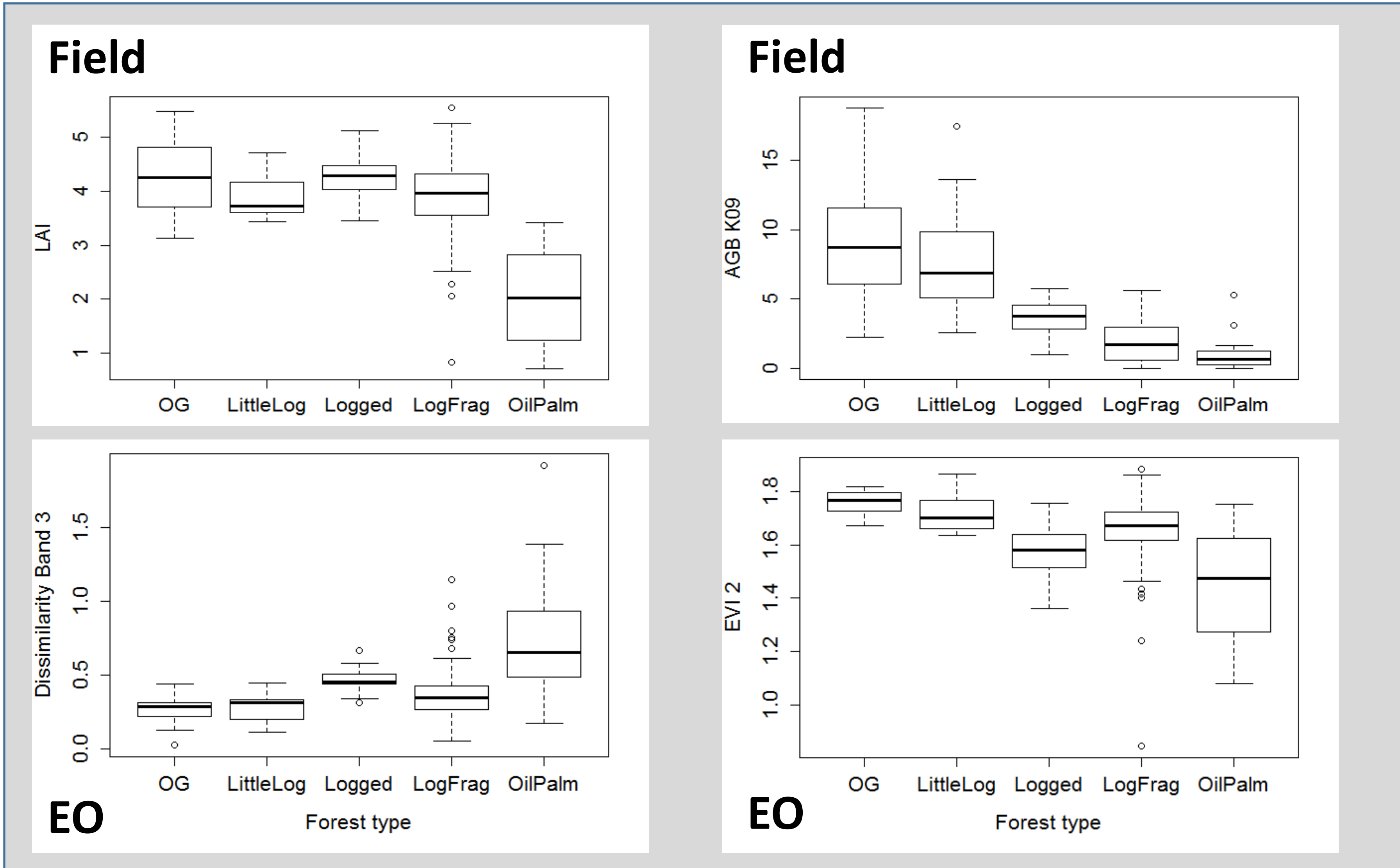
Leaf Area index, Hemis



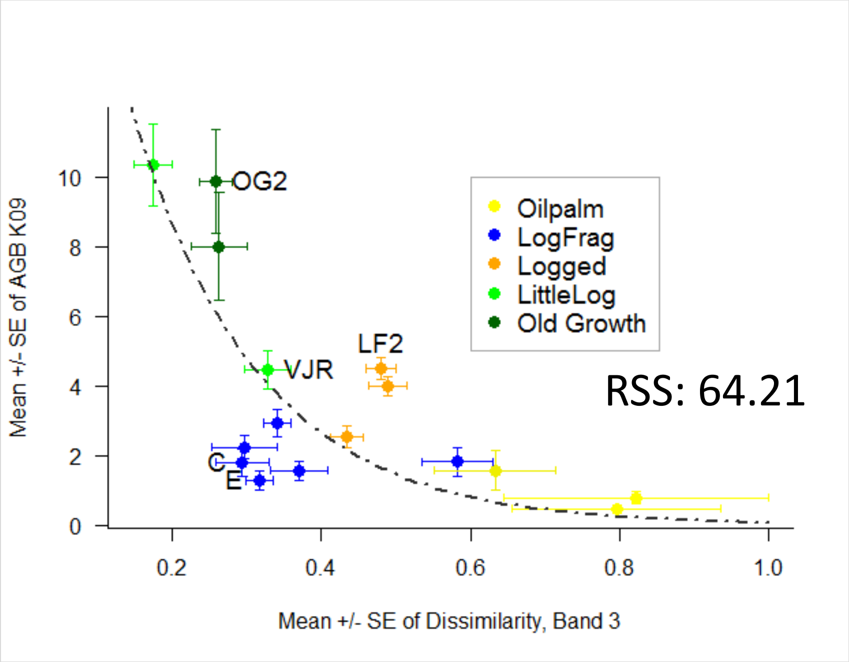
AGB_{live}, K09

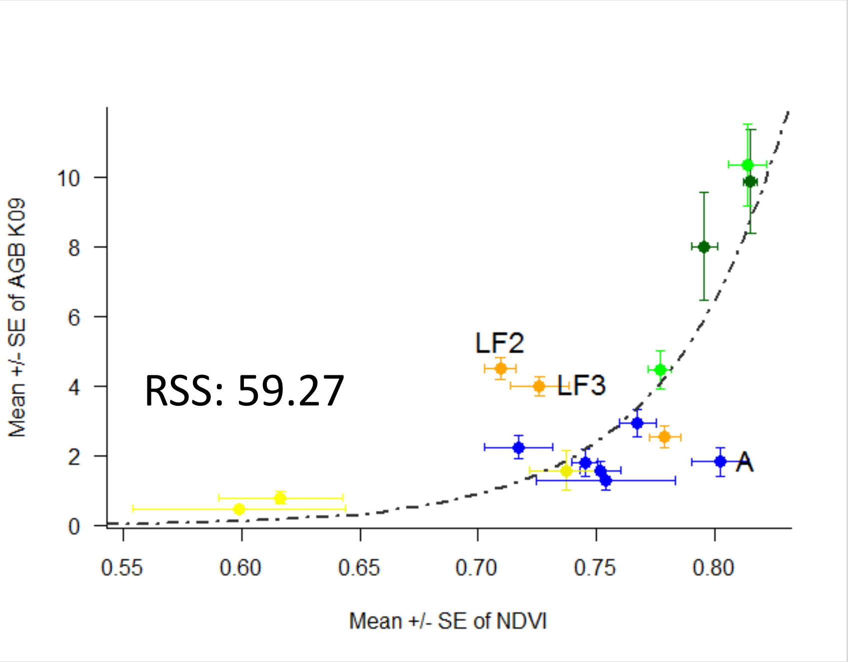


Mapping forest attributes

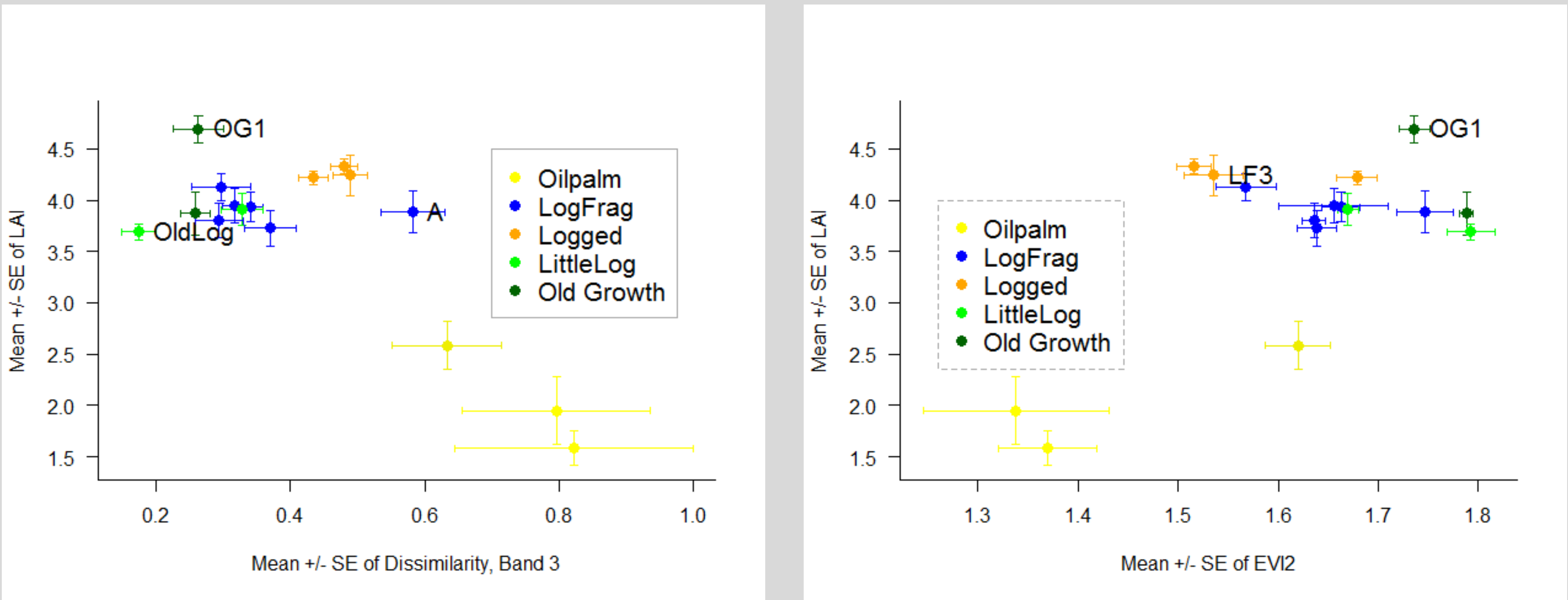


Maybe, at stand level, there is some relationship between satellite derived data and field derived AGB that can be exploited……. But!

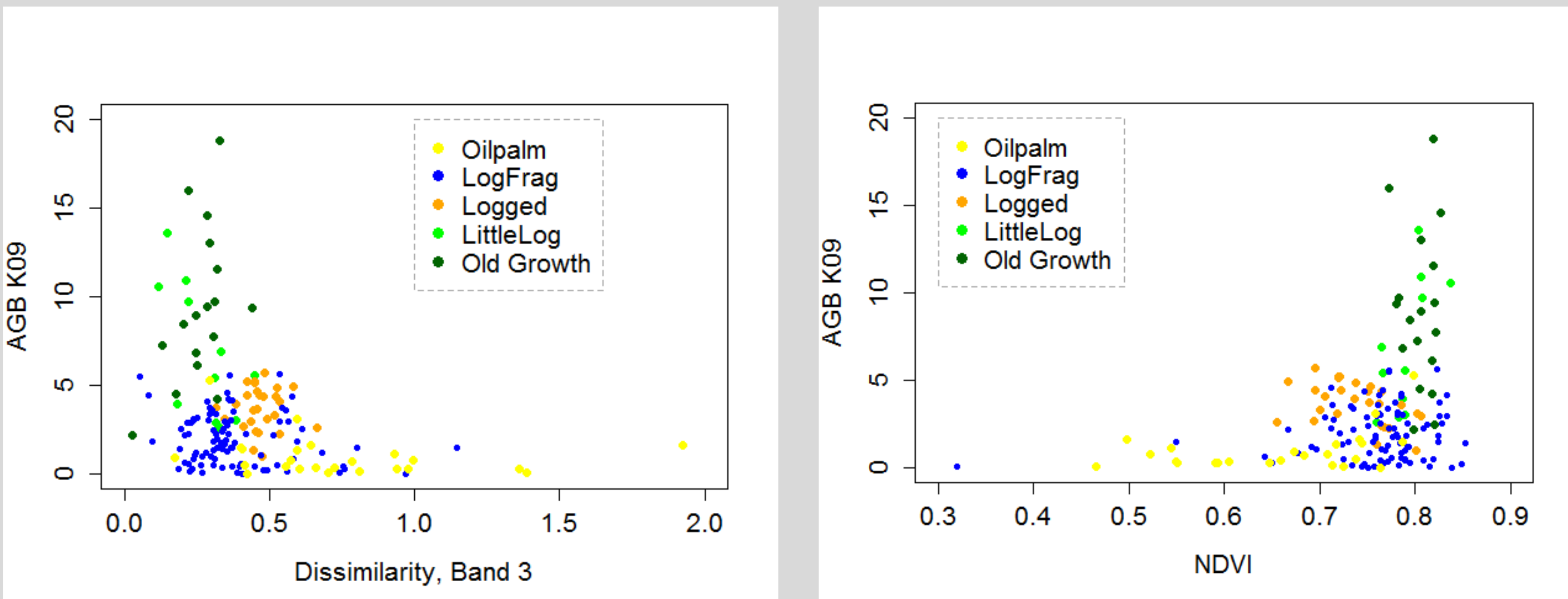




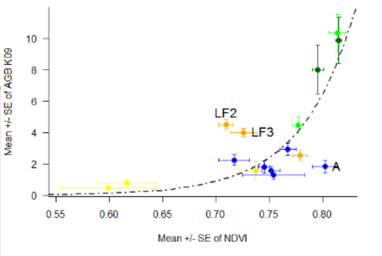
It doesn’t look really good for Leaf Area Index, which is more directly linked to impacts on microclimate

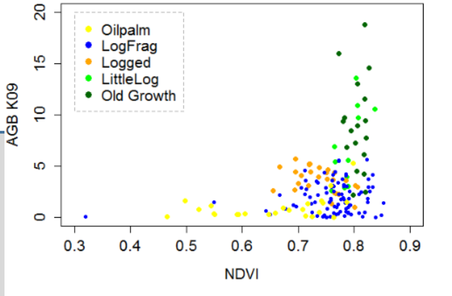


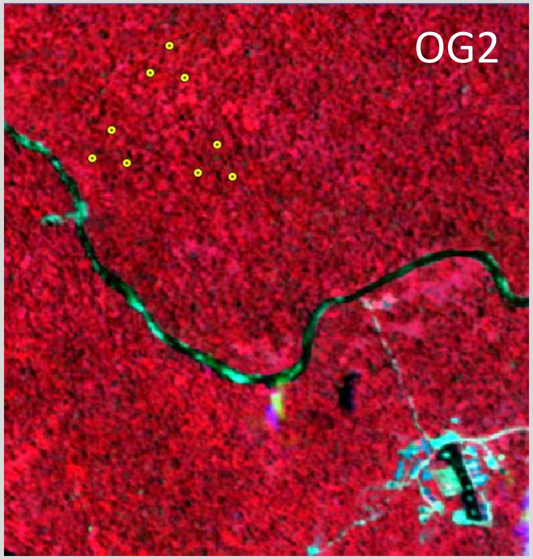
And the predictive quality at plot level is questionable.....

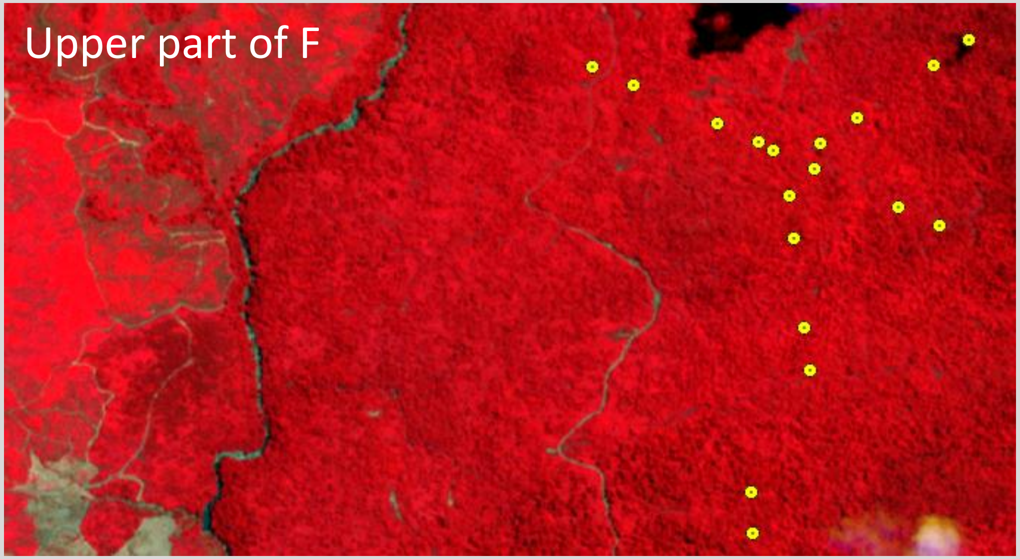


Predicting forest attributes for each pixel using these algorithms will come with uncertainties.

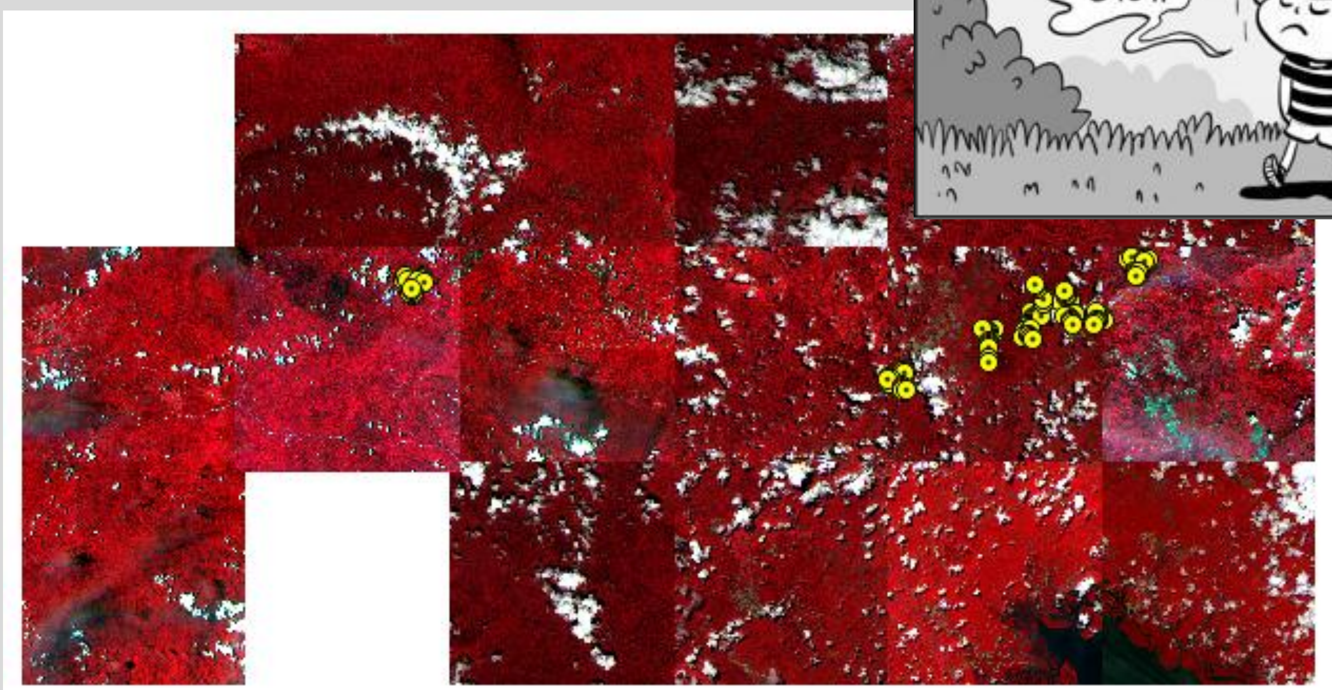








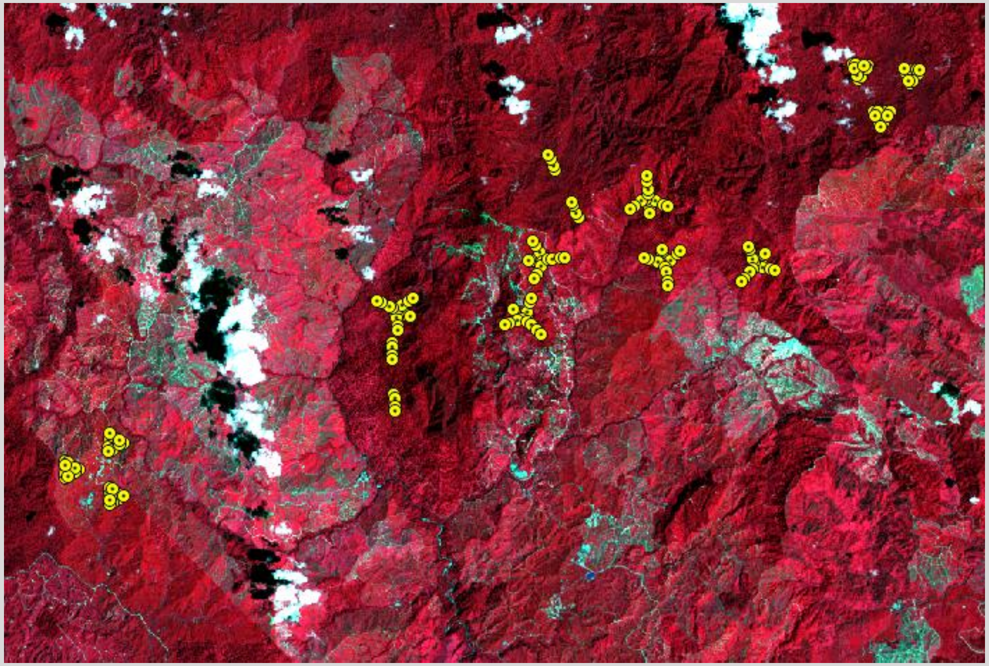
And to do so across the whole SAFE landscape requires to get cloud-free images first.

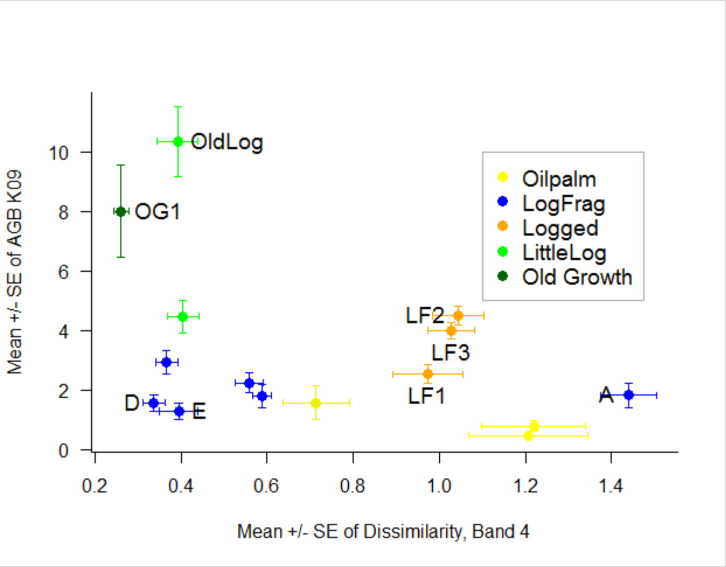


False Colour Composites

Landsat images are good for cover change detection. But they seem to be less capable of depicting degradation.

LS_03, 30 m, 29/01/2014





But we do have high hopes for aerial images/aerial sensor data. Not that finding algorithms for these will make life any easier, for upscaling or back-casting. And there is plenty of room for using Sentinel data or other data sources.

?? Some time soon

At the 'workshop' tomorrow:

- Which satellite data do we have in the SAFE database?
- Which sensor data are we hoping to get over the next years?
- What are these data – what do they mean for my study?
- How can I make the image data work for me?
- And which maps are being produced to make life easy for me?

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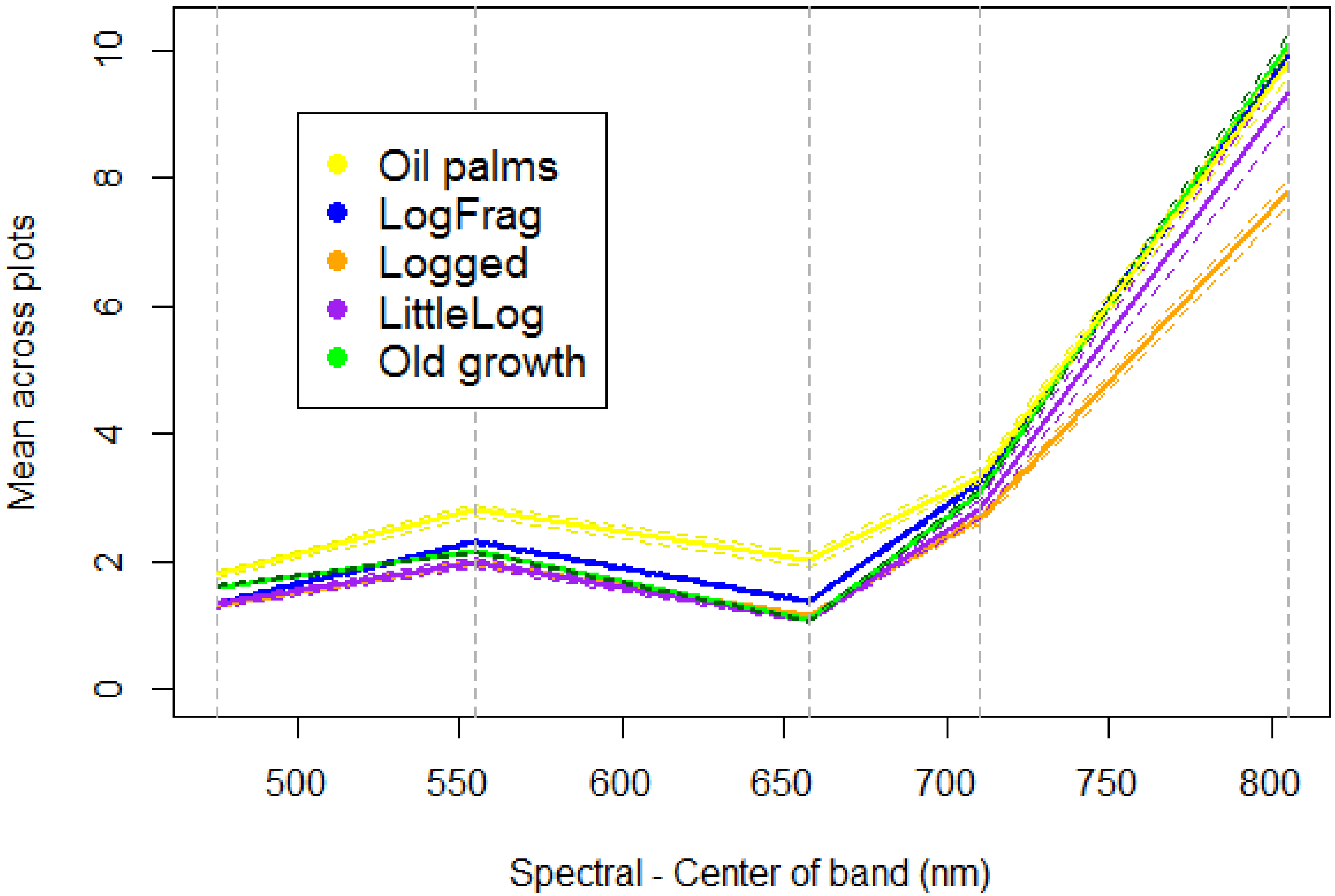
Earth Observation At SAFE

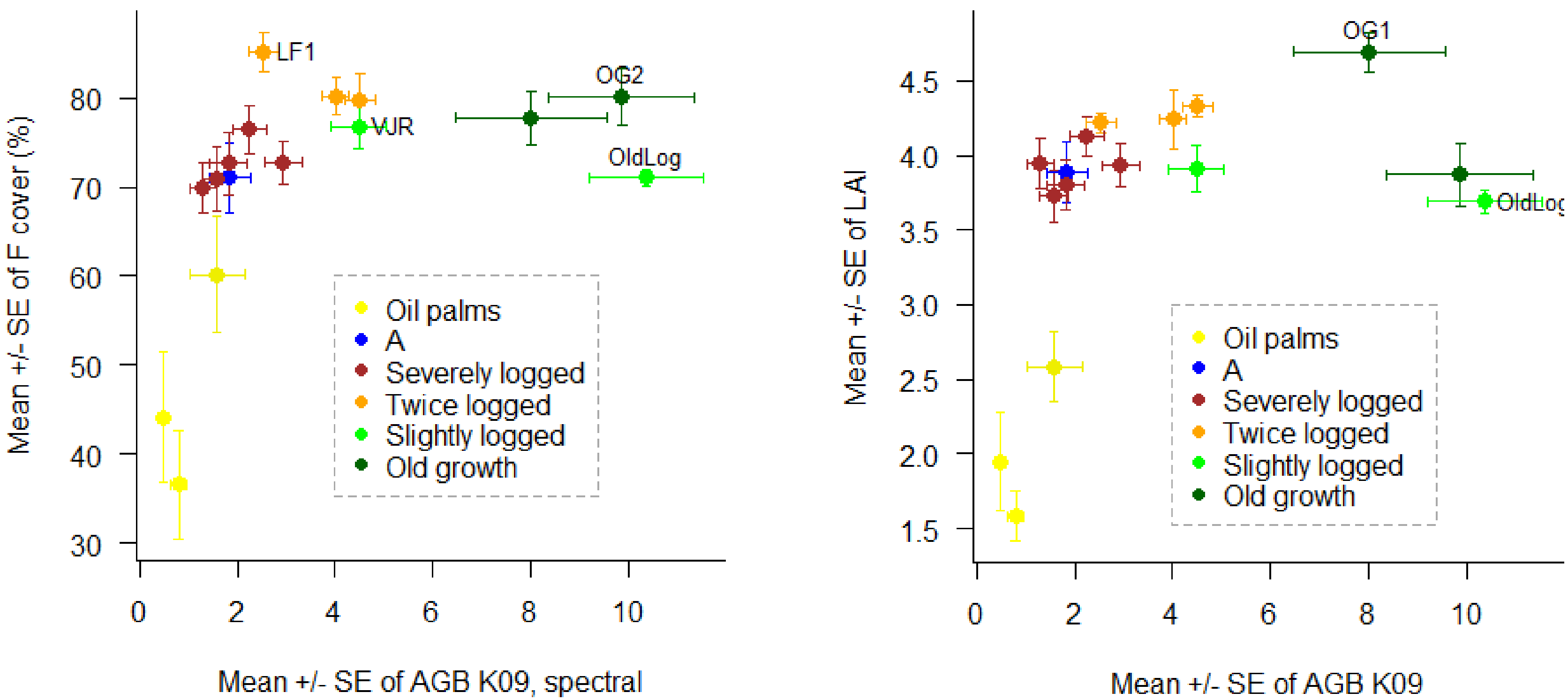
Thank you

Funding ERC, Sime Darby Foundation, European Space Agency

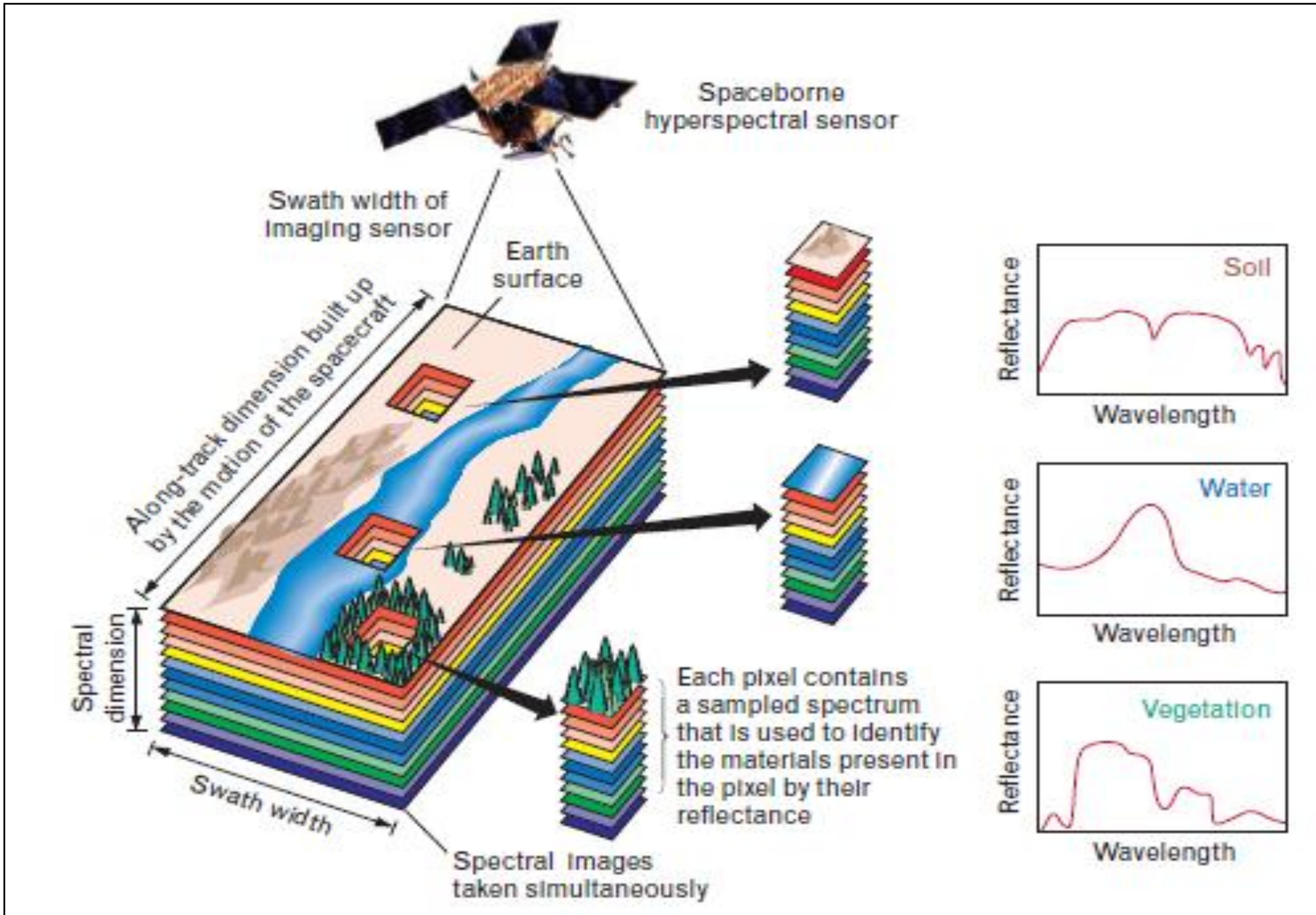


Oil palms
LogFrag
Logged
LittleLog
Old growth
Mean across plots
0
2
4
6
8
10
500
550
600
650
700
750
800
Spectral - Center of band (nm)

Mapping forest attributes



Remotely Sensed Data



Shaw & Burke, 2003. Lincoln Laboratory Journal

RapidEye

- five Earth Observation satellites, since 02/09
- Sensor: RapidEye Earth Imaging System (REIS)
- Image bands

Blue:	440 – 510 nm
Green:	520 – 590 nm
Red:	630 – 685 nm
Red Edge:	690 – 730 nm
Near IR:	760 – 850 nm

- Resolution: 6.5 m (resampled to 5 m)
- Capability for daily revisit to any point on earth

Texture analyses: e.g. grey level co-occurrence matrix (glcm)

- N of similar combinations of neighbours within window of specified size: to the right with offset = 1 (asymmetric)
- Option to rescale grey values before analyses

1	3	3	3	4
1	3	3	3	4
2	2	2	2	2
4	4	1	5	5
4	4	1	5	5

Image with 5 grey values

	1	2	3	4	5
1	0	0	2	0	2
2	0	5	0	0	0
3	0	0	4	2	0
4	2	0	0	2	0
5	0	0	0	2	0

Co-Occurrence matrix: 1 to right

For each combination of neighbours: 1,1: Zero; 1,2; Zero; 1,3: Two, ….