Project Database of ICP Forests

PROJECT DESCRIPTION

PROJECT INFORMATION

Project title:	**Modeling and analysis of carbon-climate interactions in northern latitude ecosystems**
Project ID:	285
Contact person:	Tim Green // tim.green@ed.ac.uk

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The data requested herein would be used to facilitate the reduction of carbon cycle dynamic uncertainty in the boreal forests of the Fennoscandian region (namely Sweden, Finland, and Norway) and the UK. My PhD research employs the use of a state-of-the-art, model-data fusion framework (CARDAMOM) developed at the University of Edinburgh in Scotland and NASA's Jet Propulsion Lab in the USA. CARDAMOM couples Bayesian calibration techniques with DALEC, a medium-complexity terrestrial ecosystem model (TEM), to probabilistically represent carbon stocks and flows through an ecosystem. The flexibility of CARDAMOM allows for the assimilation of multiple data streams from remote sensing to field data, in order to constrain parametric uncertainty and ultimately the net carbon balance of an ecosystem at various user-defined spatial scales.

One important, remotely-sensed data product that is often assimilated into TEMs is leaf area index (LAI). However, it seems that major satellite products of LAI (Copernicus, MODIS) exhibit unrealistic seasonality at the northern latitude evergreen needleleaf forests (see Figure 1).

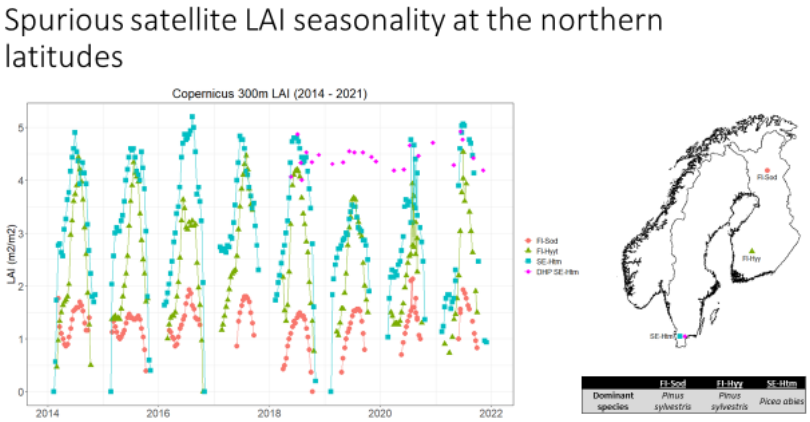

Figure 1. Time series of extracted Copernicus LAI at three sites in Finland and Sweden. Magenta diamonds represent field-level, digital hemispheric photograph-based LAI at the Hyltemossa, Sweden site (notice the lack of extreme seasonal fluctuation in LAI at this site compared to the satellite observations).

Assimilating these satellite-based observations of LAI has significant modelling implications and ultimately limits our ability to accurately assess carbon dynamics at these latitudes. Without getting into too much detail, one work-around that has been tested at the site-level is to assimilate summer-peak only satellite LAI and constrain the prior on DALEC's leaf lifespan parameter. Herein lies the main purpose for this data request. ICP Forests Level I and II sites contain valuable information on the number of needle cohorts for each measured tree, which can be used as a proxy for needle lifespan. Various approaches could be employed to produce species-specific needle lifespan maps across Finland, Sweden, Norway and the UK (see Tupek, 2015 as an example). Any data on LAI would also be useful to compare against satellite products, as well as the timing of phenological events at the plot level. Additionally, growth and yield data can assist in the validation of model outputs. Finally, soil water measurements would provide valuable information for model behaviour. Thank you and please feel free to direct any questions to tim.green@ed.ac.uk.