# COMBINED ANALYSIS OF TREE RINGS AND MODIS IMAGES TO EVALUATE BEECH FOREST PRODUCTIVITY ALONG GEOGRAPHIC GRADIENTS

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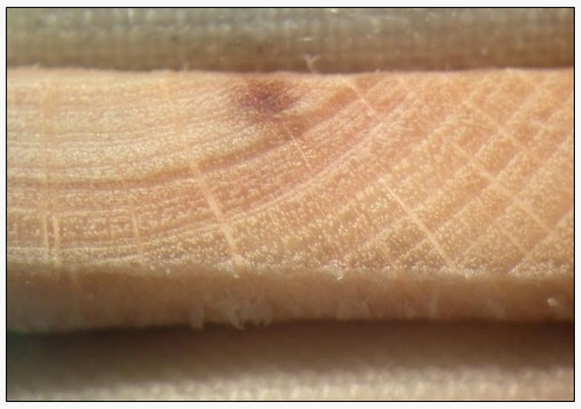
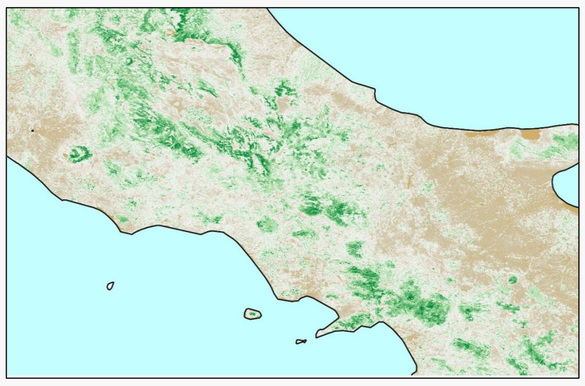
## Tree ring data



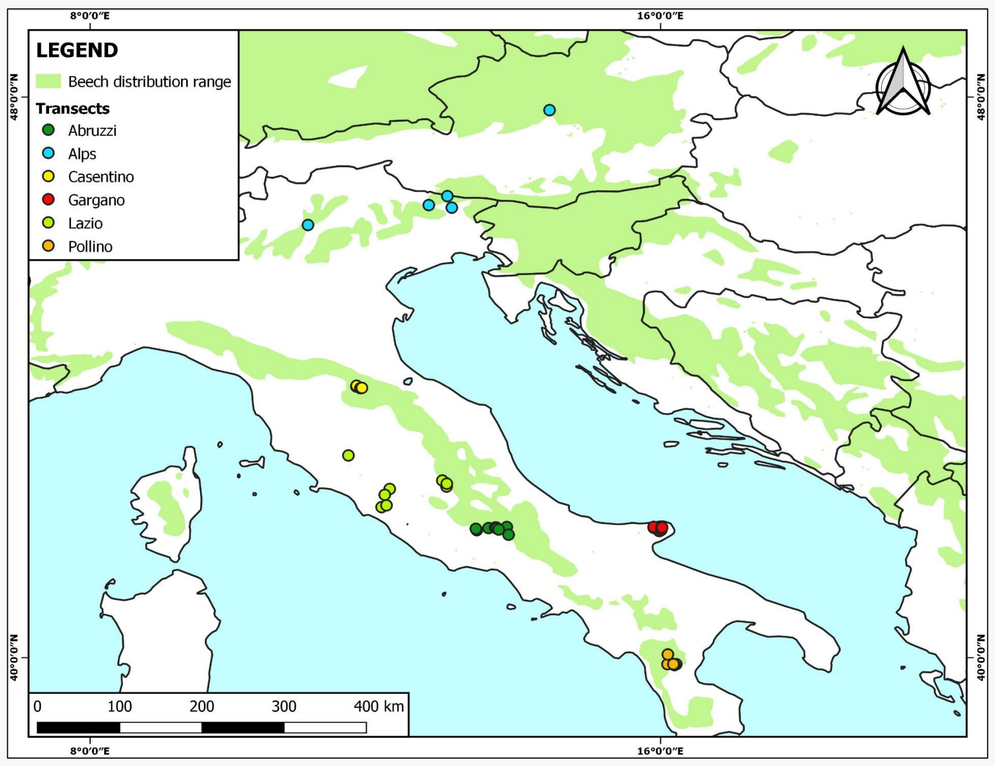
- Connected to **net** primary production.
- **Long time series** available (hundreds or thousand of years).
- **Spatially limited,** referred to a part of the forest.
- Sampling is labor intensive.

## Remote sensing data

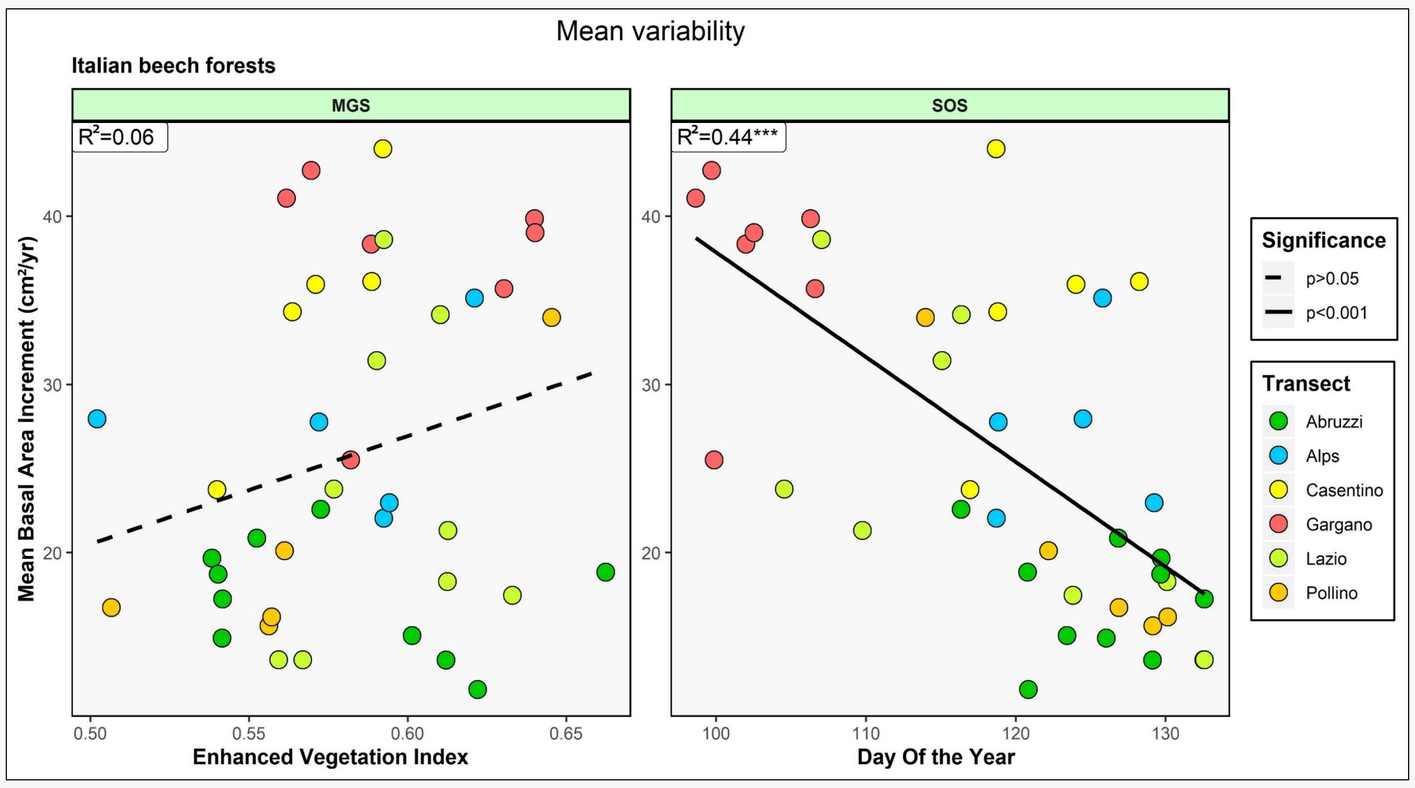


- Connected to **gross** primary production.
- Relatively **short time series** (less than 50 years).
- **Large spatial coverage** and near-real time data.
- Free data available.

- Have been combined **mostly for boreal ecosystems** and **less in other areas sensible to climate change**.
- Intensive use of raw or cumulative **NDVI, at coarse spatial resolution (>1km)**.




Calculation of MODIS 250m **EVI** derived **phenological metrics** and comparison with radial growth measure (**BAI**: Basal Area Increment) of **41 beech forests** along the Italian peninsula for the period **2000-2009**.




## Mean Variability

Metrics were split in two groups according to PCA results:

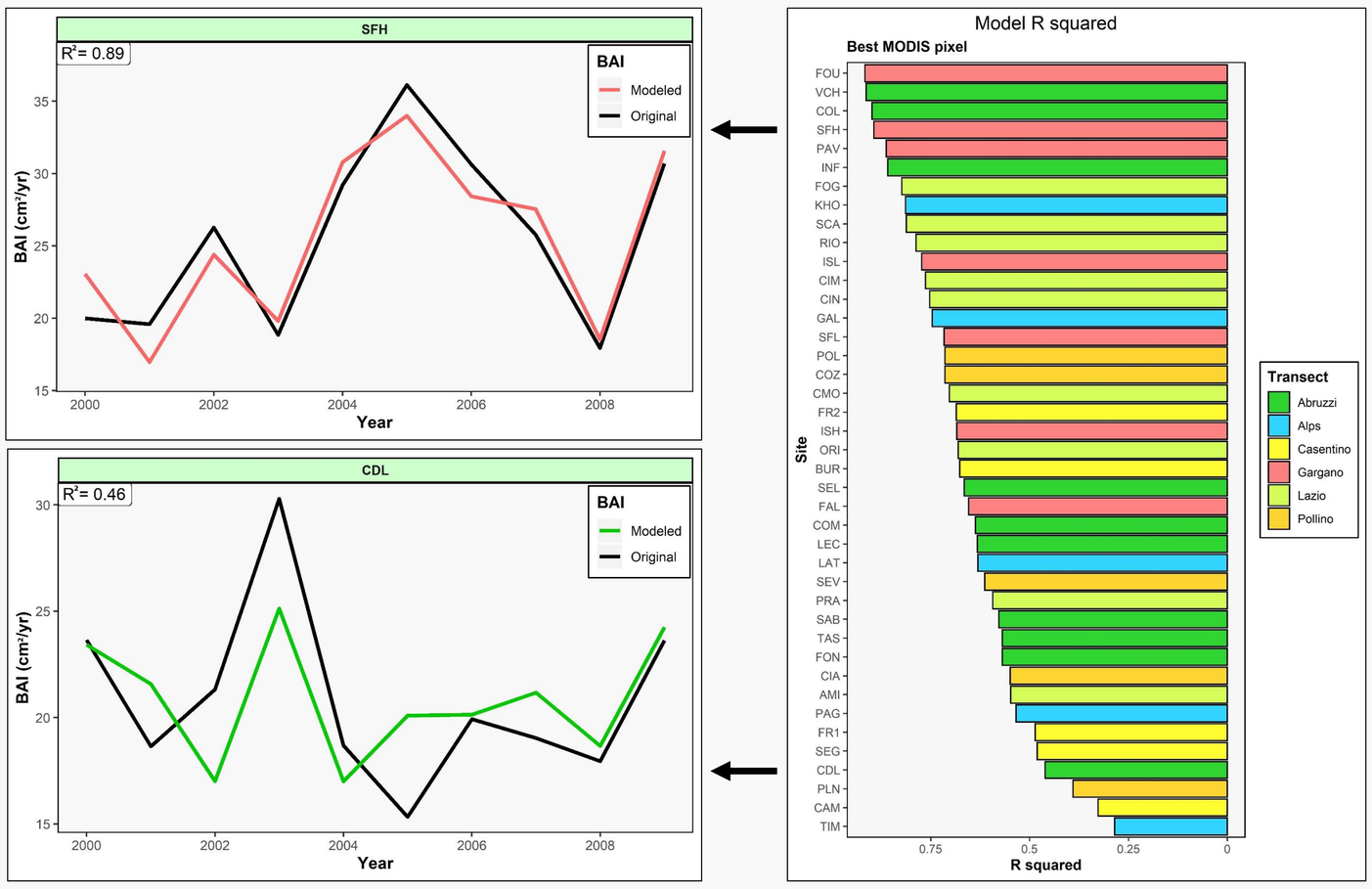
- Metrics connected to the EVI values (**VALUE group**), which are not related to the mean BAI.
- Metrics connected to the day of the year **(DOY group**), which were significantly related with the mean BAI.

**Metrics calculated and their relations with the mean BAI.**

| METRIC ACRONYM | METRIC NAME | $R^2$ |
|---|---|---|
| **SOS** | Start Of the growing Season | 0.44 |
| **EOS** | End Of the growing Season | 0.25 |
| **LOS** | Length Of the growing Season | 0.41 |
| **POP** | Position Of Peak value | 0.39 |
| **MGS** | Mean Growing Season value | 0.06 |
| **PEAK** | Peak value | 0 |
| **MSA** | Mean threshold value | 0.07 |

## Inter-annual variability – growth modelling

Annual growth is modeled with good accuracy for most of the sites using the best correlated metric of each group.
The few sites with low $R^2$ are have a complex forest structure. Comparing the frequency of the significant predictors, DOY metrics are significant at low and high altitude more times than VALUE metrics and less times at mid altitude.




## CONCLUSIONS

These preliminary results are promising considering the increase of the common time span between remotely sensed and dendrochronological data. These data could provide near-real time information about tree growth over large areas, useful for forest monitoring in a climate change perspective.

**REFERENCES**

L. T. Berner, P. S. A. Beck, A. G. Bunn, A. H. Lloyd, and S. J. Goetz (2011) High-latitude tree growth and satellite vegetation indices: Correlations and trends in Russia and Canada (1982-2008). J. Geophys. Res. Biogeosciences, vol. 116, no. 1, pp. 1–13.

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