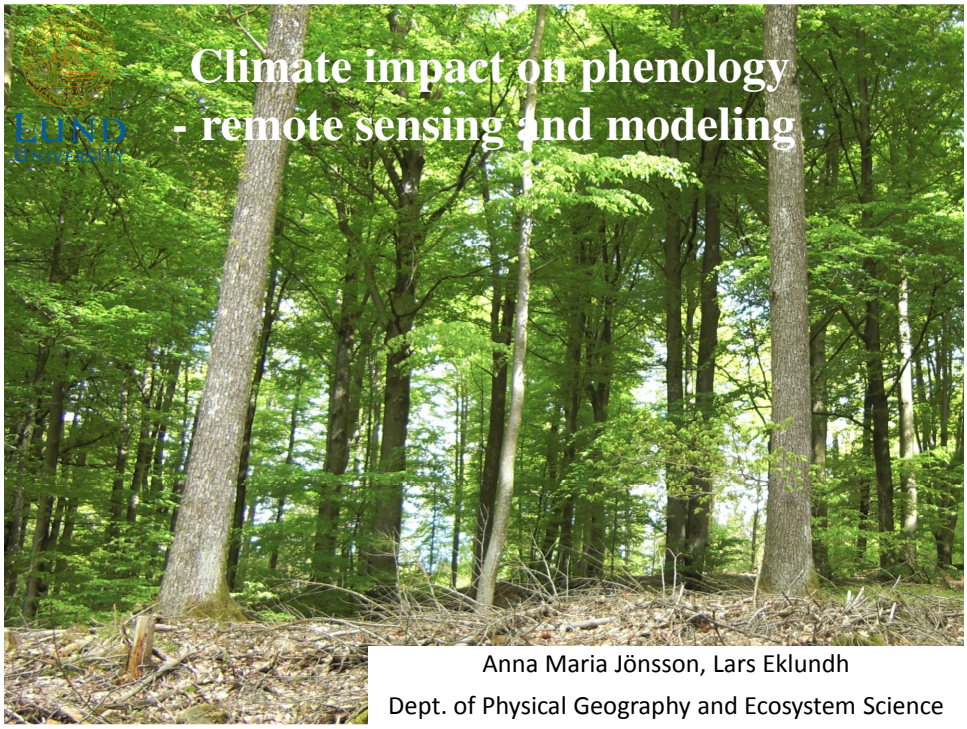

Anna Maria Jönsson, Lars Eklundh
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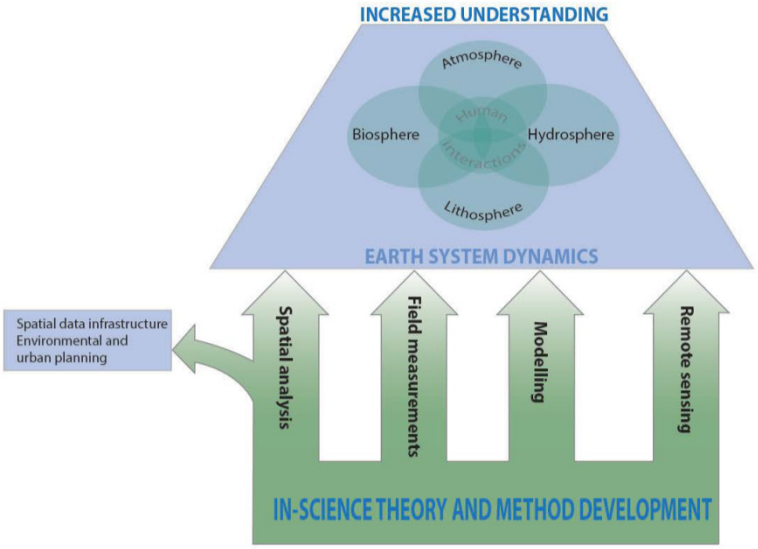
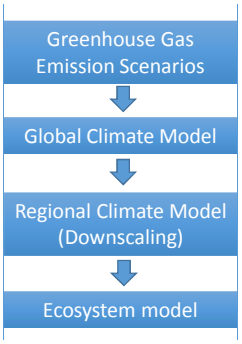


Impact modeling



- Process based models to translate climate model projections into ecosystem effects
- Perform climate change impact assessments
- Develop adaptation strategies

Development of phenological models

Plant phenology

Norway spruce, Populus, potato

Insect phenology

Spruce bark beetle

Colorado potato beetle

Damage caused by weather events

Spring frost damage

Storm damage

Drought stress

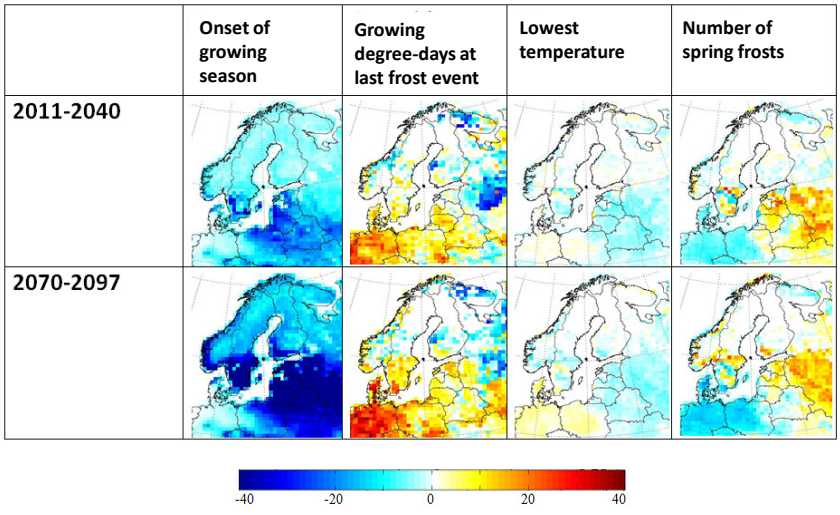
Ecosystem model analysis of multi-use forestry in a changing climate

- Species specific response to climate change
- Ecosystem interactions
e.g. tree species & insect pests
- Management aspects
- Strategy development

- Direction of change?
- How to quantify risks?
- Can we do something?
- How to combine management alternatives at the landscape level to optimize goal fulfillment?

Lagergren & Jönsson 2017 Ecosystem services 26:209-224

Risk for spring frost damage

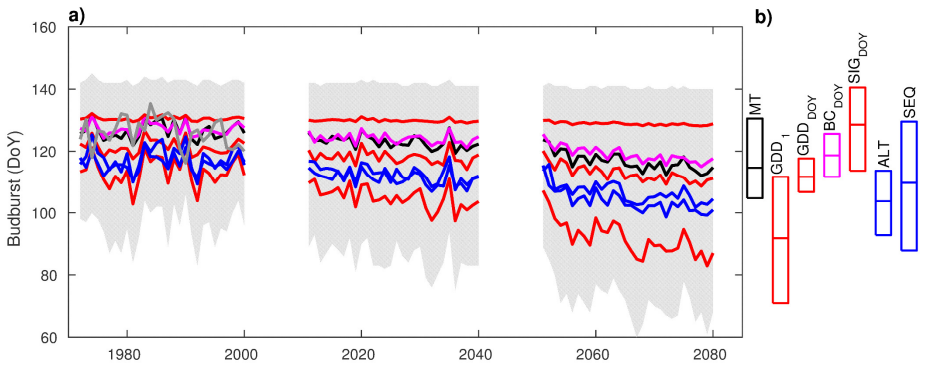


Climate change signal – scenario A1B compared with 1961-1990

Jönsson and Bärring 2011 NHESS

Norway spruce in Europe - phenology model projections

(a) interannual variation (b) variation among phenology models



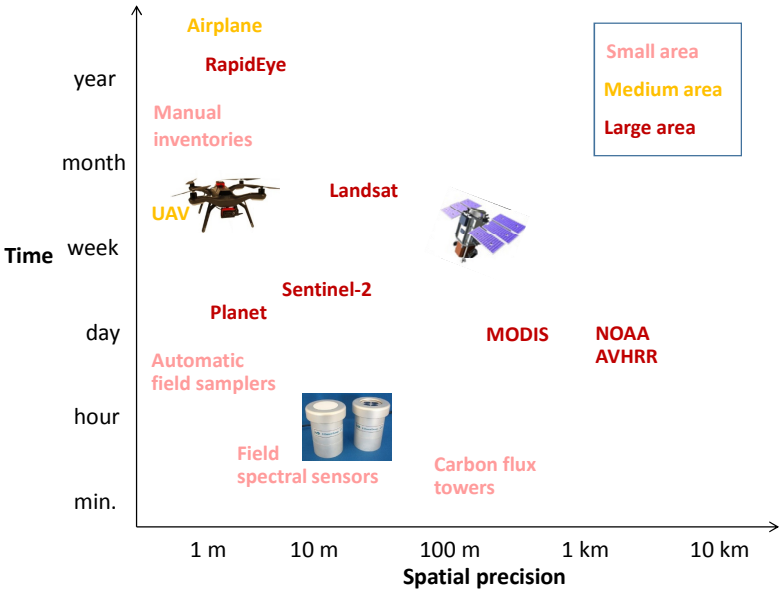
Olsson et al. 2017 Ecology and Evolution

Uncertainties: spread among models ~1 month, caused by different representations of cues from temperature and day length

Ongoing: developing a new phenological model based on mechanistic understanding of regulatory processes

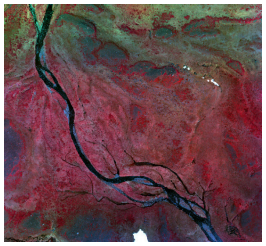
Aim: disentangle the effects of seasonal progression and inter-annual variation in temperature conditions

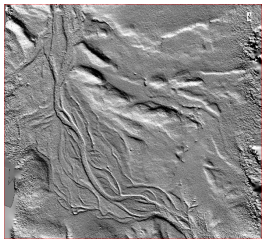
Remote sensing expands the time-space domains



Our application fields

- Mapping of plant types and land cover
- Mapping of forest structure/volume
- Topographic and 3D mapping
- Plant phenology and relations with climate and disturbances
- Growth/productivity
- Carbon cycle studies
- Disturbance effects (disease, drought, fire, storms etc.)

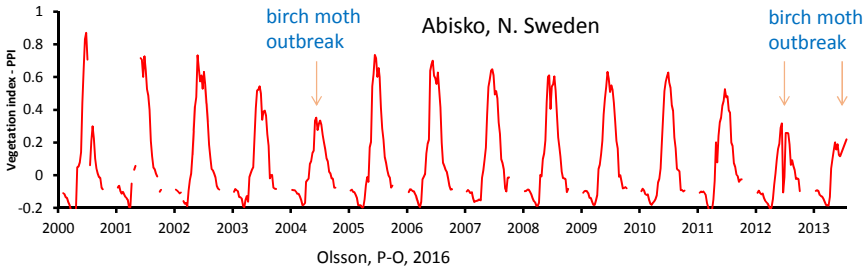




UAVs provide IR maps at cm-resolution

Ca 300 images to build this composite

Time-series of satellite data showing insect damage

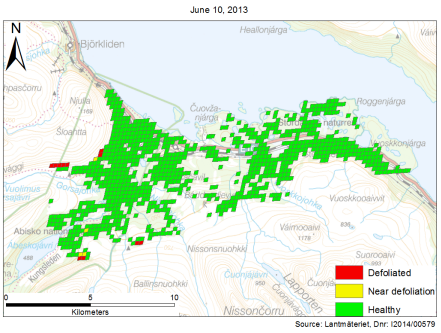


Olsson, P-O, 2016

Autumnal moth

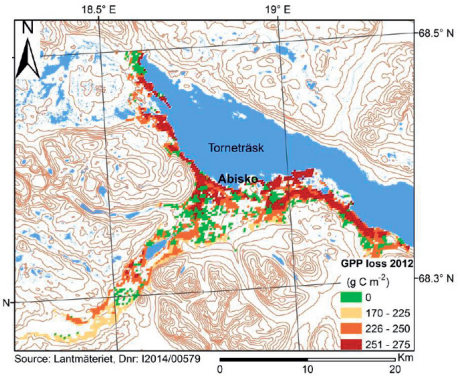
Effect of birch moth damage

Birch moth outbreak, Abisko



GPP model

Decrease in carbon uptake

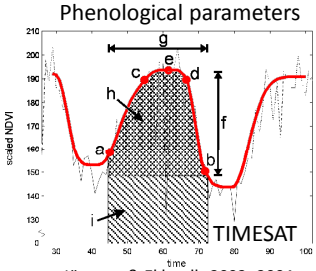


- Based on MODIS 250 m resolution data
- 76% of the 100 km^2 defoliated
- Annual GPP loss nearly 50% (20 Gg C) in 2012

Olsson et al., 2017

Continental phenology studies

Phenological parameters

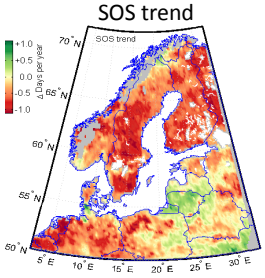


Jönsson & Eklundh 2002, 2004

Start of growing season

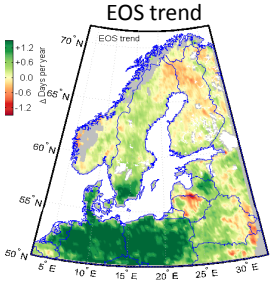
EEA phenology indicators 2000-2016

SOS trend



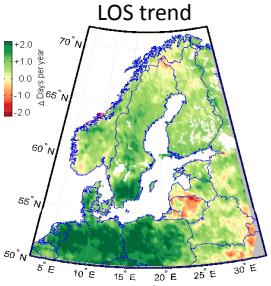
- 0.3 d/year

EOS trend



+ 0.2 d/year

LOS trend

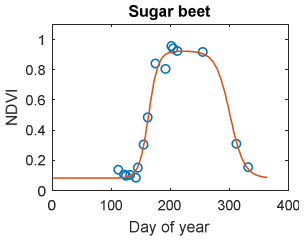


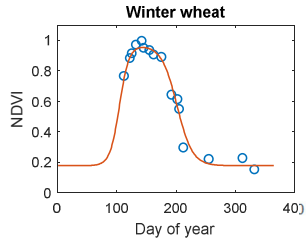
0.5 d/year

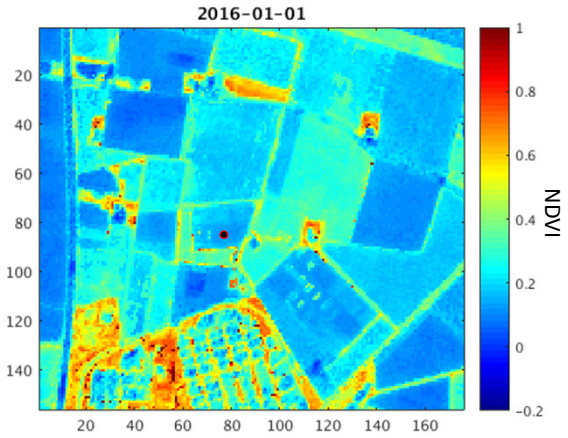
Jin et al. 2017, 2018

Vegetation dynamics from satellite (Sentinel-2)

Alnarp - Lönnstorp







- Spectral mast

SITES – Swedish infrastructure for Ecosystem Science

- Polar Research Secretariat
- Swedish Agricultural University
- Stockholm University
- Univ. of Gothenburg
- Uppsala University

SITES
A national infrastructure for terrestrial and limnological field research.
http://www.fieldsites.se/

SITES Spectral – Lund University
Data collection on vegetation state and seasonal variations

- Year-round multispectral measurements
- Seasonal drone flights
- Phenology cameras
- Satellite imagery

Free and open data policy

Climate impact on phenology - remote sensing and modeling

- Research across scale – from local to global
- Analysis of time series – interannual variations
- Integration of methods – observations to support model development

Thank you!

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