



Monitoring the invasion of an exotic tree (*Ailanthus altissima*) (Mill.) Swingle with Landsat satellite time series imagery in urban forest

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Introduction

Biological invasions have become one of the main components of global change over the past 50 years and have adversely affected ecosystem functioning and biodiversity.

In the Mediterranean area, one of the most threat tree to various ecosystems is *Ailanthus altissima*. This is an aggressive invasive species common in natural and semi-natural habitat.

The *Ailanthus altissima* is a winter deciduous tree, native to the Moluccas, North of Vietnam and China. The seasonal vegetation period starts later and lasts longer than in many other native deciduous tree species. Leaf emergence occurs around April, while flowering starts in mid-April to July. Samaras' ripening lasts until September/October while their releasing occurs in early to middle of the following year (Kowarik and Saümel, 2007). After about 250 years of repeated introductions to all continents, the species has greatly increased its distribution area, naturalizing especially in the temperate area. The *Ailanthus* is present in Sicily since last two centuries (Badalamenti et al., 2012).

Monitoring and mapping of invasive species is an important information for the conservation and management of ecosystems. The study of distribution and diffusion of invasive species are useful to assess their environmental impacts, formulate effective control strategies, and forecast potential spread. Remote sensing is a tool that provides viable methods to map invasive plants and monitor vegetation dynamics across broad geographic extents. Landsat TM images with 30m resolution have been extensively used for ecosystem monitoring, and the almost 40-year-long record of Landsat imagery provides a rich dataset that can be helpful for mapping *A. altissima*. Whereas the SPOT-5 image with a higher spatial resolution (10 m) was used to map the distribution of specie.

Objective

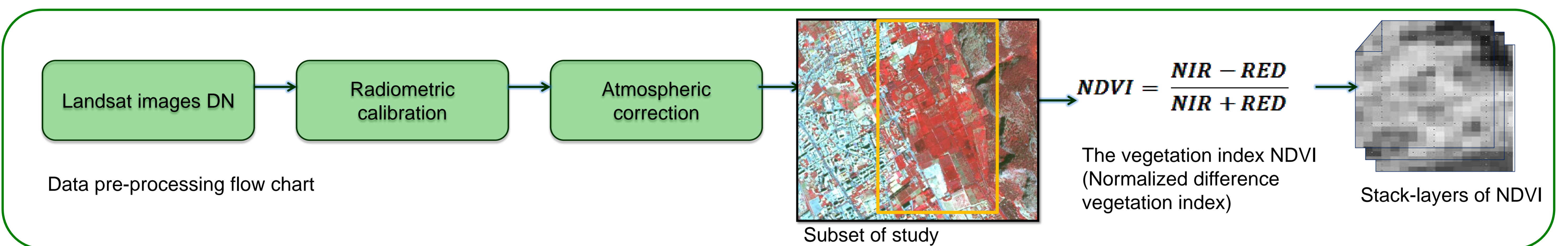
Examine the feasibility of mapping the expansion of *A. altissima* using remote sensing techniques in a highly complex urban forest setting.

We used both Landsat and SPOT 5 images in this study to delineate the expansion and map the distribution of *A. altissima*.

Methodology

Landsat images were freely downloaded from USGS website (<http://earthexplorer.usgs.gov/>) (scene path 189/row 33, from 1987 to 2014 characterizing the 4 seasons).

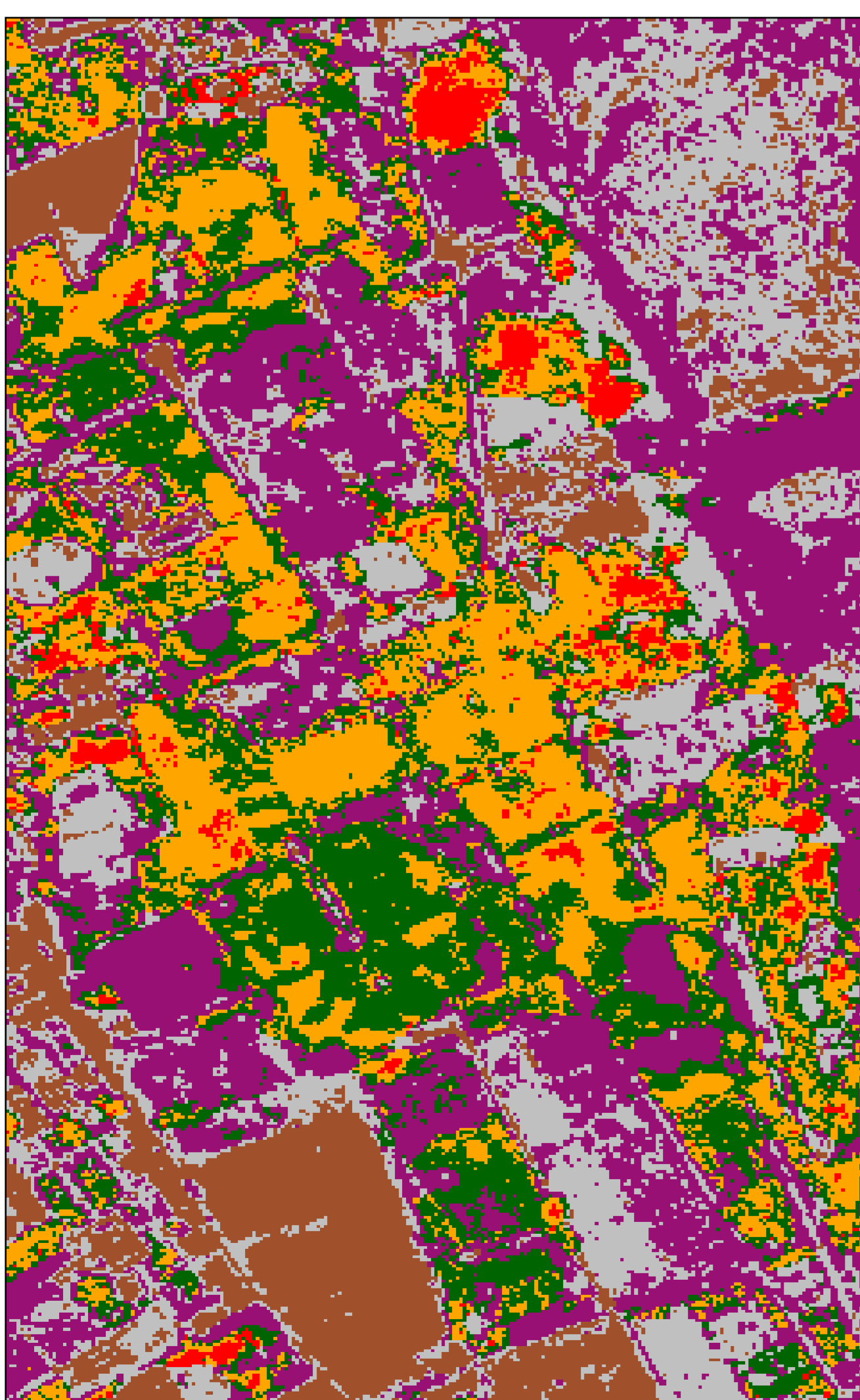
The peak of the growing season of *A. altissima* was summer to autumn. The selected images were acquired in almost cloud-free conditions. We pre-processed the images Landsat following the flow chart reported below. In order to detect the distribution of ailanthus, we conducted a pixel-based supervised classification of the SPOT-5 image (image acquired in the 27/08/2005).



Preliminary results and discussion

The study is a first attempt to evaluate the distribution of invasive specie with remote sensing in Sicily. The image from Landsat satellite are insufficient for detailed and accurate maps of invasive species spread, because of the relatively low resolution, but that allow to improve the information of spectral behavior of this specie. medium resolution data are advantageous for utilizing phenological differences between invasive/native species for detection purposes given their more frequent temporal coverage, in addition to its wide availability.

These results provide a basis for more detailed investigations on invasive species and the possibility to increase the spatial resolution with the new platforms might lead to further improvements plant species identification and their distribution patterns recognition and to solve this limitation.



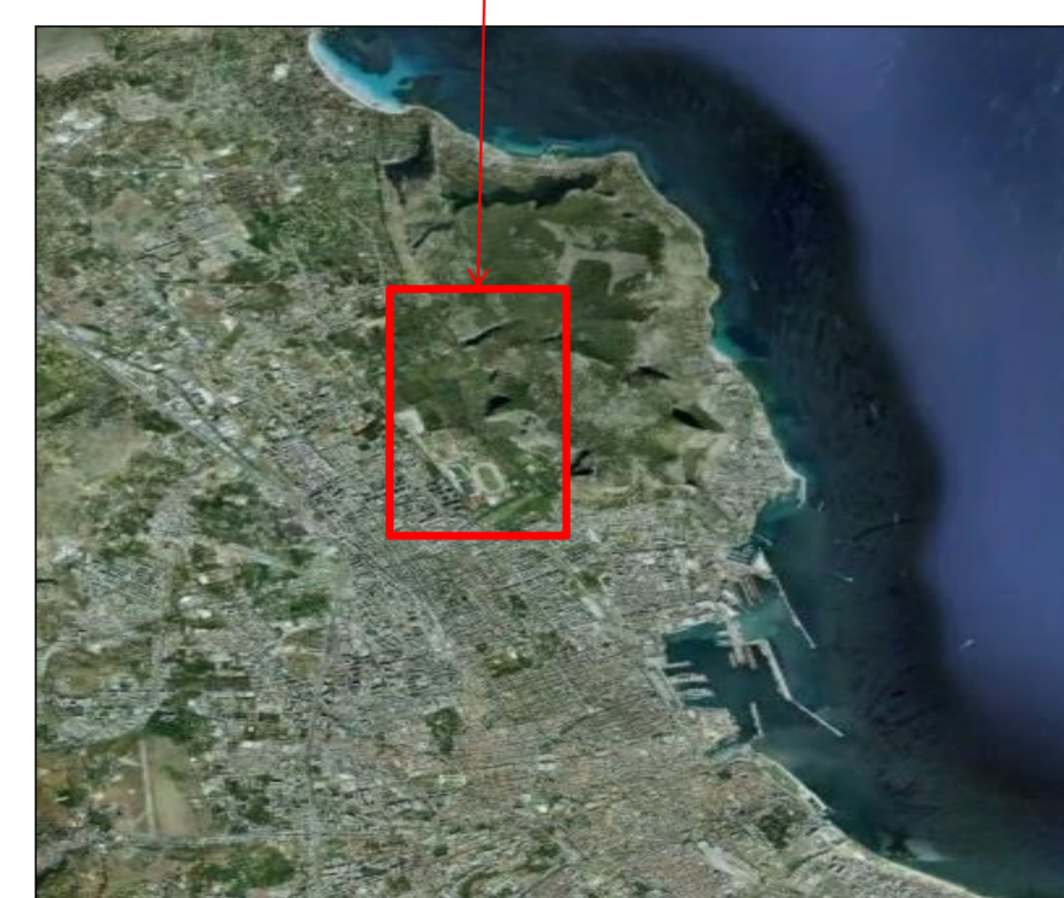
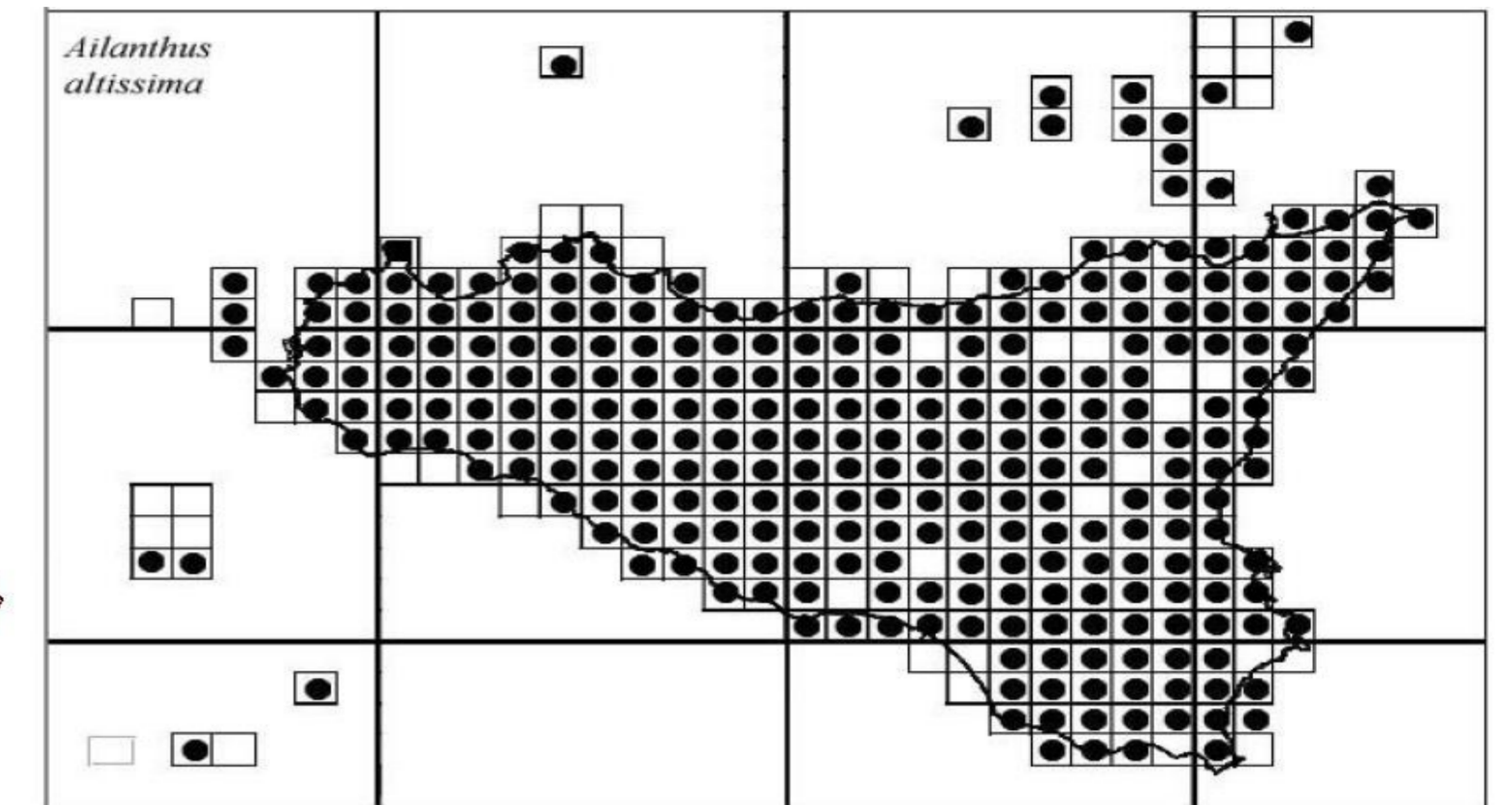
Distribution of different species based on a supervised classification of 10m SPOT 5 image. In red we show the *A. altissima*

References

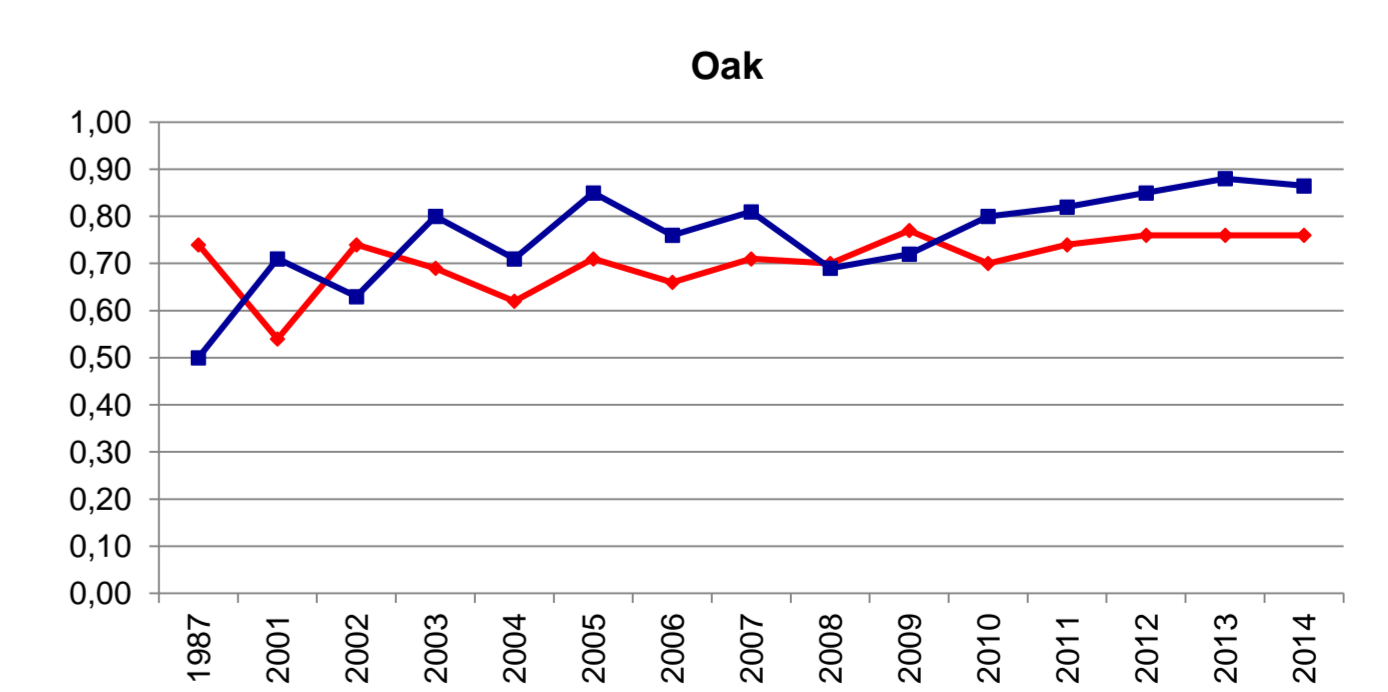
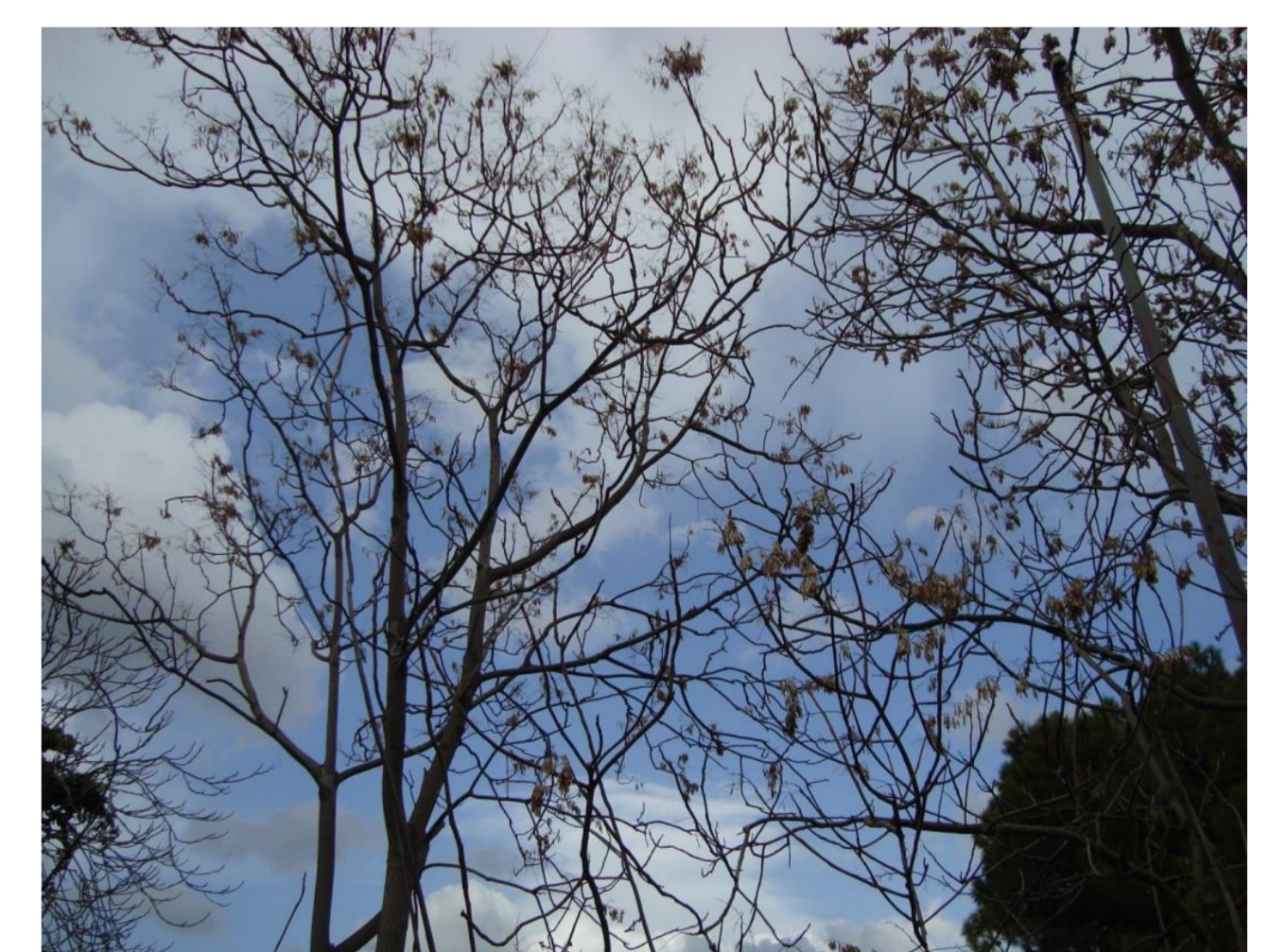
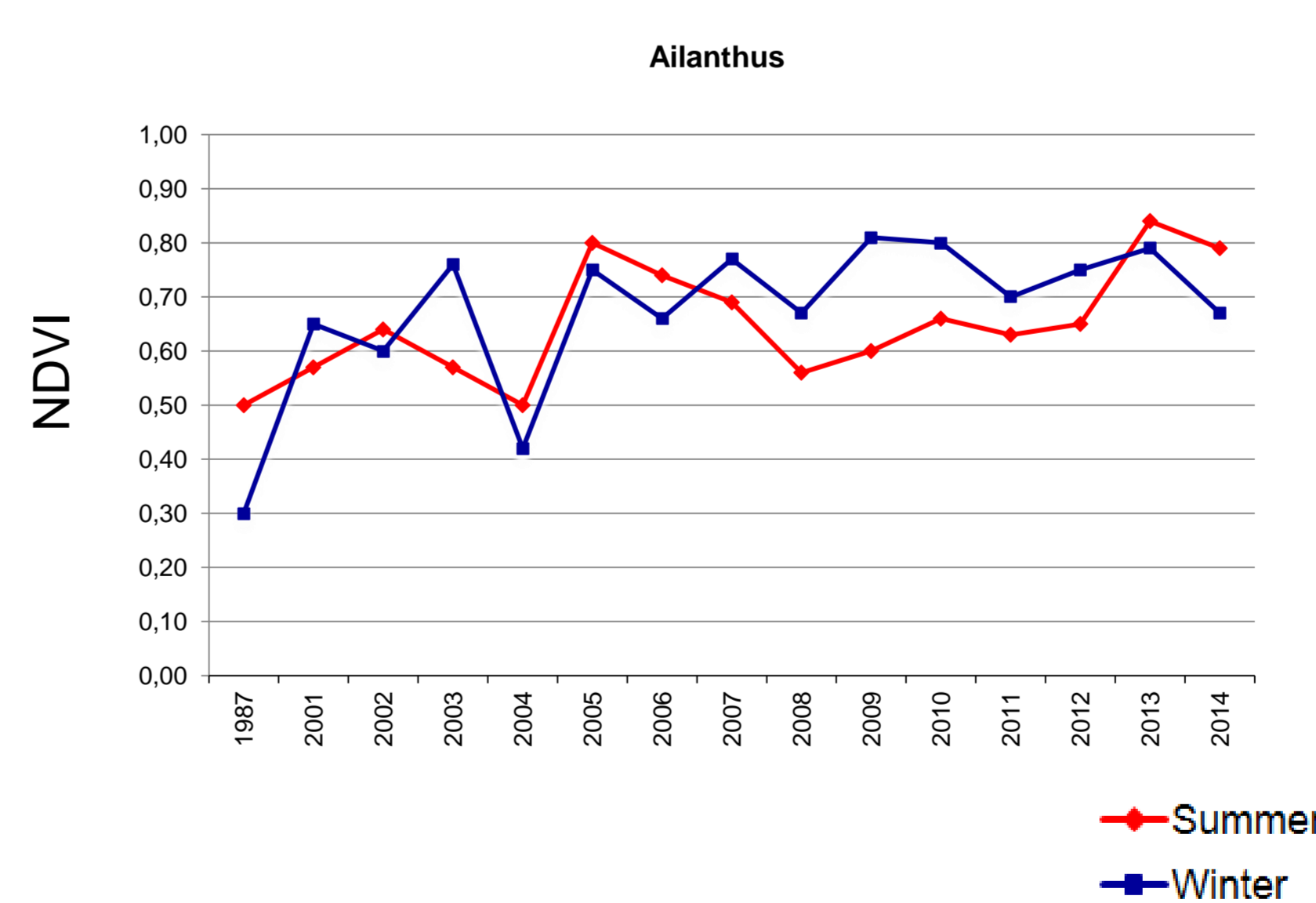
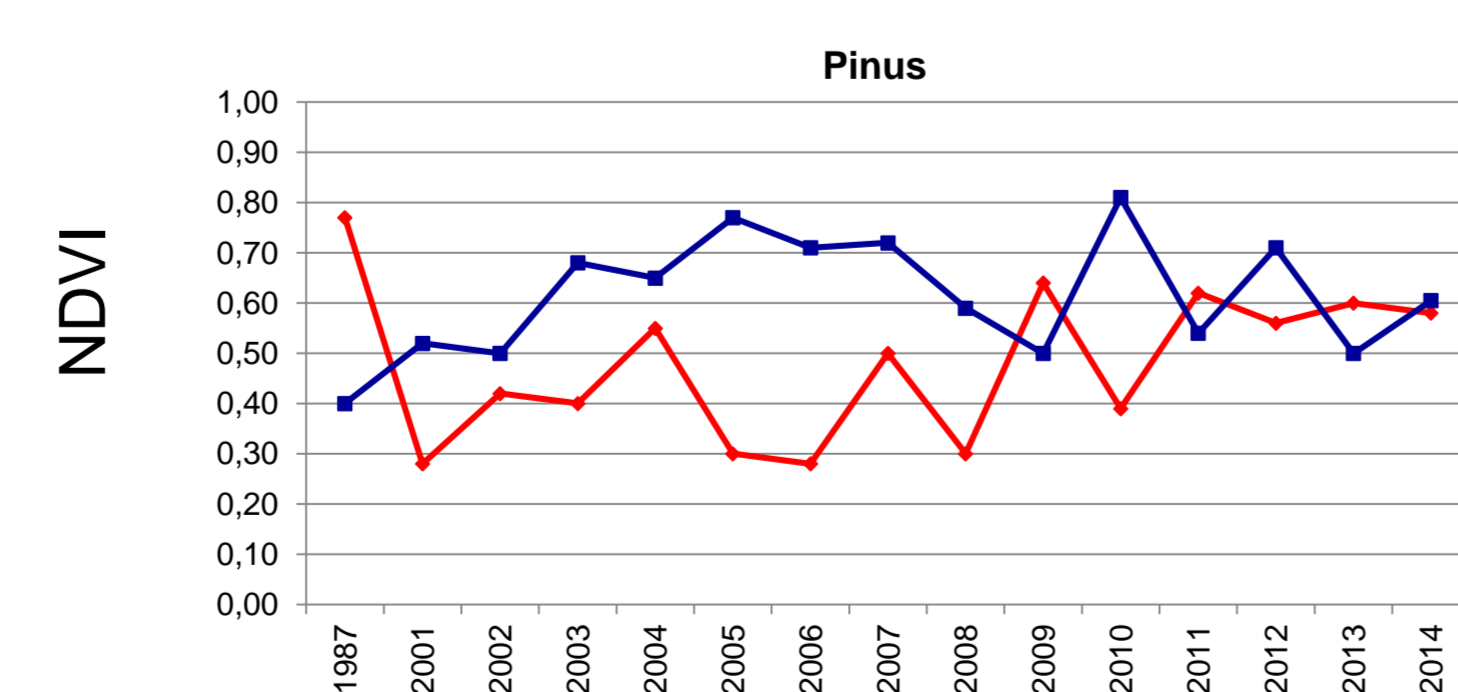
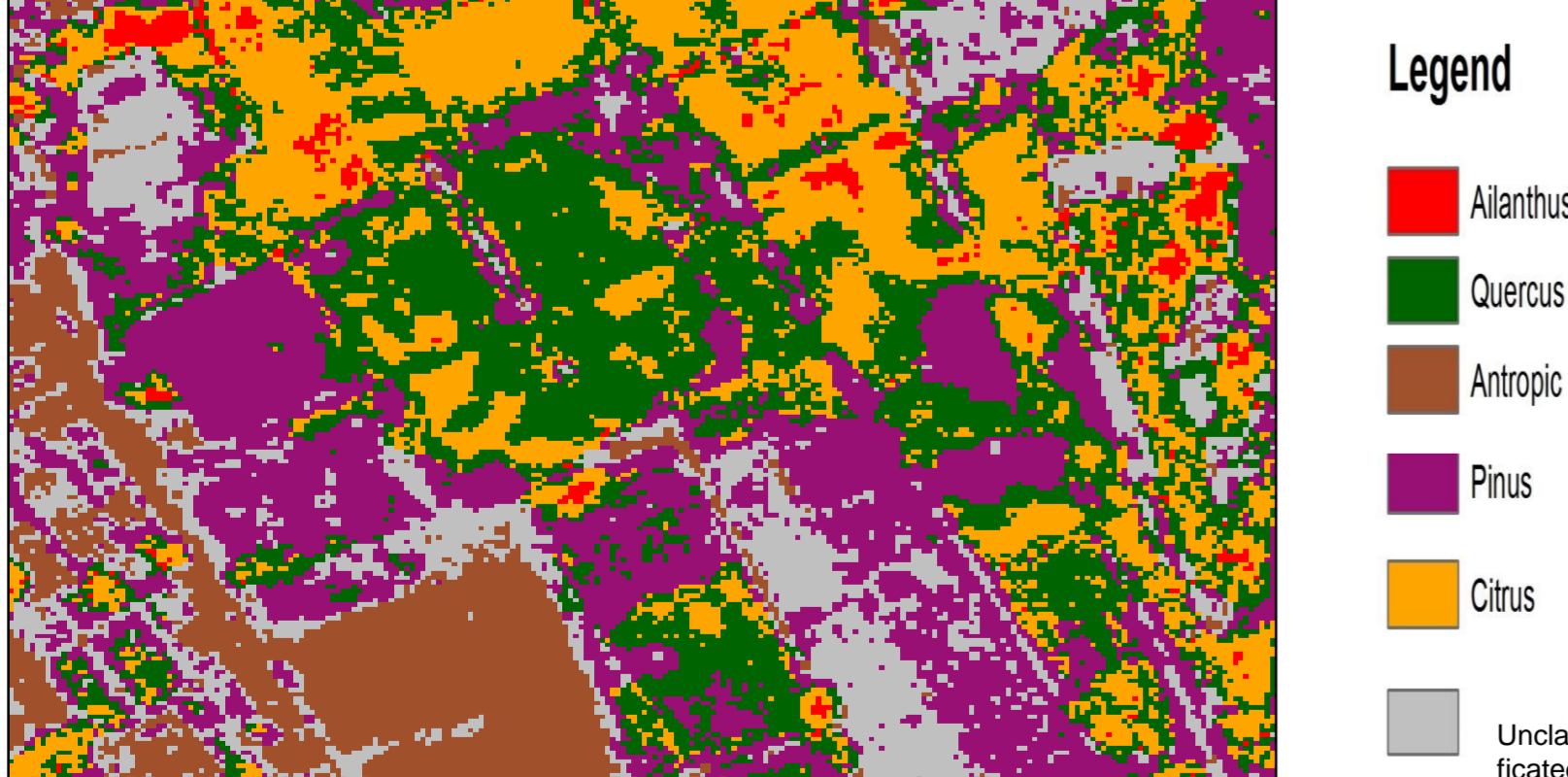
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Study area

The study area is located in the Favorita Park. This park, between Monte Pellegrino and the city of Palermo, is about 300 ha wide and belongs to the zone B of Monte Pellegrino Natural Reserve. This park give hospitality to some scattered relics of semi-natural vegetation. while other surface are still occupied by crop and gardens.



The image in the top show the distribution of *Ailanthus altissima* in all regions of Italy (Celesti-Grapow et al., 2010), in the left we have the distribution in Sicily (Badalamenti et al., 2012).



This graphics show the temporal variation of NDVI for different season in different type of vegetation (*Pinus halepensis*, *Citrus reticulata*, *Quercus ilex*) growing in Favorita park. The *A. altissima* shows an increasing of index along this period. The NDVI is no much different in two season (summer and spring). Other species have different behavior because there are evergreen plant.