SIN
Sistema Informativo Nazionale per lo sviluppo dell'agricoltura

National Information System for Agriculture Development

The multisource Remote Sensing activity for the agricultural monitoring and the EU CAP subsidy controls in Italy

March 9- 2012

Livio Rossi

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2. The EU Common Agricultural Policy steps and its evolution
3. The agro-environmental safeguard by Remote Sensing techniques
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SIN - National Information System for Agricultural Development, is a company owned by AGEA -Agency for Agricultural Subsidy Payments (by Law 231/2005), for managing and developing the Italian Agricultural Information System for: agriculture, agribusiness, forestry and fishery sectors.

SIN takes advantage of private ownership, leading companies in information technology and territorial data management

SIN uses remote sensing services, satellite and aerial, also provided through the aircrafts by its owned Telaer Ltd., and innovative sensors/products for land survey and monitoring

Main Users and Clients of SIN

Central Public Authorities

AGEA

Agenzia per le erogazioni in agricoltura

MPAAF

Ministero delle politiche agricole, alimentari e forestali

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Local subsidy Paying Agencies

- AGEA
- AVEPA (Regione Veneto)
- ARCEA (Regione Calabria)
- ARPEA (Regione Piemonte)
- ARTEA (Regione Toscana)
- OPPAB (Provincia Bolzano)
- APPAG (Provincia Trento)
- AGREA (Regione Emilia Romagna)
- …..

Other Public Bodies

- ISMEA
- INEA
- INRAN
- CRA
- UNIRE
- ENCI
- Agenzia del Territorio
- Joint Research Centre
- ….

Local Public Authorities

- Calabria
- Sicilia
- Marche
- Piemonte
- Campania
- Basilicata
- ….

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Advanced aerial remote sensing: AGEA TELAER system managed by SIN

TELAER is an integrated aerial remote sensing system assigned to AGEA by law. Telaer covers all Remote Sensing acquisition, processing and management chains for

-Aerial acquisition and processing;

-Ground segment;

-Satellite processing

The Telaer Infrastructures offer different configurations of sensor missions and cover different areas and target

AGEA uses Telaer for its institutional activities : updating of agronomic land cover/use of Italy (LPIS-refresh) and agro-subsidy declarations controls and monitoring. In addition, several R&D tasks are performed through Telaer initiatives and outputs

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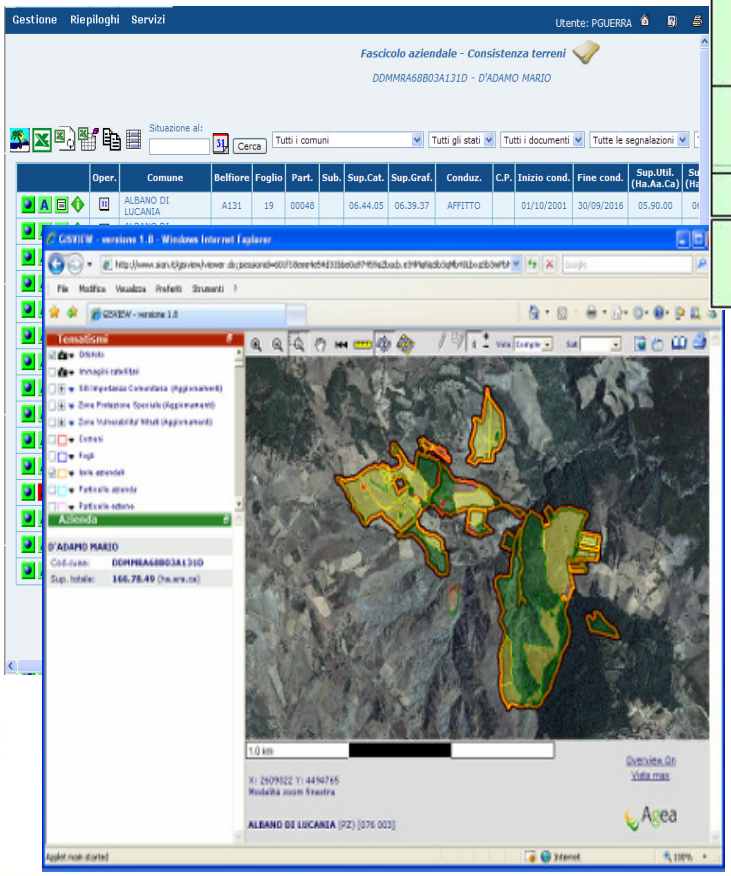
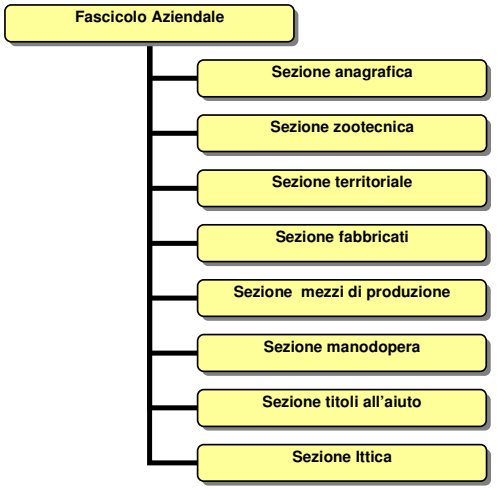
Territorial data base- the farm register: a certification system for agro-environment management

Farm register: a complete graphic and alphanumeric data base concerning all national agriculture and forestry farms





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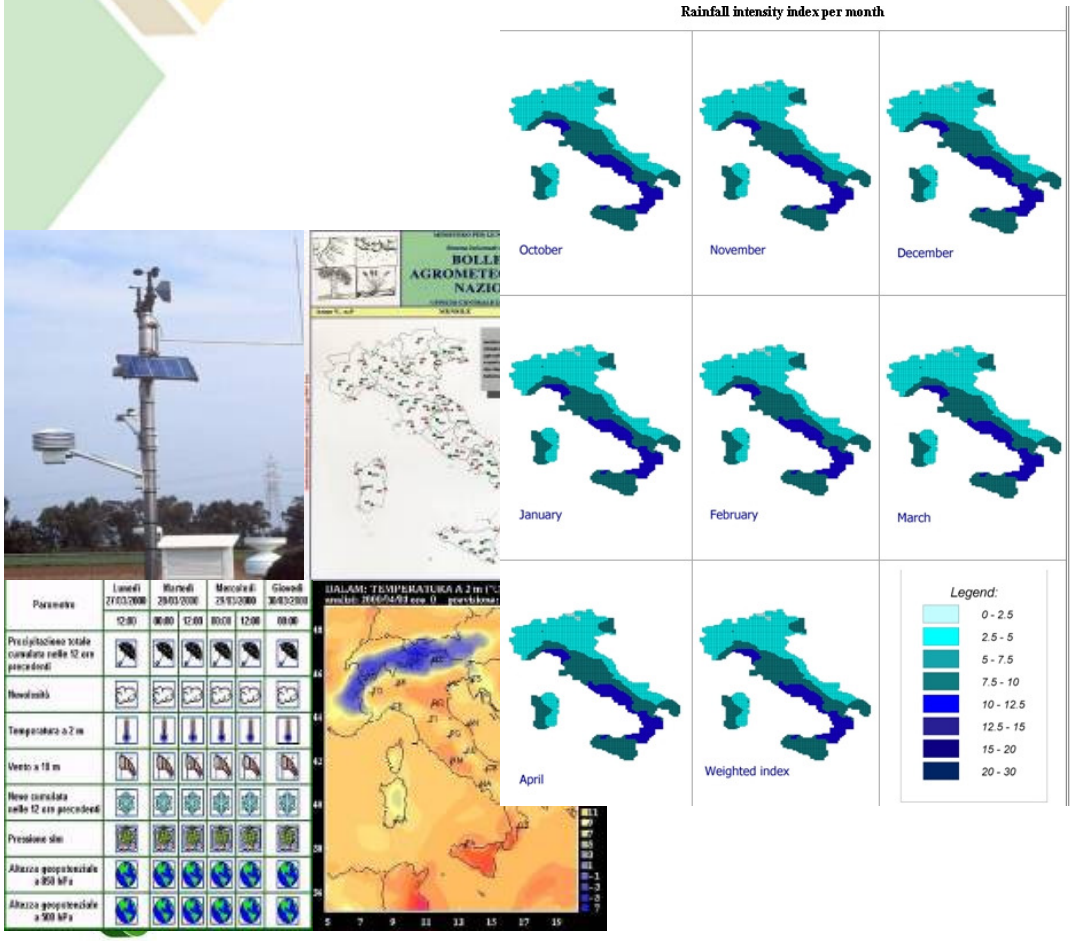
Agro meteorological services

Agro-climatic operational support to Assistance Centres, meteorological monitoring and related products diffusion and publication



National Agro-meteorological network

31 agro-meteo stations

✓ National network integration (Air force)

Services

✓ Data acquisition/diffusion

✓ Agro-meteorological bulletins realizing

✓ Climatic and climatologic services

Involved Bodies

✓ CRA (centre of Agricultural research)

✓ Military Air force service

✓ ECMWS (European Centre of forecasting)

✓ Regional services

Territorial data base - national GIS: a certification system for agro-environment management

Cartographic and thematic layers are on a continuous data base, organized in **3** informative levels

Remote Sensing imagery: digital Ortho-photos updated every 3 years for 30% of Italian territory 0,5m ris.; satellite imagery at highest resolution by DG EU JRC; Radar and hyperspectral data;

Land Data: Digital Models of terrain and surface Cadastral (320.000 maps, 70 million parcels); maps in scale 1:10,00 of Italy

Thematic layers: by RS Interpretation land cover and land use; in situ surveys; 4,5 millions of olive-groves parcels; 220 mil. of olive trees; 4 millions of vineyards; forestry data and layers; unauthorized landfills; fires scar mapping for Forest Guard Services

GIS SIN-AGEA is one of the main, detailed and updated data base available in Italy

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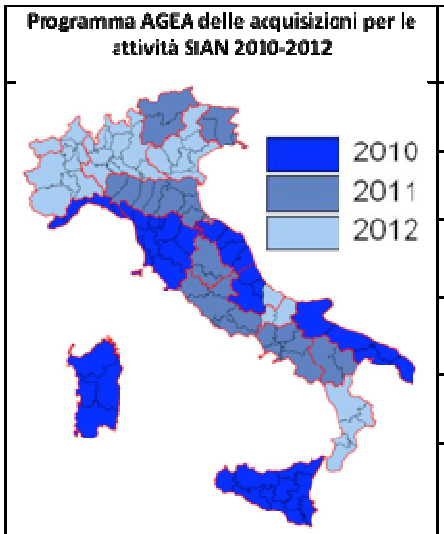
LPIS “Refresh” project for AGEA

LPIS- Land Parcel Identification System “Refresh” allows the continuous updating of the entire national Land cover/use necessary for IACS management (Integrated Agricultural Controls System).

LPIS allows the total amount of the subsidy eligibility area calculation and monitoring, detecting and delimiting all the territorial land cover of the nation.

“LPIS Refresh” uses remote sensing multispectral imagery (aerial Tealer and satellite) at very high resolution 0,50 m.

LPIS-Refresh provides the AGEA and the Italian Administration with a thematic map “wall-to-wall” 1:10,000 scale with MMU (minimum mapping units) up to 100 sm, with an updating frequency of 3 years



2010	2011	2012
Abruzzo	Basilicata	Calabria
Liguria	Campania	Lombardia
Marche	Emilia Romagna	Molise
Puglia	Friuli Venezia Giulia	Piemonte
Sardegna	Lazio	Valle d'Aosta
Sicilia	PA Bolzano	Veneto
	PA Trento	
Toscana	Umbria	

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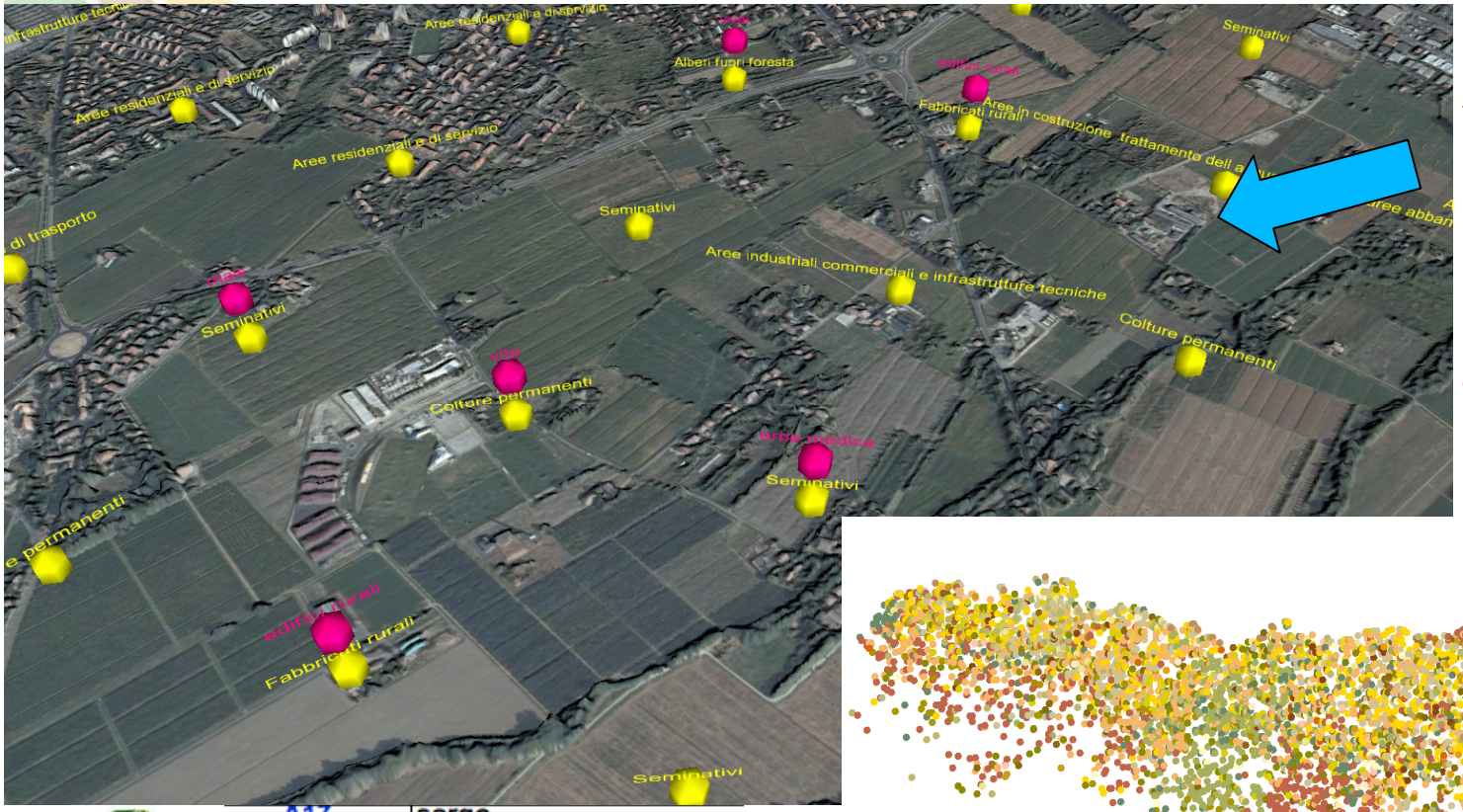
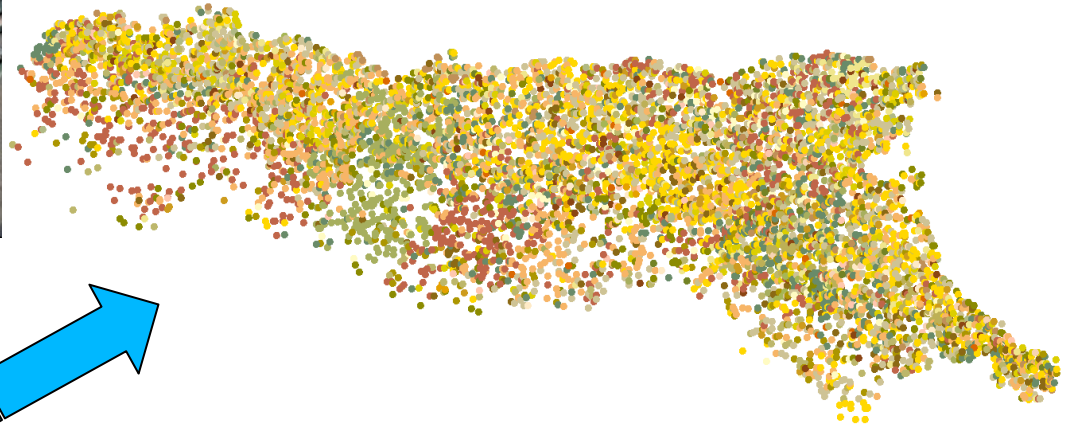
AGRIT project: statistics before the harvest

20 years of agronomic statistics in Italy
1,2 million of interpreted points on a grid 500x500m;
more than 100,000 multi-temporal ground surveys every year



Yellow:
Interpreted points

Red: agronomic
current RFV



A17	sorgo
A18	riso
A19	segale
A24	altri cereali
A25	legumi secchi
A31	colza e ravizzone
A32	girasole
A33	soia
A35	barbabietola da zucchero

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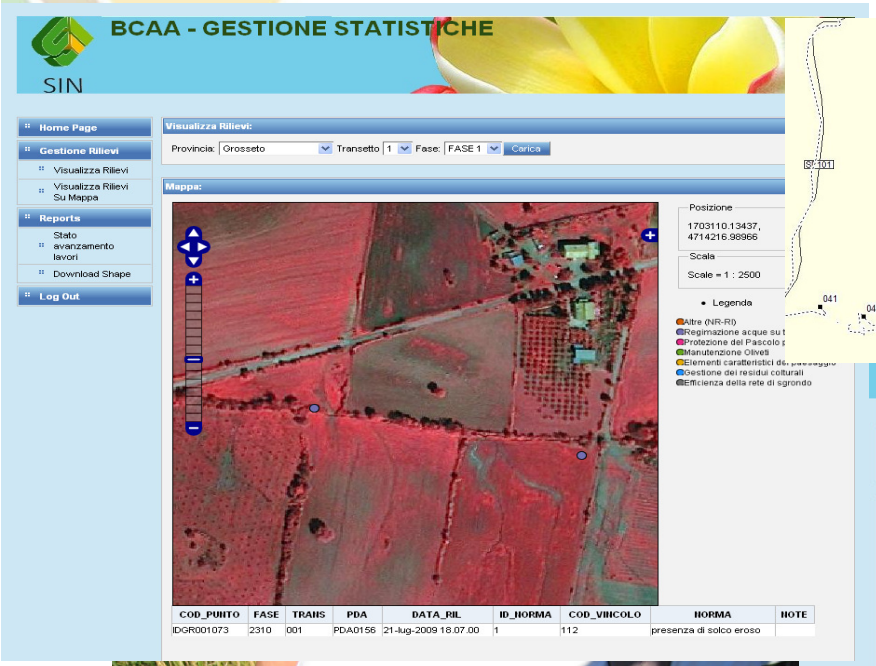
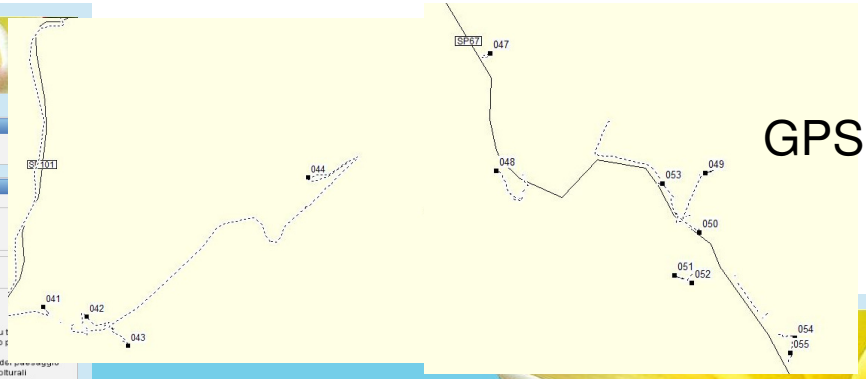
Example of Agrit grid point frame in Emilia-R

Ground surveys for speeding up operations and minimize mistakes; WEB site for ground survey management data collection and verification





GPS tracks

survey's progress on line monitoring

Visualizza Rilievi:

Provincia: Grosseto Fase: FASE 1 Carica

Report: Export

Cod Punto	Transetto	Cod PDA	Cod Vincolo	Descrizione Vincolo	Data Rilievo	Note	Foto
IDGR002111	002	PDA0156	NR	NULLA DA RILEVARE	24/07/2009 18:54	visto a distanza difficolt¿ ad avvicinarsi causa accessi chiusi con cancello	
IDGR002087	002	PDA0156	112	presenza di solco eroso	24/07/2009 18:49		
IDGR002028	002	PDA0156	NR	NULLA DA RILEVARE	24/07/2009 18:41	visibile dalla strada per cancello chiuso	
IDGR002112	002	PDA0156	NR	NULLA DA RILEVARE	24/07/2009 18:36	vista a distanza causa cancello	
IDGR002031	002	PDA0156	NR	NULLA DA RILEVARE	24/07/2009 18:19		
IDGR002113	002	PDA0156	112	presenza di solco eroso	24/07/2009 18:12	osservata a distanza causa via d accesso inadeguate	
IDGR002114	002	PDA0156	NR	NULLA DA RILEVARE	24/07/2009 18:10	osservata a distanza causa vie d accesso inadeguate	
IDGR002032	002	PDA0156	NR	NULLA DA RILEVARE	24/07/2009 17:58		
ID1248450964	002	PDA0156	111	presenza fenomeni franosi	24/07/2009 17:56	sponda laghetto punto 29	
IDGR002030	002	PDA0156	112	presenza di solco eroso	24/07/2009 17:44	vista a distanza causa strda dissestata, solchi evidenti	
IDGR002029	002	PDA0156	NR	NULLA DA RILEVARE	24/07/2009 17:41	terreno lavorato difficile riscontrare violazioni	
ID1248449416	002		111	presenza fenomeni franosi	24/07/2009 17:30		
IDGR002024	002	PDA0156	NR	NULLA DA RILEVARE	24/07/2009 17:25		
ID1248448865	002		111	presenza fenomeni franosi	24/07/2009 17:22	osservato da lontano causa recinzione	
IDGR002076	002	PDA0156	NR	NULLA DA RILEVARE	24/07/2009 17:15	osservato da lontano causa strada non accessibile	
ID1248448013	002		112	presenza di solco eroso	24/07/2009 17:08		
IDGR002077	002	PDA0156	112	presenza di solco eroso	24/07/2009 17:01		
IDGR002078	002	PDA0156	NR	NULLA DA RILEVARE	24/07/2009 16:57		

The Agriculture policy evolution….

from: Atlas of Italian Regions

De Agostini – 1951

ERP (European Reconstruction Programme)

- *The Atlas final desiderata*…"ploughing and always over fertilize new lands; drain all wetlands; build embankments for all rivers and creeks; build houses, bridges, roads; create everywhere dams and aqueducts and canals"…

EU
First attempt in agriculture management
years 80th -90th

First European agriculture subsidy target:

improve the yield through the subsidies to farm production!

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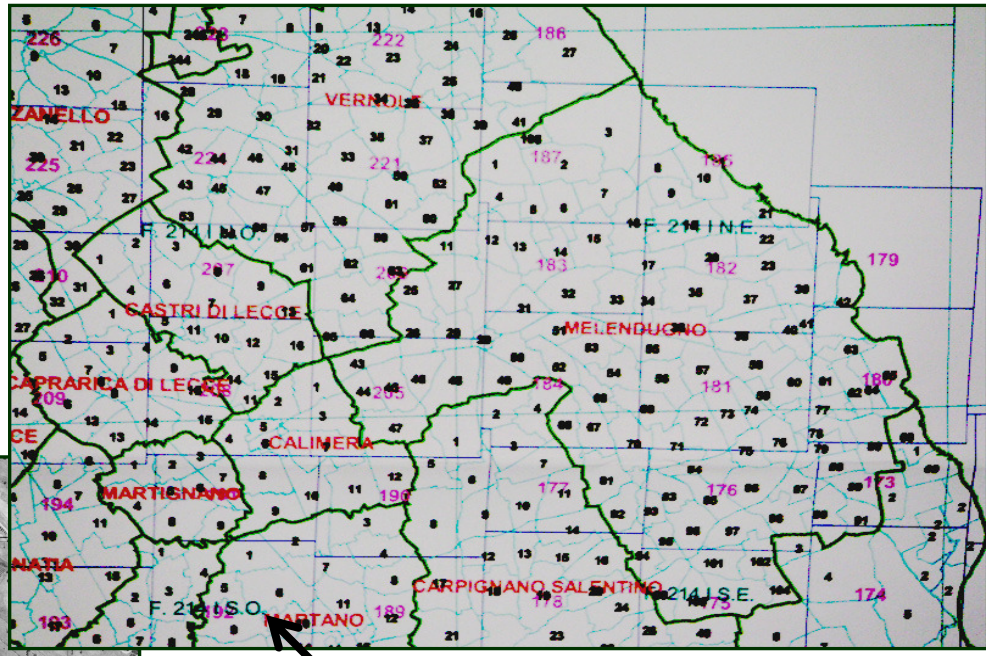
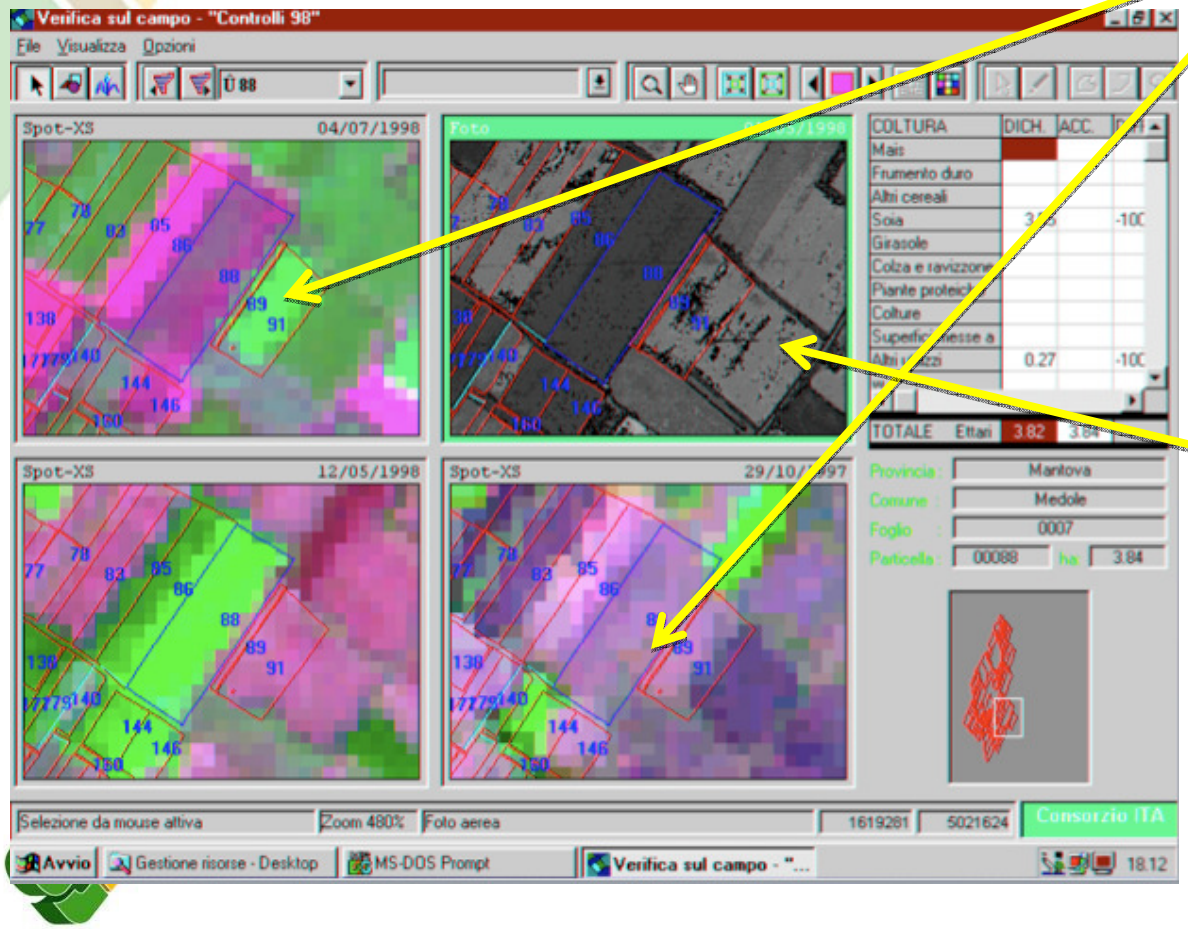
Two methods in parallel- 1st : ground surveys for agronomic input to be collected

B/W Ortho-photo for tailored in situ verifications and farmer interviews



Topographic maps for guiding the systematic field visits

2nd method: multi-temporal RS data overlaid on cadastral and declarations



- Landsat and Spot for phenological thematic info
- Graphic calculation on archive orthophotos

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EU
second attempt in agriculture management
years mid 90th - 2005

New European agriculture subsidy target:

forget production…. pay farmers for the all actual cultivated lands

(goal: reducing chemicals, fertilizers, pesticides, energy, etc.)

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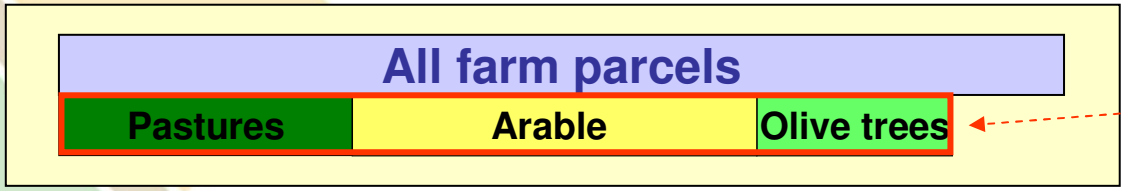
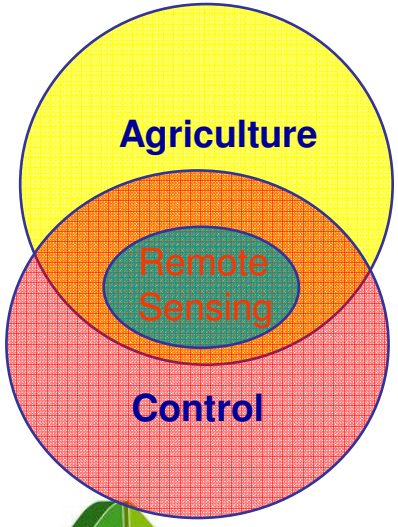
2nd method: Declared farm surfaces to be controlled by RS



To administrate and control:



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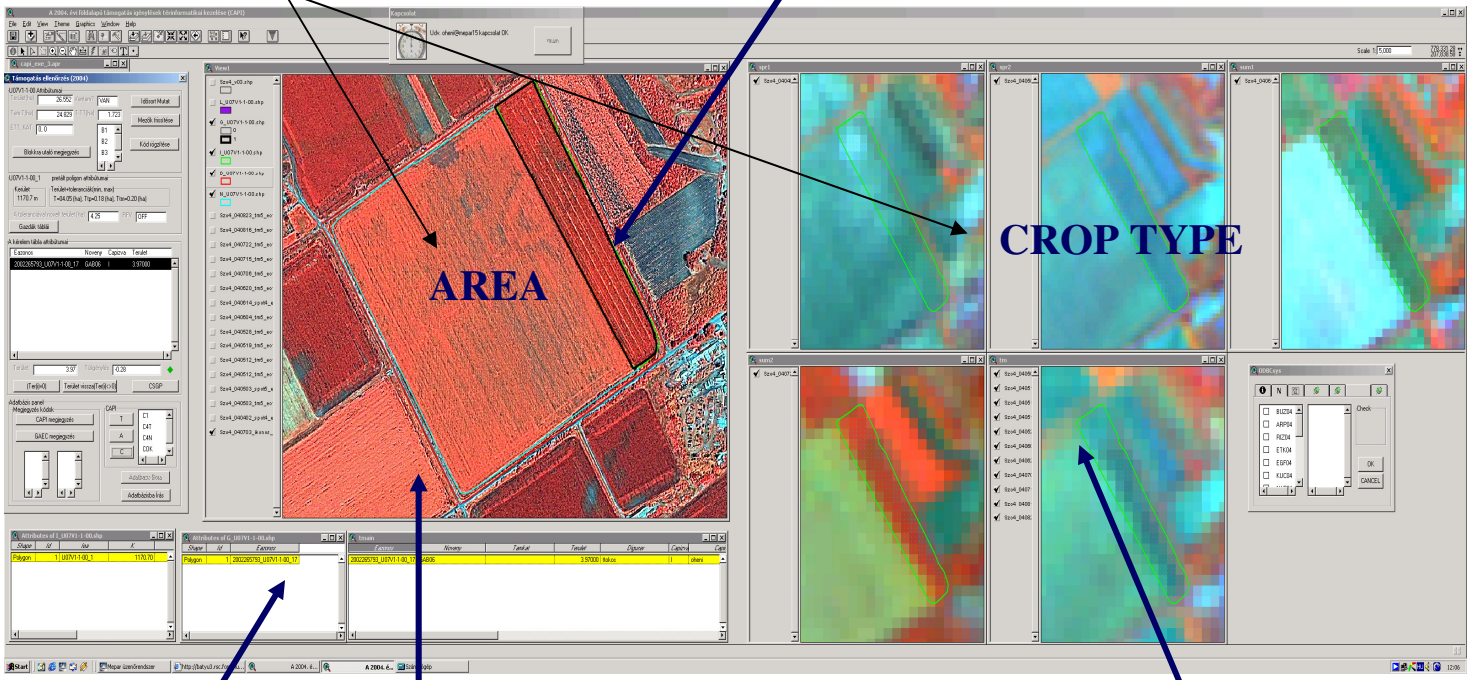
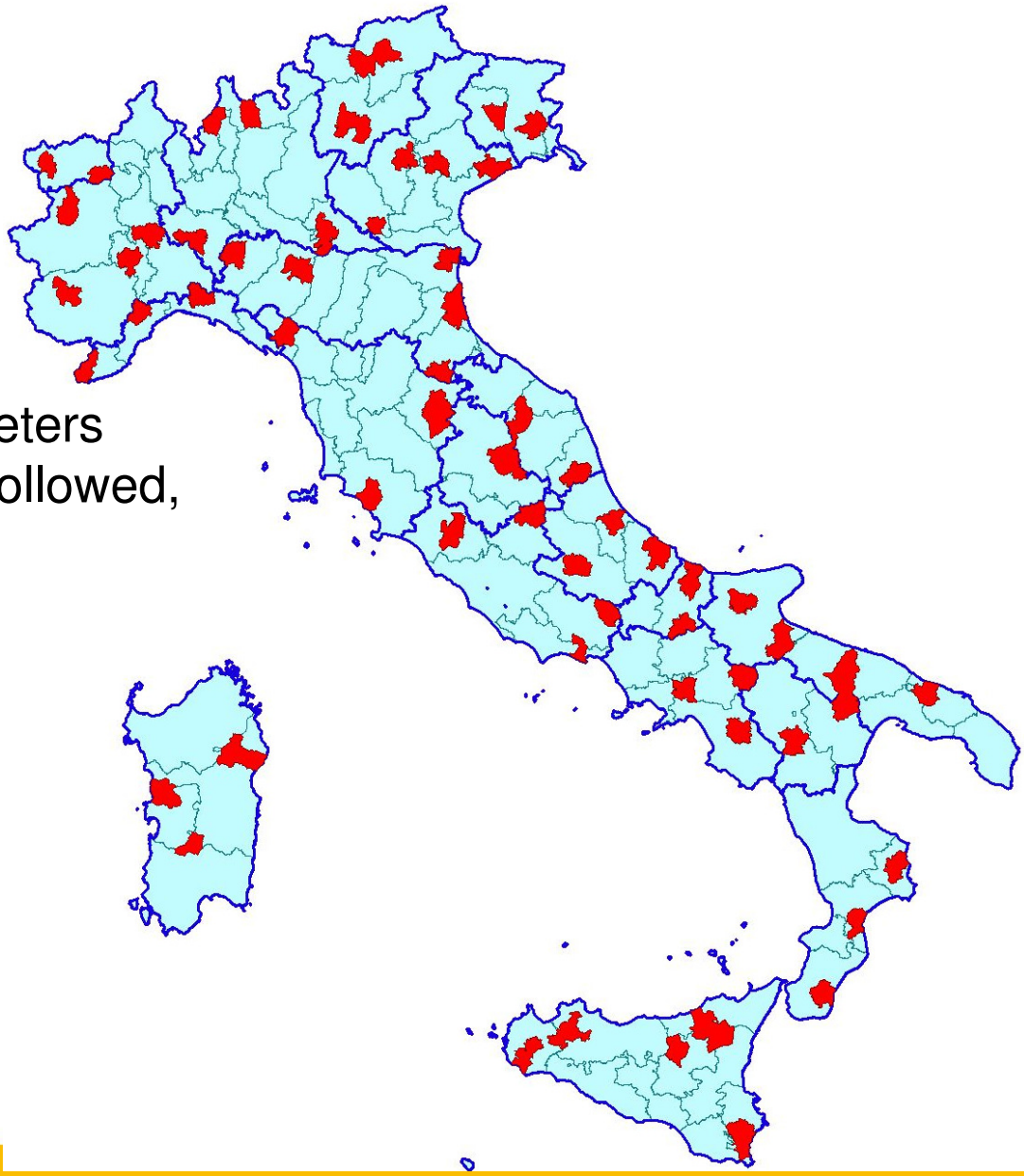


Where: Annual samples extraction by risk analysis



Several and different parameters
By EU regulations must be followed,
mainly based on:

-Geopolitical distribution
-Fraud risk score in the past
-Frequency in controls

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HOW:

on line manual with Spectral signatures library for crop groups and phenology homogeneous detection

CEREALI

gruppo coltura	*codice GIS*	*descrizione uso del suolo rilevato*
CEREALI	20	ALTRI CEREALI DEPAUPERANTI (A PAGLIA)
	202	AVENA
	2	GRANO (FRUMENTO) DURO
	200	GRANO (FRUMENTO) TENERO
	12	GRANO SARACENO
	1	GRANTURCO (MAIS)
	8	ORZO
	19	RISONE
	201	SEGALE
	203	SORGO

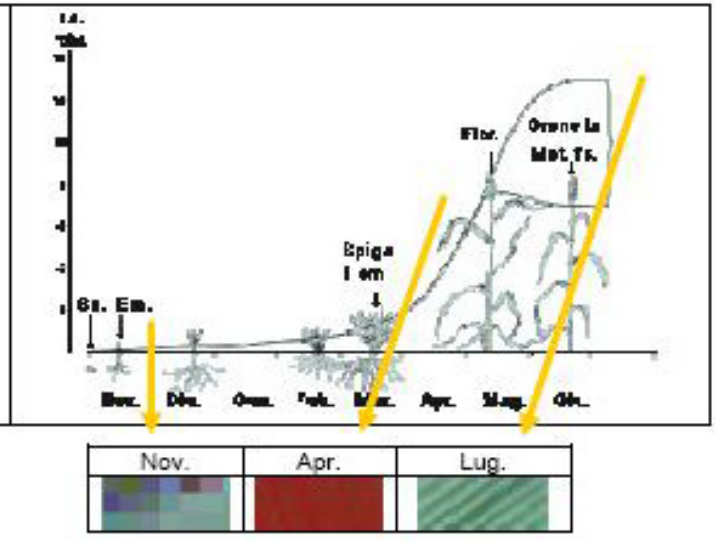
I gruppi che fanno riferimento ai cereali possono essere distinti in due macro classi:

- cereali a ciclo autunno-vernino (in arancio nella tabella)
- cereali a ciclo primaverile-estivo (in celeste nella tabella)

Cereali a ciclo autunno-vernino

Appartengono a questa classe:

- frumento duro
- frumento tenero
- orzo
- avena
- segale
- triticale



Le figure mettono in relazione le varie fasi di crescita dei cerali invernali e le risposte cromatiche che appaiono sui dati satellitari normalmente utilizzati per il progetto Controlli Oggettivi, ai vari periodi di acquisizione.

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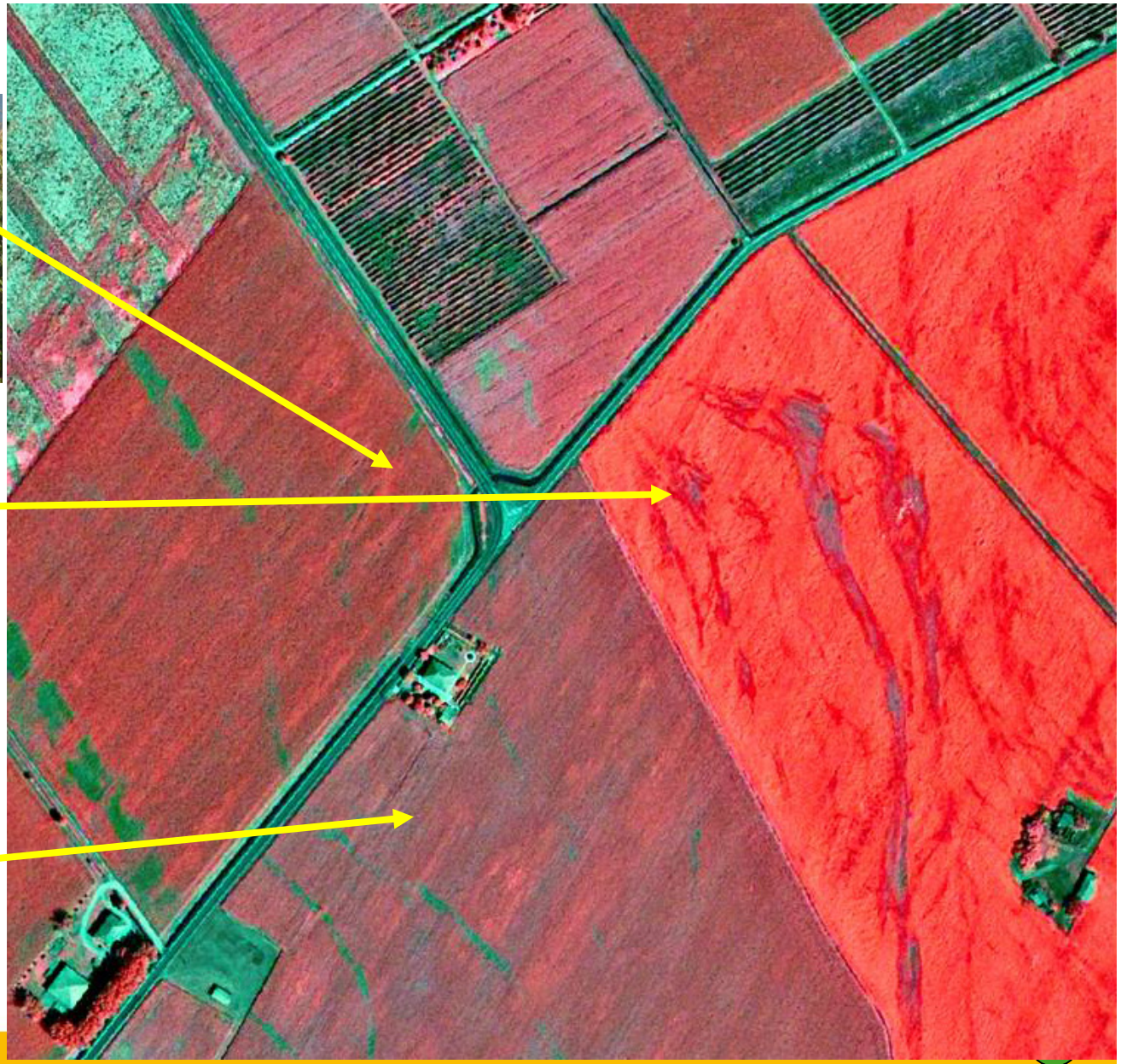
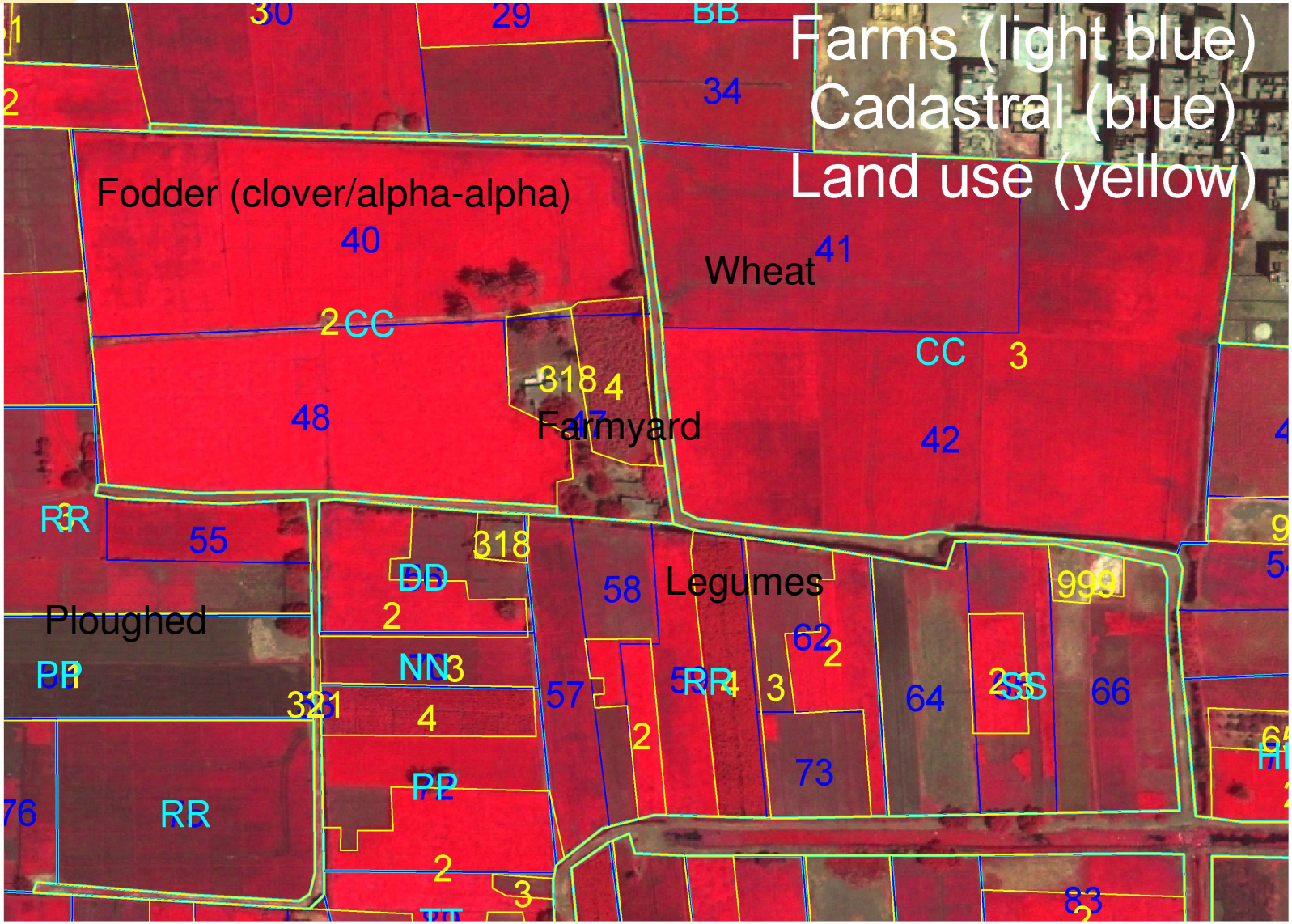
Example of good processing and sharing capability for agro-surfaces detection and measure



Zooming example of final different layers through sat VHR/ ancillary data



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EU
third attempt in agriculture management
years 2005-2013

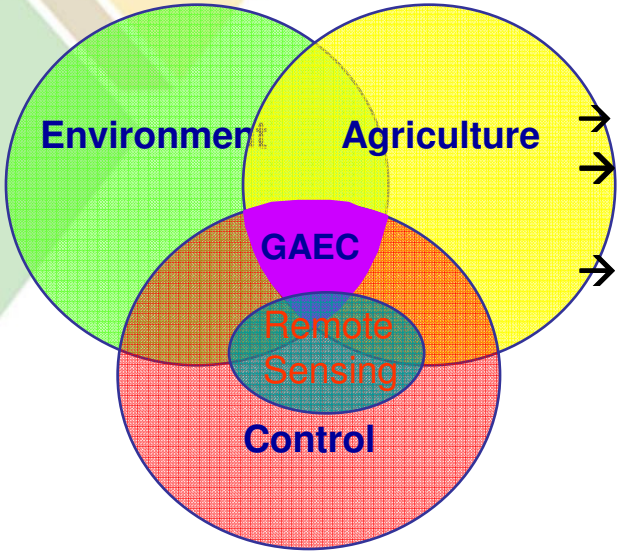
Again a new European target:

No more extensive cultivated lands only, but a well maintained agro-environment and eco-sustainable behaviour addressing

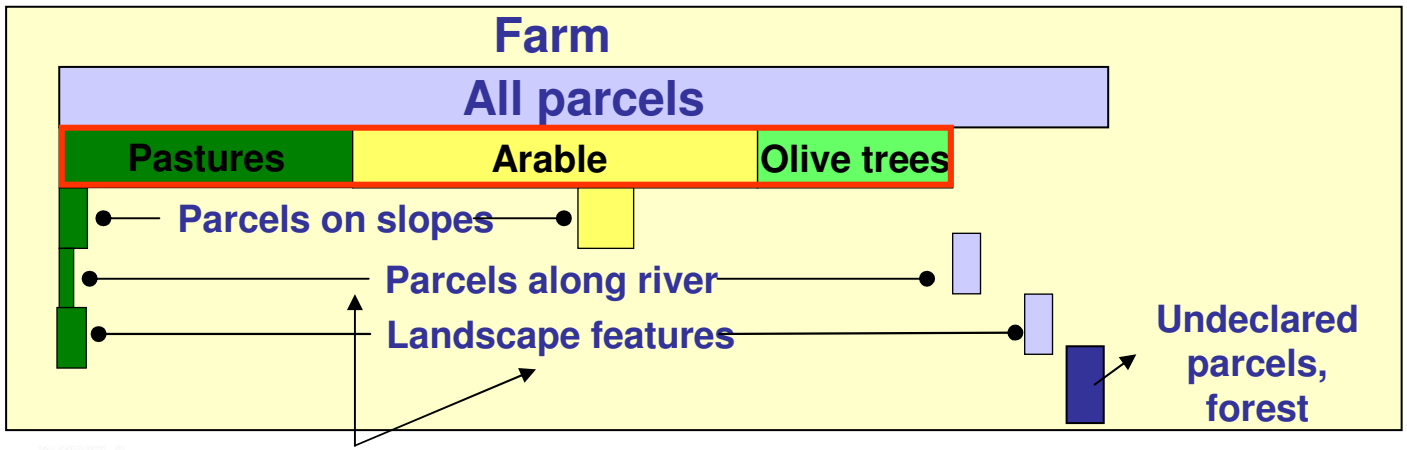
- the Cross- Compliance rules

After 2005 CAP reform

Cross compliance for the **agro-environment maintenance or amelioration**



→ **More spatial check (slope, riverside, undeclared area …)**
→ **More 'objects' to identify (fire, erosion, bush, tree lines, isolated trees …)**
→ **More temporal checks (winter, fixed date, reference period …)**



By Loudjani- JRC Mars

VHR images needed more than HR images

Third and current EU policy
Operational examples

- Agro-environment protection modeling
- Vulnerability and Risk mapping
- Remote Sensing benefit/costs advantages
- RS Multi sensors for different targets
- The importance of ancillary 3D and morphometric measures

Soil maintenance and protection by erosion 1955-current situation comparison

The correct agro-management and the good agronomic environmental conditions allow:

soil maintenance,

erosion mitigation

sustainability of the agro-practices

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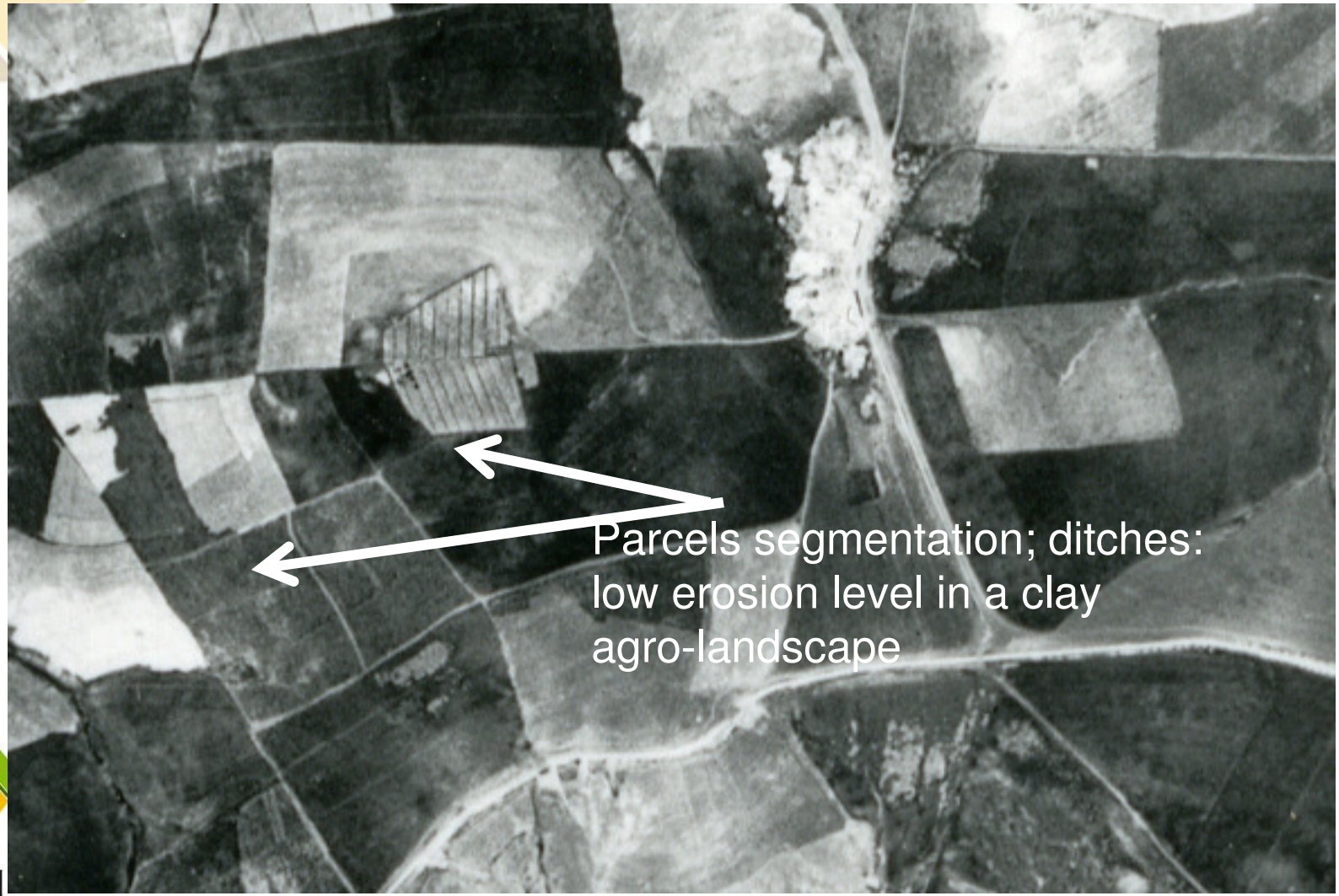
Historical analysis airborne 1955 vs. sat VHR 2009 – Sicily, erosion zones



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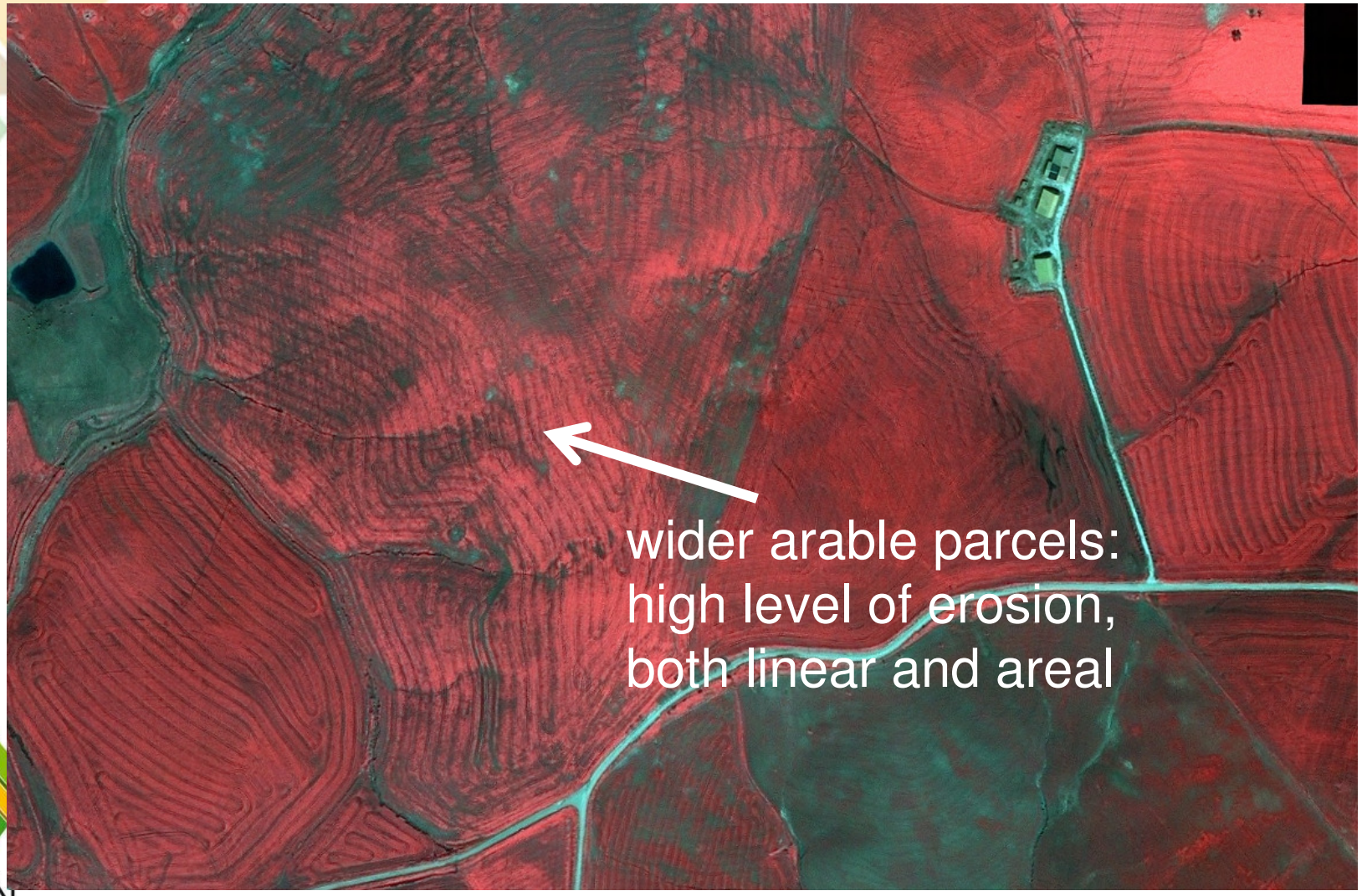
Historical analysis airborne 1955
same area sat VHR 2009 – Sicily, erosion zones



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Historical analysis airborne 1955 vs. sat VHR 2009 – Sicily, erosion zones

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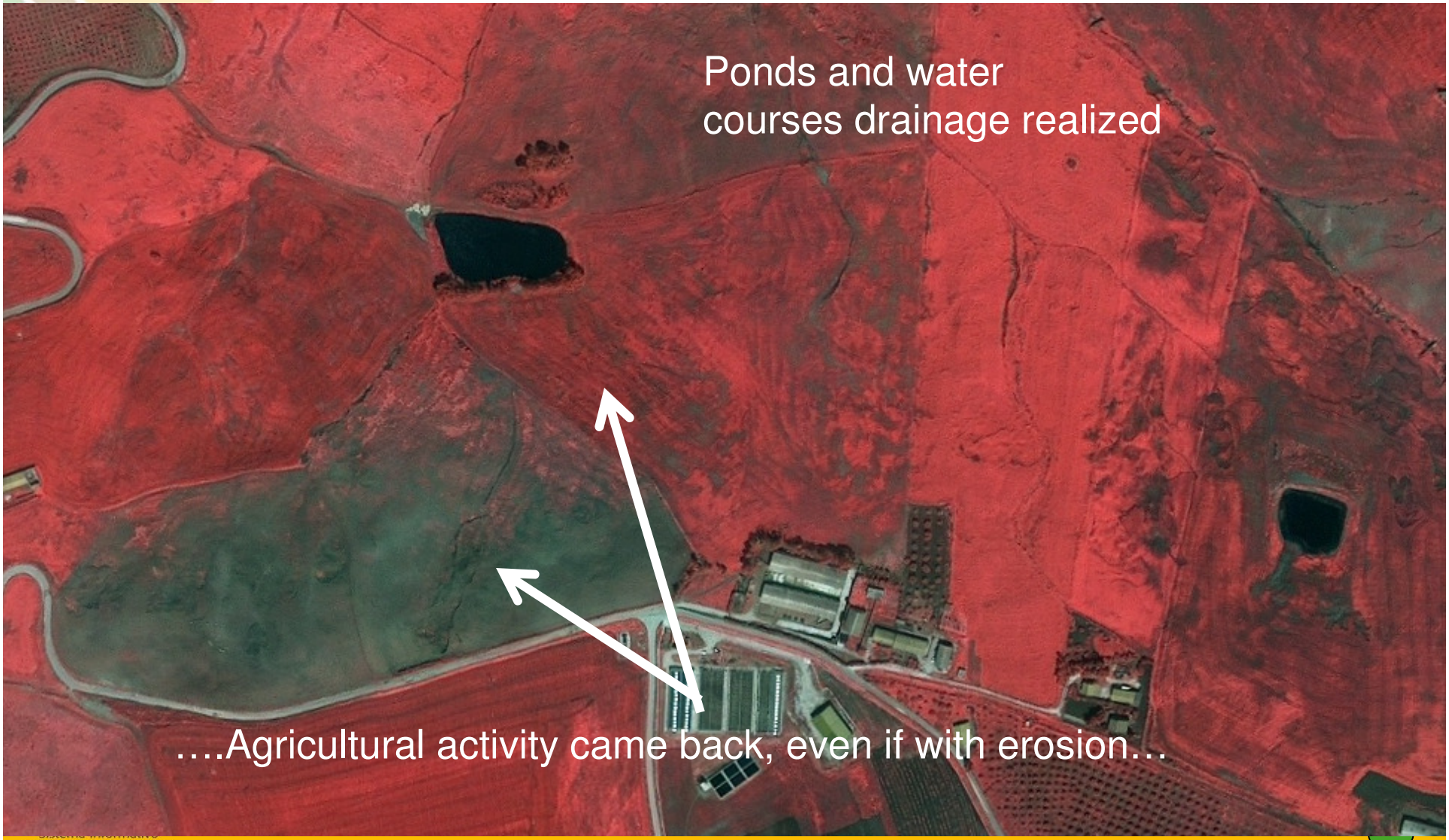
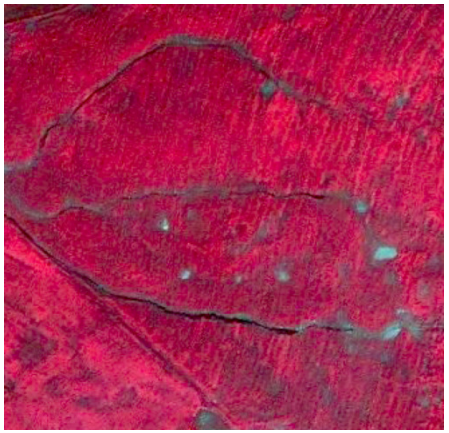
Historical analysis airborne 1955 vs. sat same area sat 2009 – Sicily, erosion zones

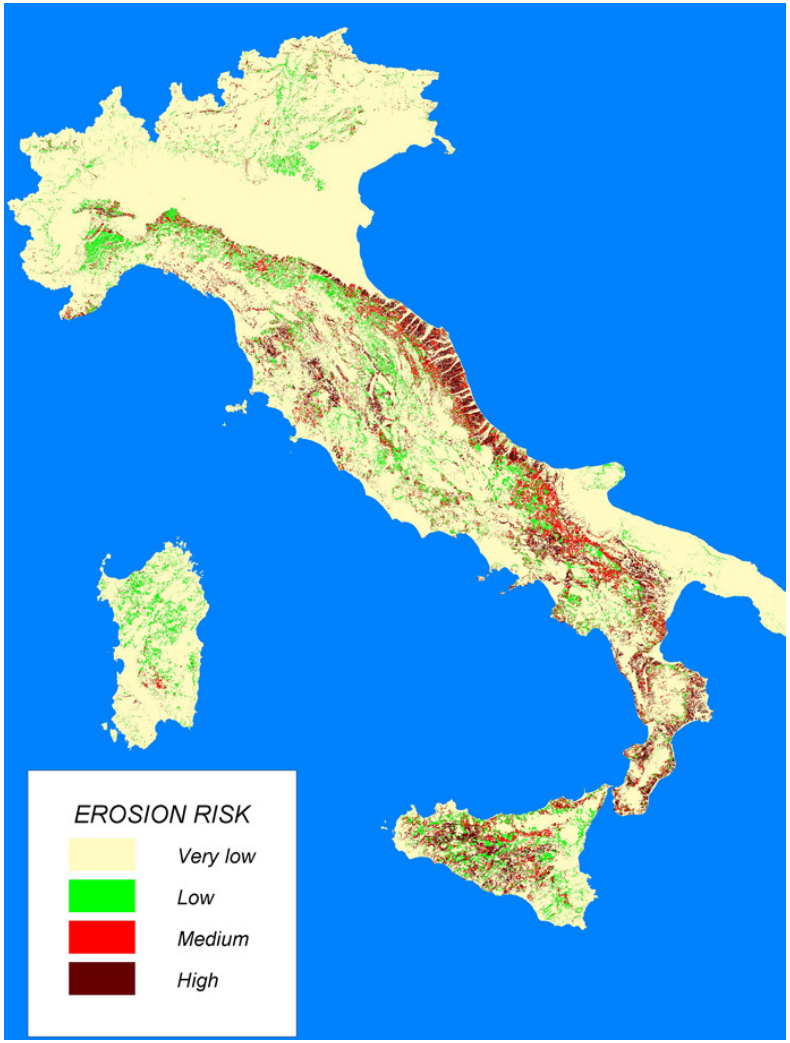


Soil erosion vulnerability mapping in agronomic zones

Goal: Good Agricultural Environmental Conditions monitoring

Synthetic map of risk erosion on agricultural areas in Italy by RS data, DSM and existing thematic layers





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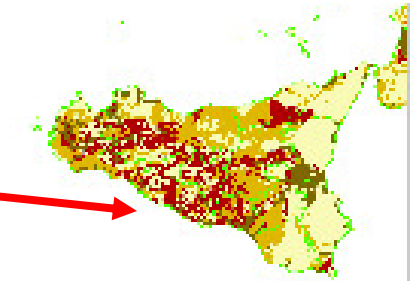
Litho

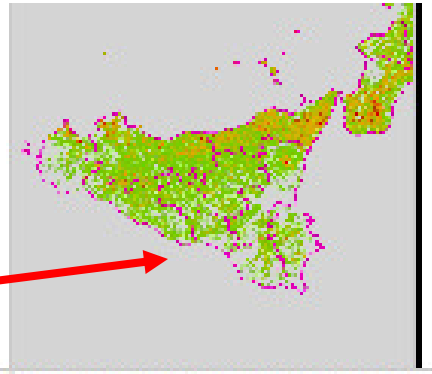
Slopes

Veg. coverage

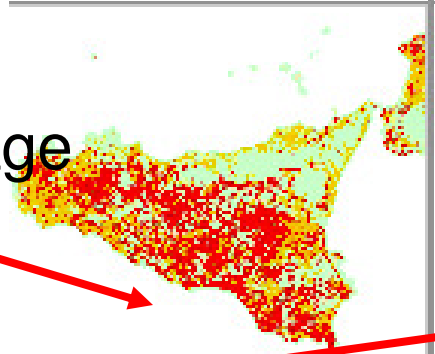
Meteo indexes



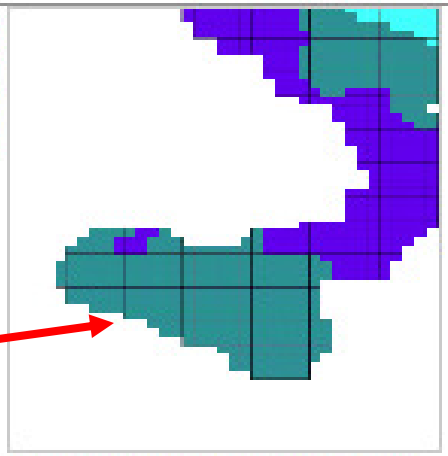
Geo-mechanical features map



Slopes classes in agricultural areas

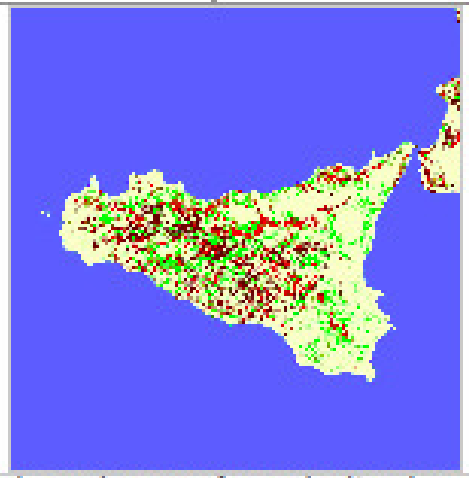


Vegetation coverage map



Rain intensity map for selected risk months

Crossing flow for erosion vulnerability on agro-environment data *used*



Risk erosion map for agricultural areas

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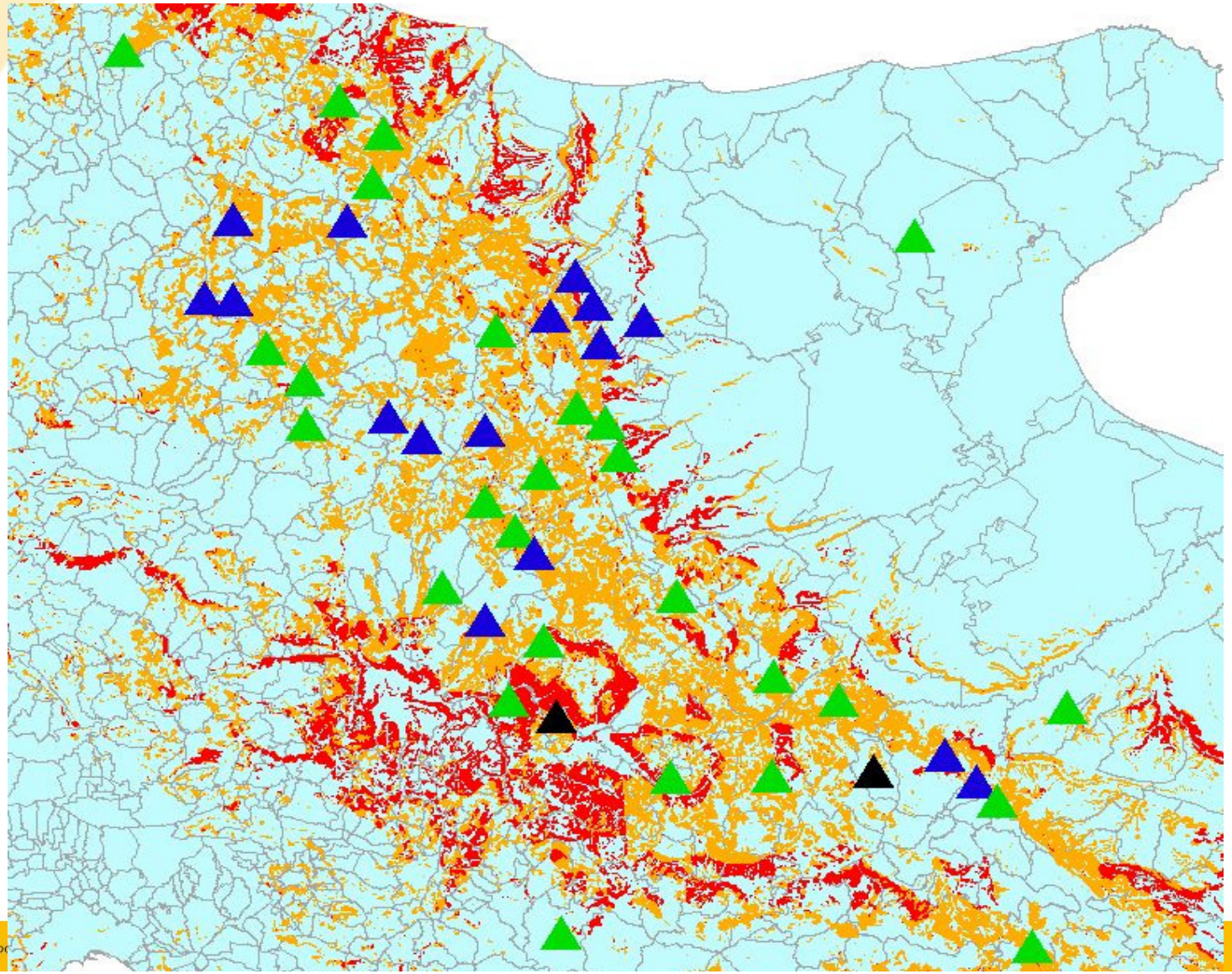
Map validation: 2006-08 in situ found violations (triangles) per municipality on vulnerability soil erosion zones (orange-red)



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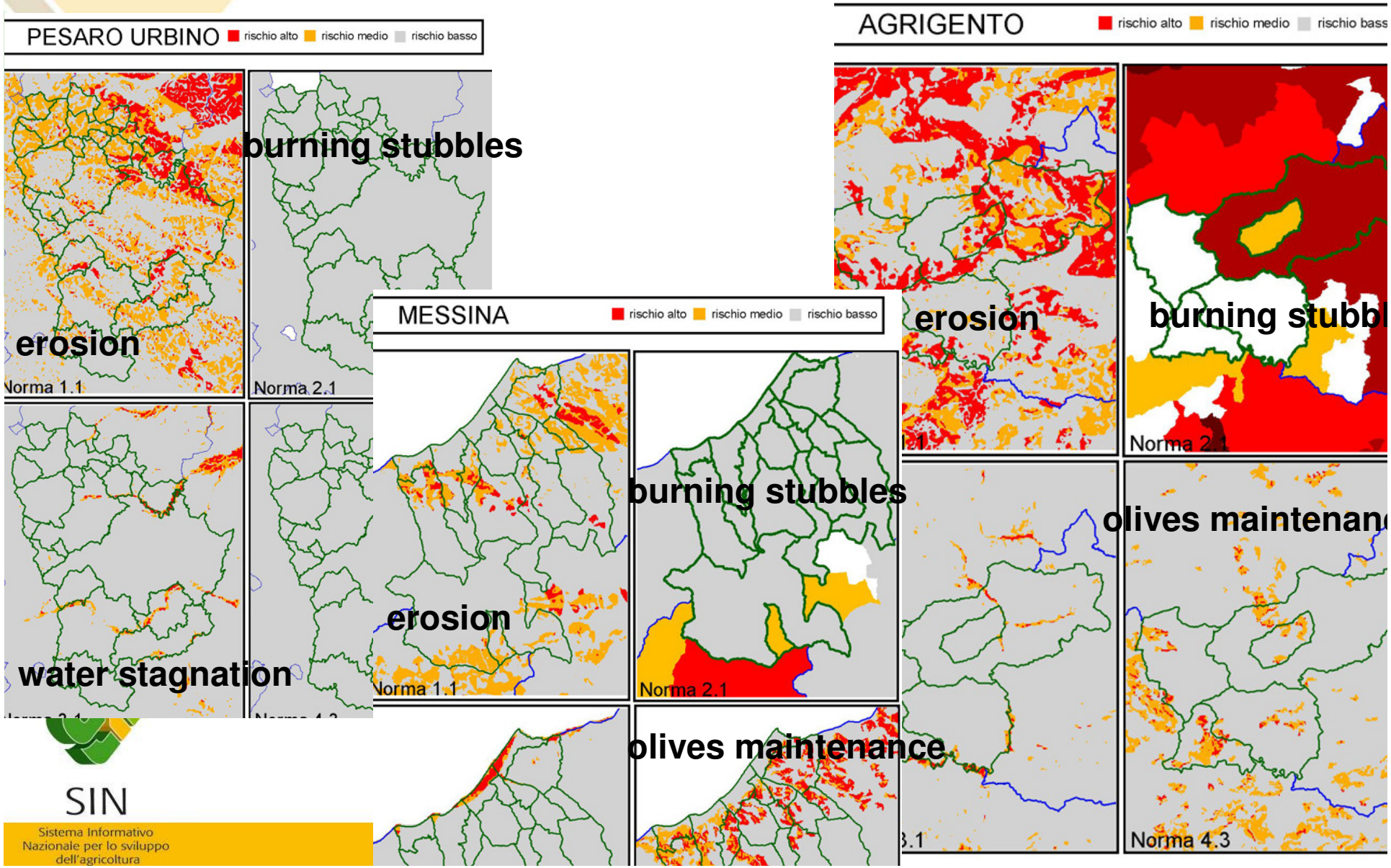
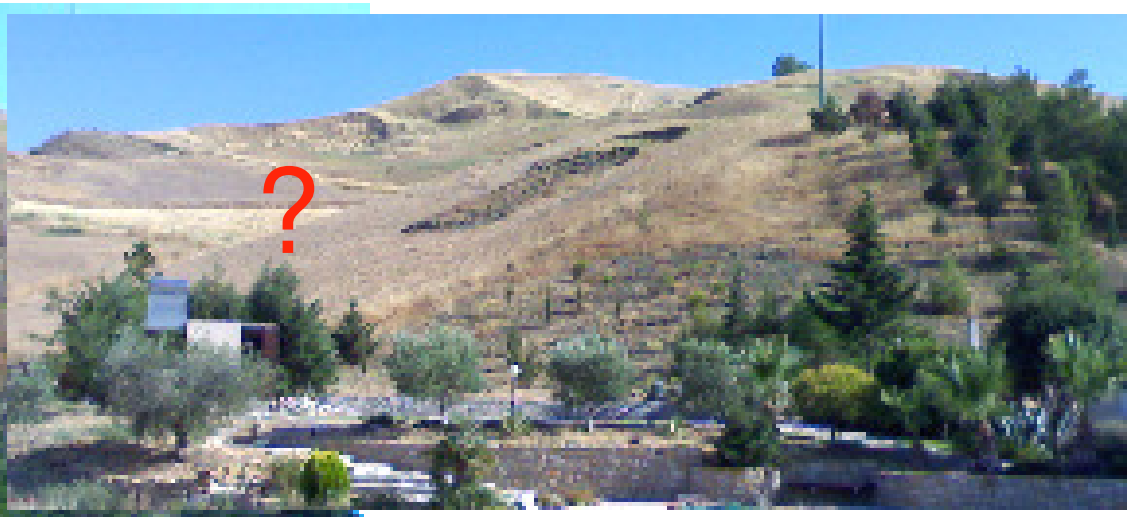
SIN-AGEA vulnerability/risk maps, overlaid on sample areas





Sicily :
small soil movements are detectable, while hidden phenomena are clear detected by RS

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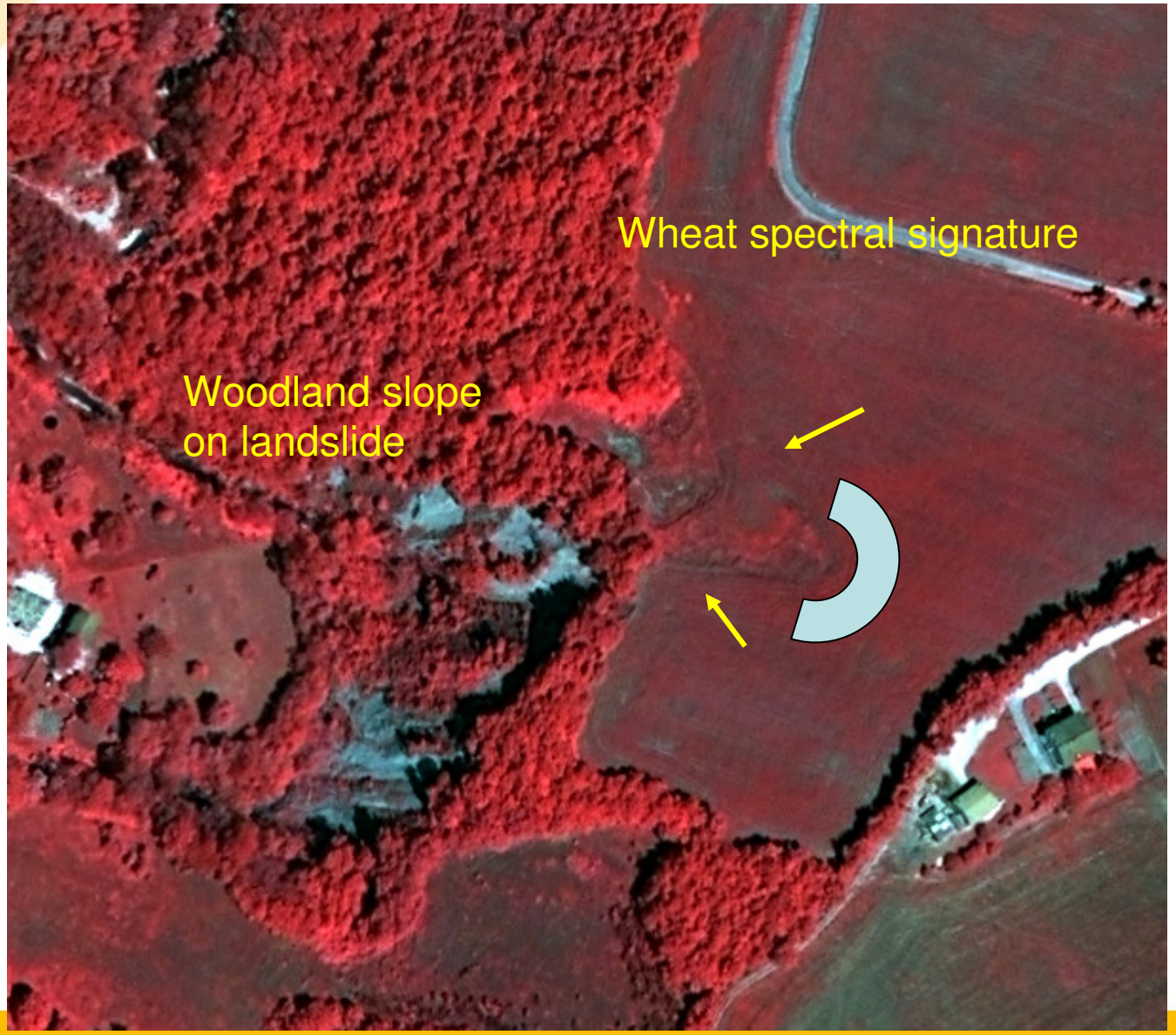
Erosion to landslide : irreversible loss of agricultural soil ; GAEC standard 1.1



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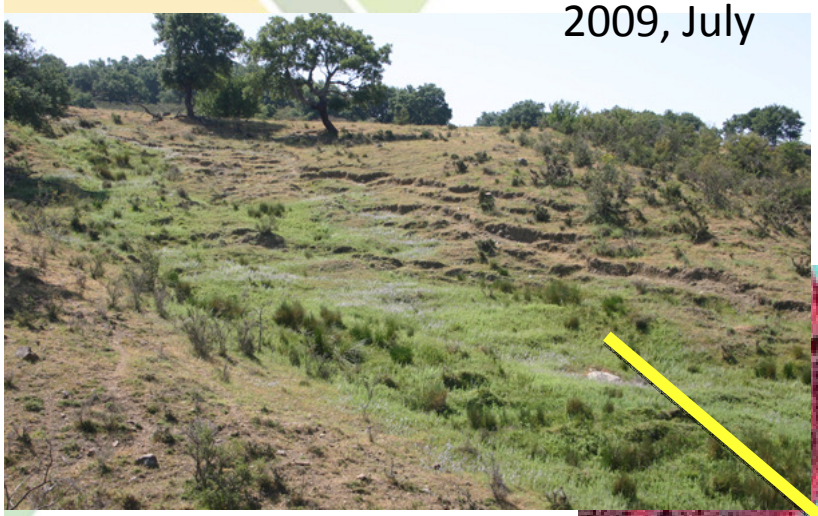
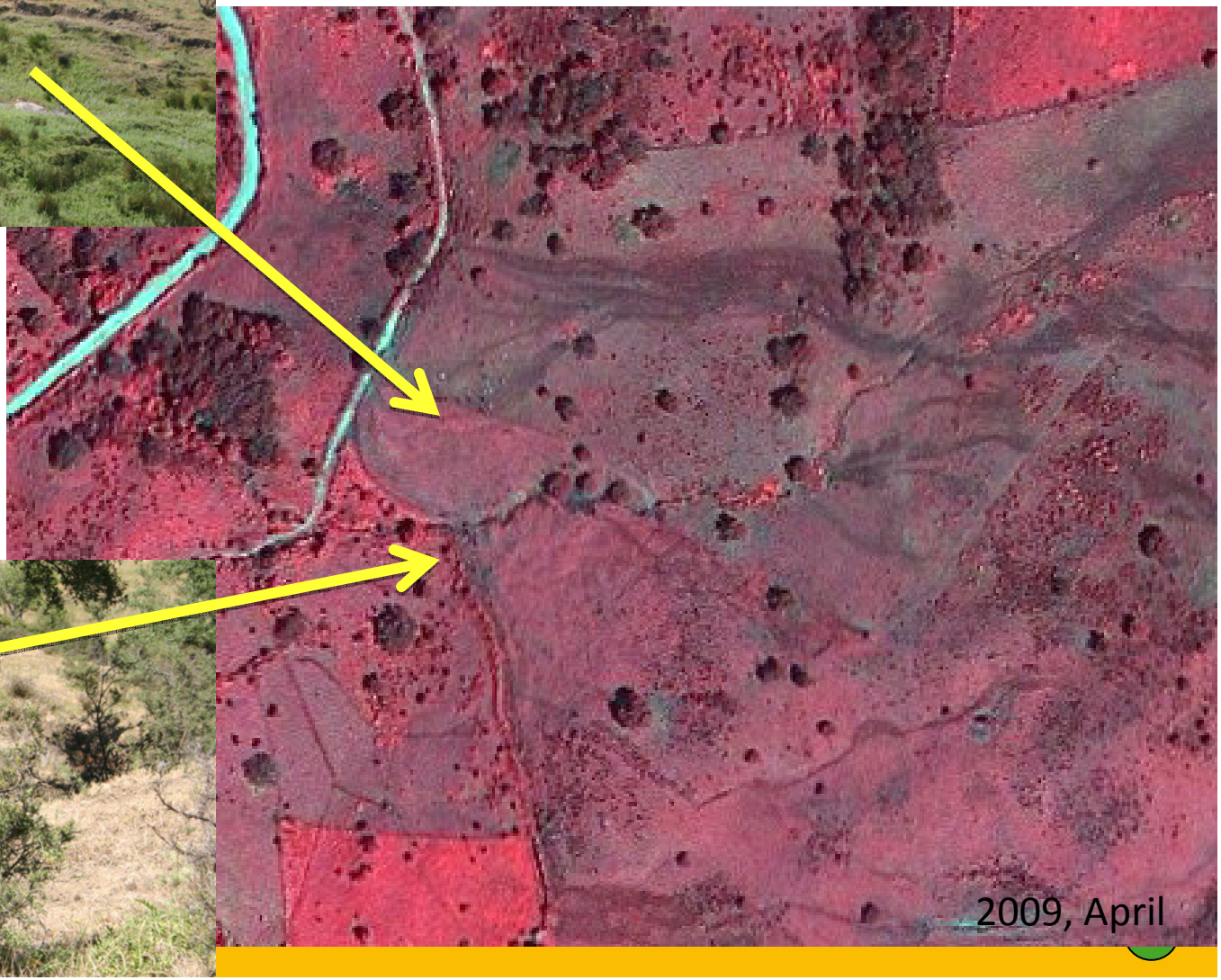
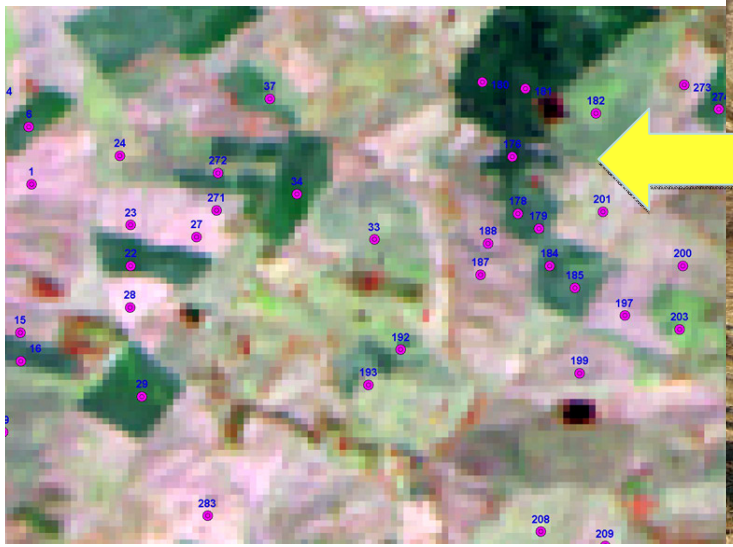
Messina
vegetation encroachment on pastures monitoring



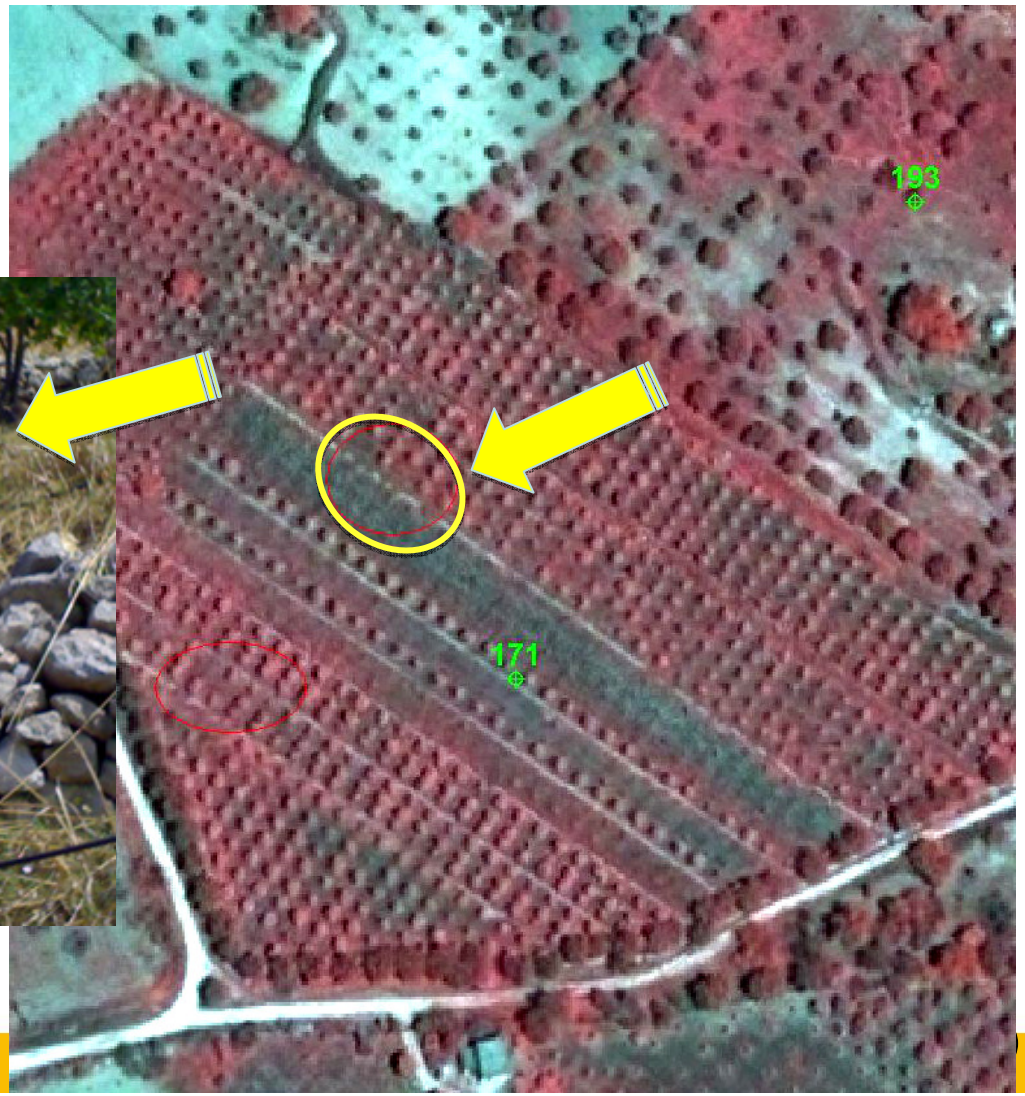
Active creeping detection



Ground pictures on test areas for standard 2.1 (Sept 11-13th)



Siracusa: slight damage on stone walls/ terraces: best VHR is needed



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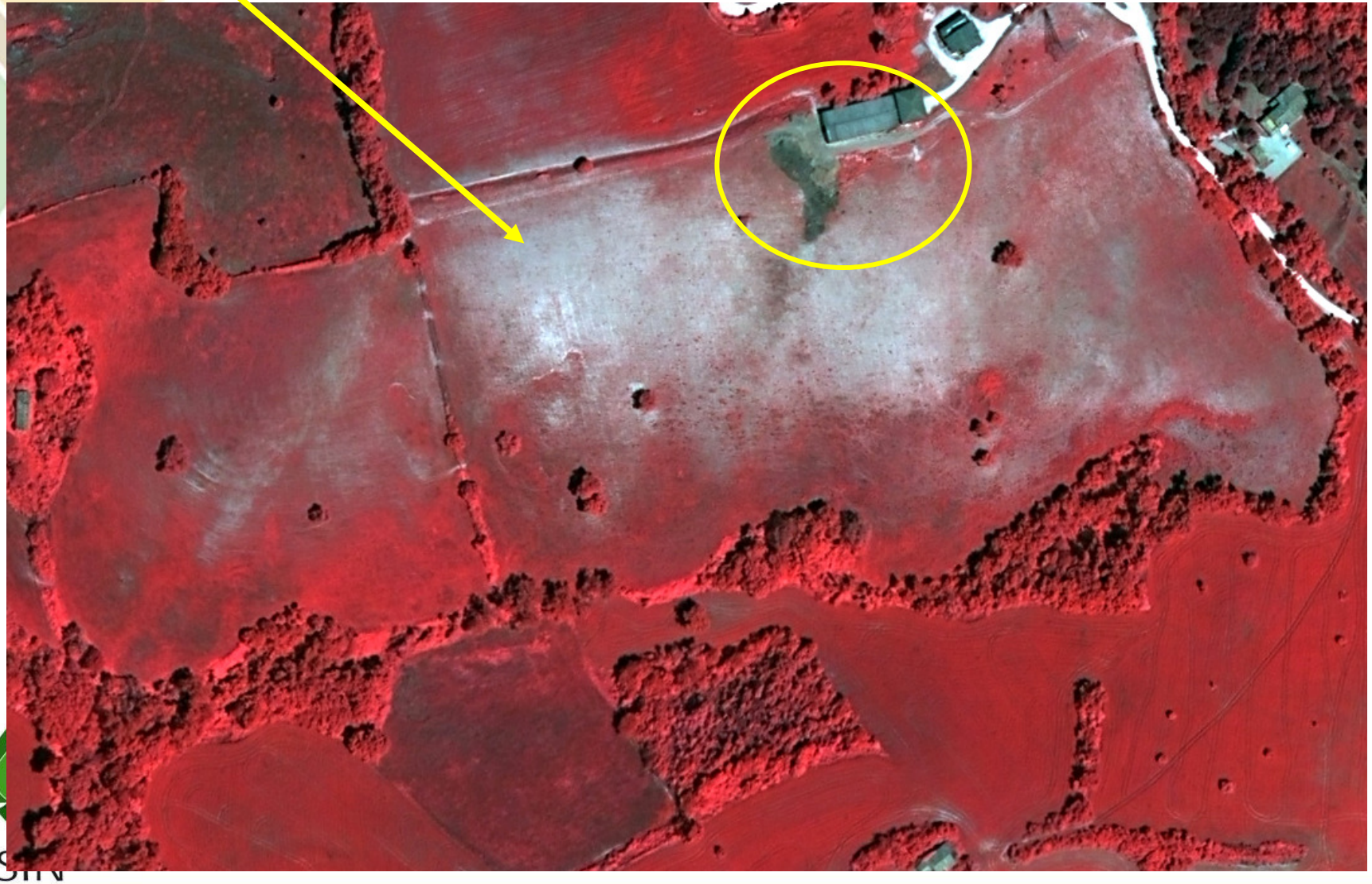
Marche: Extended overgrazing on pasture; uncorrected sludge near the stable => rapid field visit necessity



Tuscany, Environmental monitoring and alert near reservoirs and water courses..
Waste deposit, manure? => rapid field visits necessity

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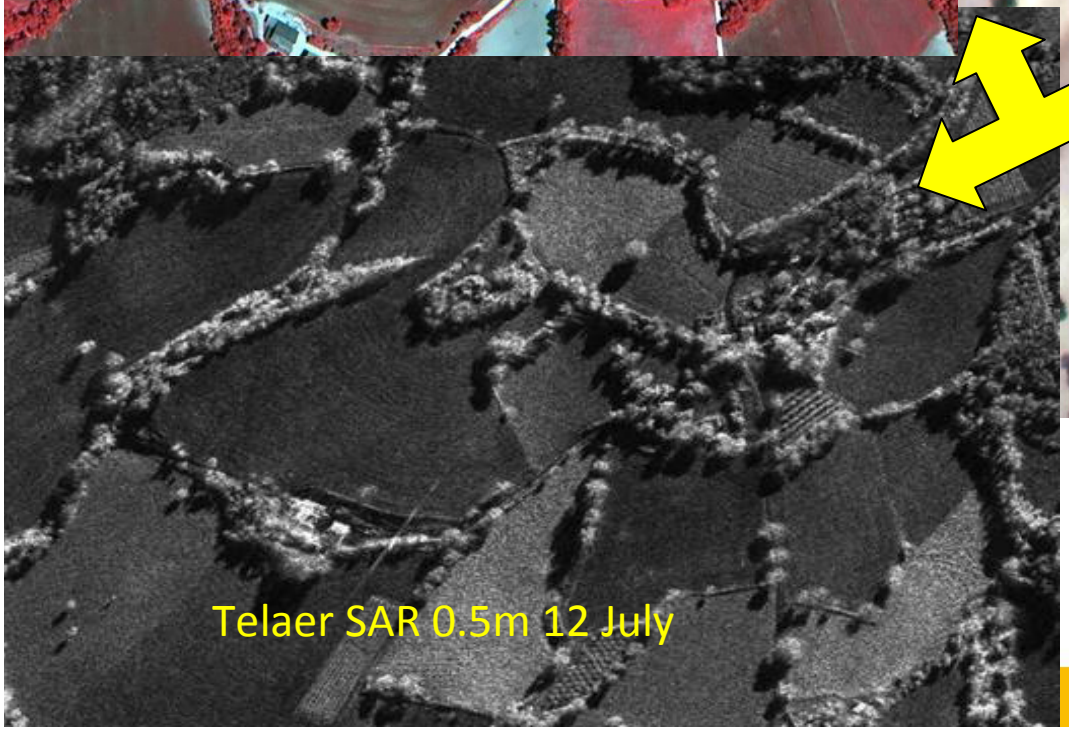
Remote Sensing activity benefit/cost positive ratio - Final statistics for DG Agri

Total points/parcels investigated				**1129**	
parcels with total accordance VHR/Ground				**773**	**68,5%**
		VHR	***Ground***		
		NO	NO	615	54,5%
		YES	YES	158	14,0%
parcels with partial accordance VHR/Ground (3 interpreters/2 inspectors)					
		YES	YES	109	9,7%
non conforming points/parcels					
		YES	NO	**200**	**17,7%**
		NO	YES	**19**	**1,7%**
		NO	*YES*	***11***	***1,0%***
Real number, after 1 to 1 check					
impossible ground survey					
		NO/NR		10	0,9%
		YES/NR		**17**	**1,5%**

Including "partial impossible survey" the total is 27+39 => **66 => 6%**

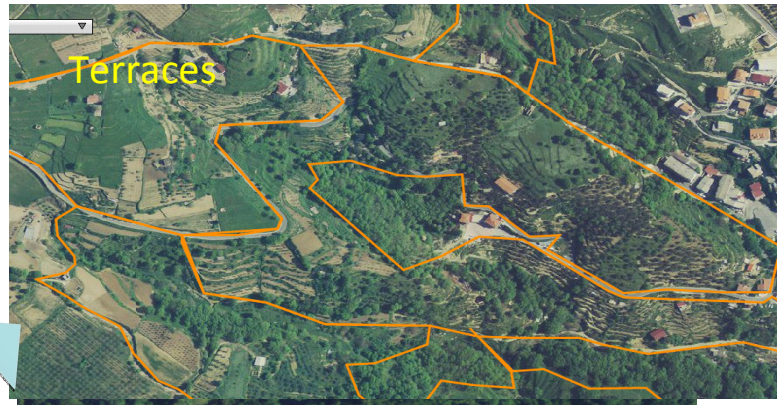
Multisensor availability by Telaer system

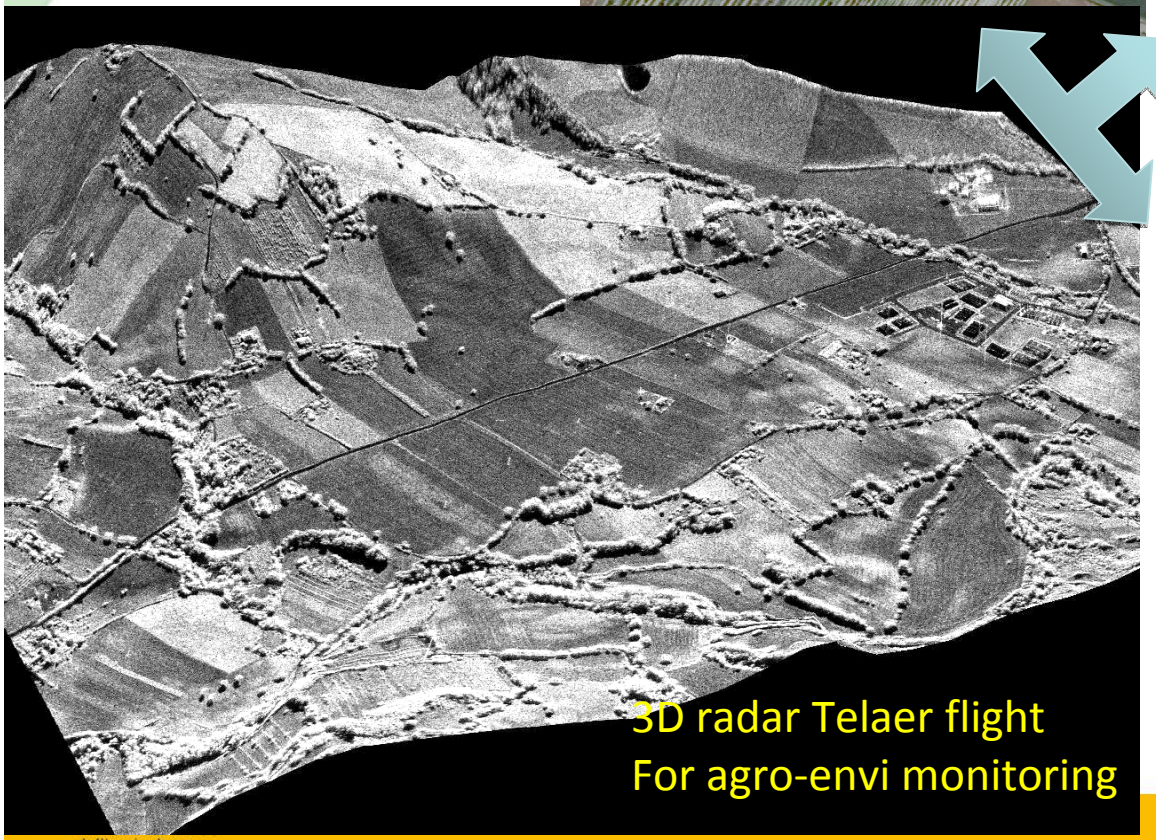


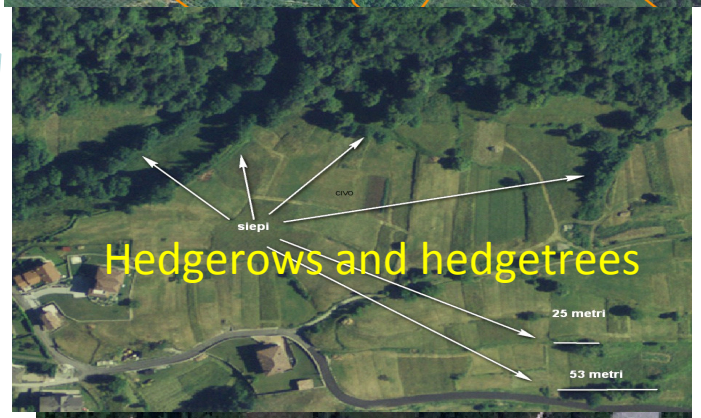
Telaer *hyper spectral- 700 bands*
5 Aug

Telaer Airborne high res Radar for Landscape elements detection and risk layers generation

Agro-environment safeguard and monitoring; maintenance of bio-diversity







What's for the future?
The Greening policy after 2013

e.g. Detailed characterization of rural landscapes (Managed through Land Parcel System LPIS)

Landscape features (location, type)
- Hedgerow
- Group of trees
- Isolated trees
- Pond
- Stone walls
- Terraces…

Land use / land cover
- Arable land
- pasture
- Forest
- Permanent crop
- …

Eligibility of land **100% eligible**

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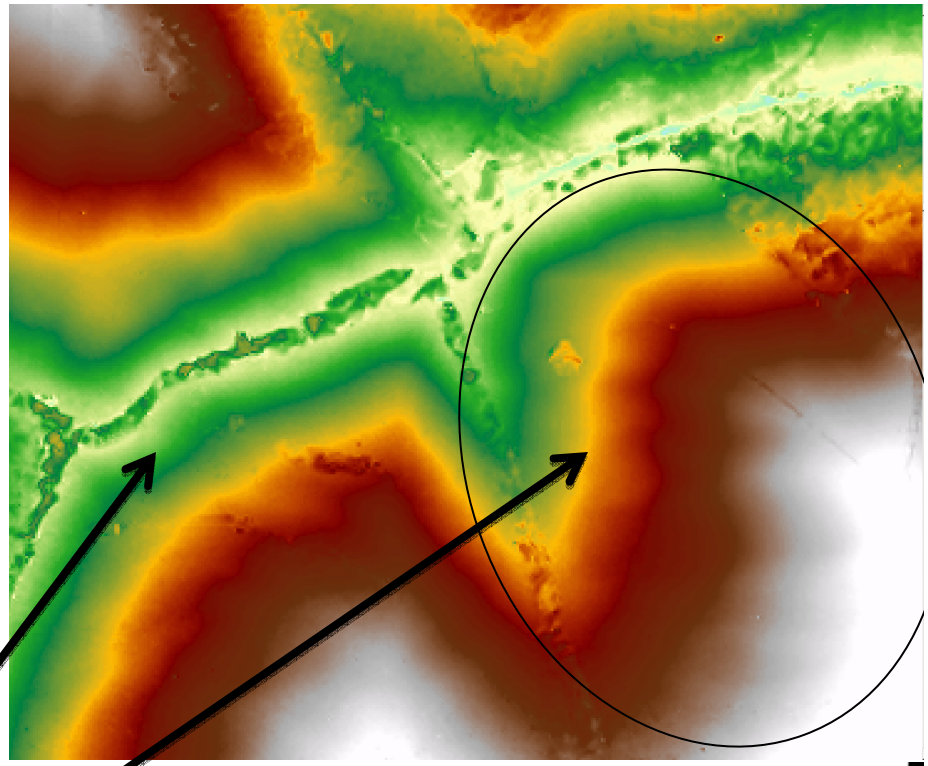
By Loudjani

High accuracy level of DSM 2m by 0,5m air stereo couples *already acquired for LPIS updating*



ORTHO-PHOTO

DSM 2m

ortofoto_pv_bologna.img

RGB

Red: Layer_1

Green: Layer_2

Blue: Layer_3

Automatic extraction of both landscape features and complete parcel sloping**, not more in average**

Legenda

DSM_2m

Value

High : 480

Low : 260

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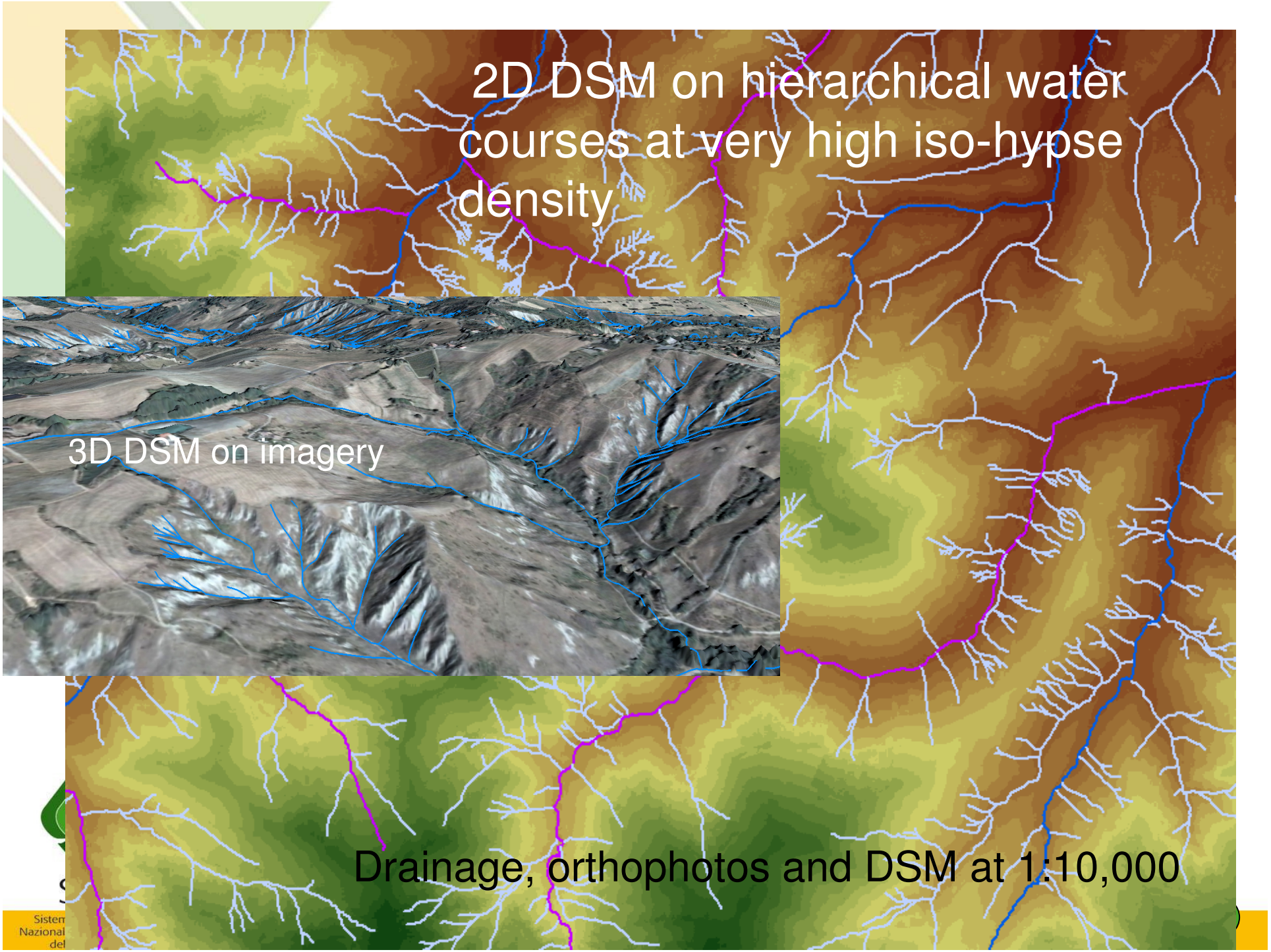
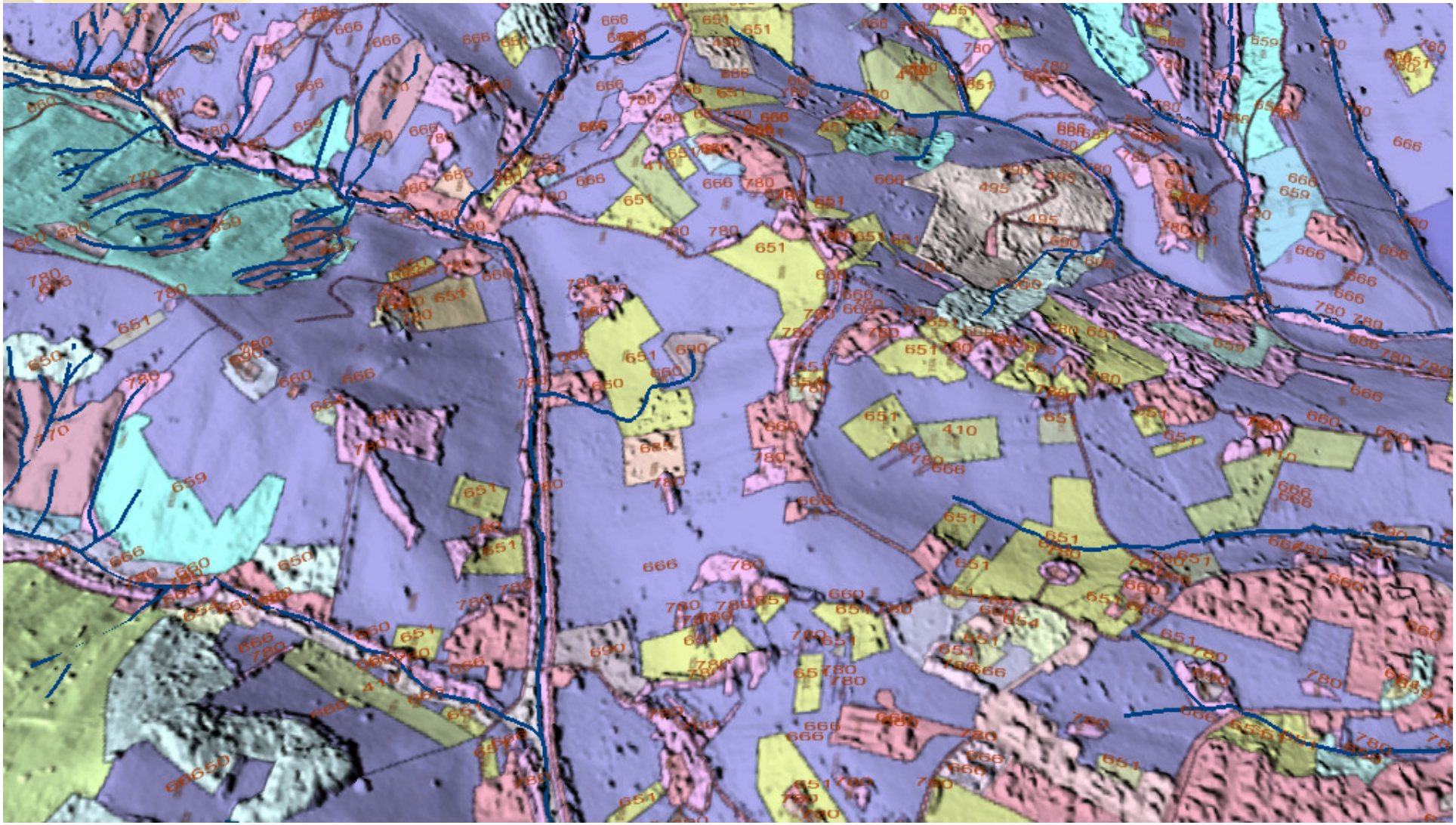
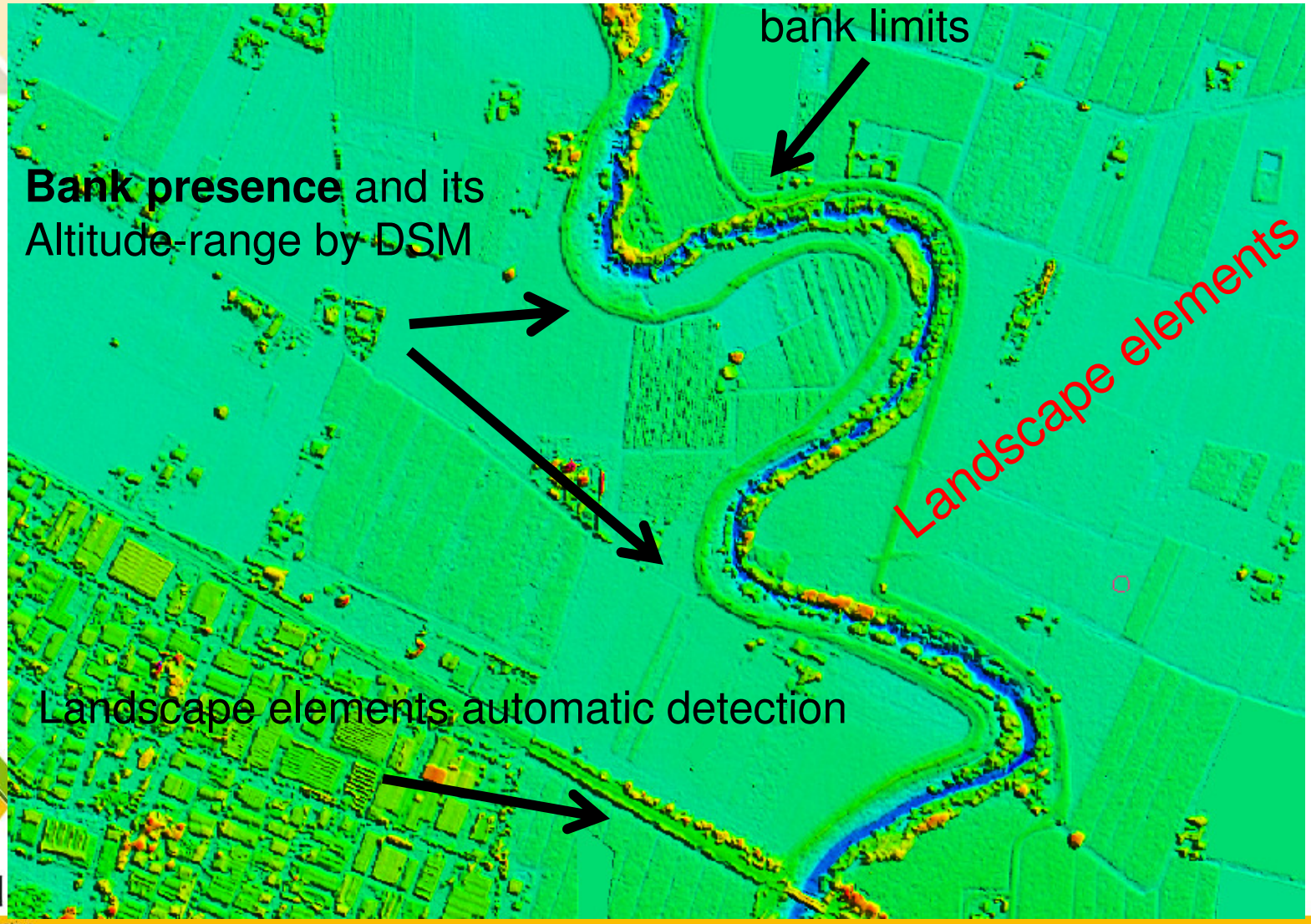

2D DSM on hierarchical water courses at very high iso-hypse density
3D DSM on imagery
Drainage, orthophotos and DSM at 1:10,000

LPIS parcels and water courses:
agro Land use immediate visualization and issue



Complete and synoptic agro-environment monitoring: Agro-landscape mapping, pollution and flooding risk detection



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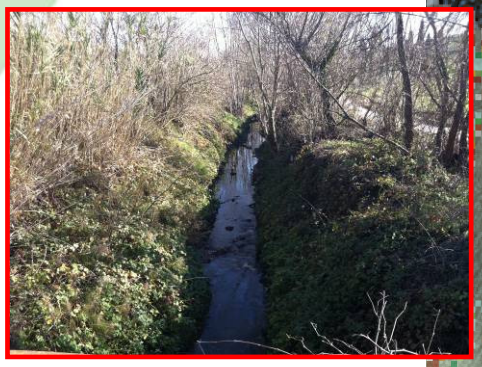
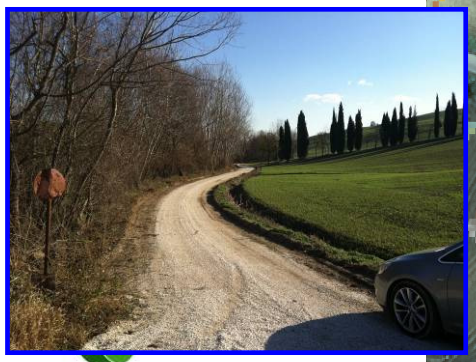
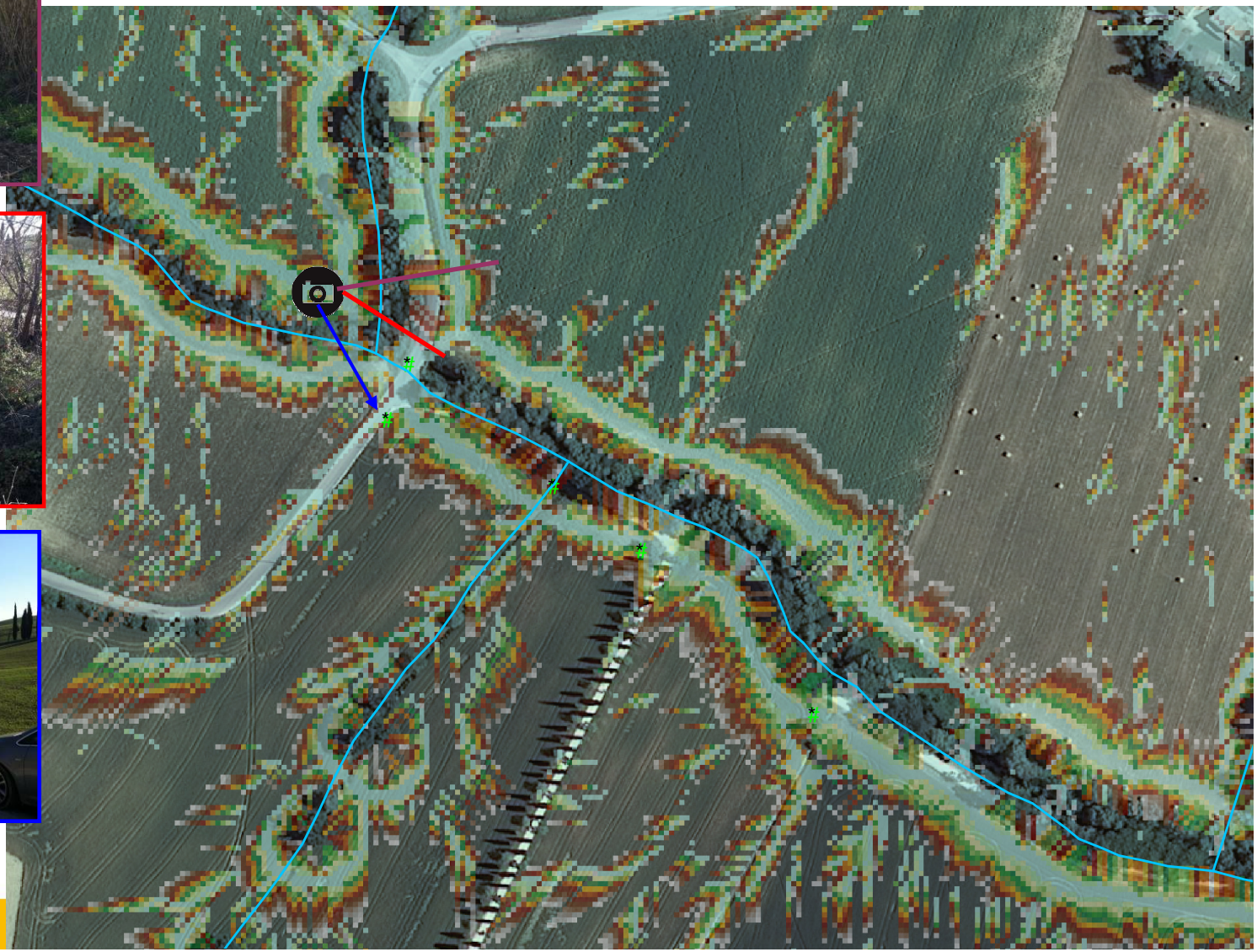
Nat. vegetation Buffer Zone against agricultural run-off pollution







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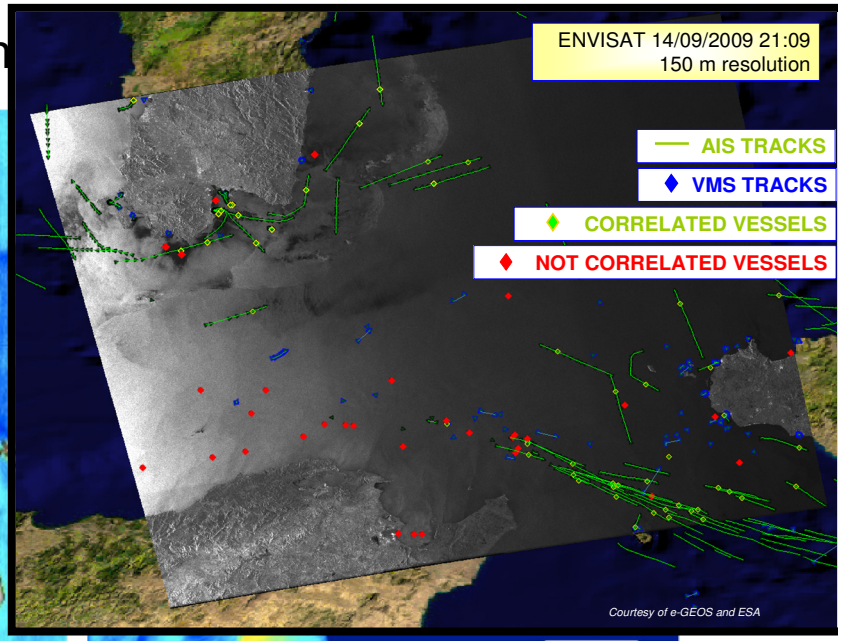
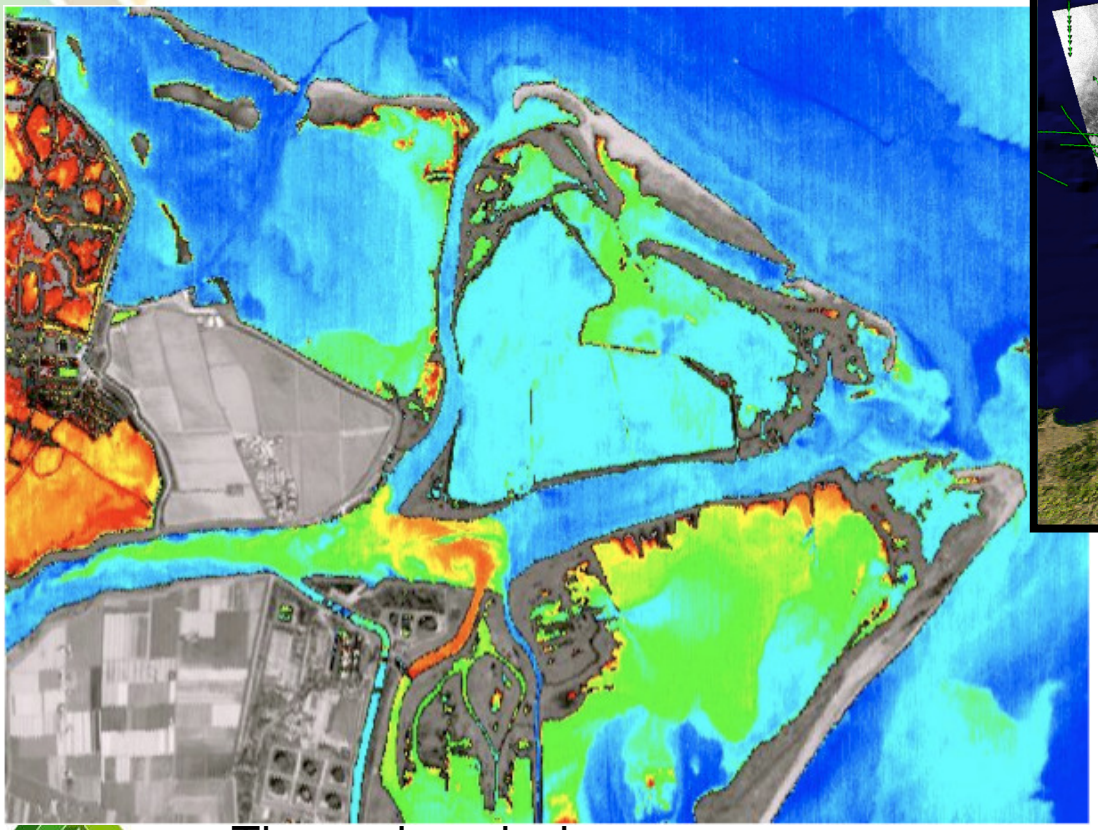
Fishery support: monitoring of marine and inland waters

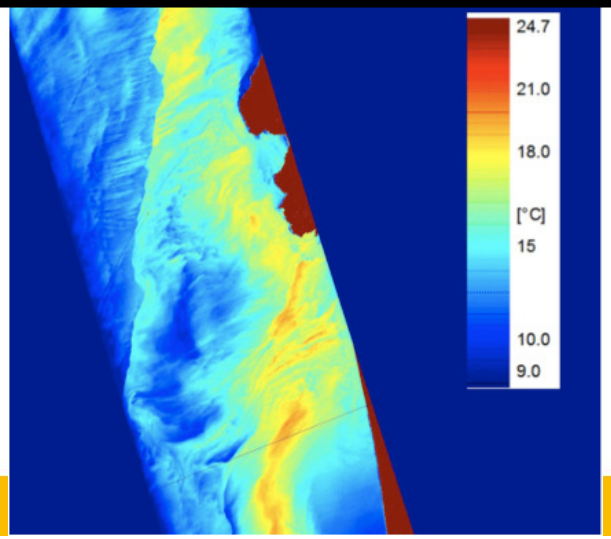
Indexes for water health status (aquiculture monitoring) fishing vessels correlation by Radar satellite and blue boxes

Radar acquisition





Thermal analysis



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Next EU agro-management the 2013-2020 approach: 4th attempt

Next forthcoming European agriculture policy purposes:

- No more monocultures and absence of farm crop variability
- Agro-environment and ecological behaviour stronger addressing
- Young farmers encouraging and funding
- Greening farms mandatory (min of 7% of natural elements, etc)
- Pollution fighting and climate changes mitigation (CO2 fluxes)

Main international advantages by EU agro-policy

- EU Agronomic production maintenance means: reduce risk of other continents' colonization (e.g. massive land acquisitions and export addressing…)

- EU agro-environment and greening policies realizing means: offer best practices, tested and operational methods for a forthcoming expanding worldwide application, tuning the already achieved results….