Land cover and land cover change detection at national scale: An example from Greece

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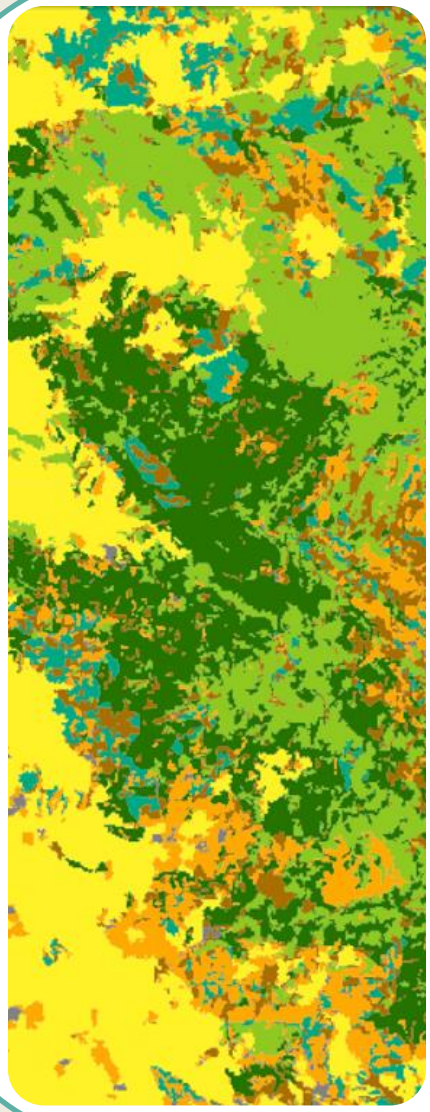
Prague, 18 June 2013

motivation



- ✓ *Mapping and monitoring land cover is the **basis** for the identification and assessment of the human imposed stresses to the natural environment*
- ✓ ***Lack of** reliable land cover **spatial** information*
- ✓ *Available data often remain **scattered and inaccessible**, hindering the process of land cover mapping*
- ✓ *Availability of **modern** computational **methods** and reliable means of mapping and spatial analysis, such as Remote Sensing, GEOBIA and Geographic Information Systems (GIS)*
- ✓ *Opportunity to produce an **independent** land cover product.*

idea

rationale

The creation of up to date maps to support sound decision-making for:

- ✓ *planning,*
- ✓ *developing, and*
- ✓ *coordinating actions related to the protection of forests and the environment in general.*

objectives

Land cover mapping and Land cover change detection:

- ✓ *national land cover map of **2007**, and further spatial analysis per region and elevation zone*
- ✓ *national land cover map of **1987** , and further spatial analysis*
- ✓ *national land cover change **between 1987 and 2007** map , and further spatial analysis*
- ✓ *Focus on protected areas*

presentation outline

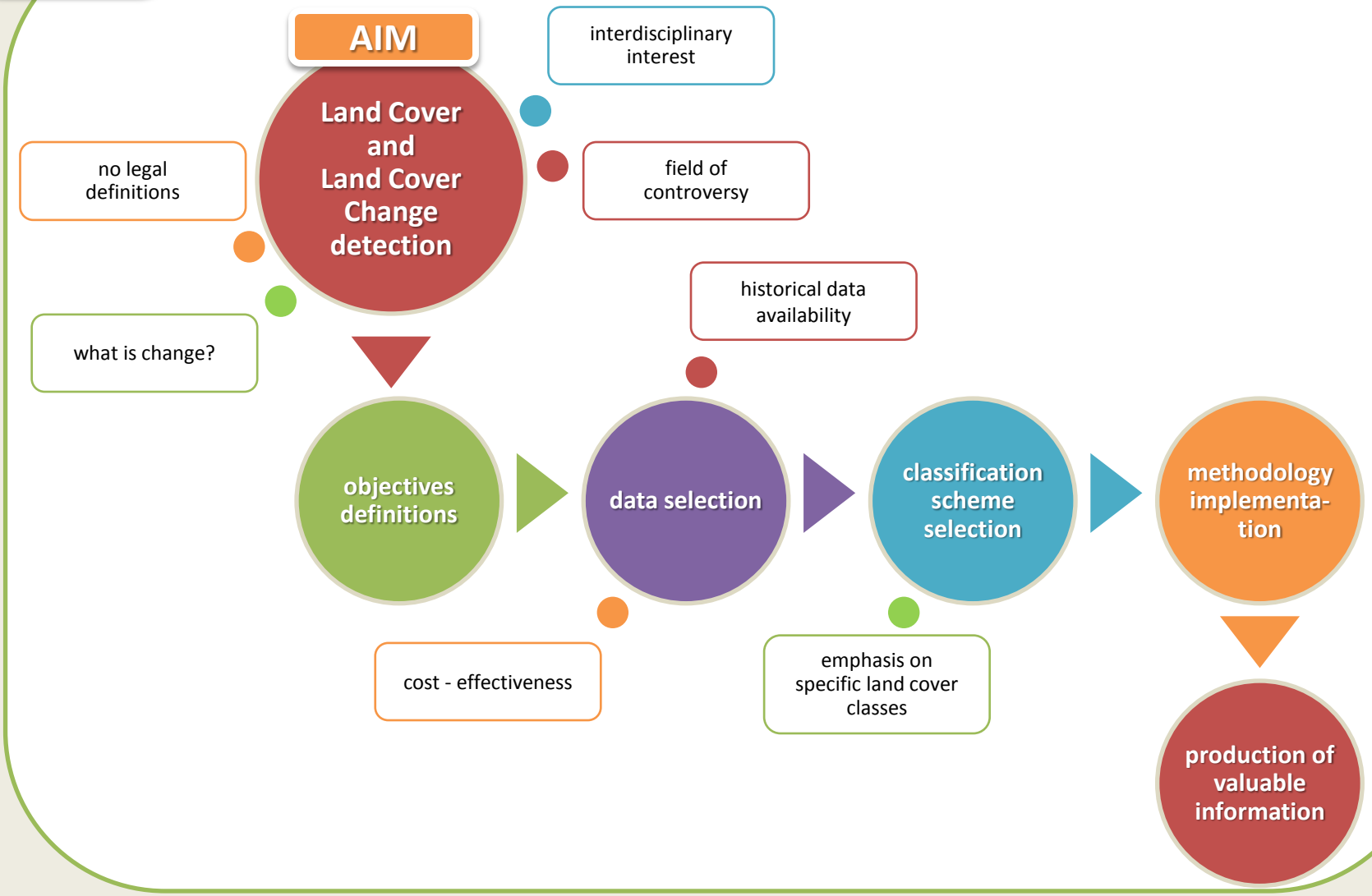
DEVELOPMENT

METHODOLOGY

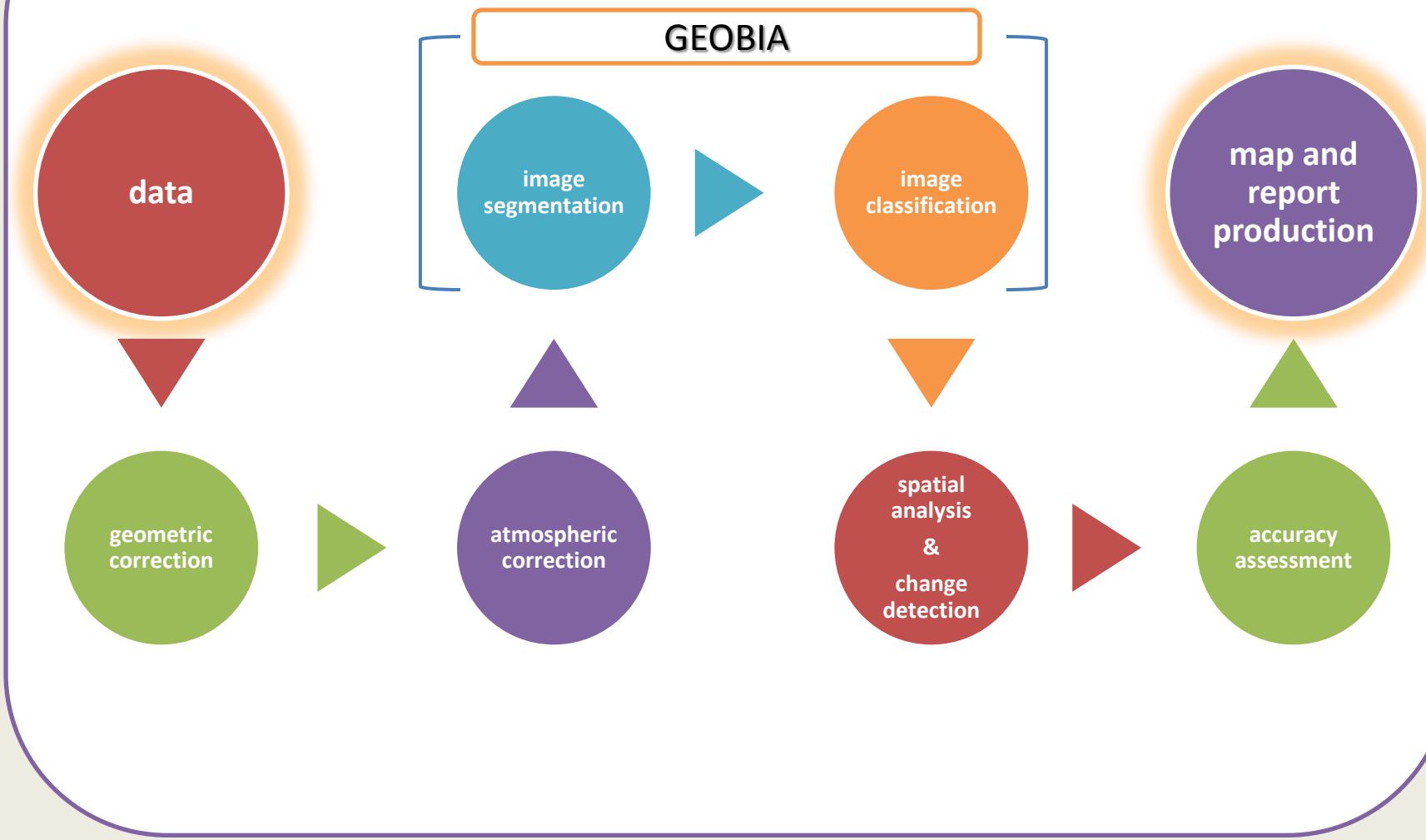
PRODUCTS

CONCLUSIONS

development



methodology



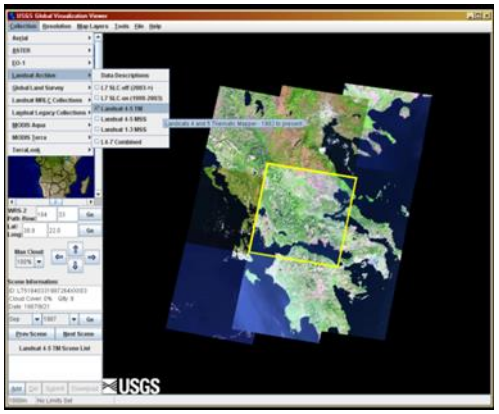
methodology

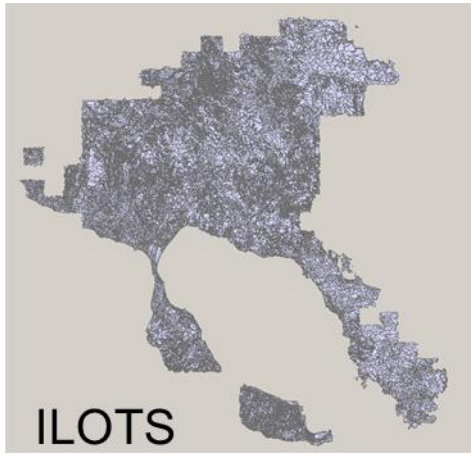
data

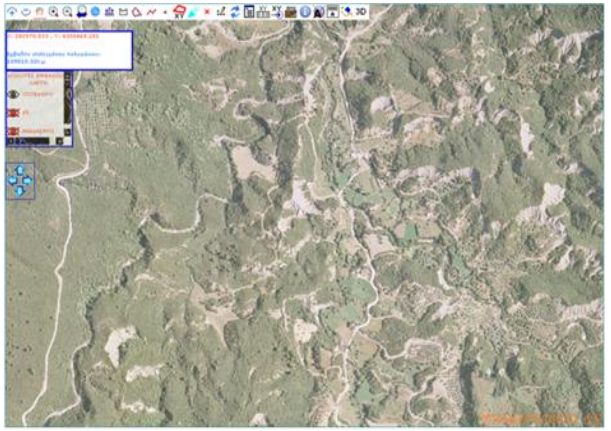
- LANDSAT TM satellite imagery & KTHMATOLOGIO aerial-photos
- A 28m Digital Elevation Model
- CORINE LAND COVER map (1990 & 2000) & LPIS (2007)
- administrative and environmental boundaries
- 1.376 reference data from field survey (WWF team & volunteers)
- LUCAS reference data

methodology

data



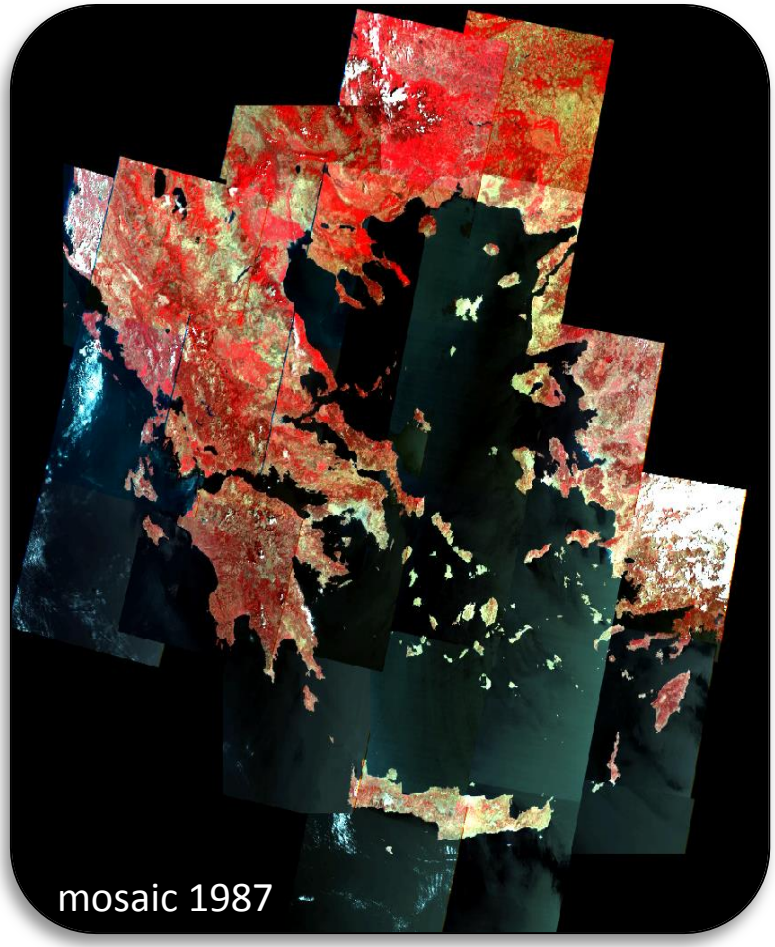


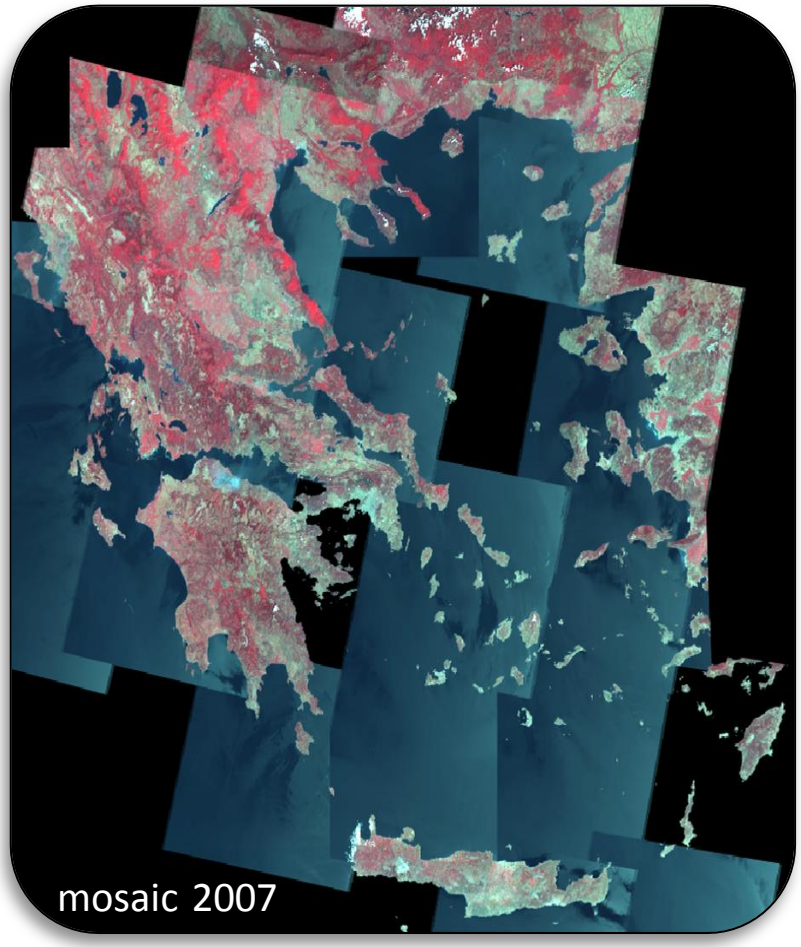


methodology

geometric & atmospheric correction

27 images for each reference year





methodology

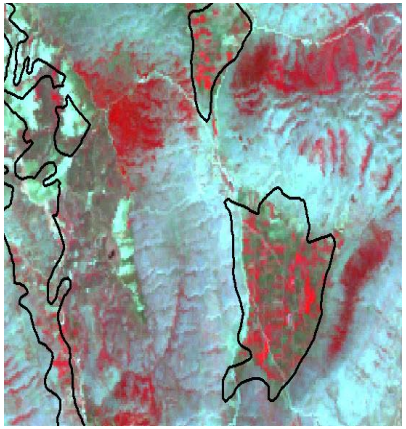
GEOBIA - segmentation

1st level: agricultural / non agricultural

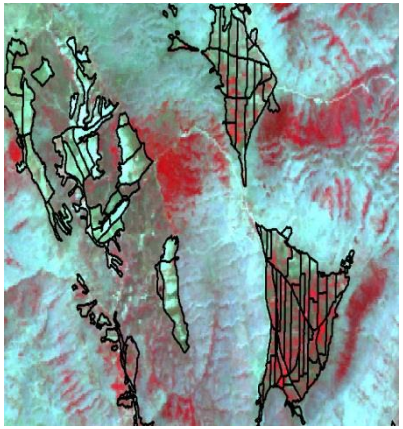
CLC for wetlands and agricultural - LPIS for agricultural

2nd level: remaining land cover classes

homogeneity criteria



CORINE 2000



LPIS - ILOTS 2007

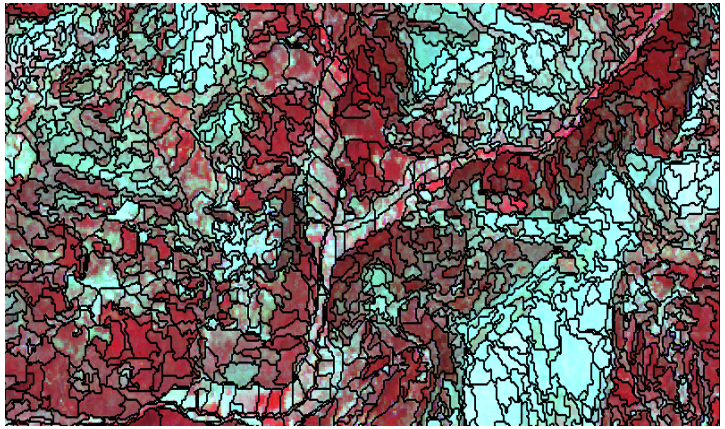


image objects

methodology

GEOBIA - Land Cover classification

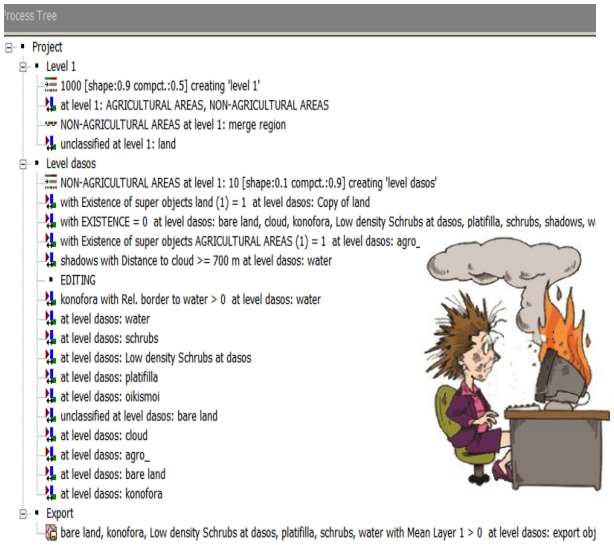
Land Cover classification scheme

- conifer forest
- broadleaved forest
- maquis
- shrubland
- low vegetation
- agricultural land
- bare land (exposed ground, settlements, snow)
- burned areas
- water bodies

GEOBIA – classification model

- **1** *object based classification model*

- *tuned based on field data and applied* **102** *times*

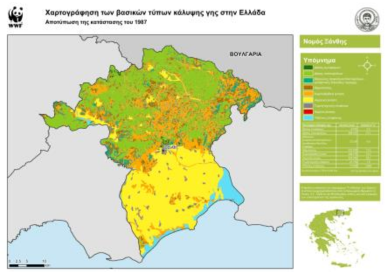


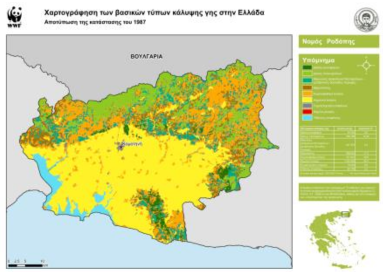
methodology

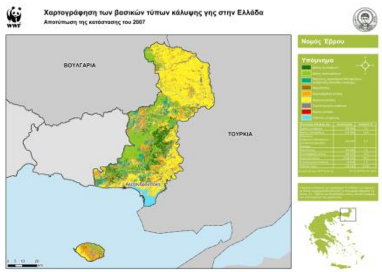
spatial analysis

basic analysis:

county/prefecture level

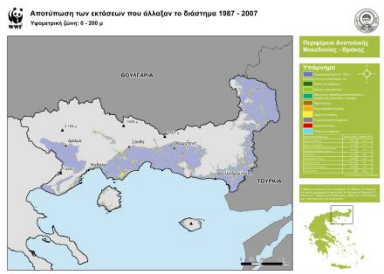


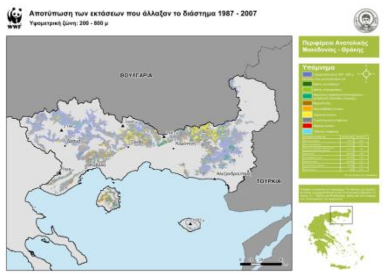


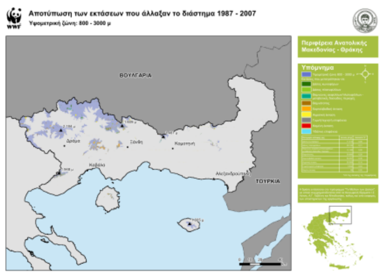


stratified by terrain elevation zone (3 CLASSES – 0-200m, 200-800m, >800m):

region level

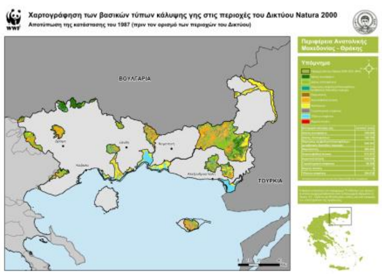






areas under national and international environmental protection regimes:

protected area level



methodology

change detection and spatial analysis

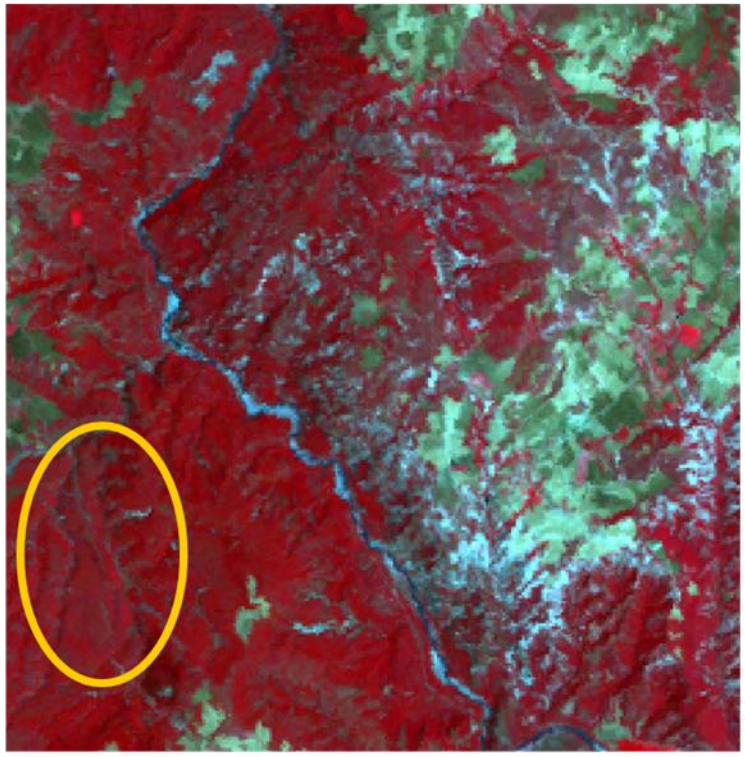
- map difference
- in all 3 levels
- investigation of specific trends

		trend
forest	other	deforestation
forest	low vegetation	forest degradation
other	forest	afforestation
agricultural	other	agricultural land abandonment
other	agricultural	agricultural land expansion
other	bare	desertification

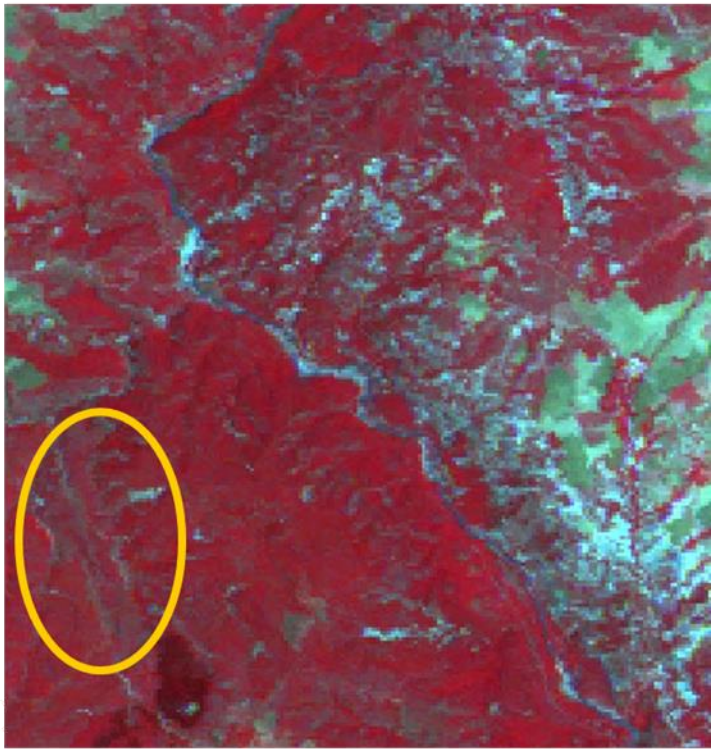
methodology

Change detection - Problems & difficulties

Differences in image quality



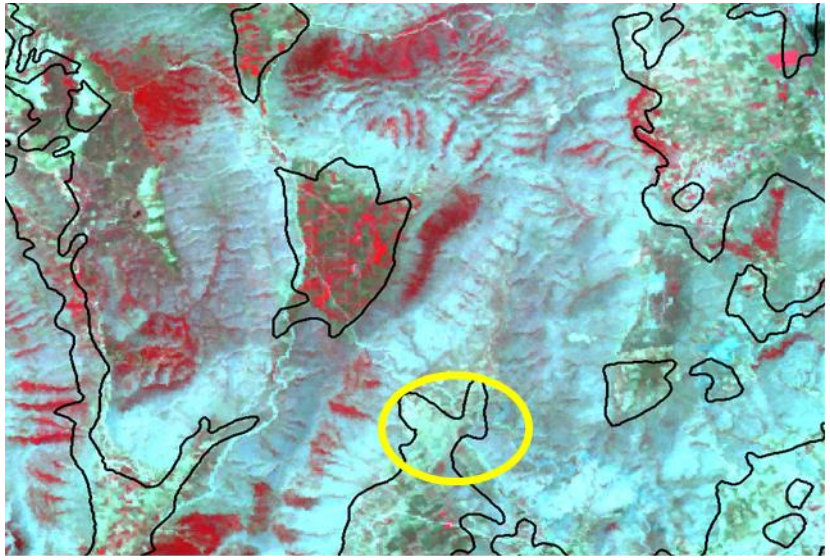
LANDSAT 1987



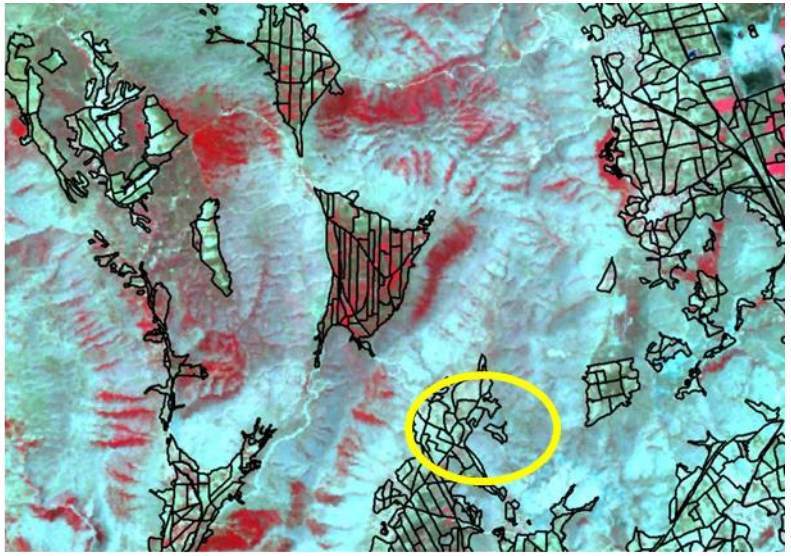
LANDSAT 2007

Problems & difficulties

Differences in the Minimum Mapping Unit and the geometric accuracy of ancillary data



CORINE 1990



ILOTS (2007)

methodology

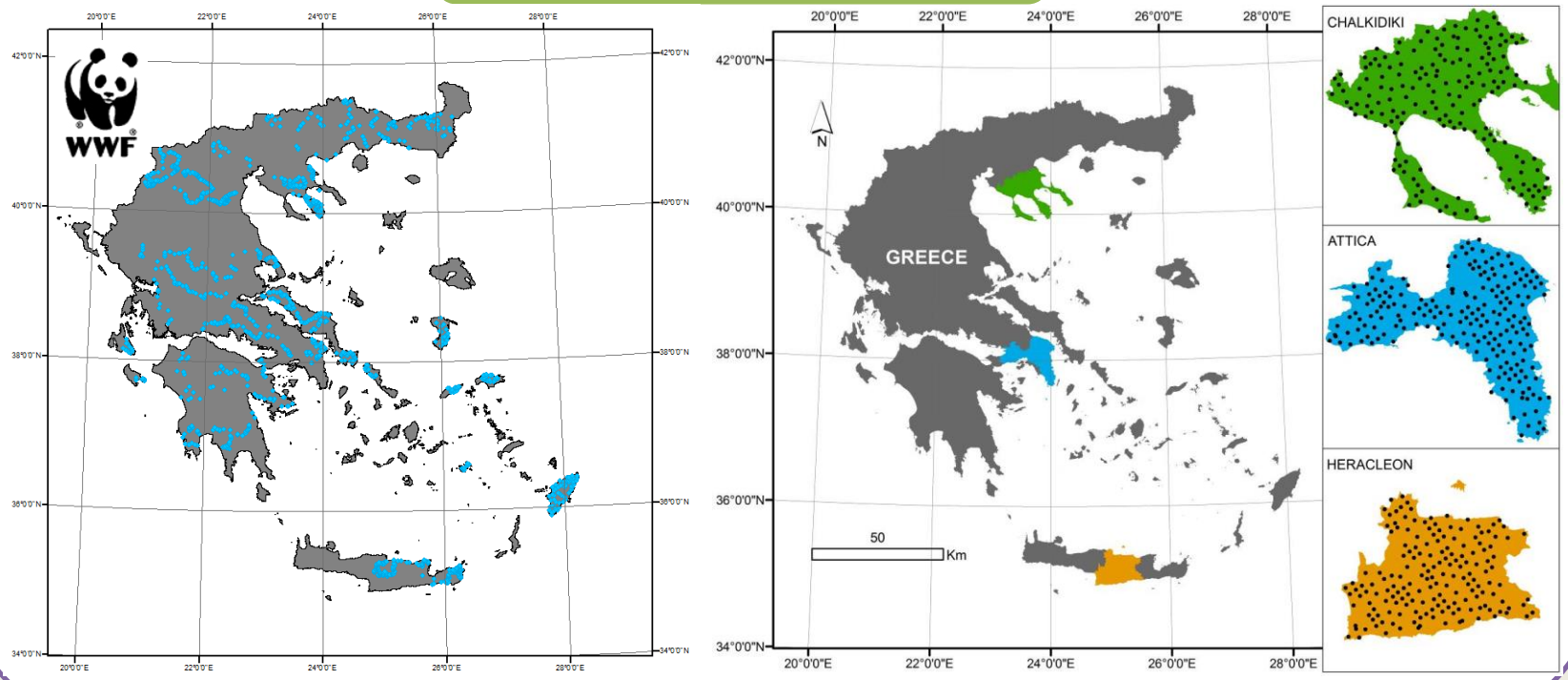
accuracy assessment

reference data

field survey

LUCAS
Land use/cover area frame survey

Overall accuracy between **76%** and **91%**, subject to area and assessment method



methodology

remarks

multi stage processing to accommodate....

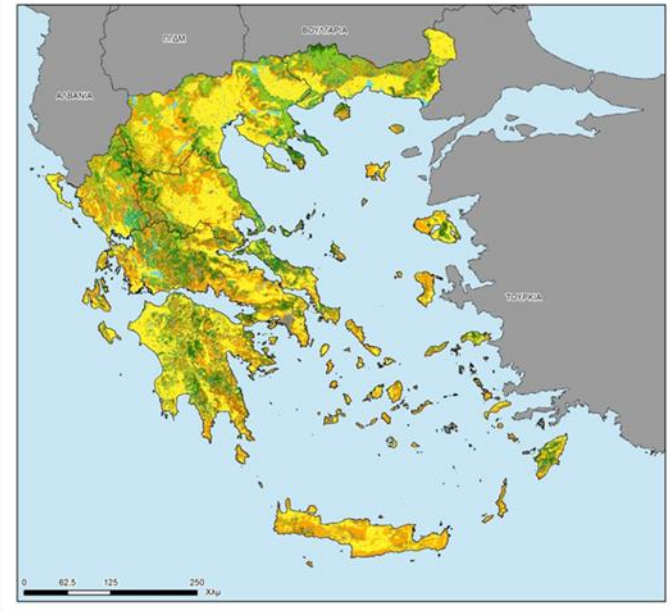
- error identification and correction
- methodological adaptations based on continuously changing collaborator's preferences

and to put up with ...

- incompatibility of base maps
- rapid changes during the course of study (Peloponnese fires)
- conflicts due to interdisciplinary interest
- symbology, cartography, imagination!

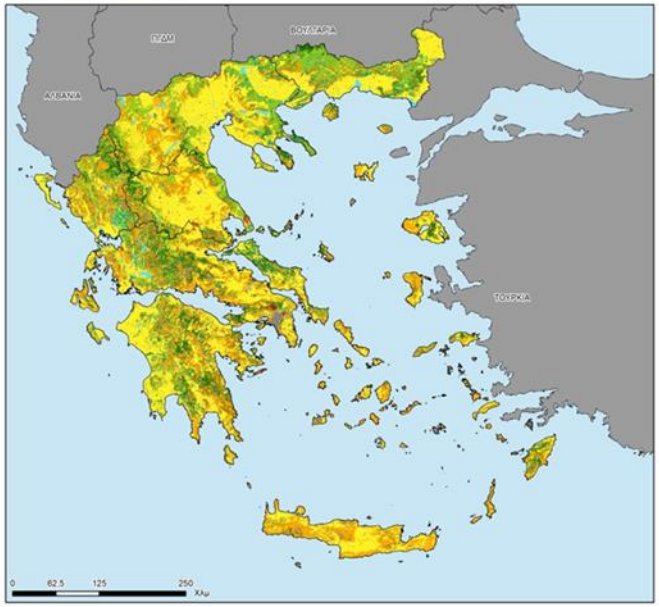
products

National level land cover maps for 1987 & 2007



1987

2007

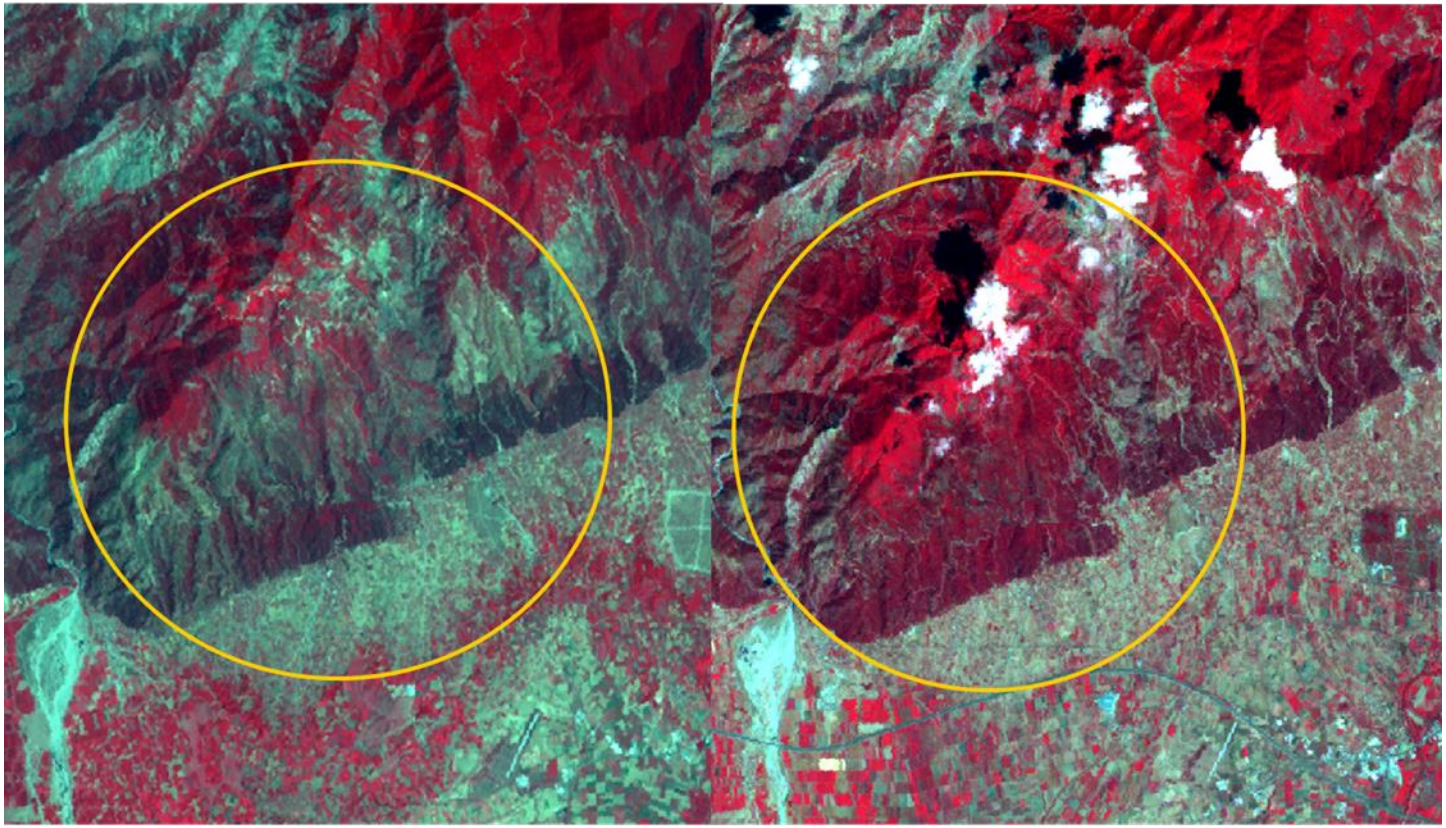


products

Locate areas of change

FMRS

FOREST GROWTH (Rodopi)



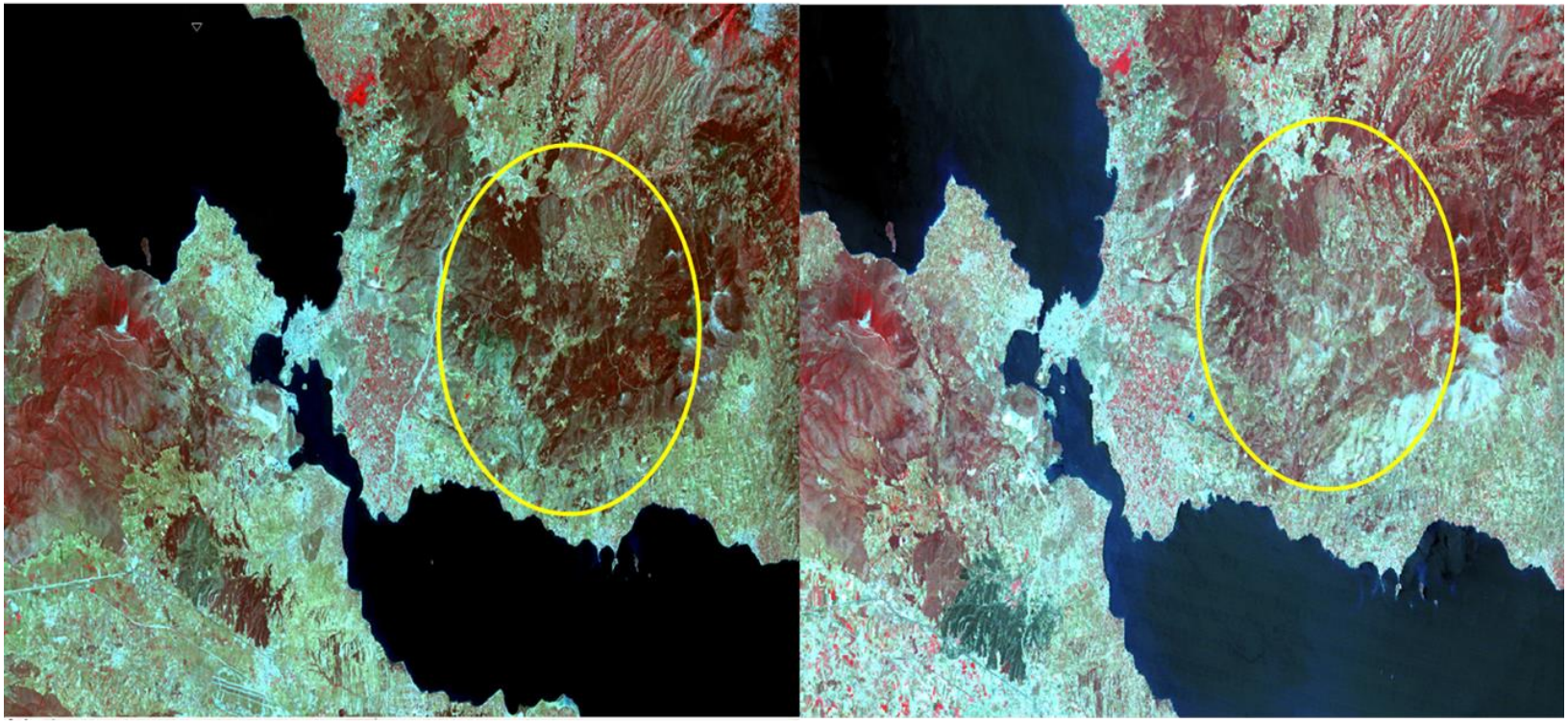
1987 **2007**

products

Locate areas of change (2)

FMRS

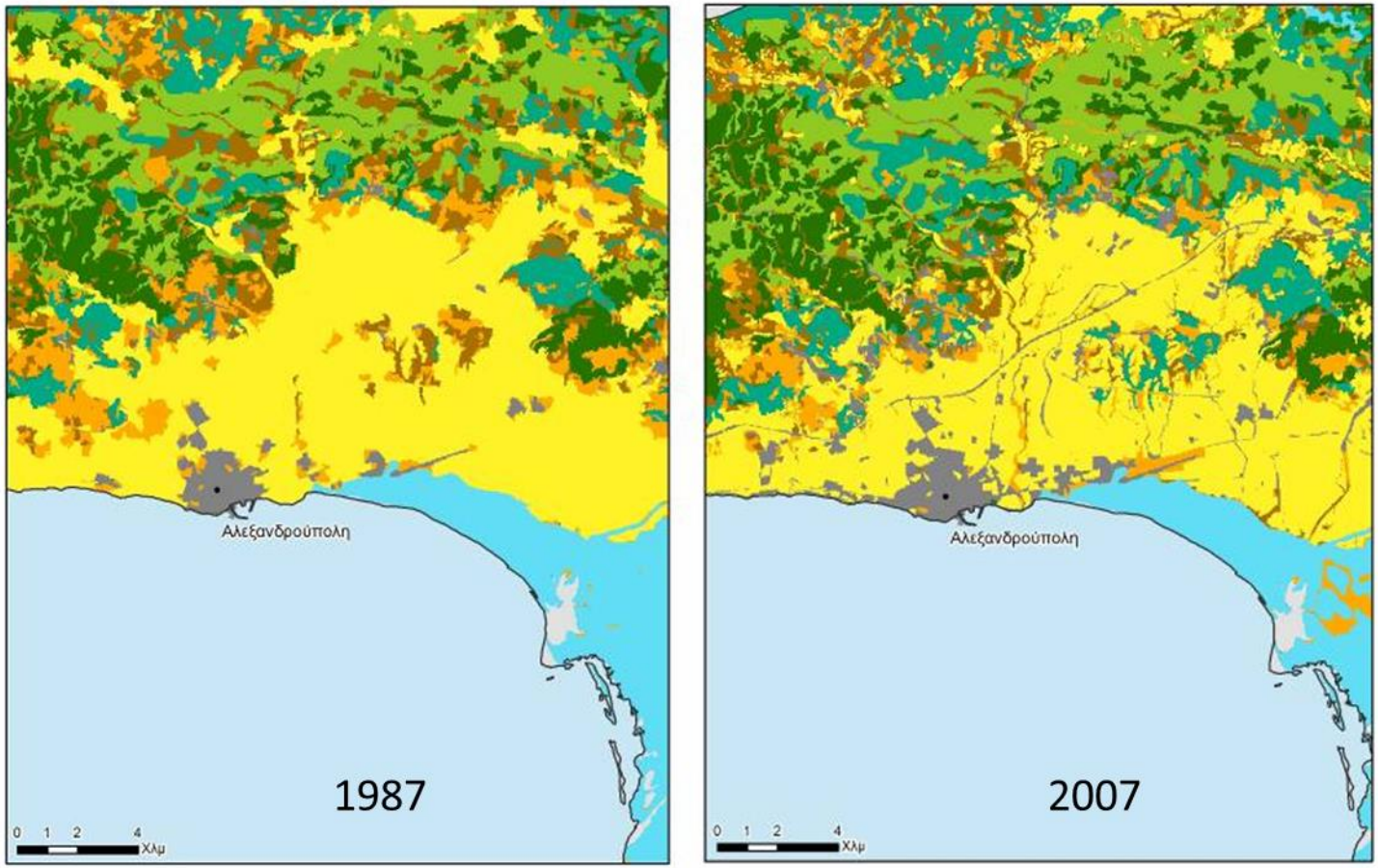
FOREST REDUCTION (Evia)



1987 **2007**

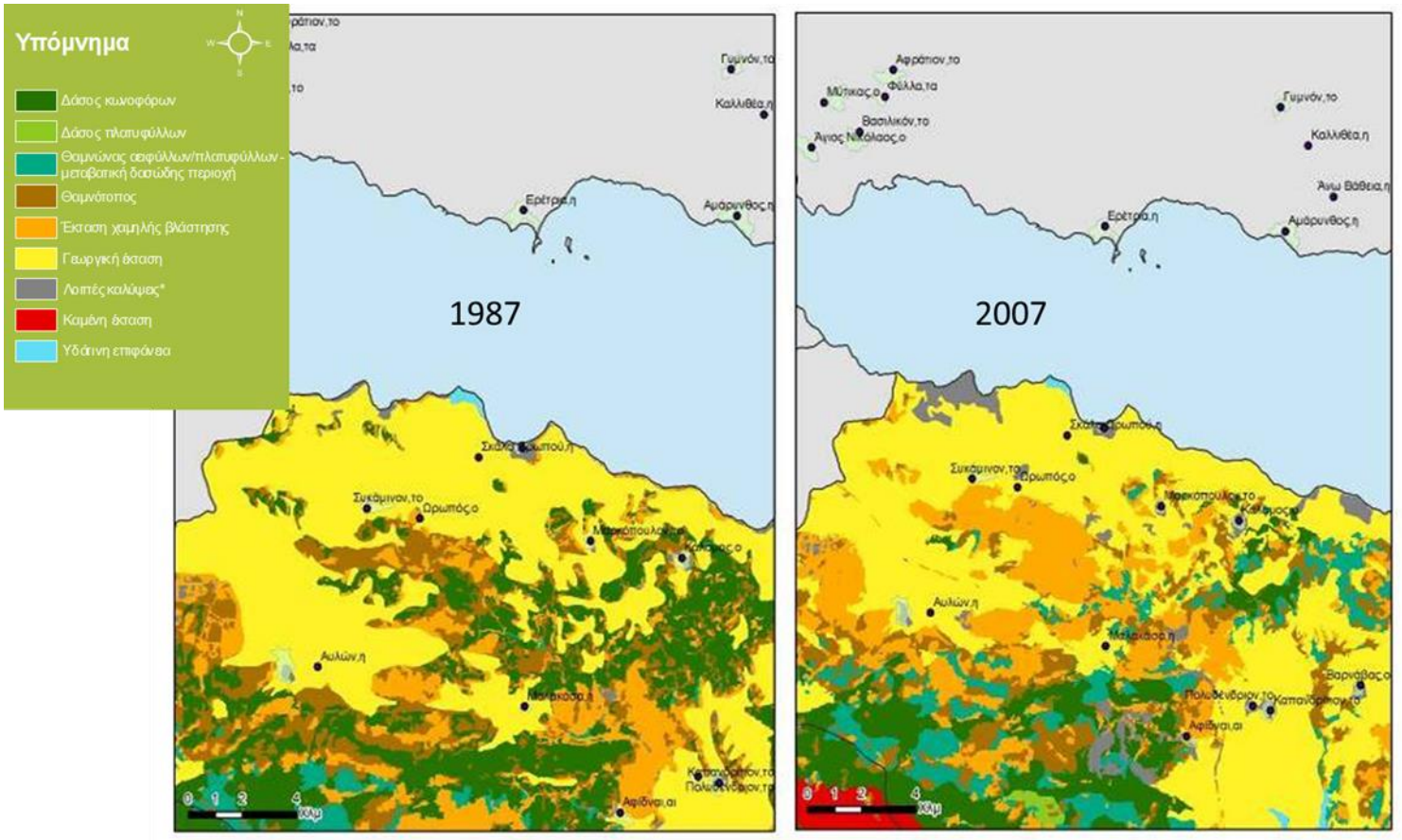
products

Locate areas of change (3)



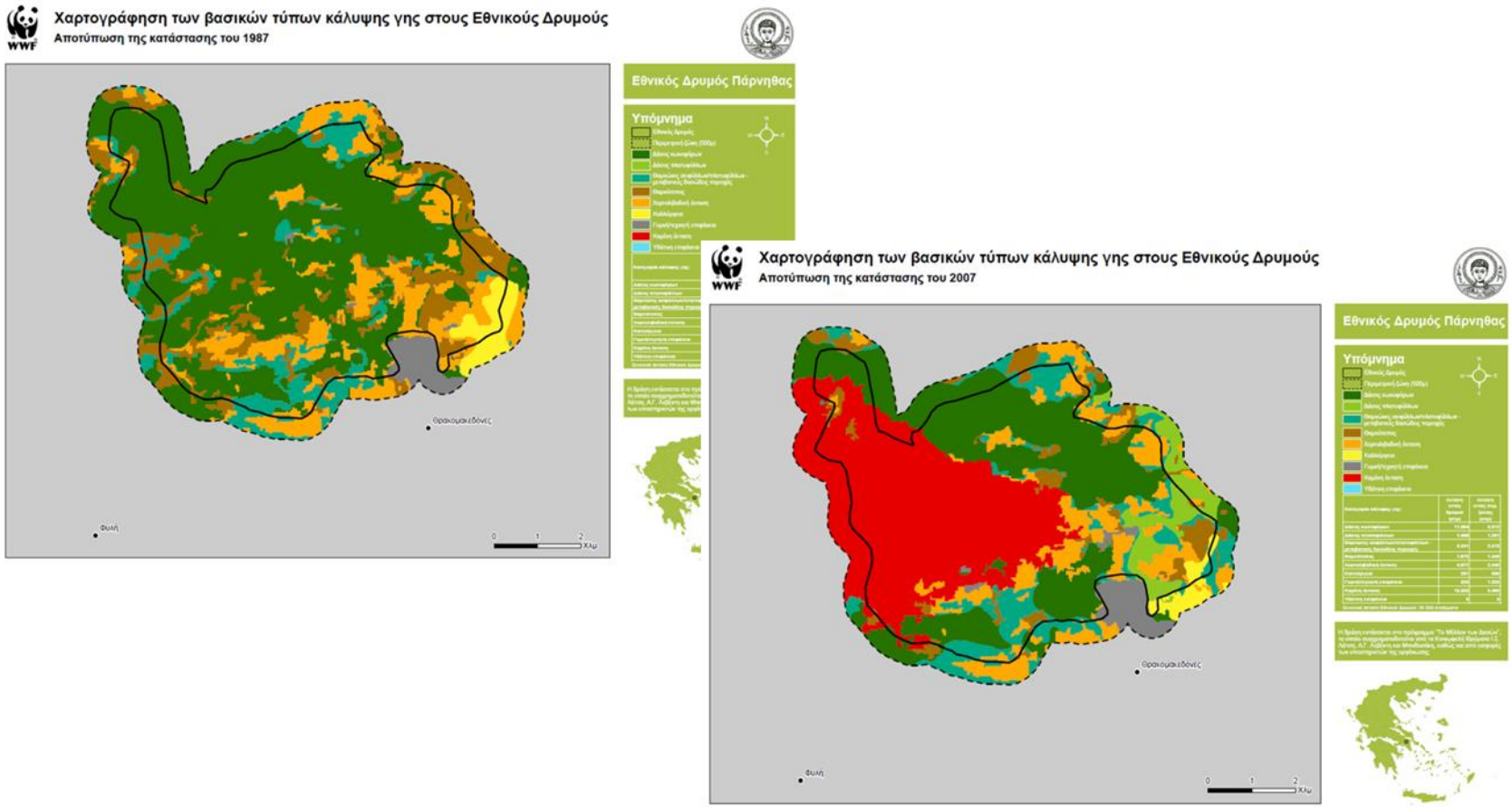
products

Locate areas of change (4)



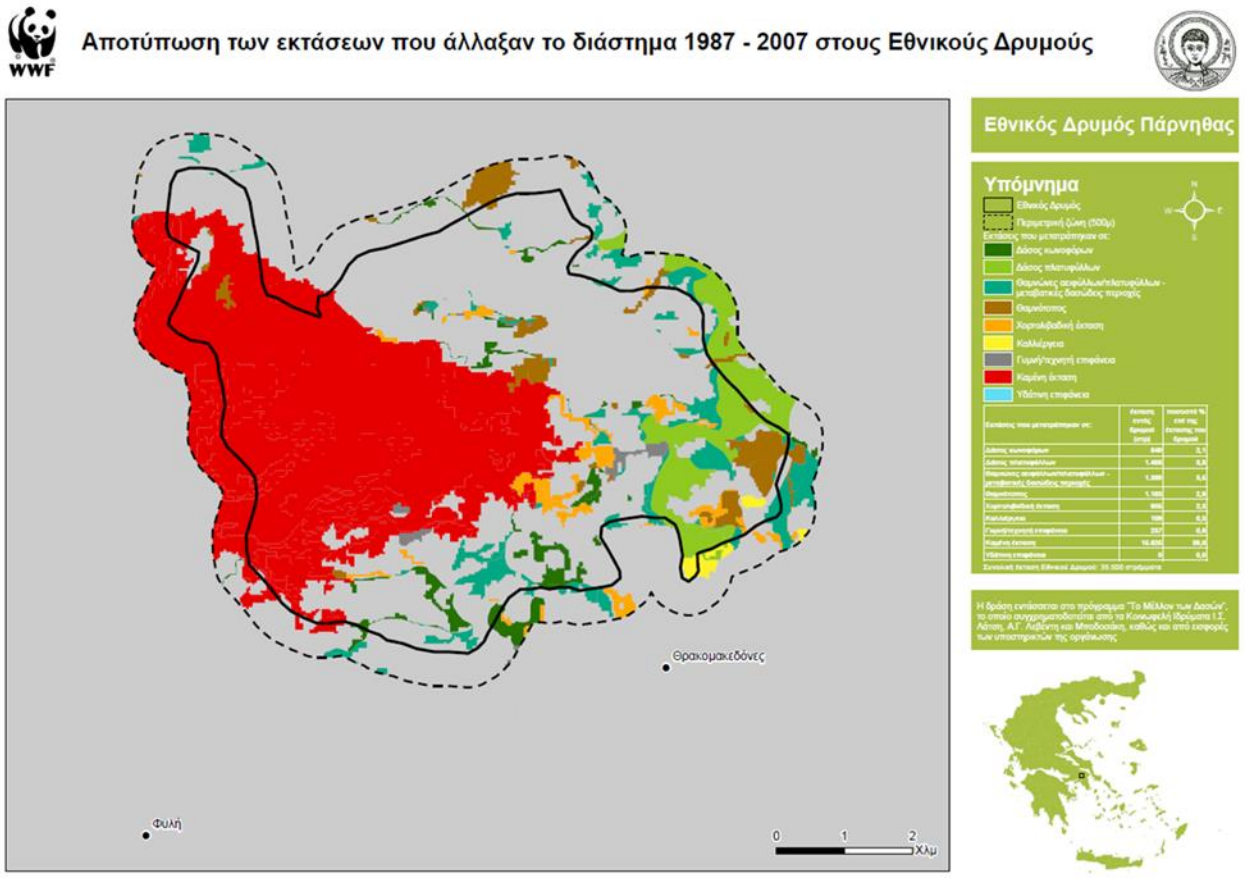
products

Focus on protected areas



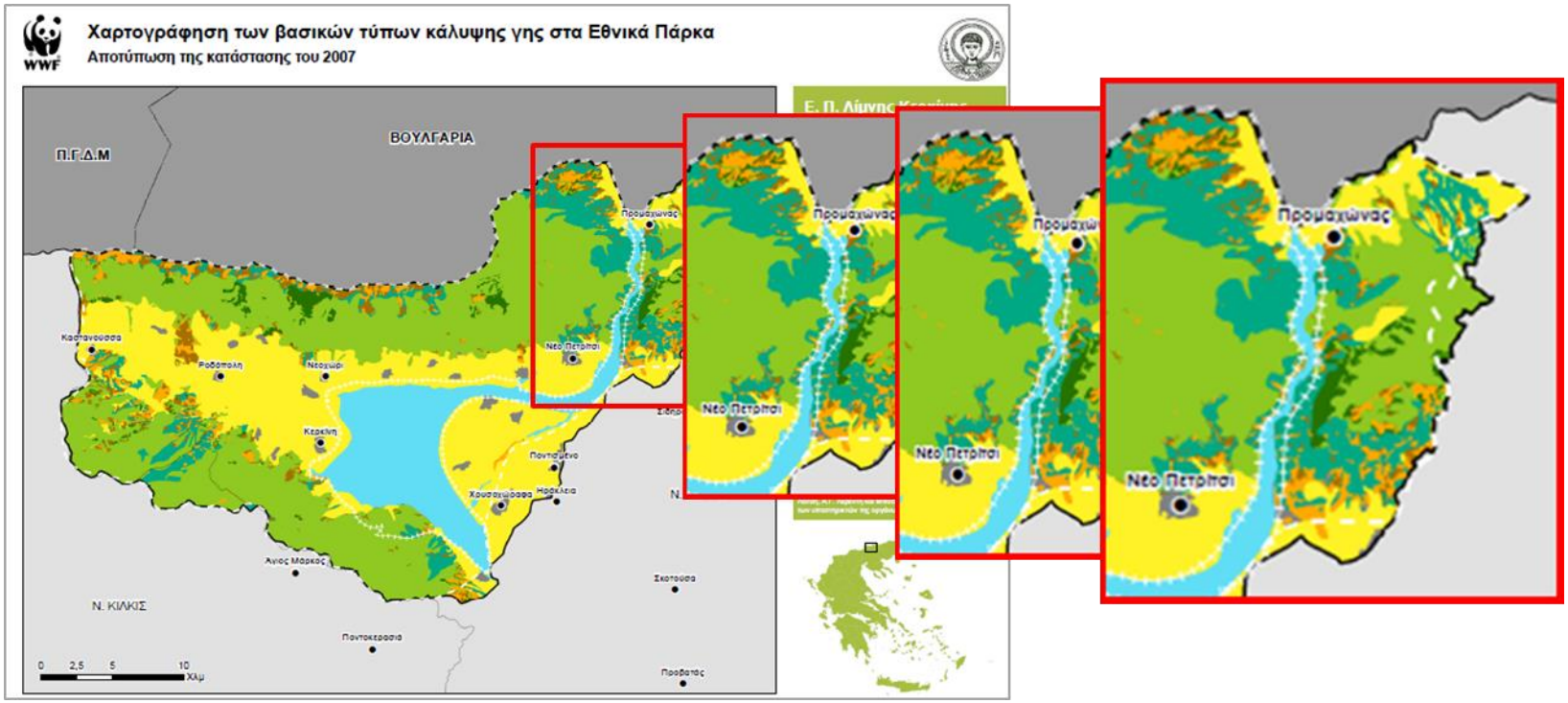
products

Focus on protected areas (2)



products

Focus on protected areas (3)

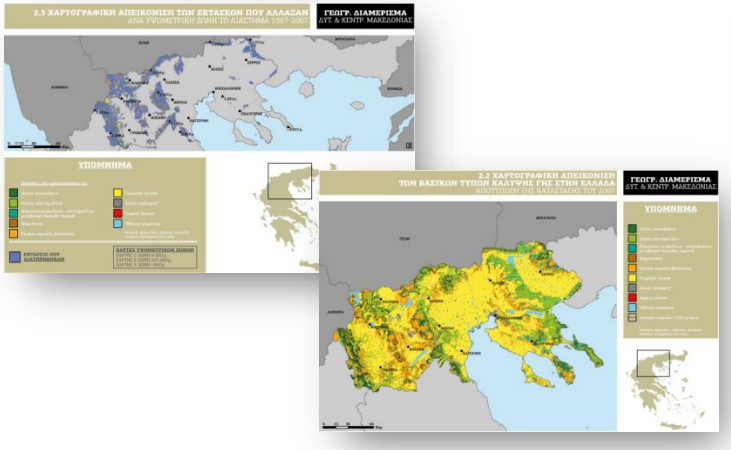


products

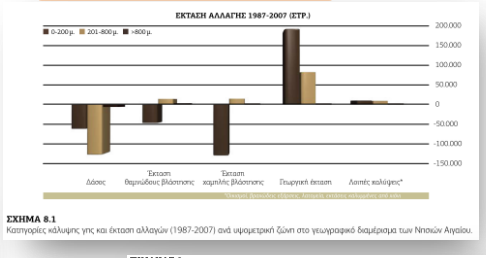
In total 956 maps and respective reports

ATLAS

maps



reports



ΣΧΗΜΑ 8.1
Κατηγορίες κάλυψης γης και έκταση αλλαγών (1987-2007) ανά υψομετρική ζώνη στο γεωγραφικό διαμέρισμα των Νησιών Αιγαίου.

ΠΙΝΑΚΑΣ 2
Βασικές τάσεις αλλαγών μεταξύ 1987 και 2007

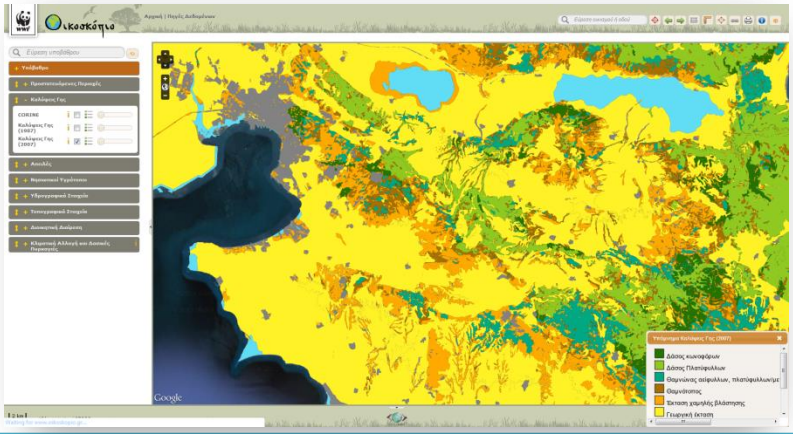
ΣΥΝΟΛΟ ΧΩΡΑΣ

1987 \ 2007	Δάση	Θαμνώδης βλάστηση	Γεωργικές	Χαμηλή βλάστηση	Γυμνές / Τεχνητές
Δάση	-	1.265.600	1.029.310	656.666	40.625
Θαμνώδης βλάστηση	826.781	-	2.367.007	N/A	135.086
Γεωργικές	445.635	1.268.085	-	2.061.154	401.603
Χαμηλή βλάστηση	480.629	N/A	5.895.621	-	427.855
Γυμνές / Τεχνητές	N/A	N/A	340.293	N/A	-

*N/A: αλλαγές που δεν εξετάζονται

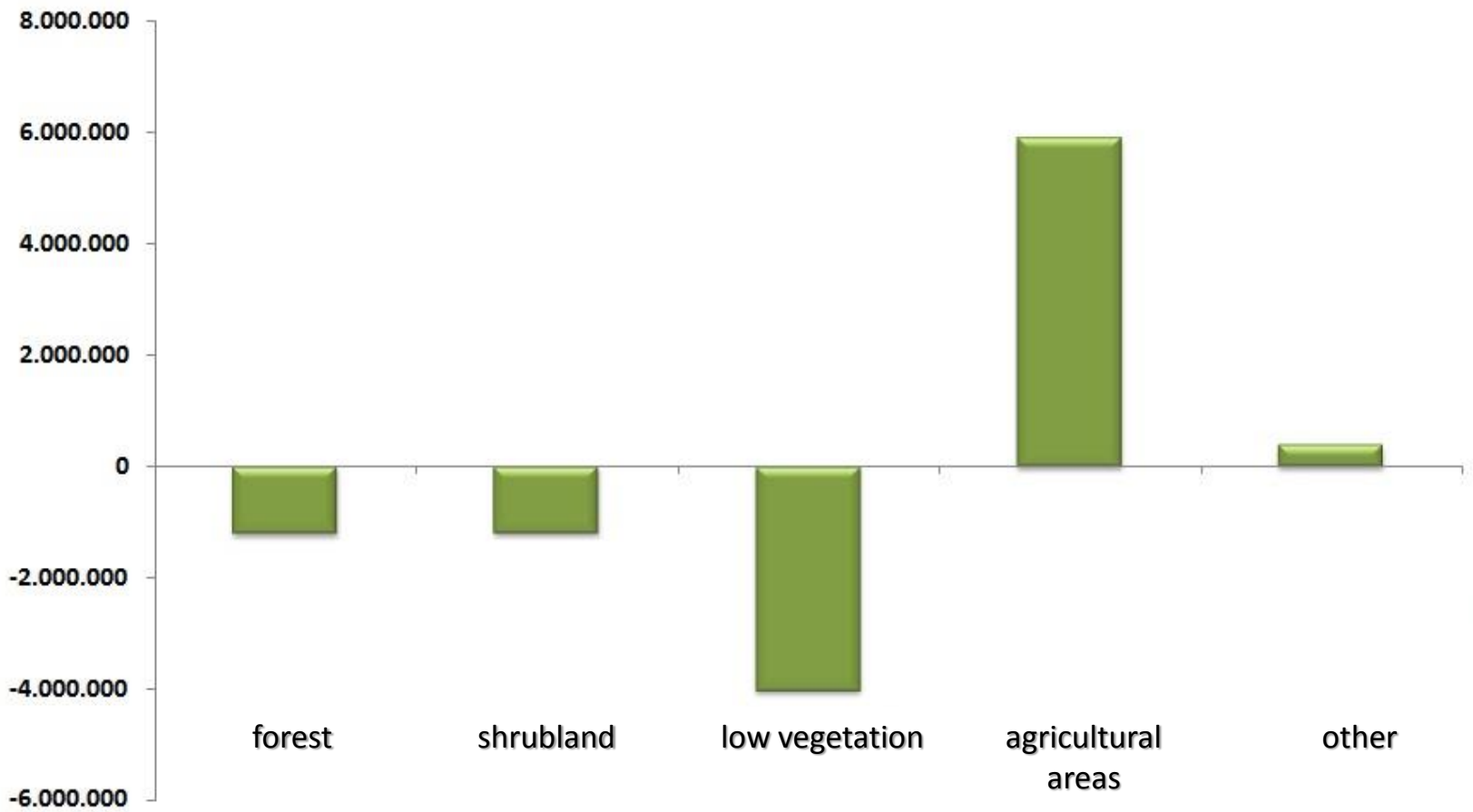
ΟΙΚΟSKOPIO

www.oikoskopio.gr



products

general trends revealed



(str)
(1str = 0.1ha)

challenges in ...

DEVELOPMENT + IMPLEMENTATION = VALUE

... in products

conclusions

development

*The appropriate **combination** of objectives, data and methodology…*

Imple-mentation

*…the **standardized** methodological approach and the systematic way of analysis within a GIS environment…*

products

…contributed in the production of integrated 3 year-turnover maps:

- ✓ *National Land Cover map of 2007*
- ✓ *National Land Cover map of 1987*
- ✓ *National Land Cover Change map between1987 and 2007*

value

…which:

→ *cover the gap in national land cover data,*

→ *enable multitemporal monitoring of the Greek forests as well as trends they exhibit, and*

→ *provide valuable experience for future studies (**capacity building**)*

value because of…

INNOVATION

CONTRIBUTION

EXPERTISE

VALUE

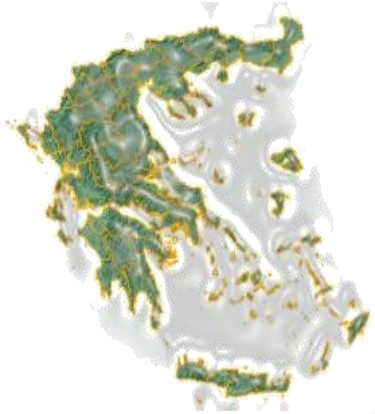
innovation

- ✓ *Production of two products at National level that are comparable between them*
- ✓ *Production using advanced automated classification methodology based on GEOBIA*
- ✓ *Accuracy assessment of the products using data collected by extensive field surveys*
- ✓ *Focus on protected areas using multi-temporal data of the same origin and scale*

VALUE

contribution

- ✓ *cover gap in accessible national Land Cover spatial data*
- ✓ *make possible multi-temporal study of the Greek forests and the trends they exhibit*
- ✓ *contribute to the sound management for the protection and conservation of protected areas, forests and the natural environment in general*
- ✓ *can be used as an end product as well as base map for a variety of studies. For example make possible the generation of useful conclusions when combined with other other data such as ecological, statistical, etc.*



VALUE

expertise

- ✓ *gain and 'loss' of expertise*
- ✓ *transferable methodology to allow mapping in future date(s)*
- ✓ *option to update maps, based on new available auxiliary data (updated LPIS, new protected areas)*
- ✓ *option for further spatial analysis and information generation based on demand*

Framework - collaborators

✓***Latsis, Leventis and Bodosakis foundations***: *funding*

✓***Lab of Forest Management and Remote Sensing, School of Forestry and Natural Environment***: *Methodology development and mapping implementation*

✓***WWF Greece***: *Methodology development*, fieldwork interpretation of the results

✓***WWF US – Conservation Science Unit*:** Contribution in establishing the project implementation framework

✓***Local authorities and national experts:*** *data contribution and* interpretation of the results

✓***Scientific :*** *Expert interpretation of results, analysis of trends, policy proposals*

✓***LEICA, USGS, EU-CORINE***: *data providers*

✓***QUERCUS***: *data uploading in www.oikoskopio.gr*

Announcements

- ✓ ***9th EARSeL Forest Fire Special Interest Group workshop**, 15-17 October 2013, Coombe Abbey , Warwickshire, UK http://www.earsel.org/SIG/FF/9th-workshop/*

- ✓ ***GEOBIA 2014**, 21-23 May 2014, Thessaloniki, Greece http://geobia2014.web.auth.gr/*

Thank you

For

Your attention