

Living in the Golden Age of Digital Heritage: from Discovery to Documentation, Management and Preservation



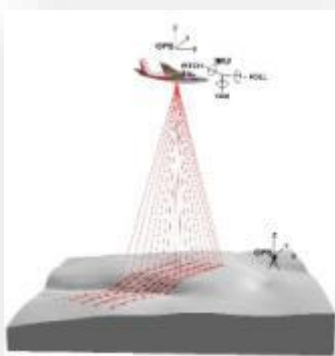
Rosa Lasaponara^a and Nicola Masini^b

^a *CNR-IMAA, Istituto di Metodologie di Analisi Ambientale -*

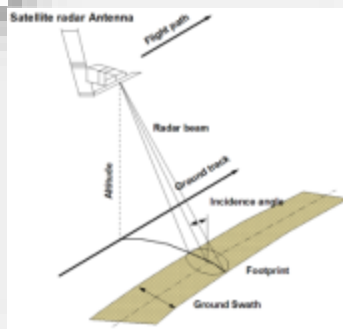
^b *CNR-IBAM, Istituto per i Beni Archeologici e Monumentali -*

Outline

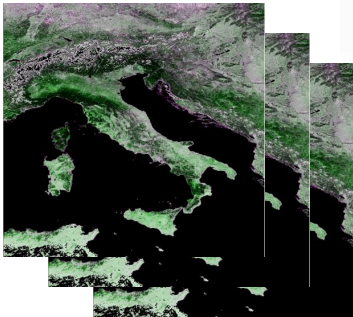
EO technologies for Archaeology and cultural heritage



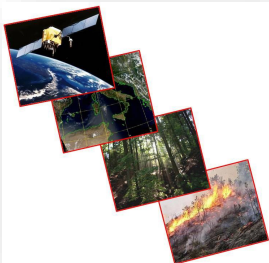
The added values of Lidar: The medieval village of Yrsum



The added values of SAR in desert areas:

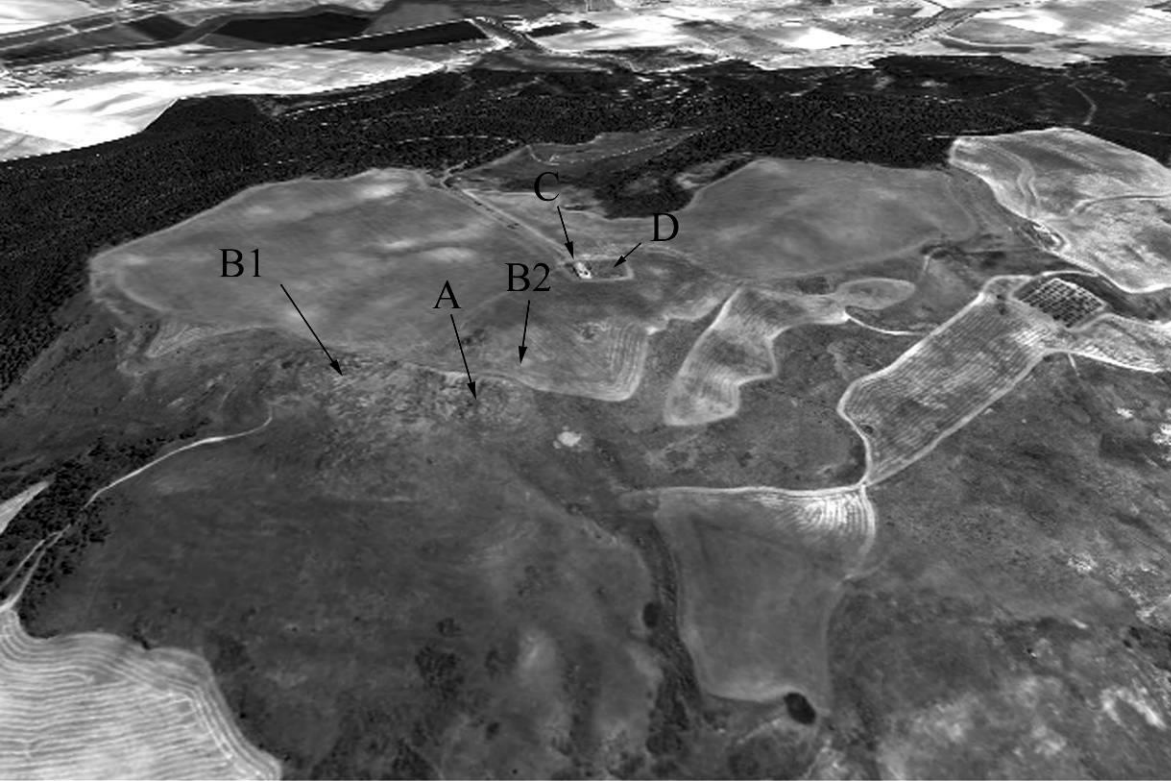


The added values of historical archives



Operational Fire monitoring using free of charge data

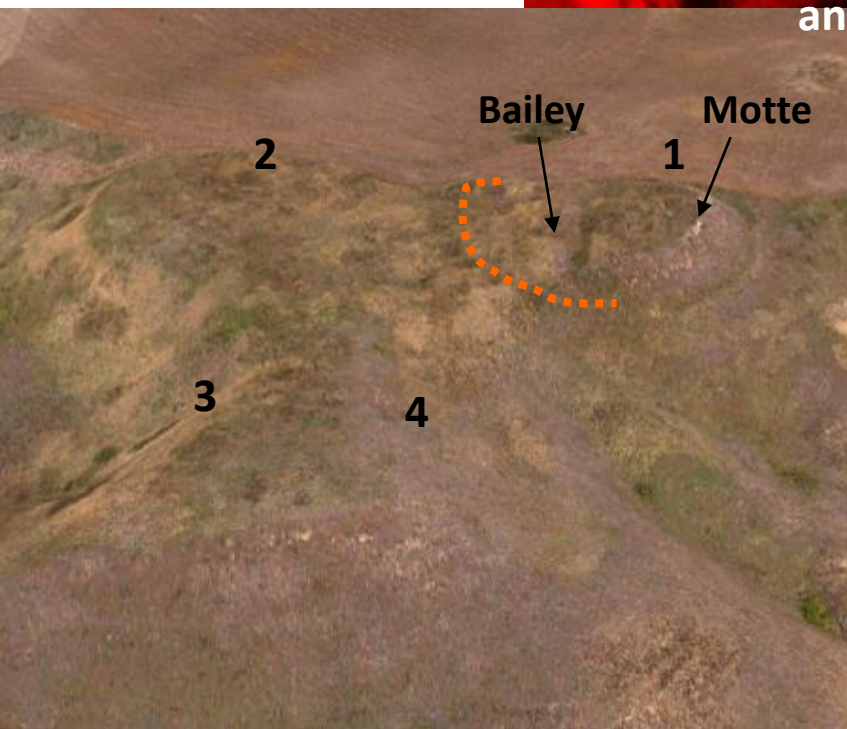
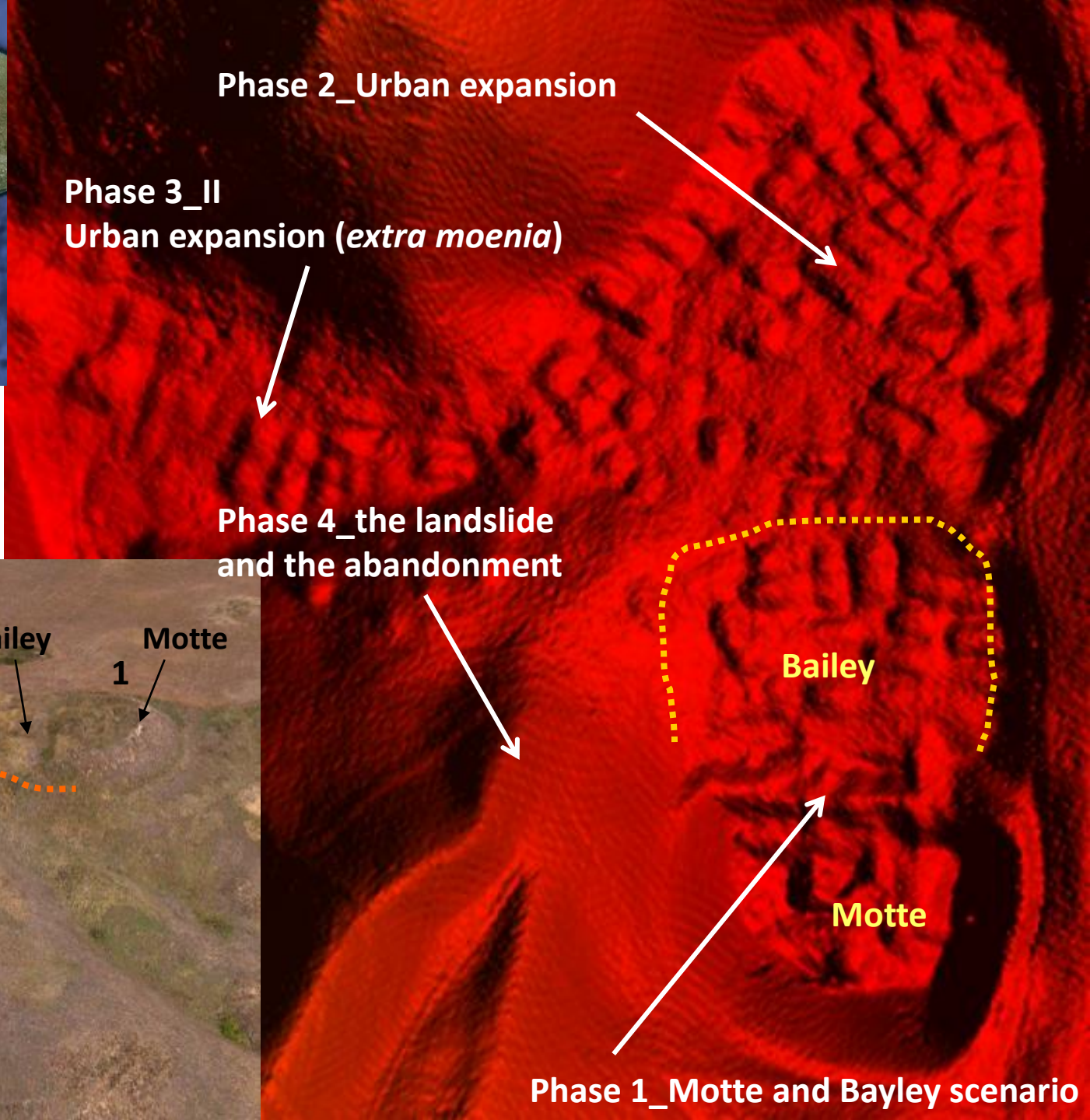
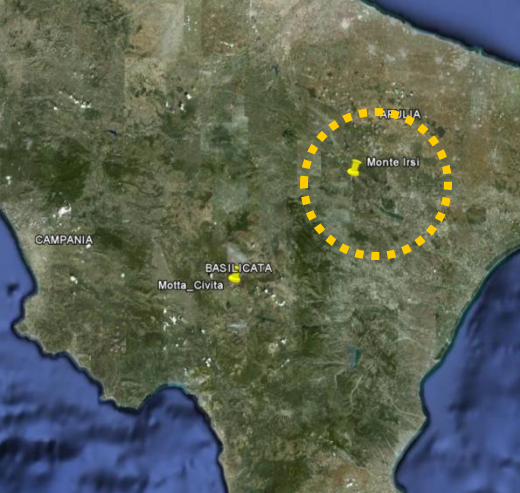
Medieval village of Yrsum



- **Irsi o Yrsum o Castrum Ursum** close to the Northeastern border of Basilicata with Apulia (Italy)
- strategic location: the confluence of the Bradano and Basentello rivers
- long human frequentation: iron age, roman period, byzantine age
- inhabitants: (550 in 1277 and 5090 in 1320)
- **12th century**: first documentary attestation
- **1123** : Yrsum depends on Episcopate of the near town of Montepeloso
- **1133**: Destruction of Montepeloso. Yrsum depends on the Abbey of Chaise-Dieu (France)
- **1288**: first description of a part of the village from a documentary source (a church, a square, some houses, grain storage)
- **1370**: The village is sacked, the monastery is destroyed. Abandonment of the village.

First identification of Irsi from Quickbird based analysis

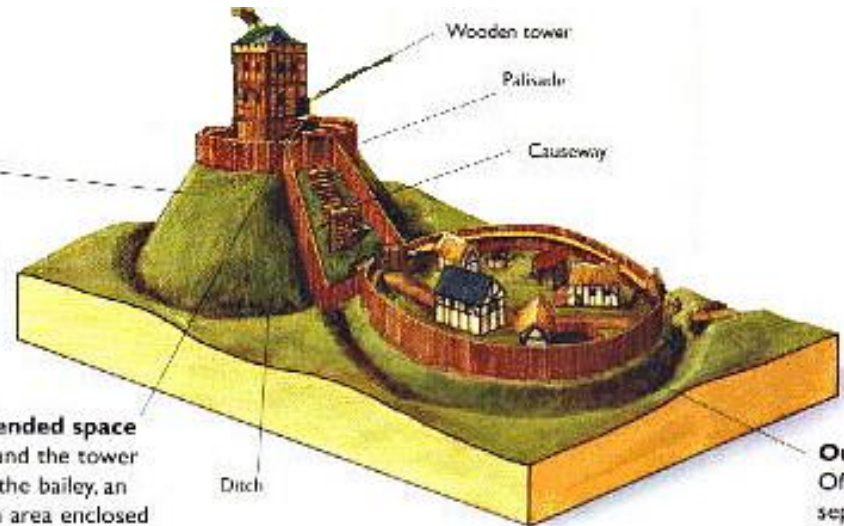




COMPARATIVE HISTORICAL STUDIES

Motte and bailey

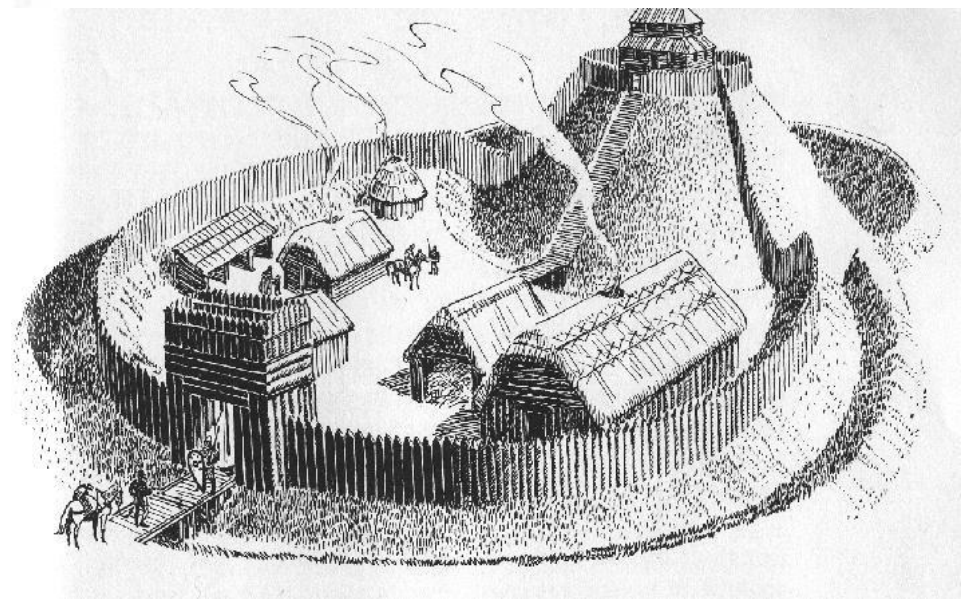
In early medieval castles a strong tower was built on a mound of earth called a motte.



Defended space

Around the tower was the bailey, an open area enclosed by a defensive wooden fence called a palisade.

Outer bailey
Often there was a separate bailey connected to the tower by a fortified causeway.





YRSUM

LIDAR

LIVELLO 1

LIVELLO 2



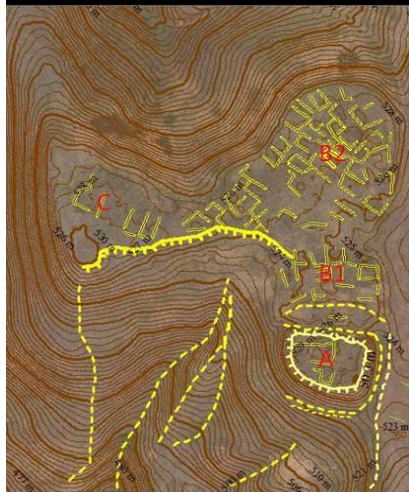
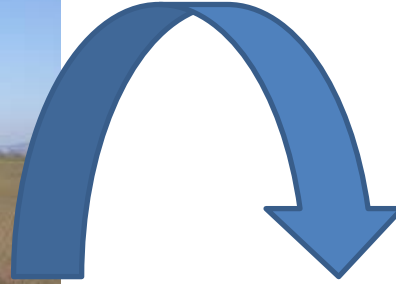
YRSUM

A SERIOUS GAME
BASED ON A LIDAR PROSPECTION



VIRTUAL RECONSTRUCTION – SCENARIO 2 URBAN EXPANSION

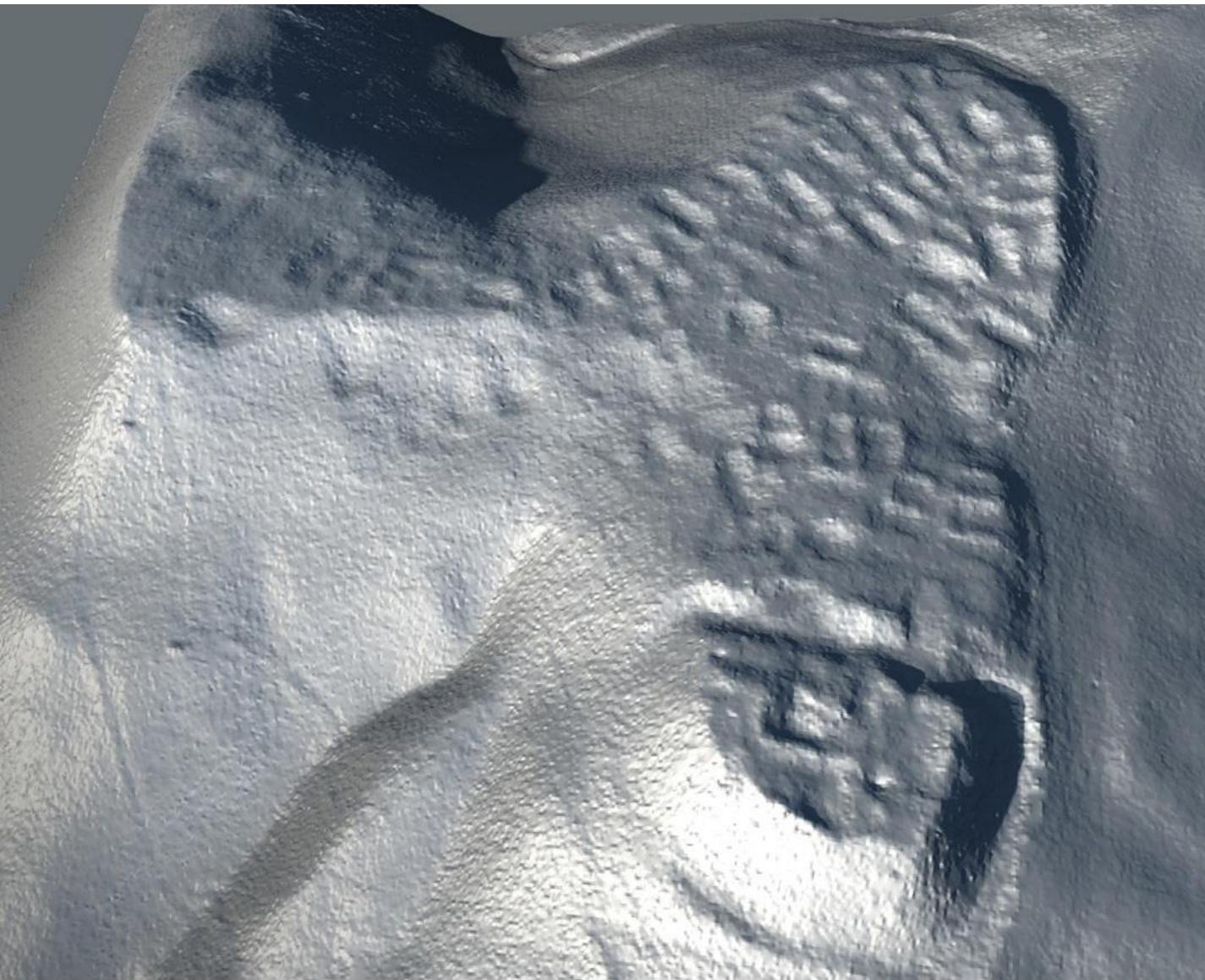




Historical phases:
 I) castle and first nucleus of Yrsum
 (A): XI century
 II) Sector B
 III) Sector C



PLAYING INTO THE PAST BY REMOTE SENSING



PLAYING INTO THE PAST

© 2011 Basilicata Innovazione - CNR IMIAA - 3D Francesco Gabellone e Maria Chirri



ON

Features



Trasparenza 0.0000

ON



Multi light

ESPLORA **PTM**



PLAYING INTO THE PAST TO RECONSTRUCT THE URBAN LANDSCAPE

© 2011 Basilicata Innovazione - CNR IMIAA - 3D Francesco Gabelione e Maria Chiri

YRSUM

R OFF  Features  Trasparenza 0.0000 ON  Multi light ESPLORA **PTM** 



THE ADDED VALUE OF SAR: THE ROMAN TOWN OF SABRATHA



The added value of SAR imaging

THE ADDED VALUE OF SAR: THE ROMAN TOWN OF SABRATHA



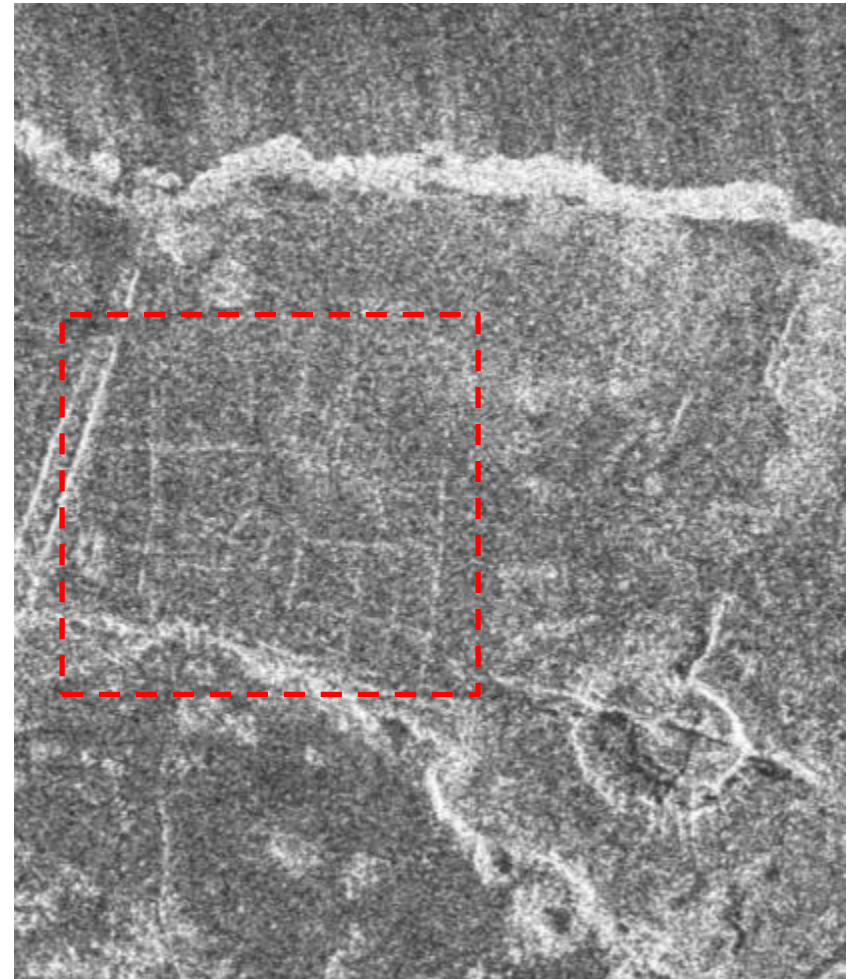
Sabratha: optical satellite image

Sabratha: Stripmap - Himage

Sabratha was founded in the 7th century BC by the Phoenicians of Tyre in one of the few natural harbors of Tripolitania . Because of its strategic location it was a trading post at the mouth of a major caravan route. After the Phoenician age, Sabratha passed under the control of Carthage and later under the Kingdom of Numidia. In 46 BC Sabratha was taken by the Romans, under which the city was completely rebuilt and embellished by the emperor Septimius Severus who was born in nearby Leptis Magna.

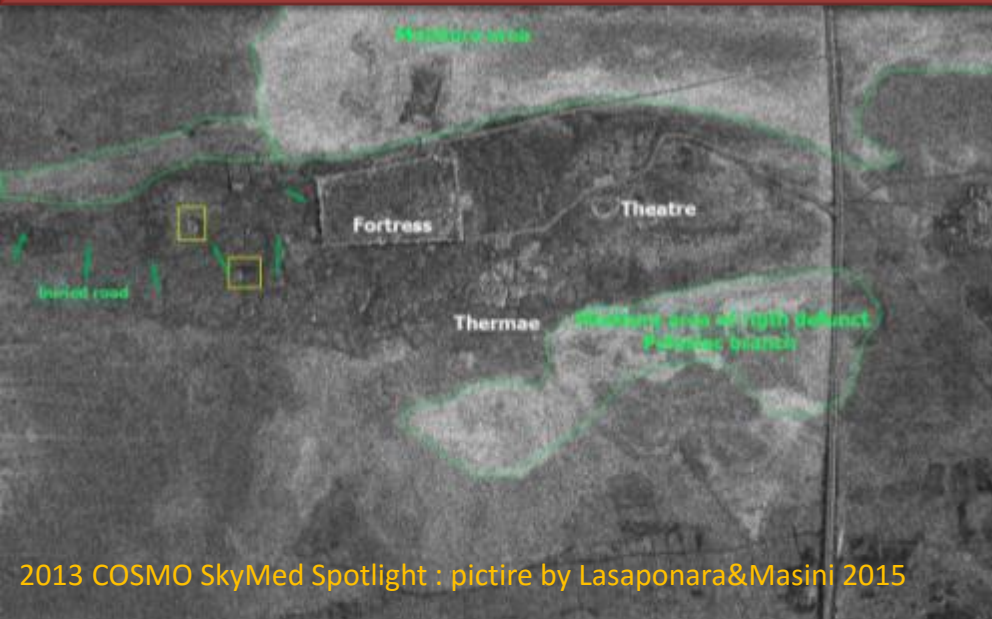
The added value of SAR imaging

THE ADDED VALUE OF SAR: THE ROMAN TOWN OF SABRATHA



Comparisation between the optical and SAR Image: the Cosmo SkyMed stripmap (on the right) puts in evidence traces of bured remains

The added value of SAR imaging



Pleiades and Spotlight Cosmo SkyMed data proved to be complementary for the extraction of information of cultural interest.

The dark tone in the satellite optical image would suggest the presence of surface moisture. In theory, this is not so obvious. The dark tones could be also due to soil pedological properties. However, the above said areal feature is also visible from the Cosmo SkyMed data and characterized by high amplitude values. This makes more consistent the hypothesis that it is a moisture area much probably referable to one of the defunct branches of *Pelusiatic* river

Case study : Metapontum



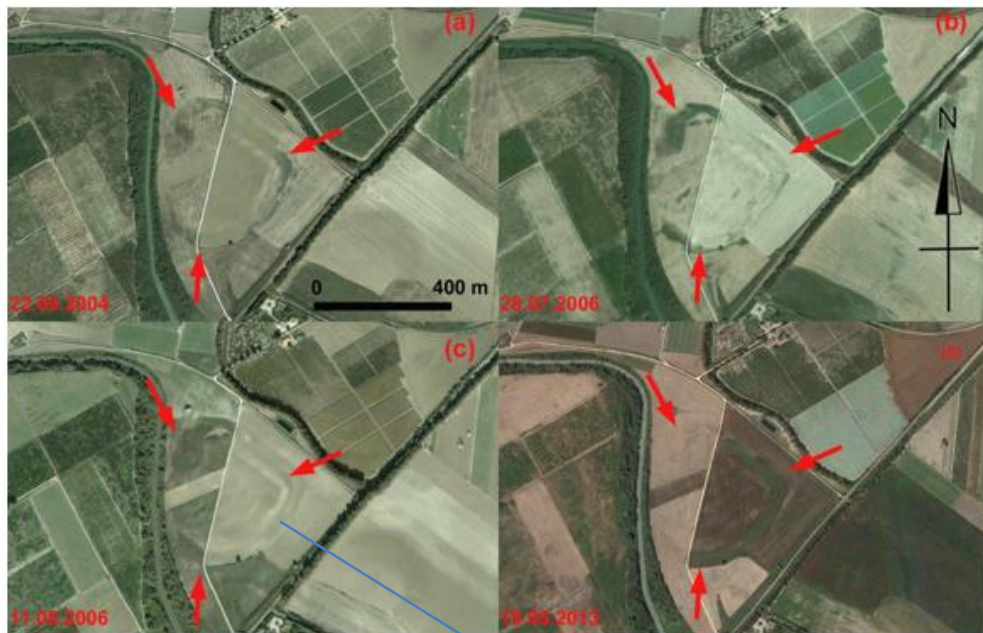
© Lasaponara & Masini

Metapontum, located between two rivers, near the Ionian Sea, is one of the most important archaeological areas in the south of Italy. Several archaeological campaigns [39-40] have established human presence there since the mid 8th century BC when Metapontum was founded by Greeks.

Between Greek colonization (700 BC to 200 BC) and the Roman age (200 BC to 400 AD), the territory was characterized by an intensive use of soil as revealed by the several rural sites that can be observed from surface surveys and excavations, and also the presence of an extensive system of parallel land divisions [39-40]. In particular, these lines are thought to have been a network of country lanes or drainage canals.

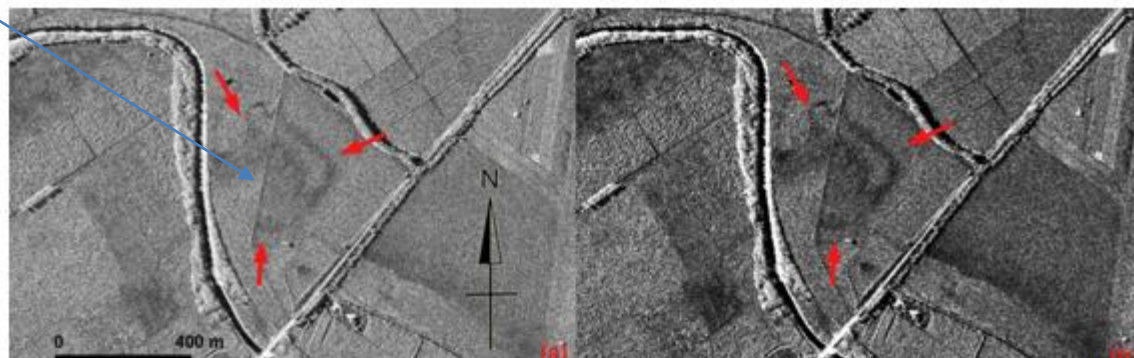
Another important element in the history of Metapontum is the spatial and temporal relationship between the hydrography, coastlines and the human settlements.

The rivers Bradano and Basento between which Metapontum is located changed their floodplains several times, influencing the settlement pattern.



- Optical data

- Cosmo



Case study : Metapontum



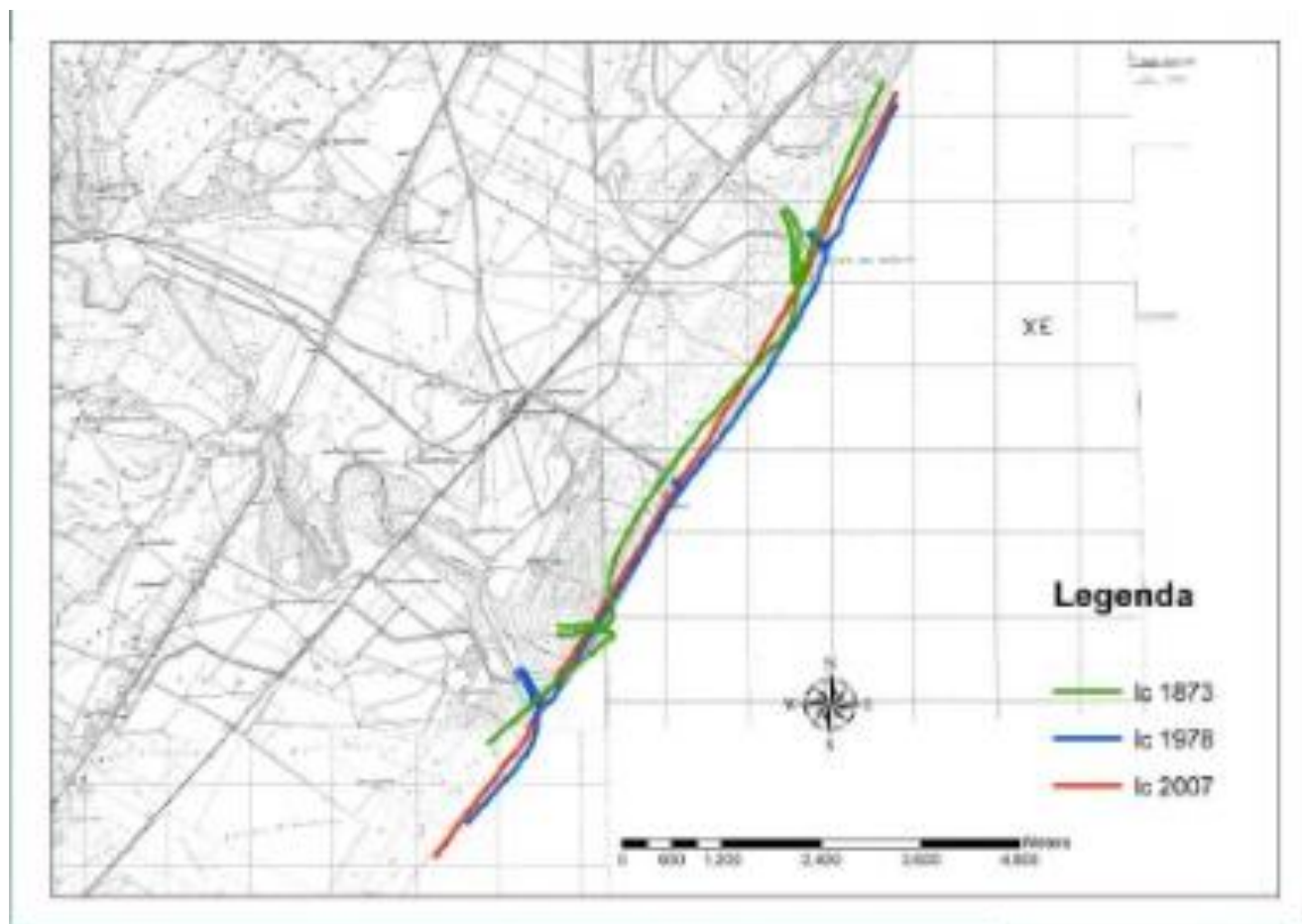
© Lasaponara & Masini

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Case study : Metapontum



1961 Satellite declassified Corona

1961 coastline

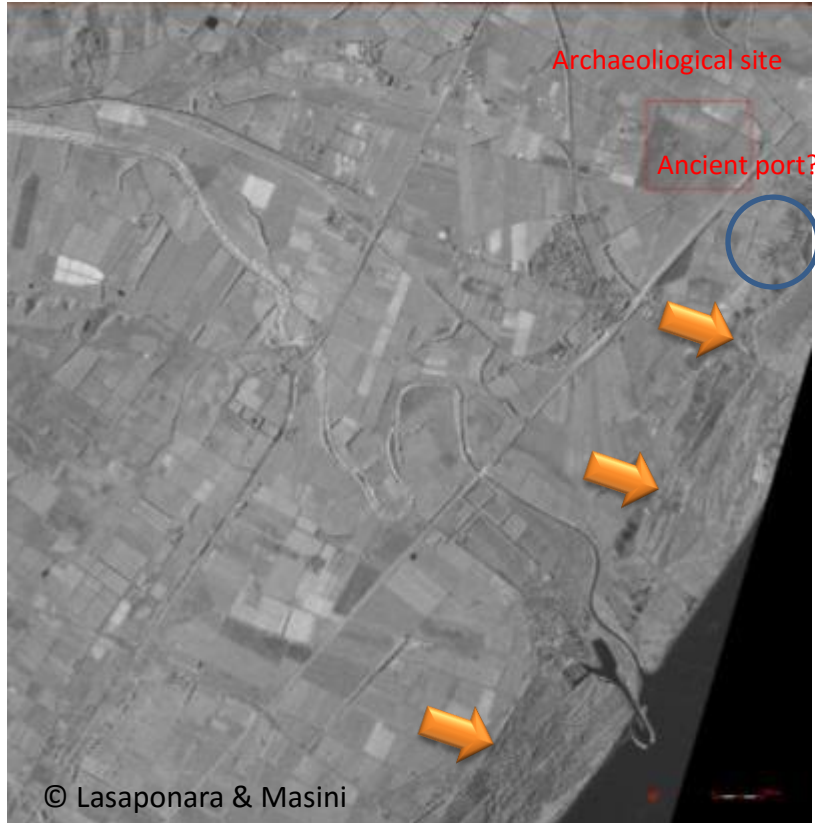


2004 Satellite QuickBird

The multi-temporal analysis (1950, 1961, 2004, 2013) enabled to follow the changes of the Ionian coast that from the middle of the twentieth century was characterized by alternating phases of growth and regression. The latter prevails since the early 60s and continues today with varying rates of erosion

(a)

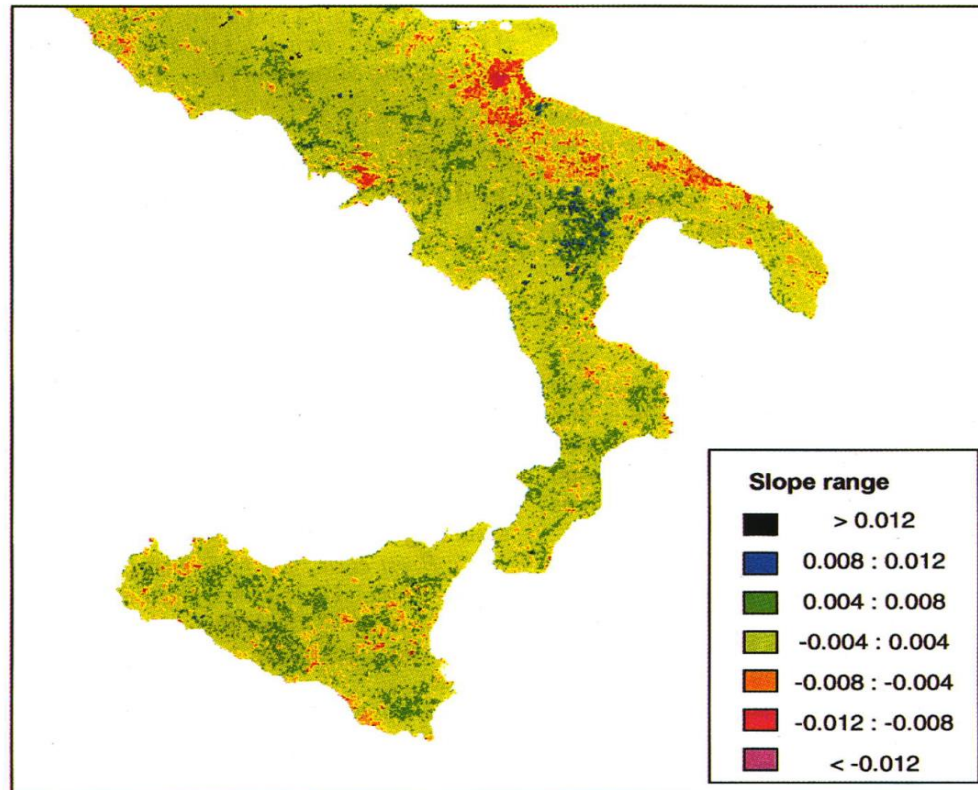
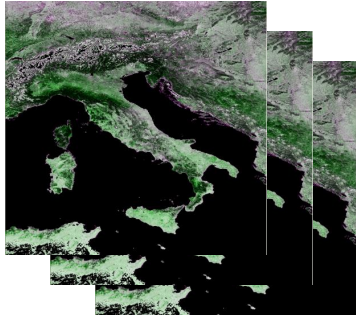
Case study Metapontum

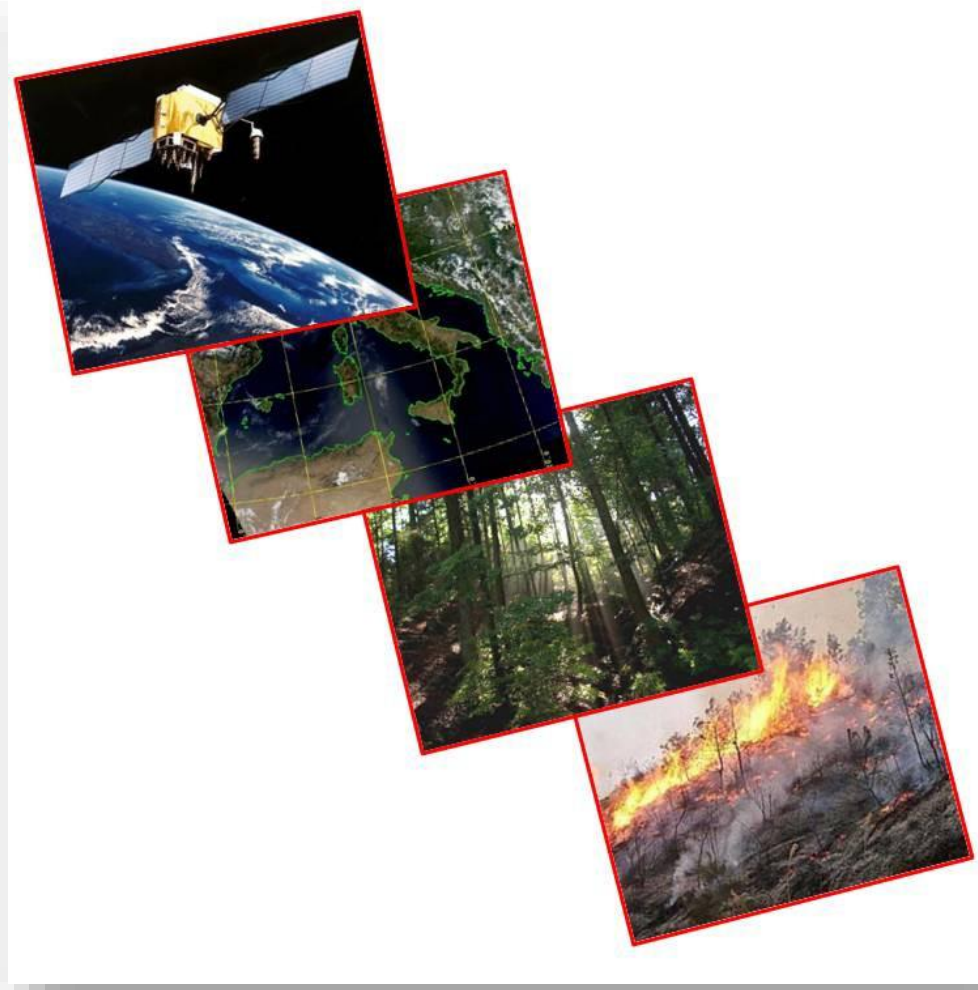


Cosmo SkyMed Spotlight : orange arrows denote the coastline in Metaponto was a greek and then roman site. At the age there was a port which si dated up to Middle Ages

Some historical data on the movements of the coastline come from archeology. In particular, the inner dune belt, near the ancient Metaponto could be dated between the 7th and 3rd centuries BC. Just in this last century the dune was cut artificially, probably to facilitate the drainage of inland wetlands to the sea. This hypothesis supported by the presence of archaeological remains, possibly belonging to the old port, would lead us to suggest the presence of a nearby coast. Two other bands of dune ridges, which are located further inland, would be formed between the Roman period and the Middle Ages. As for the medieval coastline, some indications of its position may be derived from the remains in the mouth of Basento rivers, near a medieval village, named Torre Mare, that, around the twelfth or thirteenth century, had served as a port.

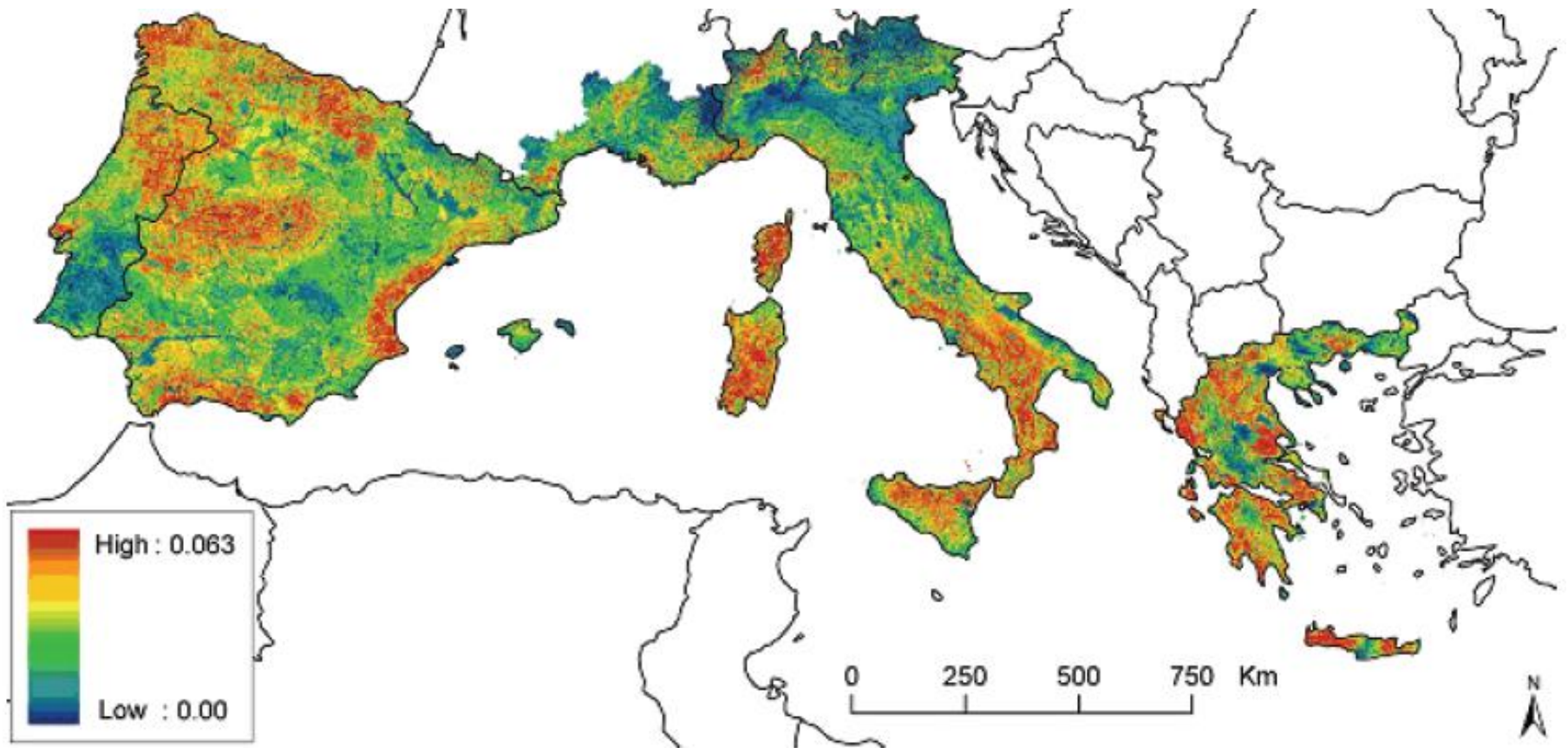
The added value of historical archive : land degradation based on AVHRR (available from 80')



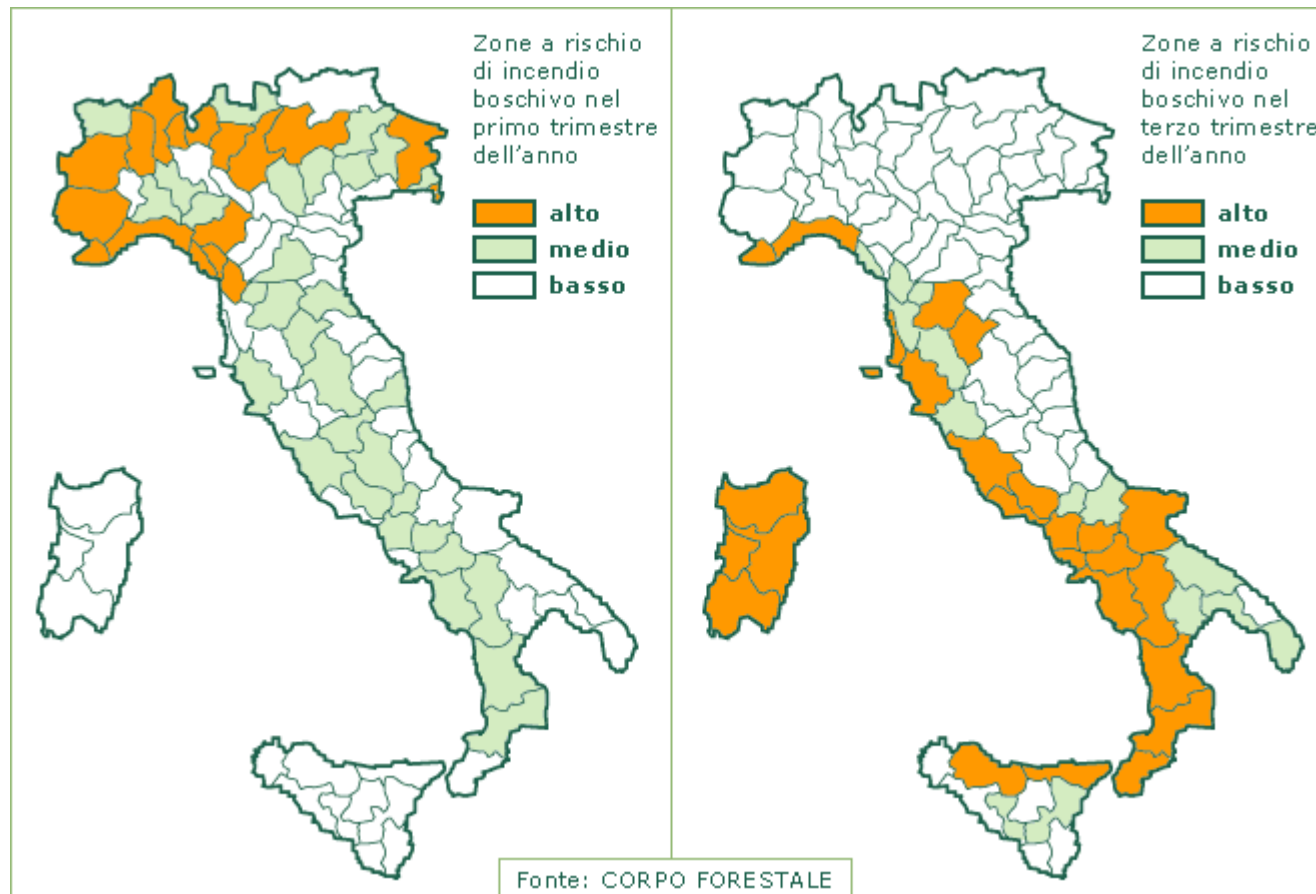


Based on free of charge data Modis, Landsat, Aster

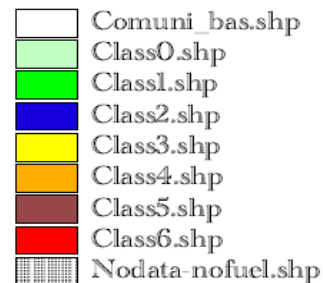
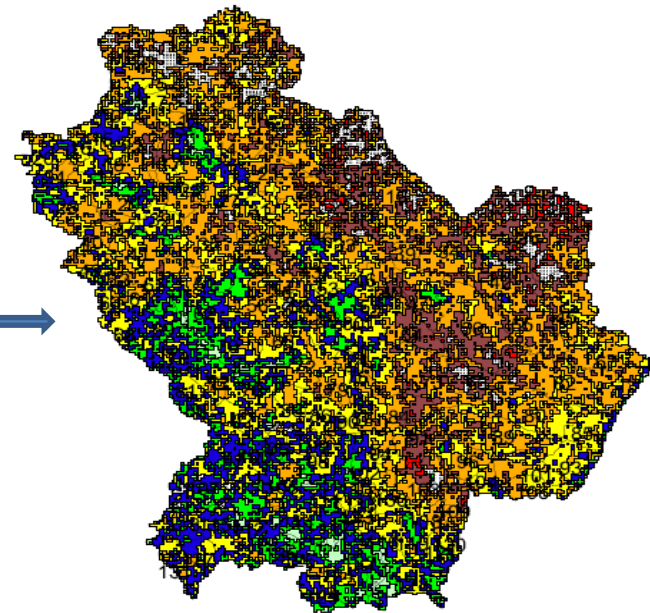
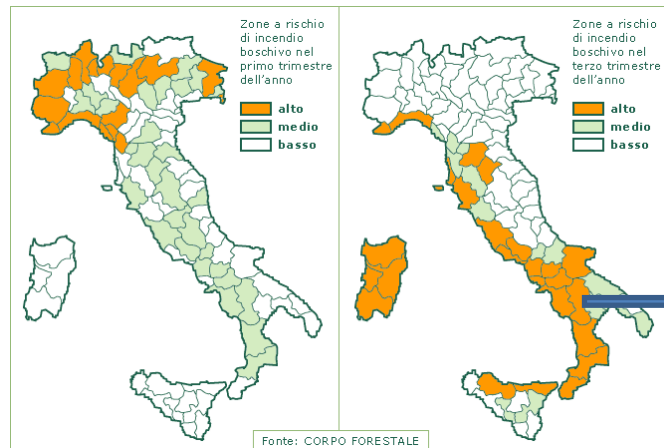
Danger maps EFFIS by JRC pixel size 5 km



**Current information provided by the Italian national Protection Agency to regional level:
Province scale**

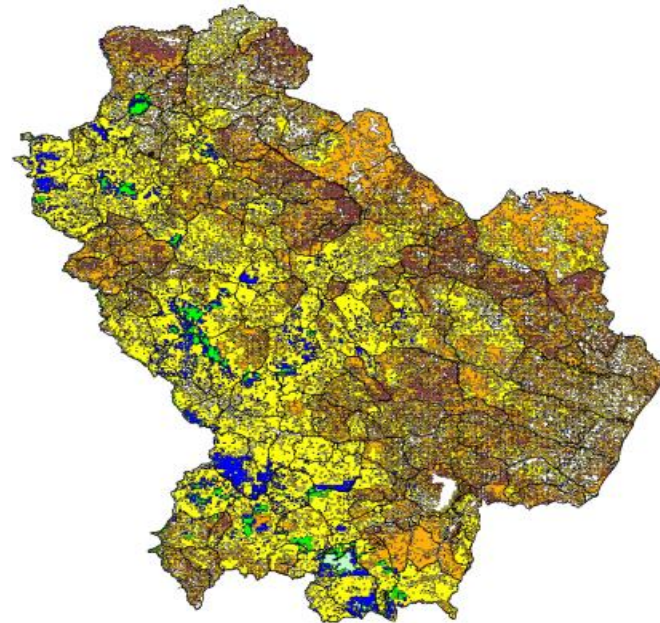
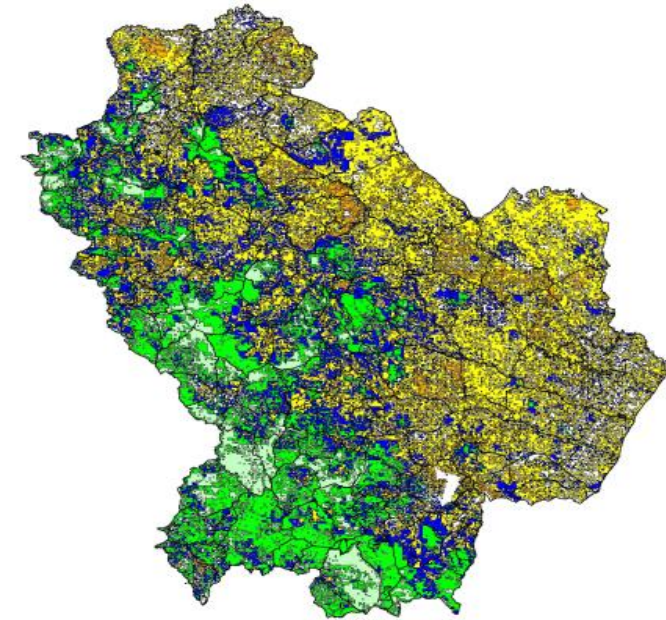
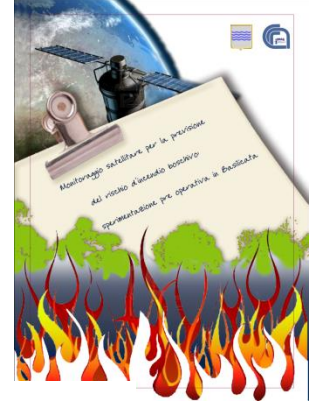


**Current information daily provided in the framework of FIRE-SAT project : pixel size 250m
next it will be improved to 30 m**

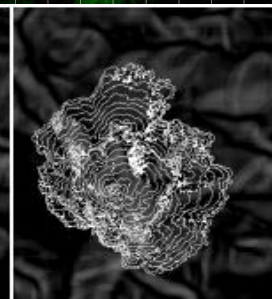
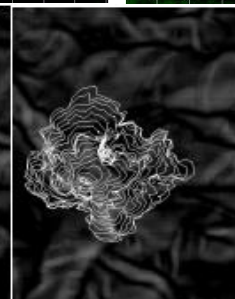
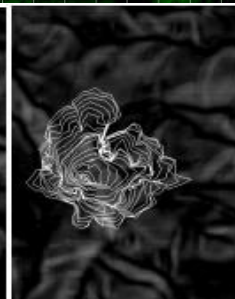
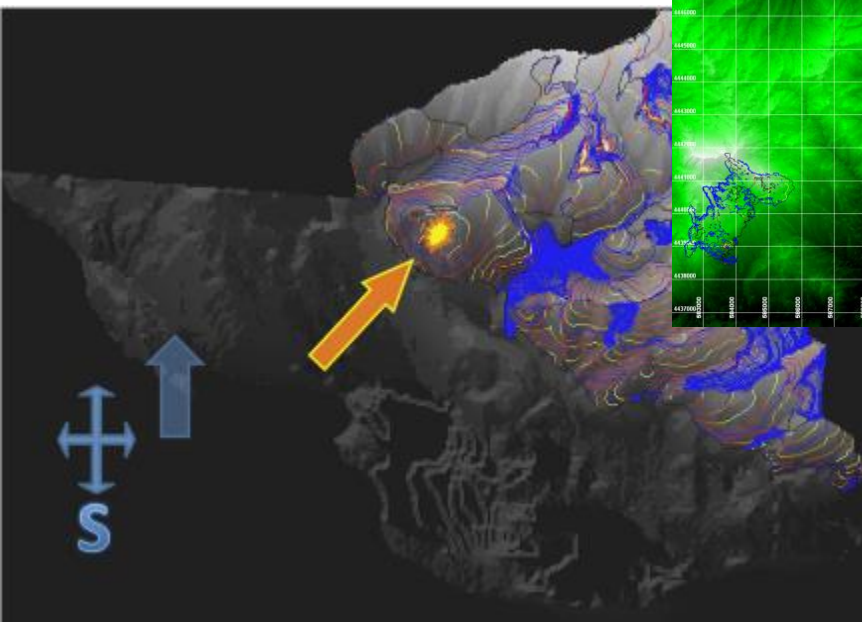
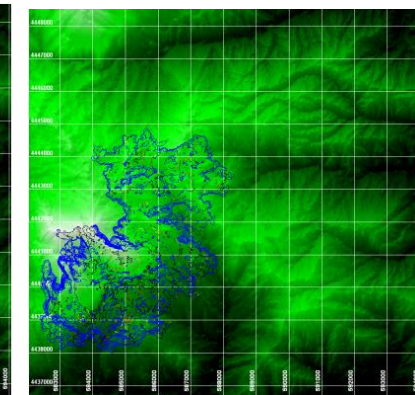
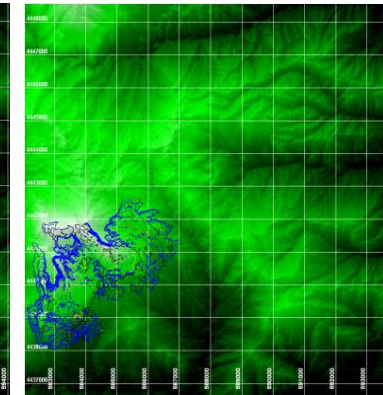
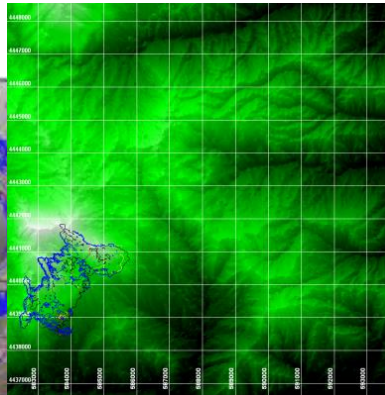
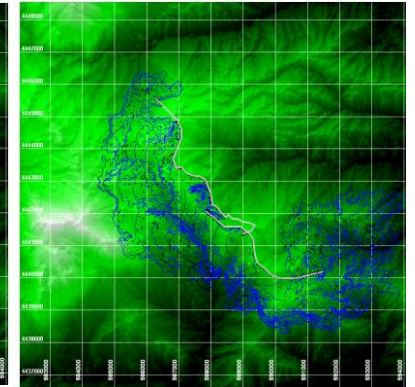
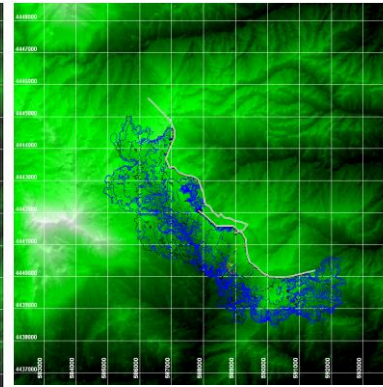
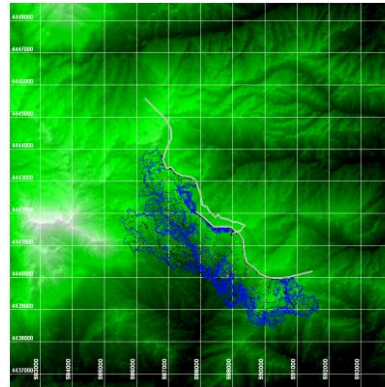
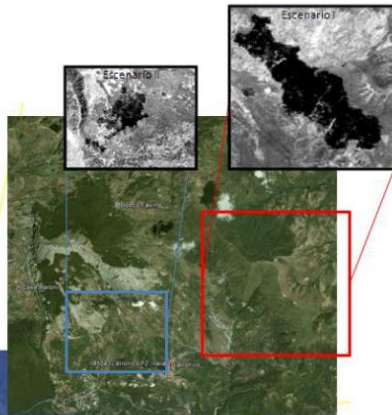


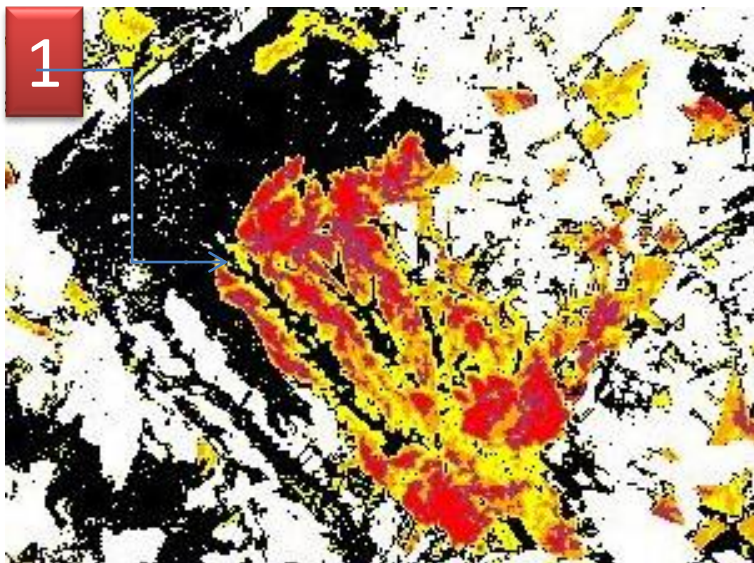
Fire_SAT project

ISBN 978-88-8080-117-7



Real time-Simulation of fire



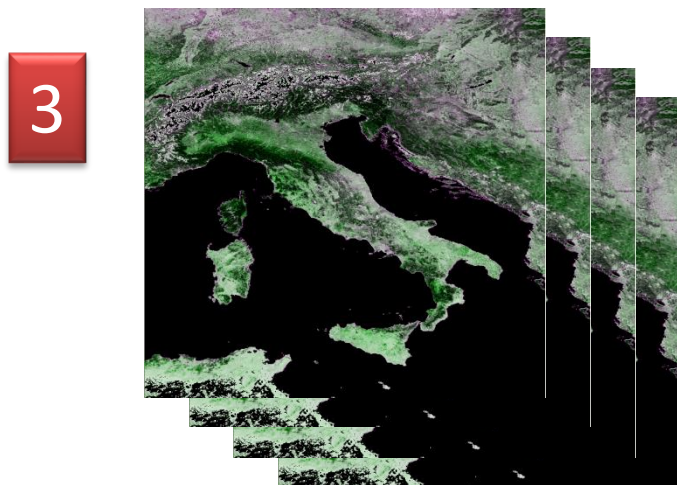


Fire severity

(I colori giallo e rosso indicano il diverso grado di danno)



Increasing of hydrogeological risk

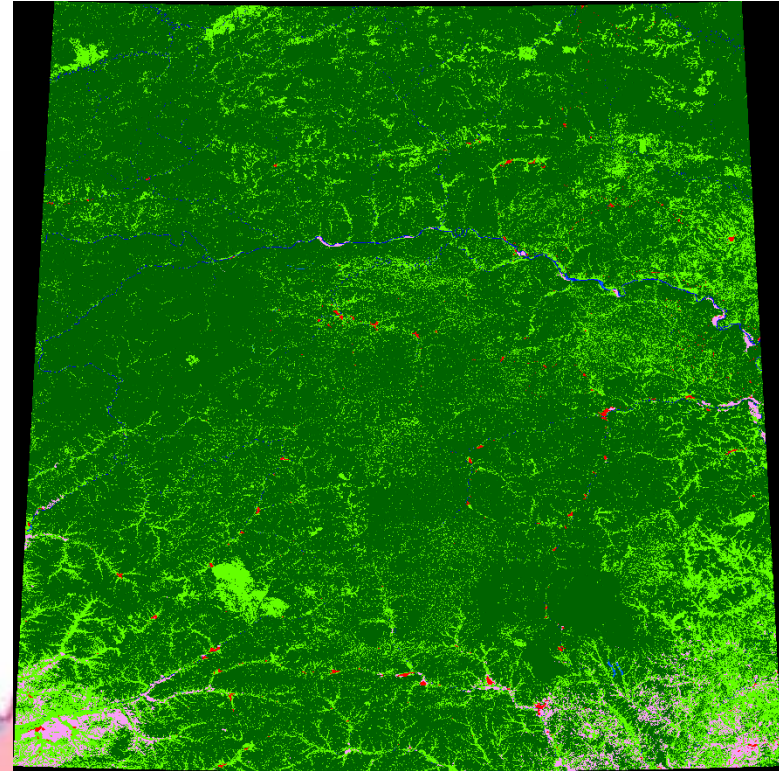


Estimation of Recovery of
Post-Fire recovery

Free of charge data (in the next future
also Sentinel 1 e 2)

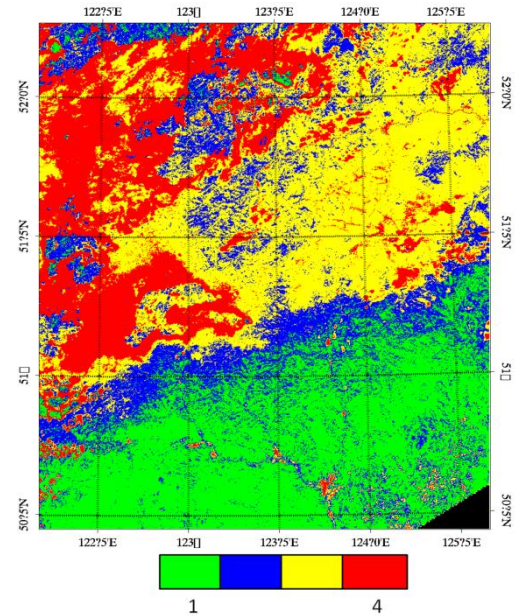
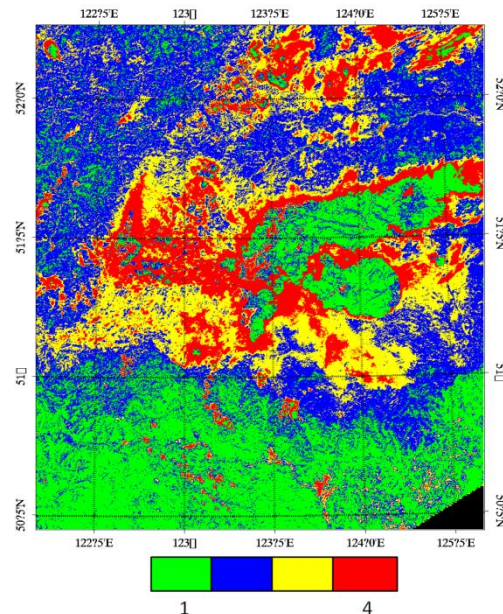
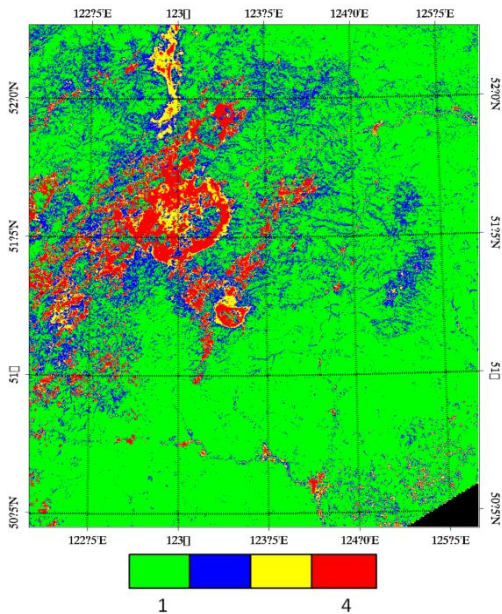


Study area in China



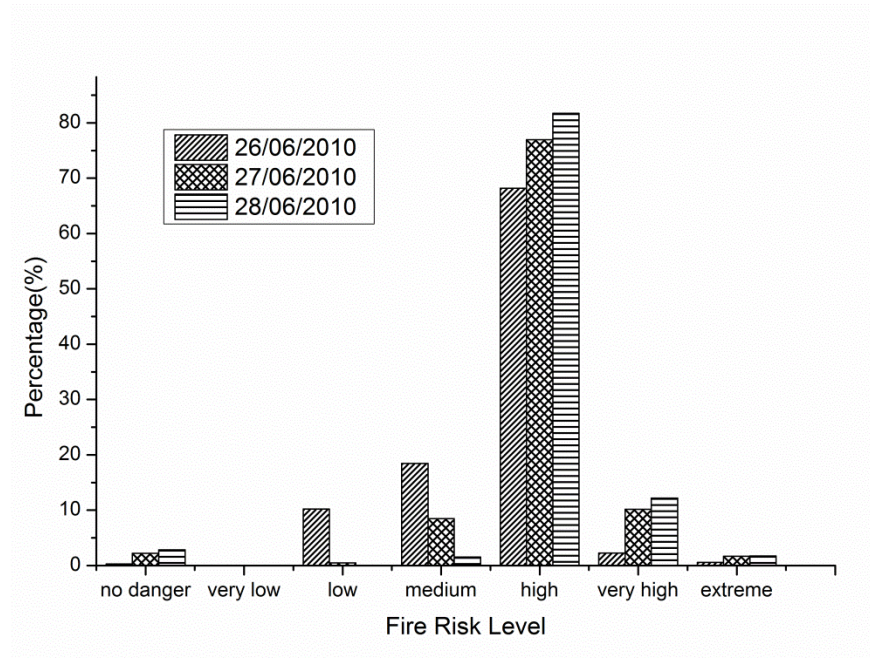
This study was carried out in part of the Daxing'anling region in northern China. This region is located in the north of Heilongjiang Province and Inner Mongolia (50.5° - 52.25° N, 122° - 125.5° E,

Results

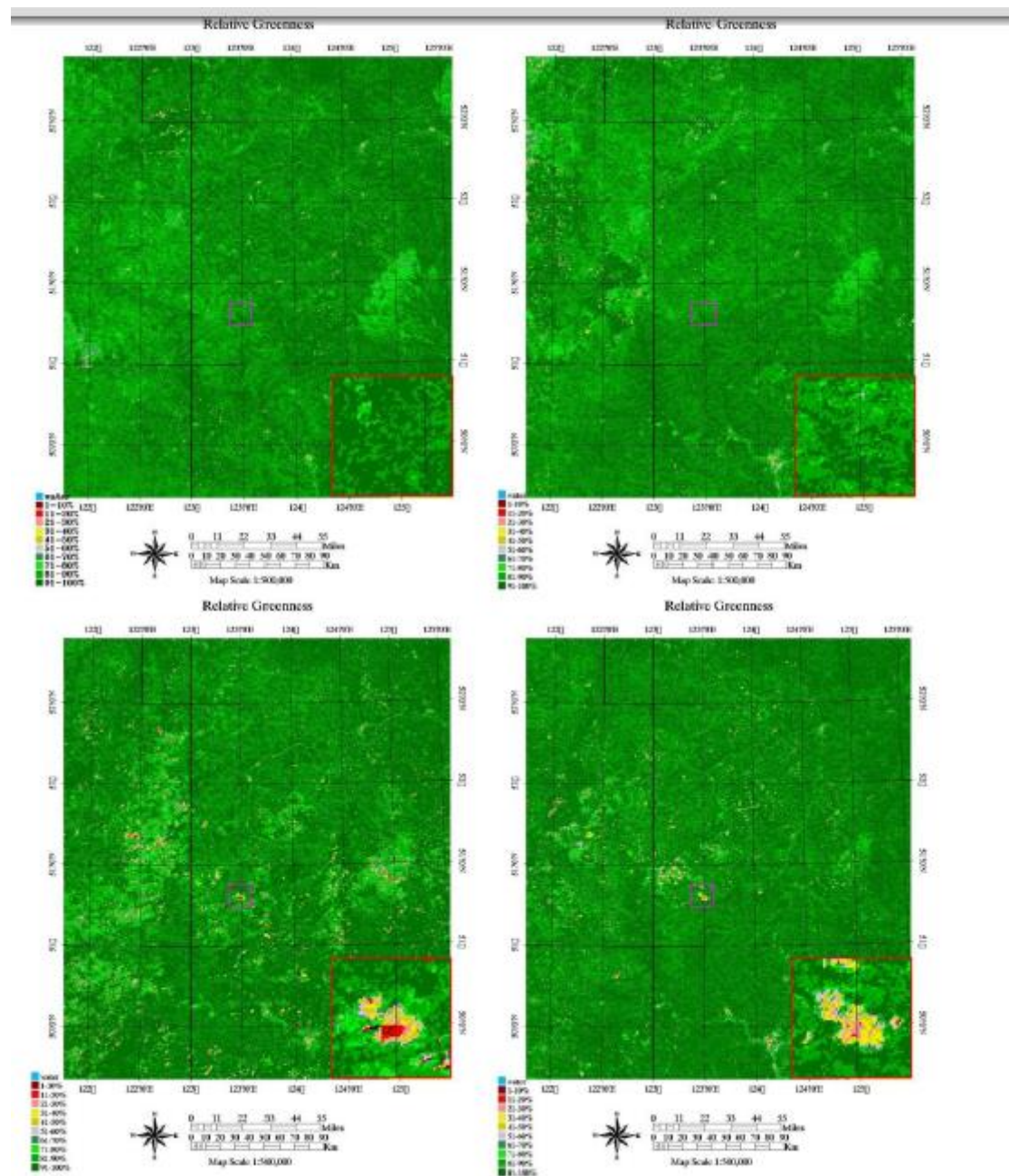


The predicted results by applying the modified fire potential index. (a) the result of 26th June, 2010; (b) the result of 27th June, 2010; (c) the result of 28th June, 2010

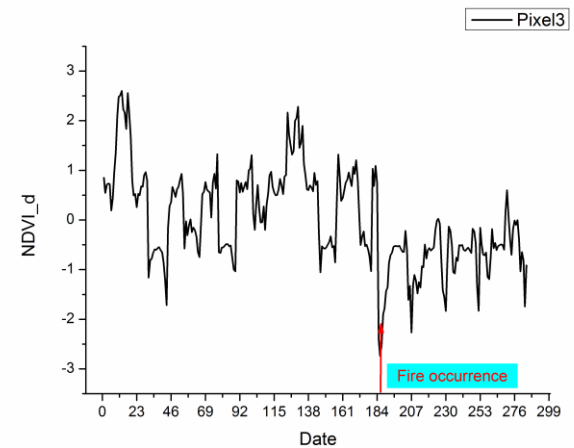
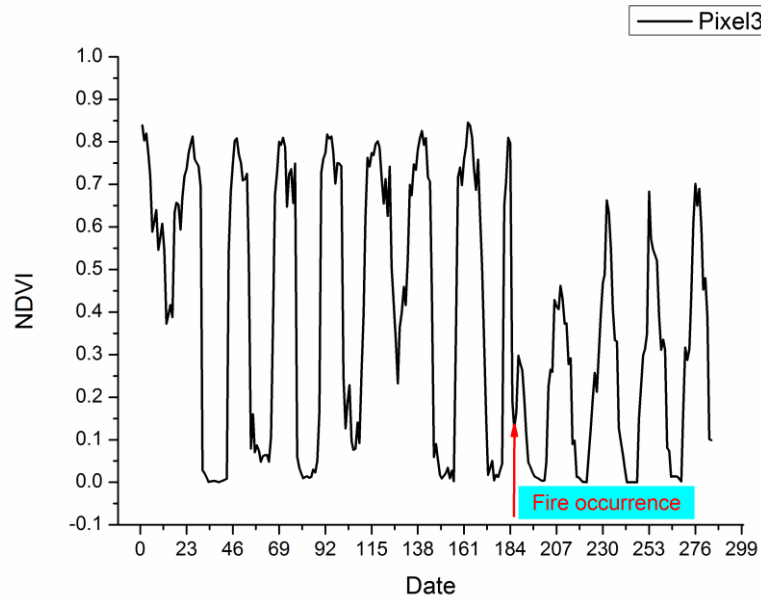
Validations



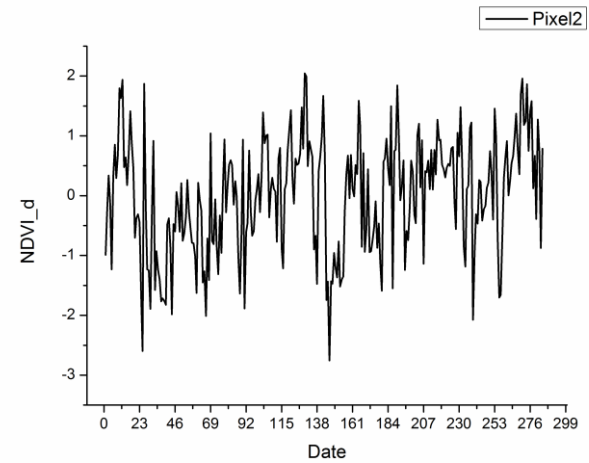
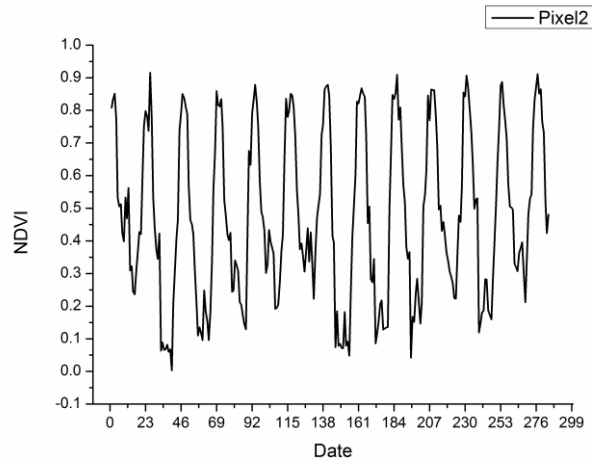
Percentage of the hotspots belonged to each risk levels on 26th June, 27th June and 28th June, 2010.



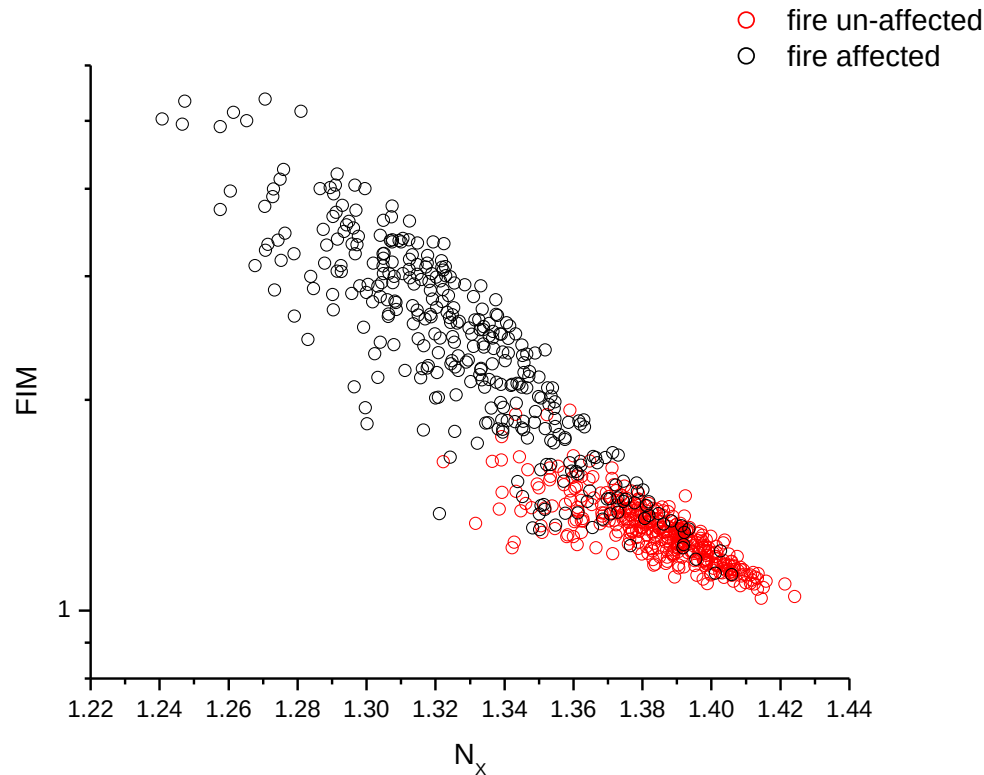
Post fire analysis



Unaffected fire pixel



Fisher-Shannon information plane of the time series of pixels investigated



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Thank you

