Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title: Characterizing spatial variation of phenology for six dominant tree species using time series data (M.Sc. thesis)

Project ID: 5

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Background

The research on plant phenology has improved the understanding of the variation in life cycle events in the past centuries (Ahlgren, 1957; Arroyo, 1990; Bianco & Pitelli, 1986; Slade, 1975; Williams, 1971). Recently, phenology has been widely applied in research on terrestrial ecosystem and ecological models.

Since phenological data are comparatively scarce in many parts of the world. Moreover, ecological models relating to climate change studies require phenology information at large spatial scales. As a result, remote sensing data for inferring phenological characteristics of vegetation is increasingly regarded as key to understanding large area seasonal phenomena (Krishna Prasad et al., 2007). As illustrated by Bin et al. (2008), remote sensing provides a key means of measuring and monitoring phenology at continental to global scales. Phenology metrics derived from satellite data as a proxy for phenology are now commonly used for this purpose.

Problem statement

1) There is no such research examining the phenology variation for different tree species using remote sensing at continental scale.
2) Analysis of phenological response as a function of geographical gradient is uncommon.

Overall, for the first time**,** research investigating the spatial phenology variation for different tree species using remote sensing at continental scale will be illuminated.

Hypothesis

1) Remote sensing can be used for phenology analysis with high accuracy.
2) There are significant differences of phenology for different tree species.
3) Significant negative relationship can be discovered between phenology and latitude/altitude. While the relationship between phenology and longitude is more complex.

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Material and method

Study area

The forest of our research scattered over EU27 countries. The results from (Köble & Seufert, 2001) showed that Scots pine, Norway Spruce, Maritime Pine, Common Beech, Birch and Holm Oak cover 68.7% of the forest area in the European countries considered. Our objects of study are focus on variation of phenology for these six tree species.

Data

1) MODIS NDVI time-series data,
2) ICP forest data (ICP-Forests, 2010): ground vegetation data, meteorological data, phenological data.
3) DEM data. The Shuttle Radar Topography Mission (SRTM) 90m data are used in this project for analyzing the relationship between phenology and elevation factor.

Method

1) Phenology derivation and validation.

Sample six dominant tree species on NDVI image using ground vegetation data provided by ICP forest; derive vegetation phenology for different tree species using software TIMESAT.

Then validate the phenology metrics by ICP forest phenology data, provide the accuracy assessment.

2) Spatial variation analysis of phenology for six dominant tree species along geographical gradient.

Firstly, inter-species variation in phenology among the six species will be analyzed with a two-way analysis of variance (ANOVA).

Secondly, generalized linear mixed models (GLMMs) will be used to analyze the effects of geographical gradient, phenology metrics and their interaction.

Thirdly, simple linear regression model of phenological timings against the mean climate factors measured by ICP forest will be constructed to estimate phenology responses to climate.