Earth Observation evoluzioni in supporto alle sfide in agricoltura. Dalle immagini all' informazione, dal pixel agli analytics.

PREMIA
Platform for Risk Evaluation & Management In Agriculture

e-GEOS
Antonella Catucci

Company General Use

Content

- e-Geos in Agriculture – la nostra esperienza
- Agro-insurance domain: potenzialità del Remote Sensing
- PREMIA
- Esempio applicativo: Assessment del danno in Texas
- Attività di Innovazione
  - GeoTagged strumento per le foto in campo certificate

e-GEOS

LEONARDO THALES

67% 33%

TELESPAZIO
a LEONARDO and THALES company

- Contracts
- People
- Assets

agenzia spaziale italiana
COSMO-SkyMed
exclusive world wide rights

80% e-geos 20%

AN ASI / TELESPAZIO COMPANY

INTERNATIONAL MARKETS 80%

MARKETS

DOMESTIC MARKETS 20%

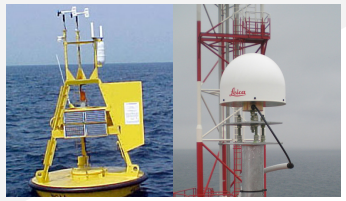
10+ SATELLITE MISSIONS DATA ACQUIRED.	9+
70millions AGRICULTURAL PARCELS	2500+
750+ MARITIME REPORTS/ YEAR	188+
100m €+ REVENUES	500+ PEOPLE

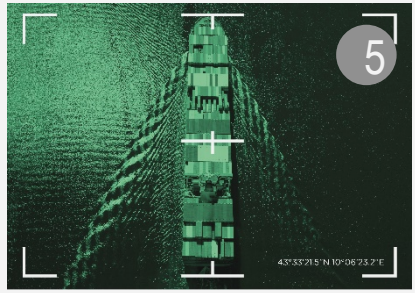
©e-GEOS 2017 – all right reserved

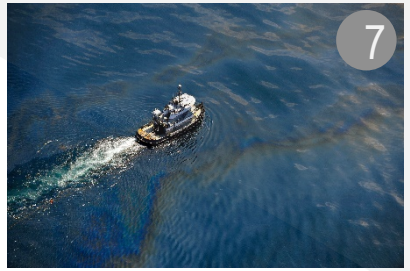
e-geos
AN ASI / TELESPAZIO COMPANY

FROM WORKFLOW TO VERTICAL PLATFORMS

DATA OPERATOR	DATA ACCESS HUB	CONTENT DEVELOPER	SERVICES AND PLATFORMS PROVIDER	DELIVERY
GEOSPATIAL DATA		PRODUCTION UNIT	GEO INFORMATION LAYERS	AS A SERVICE
SATELLITE		SPECIALISED LAYERS	VERTICAL PLATFORMS	ON PREMISES
AERIAL / UAV SURVEY		SPECIALISED DATABASES	GEO-SPATIAL ANALYSIS	
NAVIGATION				
IN SITU SENSORS				







1) Land management and Infrastructures
2) Agriculture and Food production
3) Defense & Intelligence
4) Risk & Asset management
5) Maritime Surveillance
6) Forestry & Climate Change
7) Oil & Gas

©e-GEOS 2017 – all right reserved

e-geos

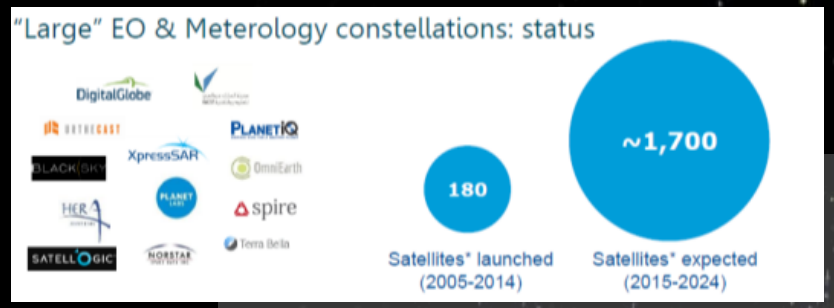
e-GEOS for Agriculture: a long history of application and geospatial Information services

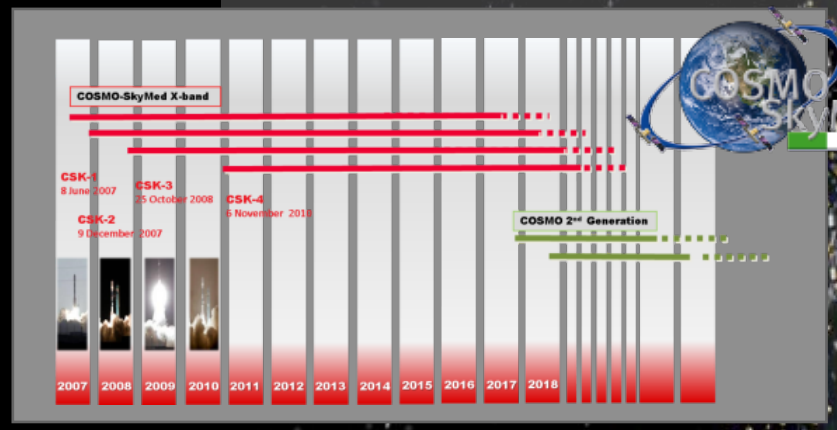
- More of 25 years of experience supporting farmer **subsidy management and control** for AGEA
- Satellite and aerial data acquisition and processing since 1992
- Management of LPIS - Land Parcel Identification System platform; specific agro-environment solutions and services for data analysis

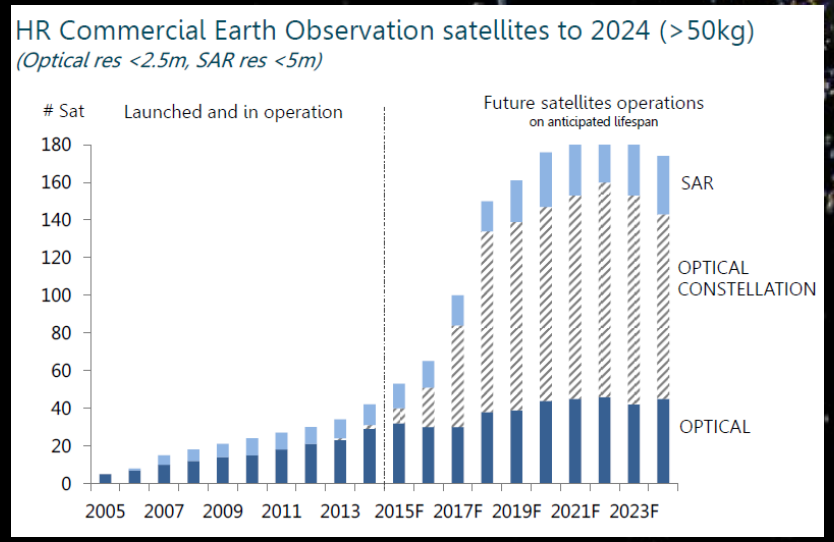
- Mapping and monitoring agriculture with production of statistics and reports
- AGRIT statistical project for Mipaaf since 1987
- Precision Farming Telespazio France in Bordeaux region: Aquitaine

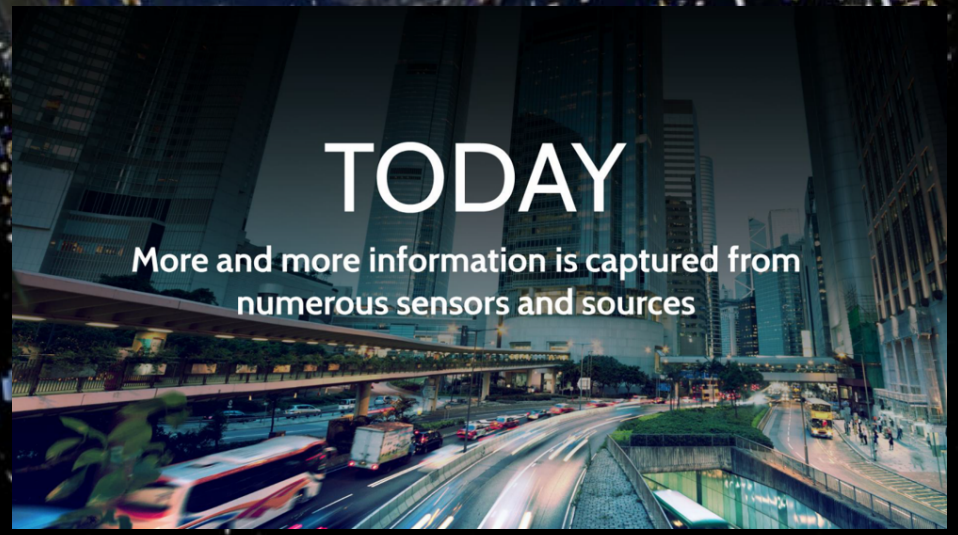
e-geos

Oggi tantissimi satelliti sono in orbita….
Ed il numero cresce velocemente….





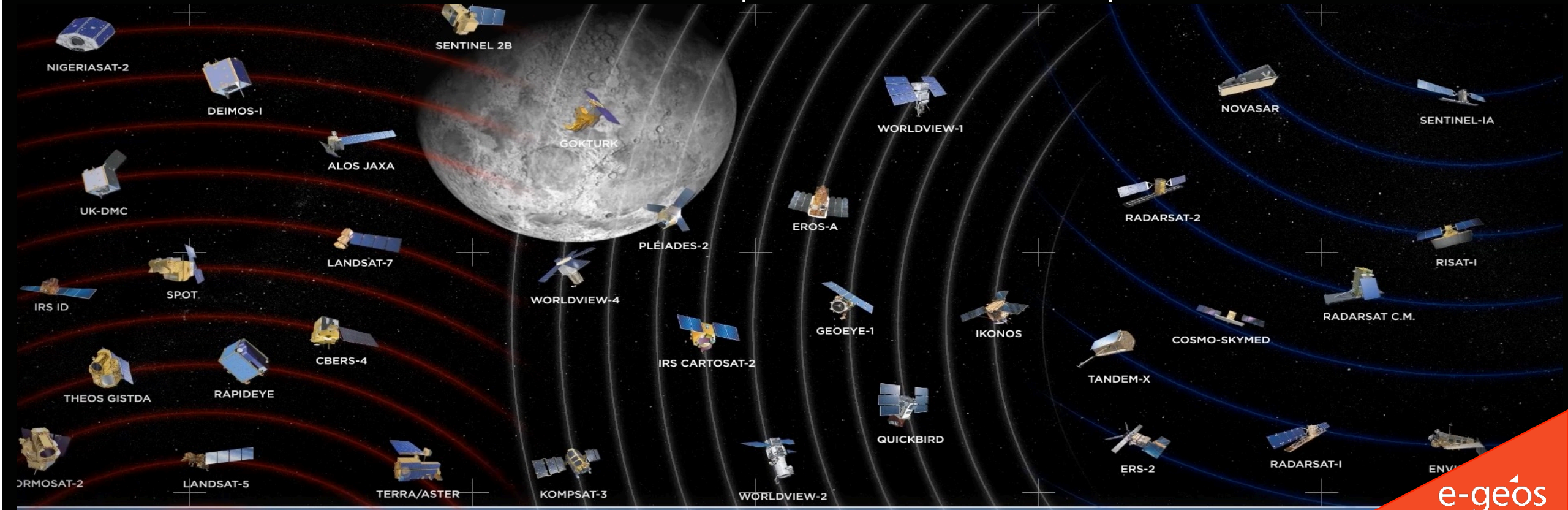


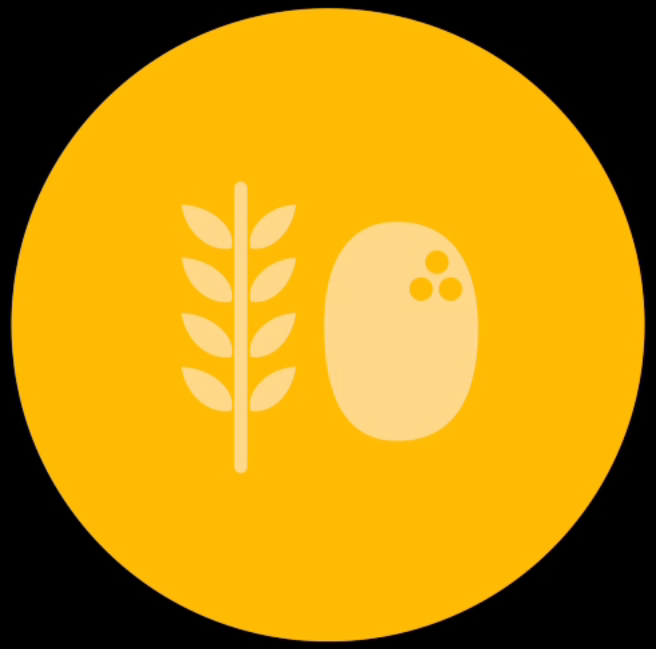


e-geos

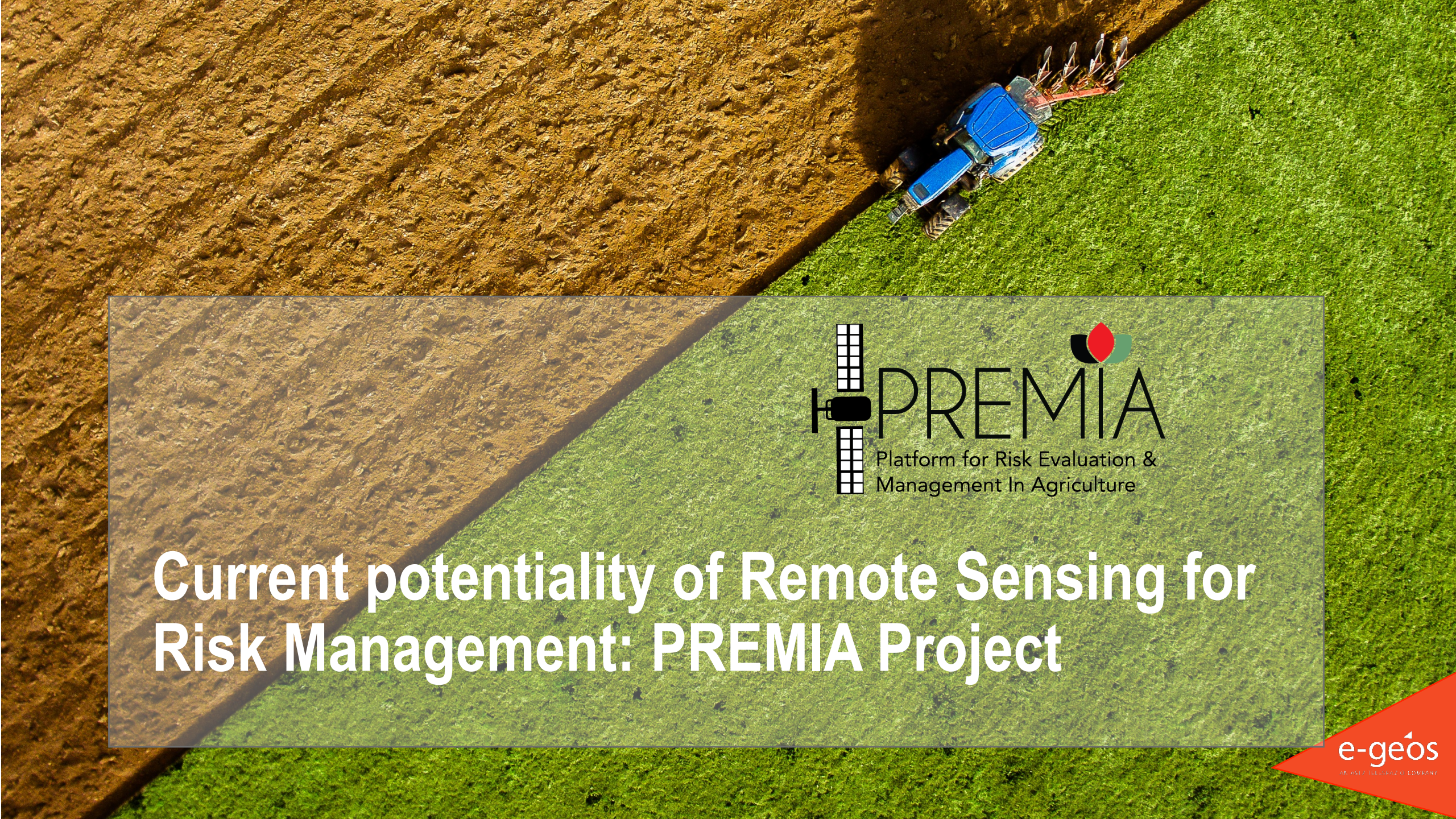
Perchè utilizzare il satellite nella gestione del rischio?

- **Geo- Informazioni indipendenti ed estensive sulle colture riferite al passato (indagini storiche) o allo stato attuale, disponibili ovunque … superando i limiti amministrativi…**
- Oggi la costellazione di **satelliti Copenicus** genera ogni giorno nuovi dati disponibili e gratuiti caratterizzati da una buona risoluzione spaziale ed un elevato tempo di rivisita...





CEREALS AND TUBERS



PREMIA

Platform for Risk Evaluation & Management In Agriculture

Current potentiality of Remote Sensing for Risk Management: PREMIA Project

e-geos

PREMIA: Platform for Risk Evaluation and Management In Agriculture

PREMIA
Platform for Risk Evaluation & Management In Agriculture

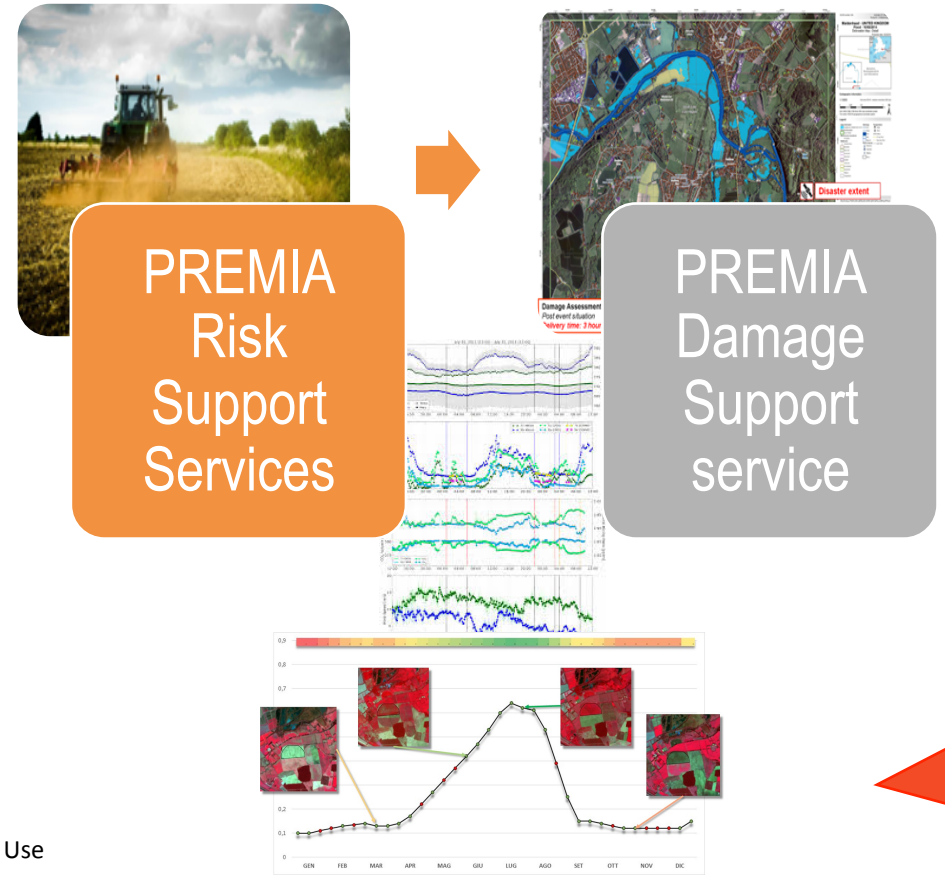
The project is co funded by **ESA** in the ARTES IAP Initiative.

Budget: 2,6 Millions € (~50% co-funded by ESA)
Start date: September 2017
Project Duration: 24 months
Consortium: 9 partners from 4 countries (3+2 Users)

PREMIA: Obiettivo

Sviluppare servizi operativi che domostrino il potenziale tecnico e funzionale di servizi basati su dati satellitari a supporto della Gestione del Richio in Agricoltura generando **nuovi contenuti e informazioni innovative in grado di supportare tutte le attività di gestione del rischio inclusa la componente assicurativa.**

L'obiettivo dei servizi messi a punto nel progetto PREMIA è quello di fornire informazioni agli utenti finali in termini di parametri, tabelle, statistiche, diagrammi e «analytics» che possano essere facilmente compresi ed utilizzati **a supporto delle attività di valutazione del rischio ed analisi dei danni generati da eventi meteorologici avversi**. Tali servizi saranno erogati da una piattaforma in grado di sfruttare le più moderne tecniche di Big Data analysis.



PREMIA: Servizi a supporto dell'analisi del rischio e valutazione danni

PREMIA
Platform for Risk Evaluation & Management In Agriculture

Meterological Data

Satellite Data Optical and SAR
(Spatial res. 10m every 5 days)

Advanced Yield modelling for crop

In situ data of past critical events and losses (where available)

Data analysis

Servizi PREMIA

Dedicated service suites

Informmazioni scaricabili dalla piattaforma e customizzabili…

e-geos

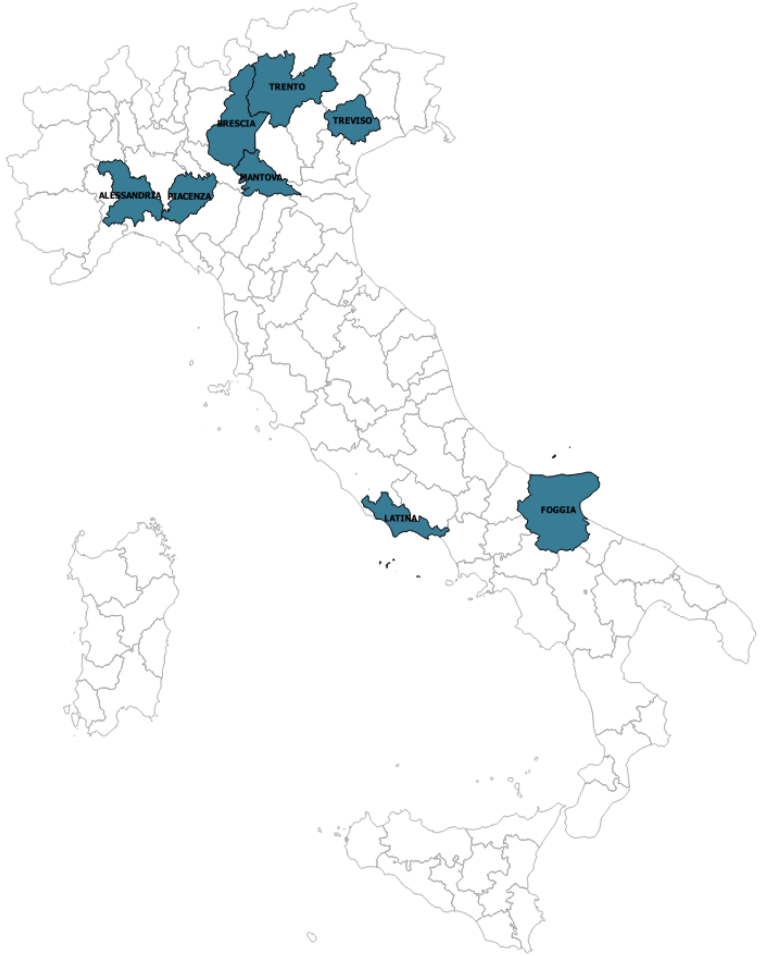
PREMIA: Servizi a supporto dell'analisi del rischio e valutazione danni

PREMIA
Platform for Risk Evaluation & Management In Agriculture

PILOT TEST SITE

Demonstration sites distributed over **8 Provinces** located mainly in North Italy:

- Alessandria (Piemonte)
- Piacenza (Lombardia)
- Brescia (Lombardia)
- Mantova (Lombardia)
- Trento (Trentino Alto-Adige)
- Treviso (Veneto)
- Latina (Lazio)
- Foggia (Puglia)



CROP

Criteria:

- Reliability/readiness of modelling approaches available worldwide
- Availability of data for model parameterization
- Crop diffusion in Europe
- Crop econimic value

ASNACODI
associazione nazionale condifesa

e-geos

Dati di Base

e-geos

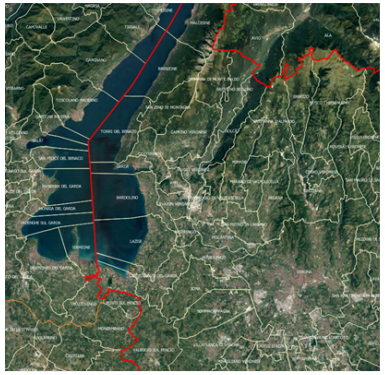
PREMIA: Dati di Base amministrativi

PREMIA
Platform for Risk Evaluation & Management In Agriculture

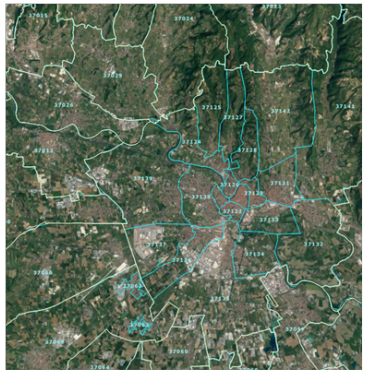
Administrative boundaries

Region

Province

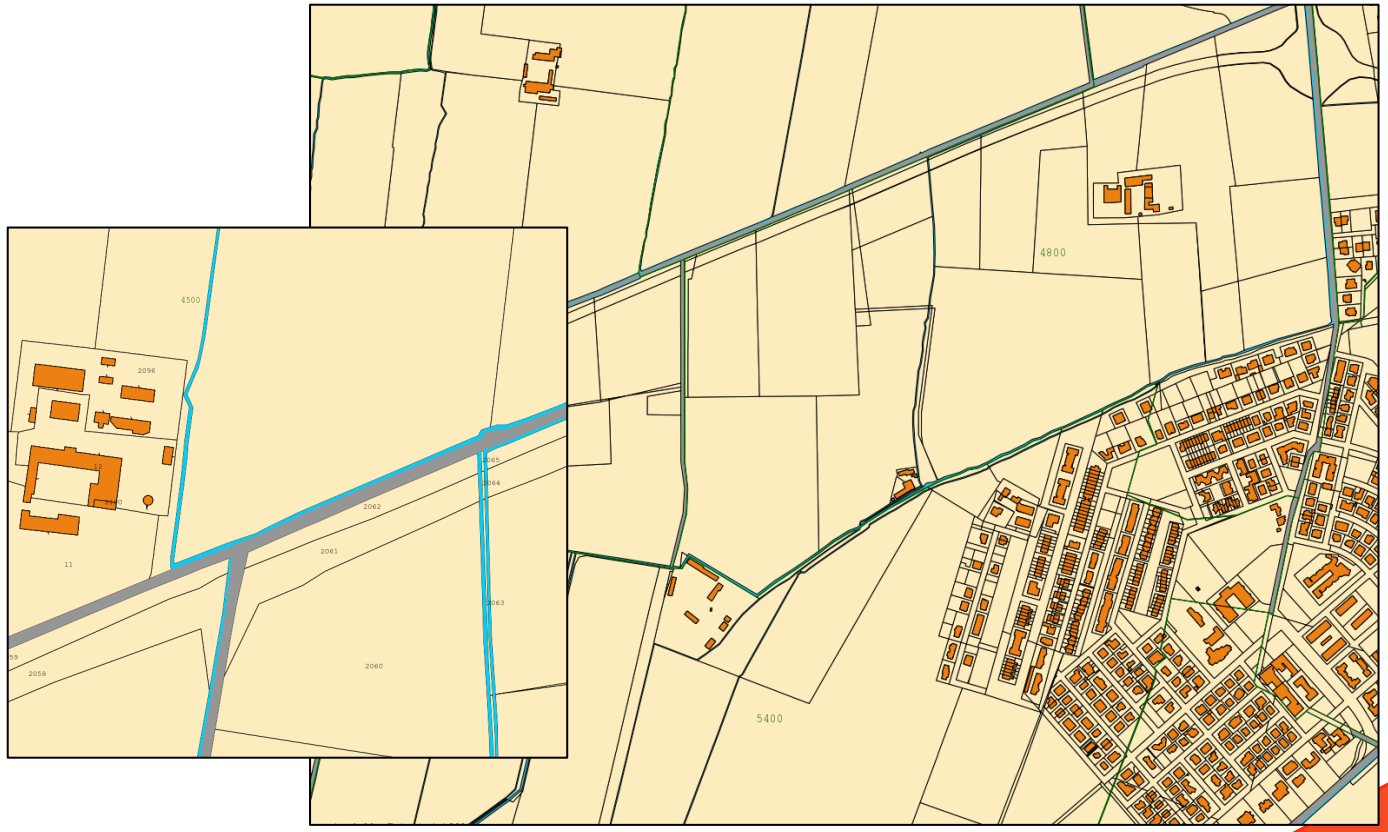


Municipality



Postal Code

Cadastre parcels (WMS)

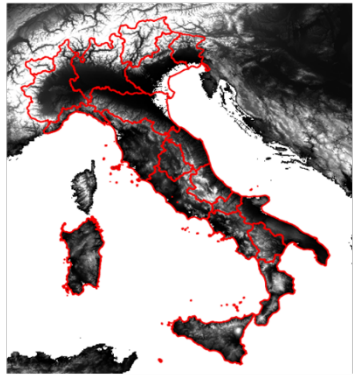


e-geos

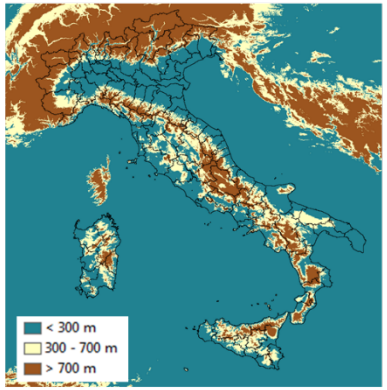
PREMIA: Dati di Base amministrativi

PREMIA
Platform for Risk Evaluation & Management In Agriculture

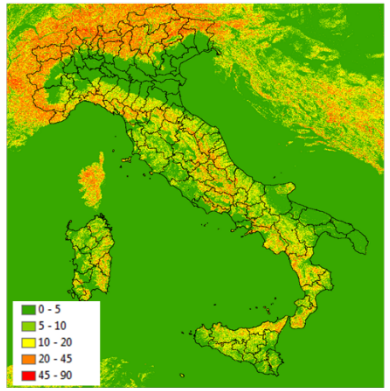
Morphology



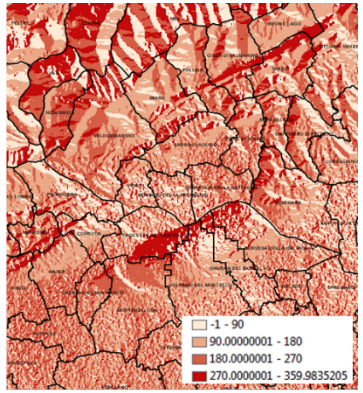
Digital Surface Model



Altimetry zone Map

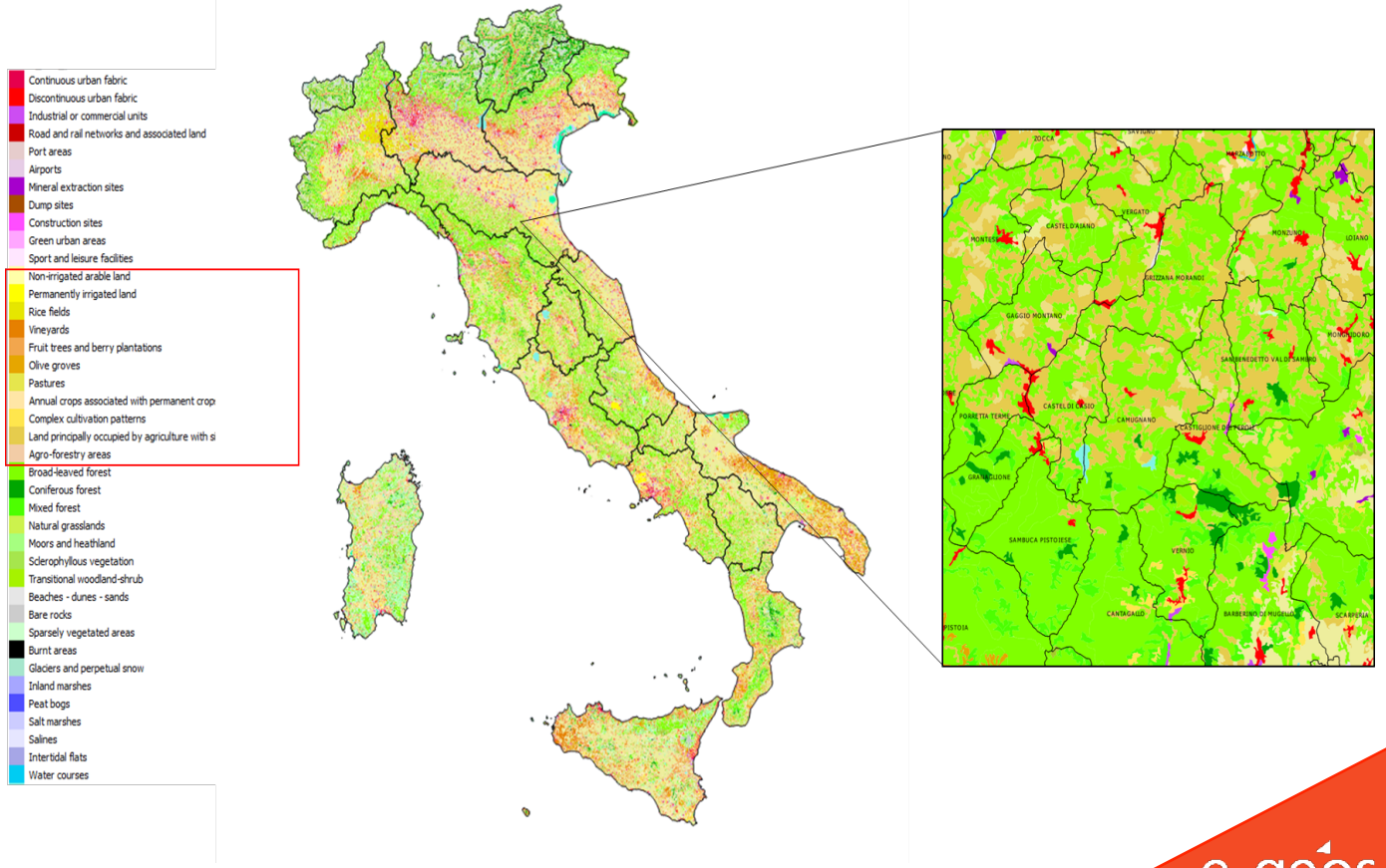


Slope Map



Aspect Map

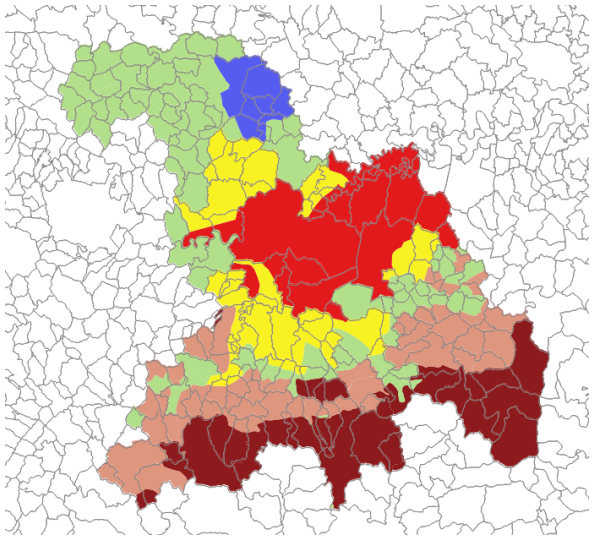
Land Use



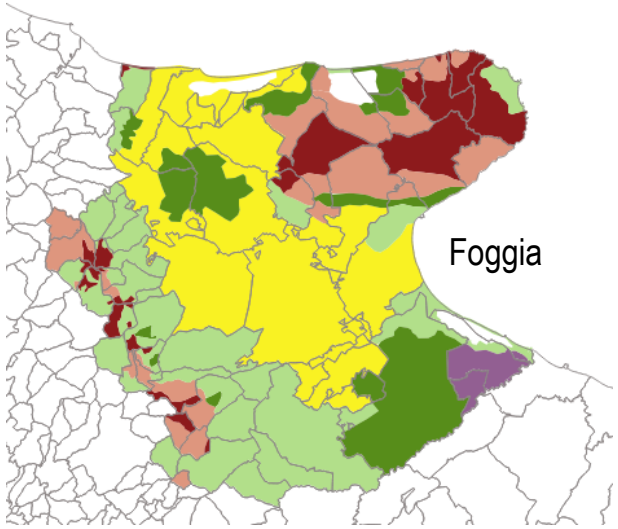
e-geos

PREMIA: Dati di Base «zooning»

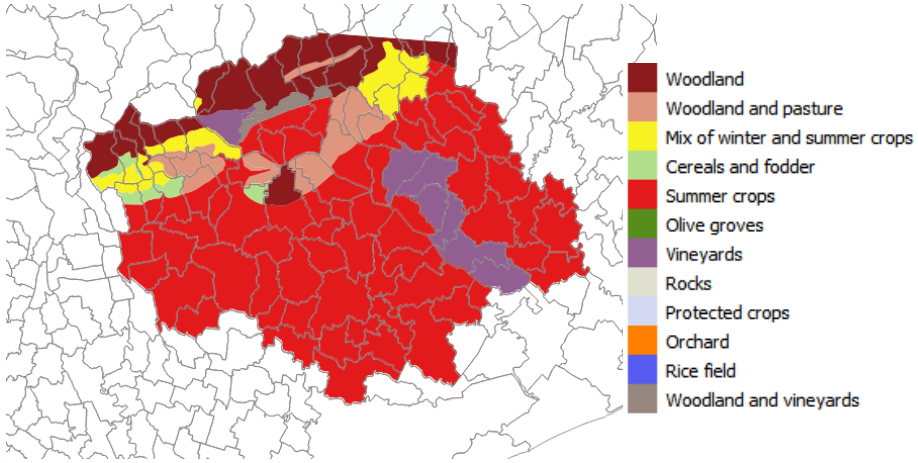
PREMIA
Platform for Risk Evaluation & Management In Agriculture



Alessandria

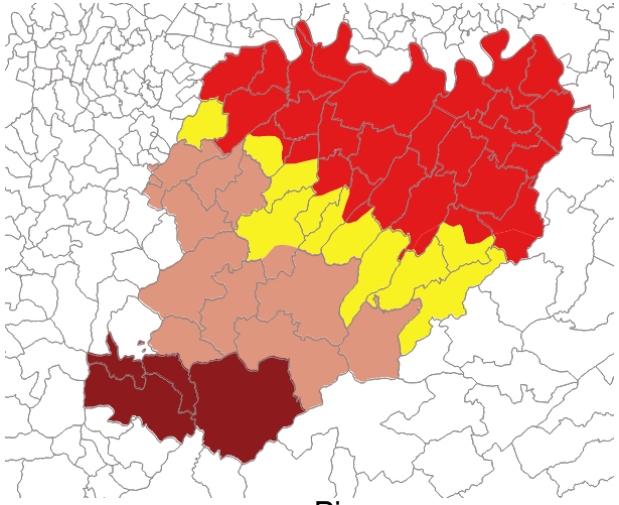


Foggia

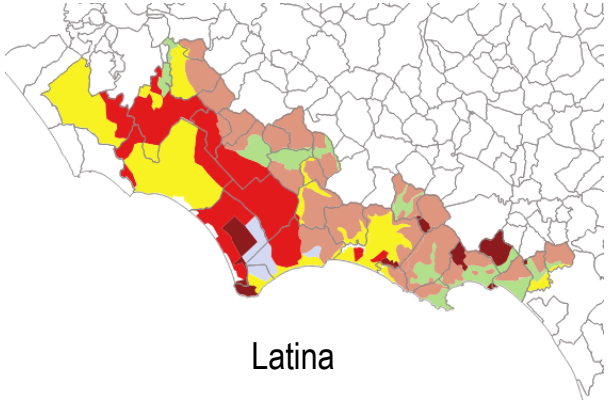


Treviso

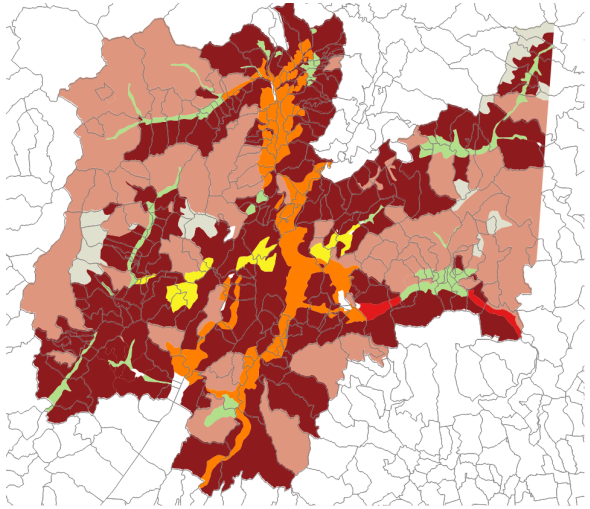
...Oltre i limiti amministrativi…



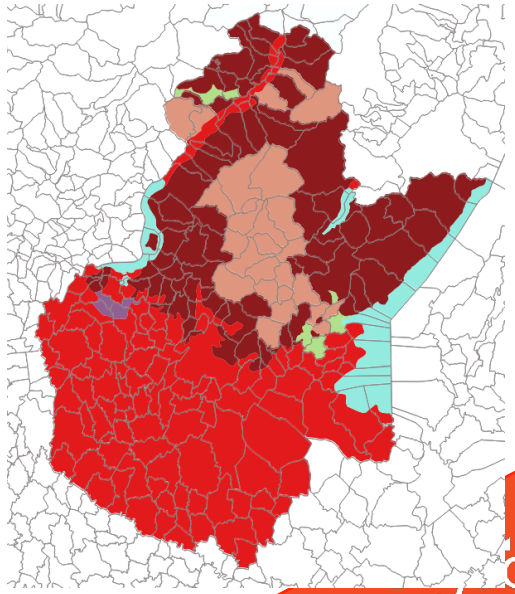
Piacenza



Latina



Trento



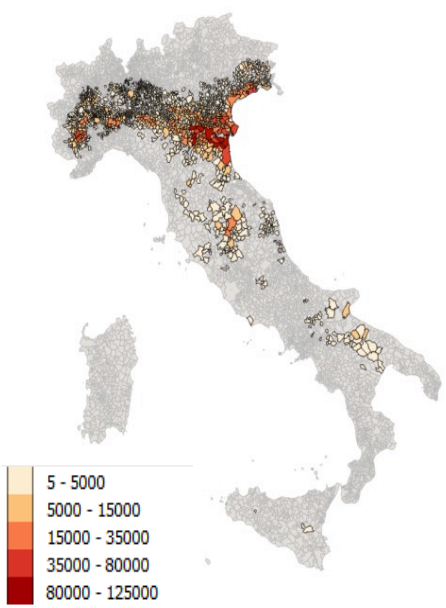
Brescia

PREMIA: Dati di Base Assicurativi

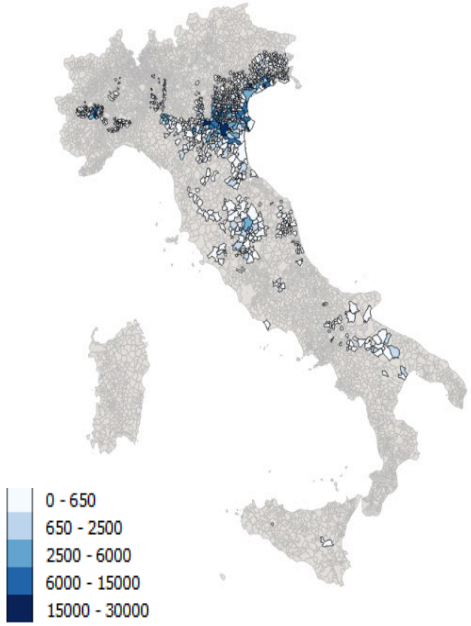
PREMIA
Platform for Risk Evaluation & Management In Agriculture

Eventi avversi basati su TIPOLOGIA di COLTURA, ANNO, EVENTO 2012 -2017. Livello comunale

Quintali (0,1 ton) di **grano** assicurato ed affetto da danni da grandine nel **2016**



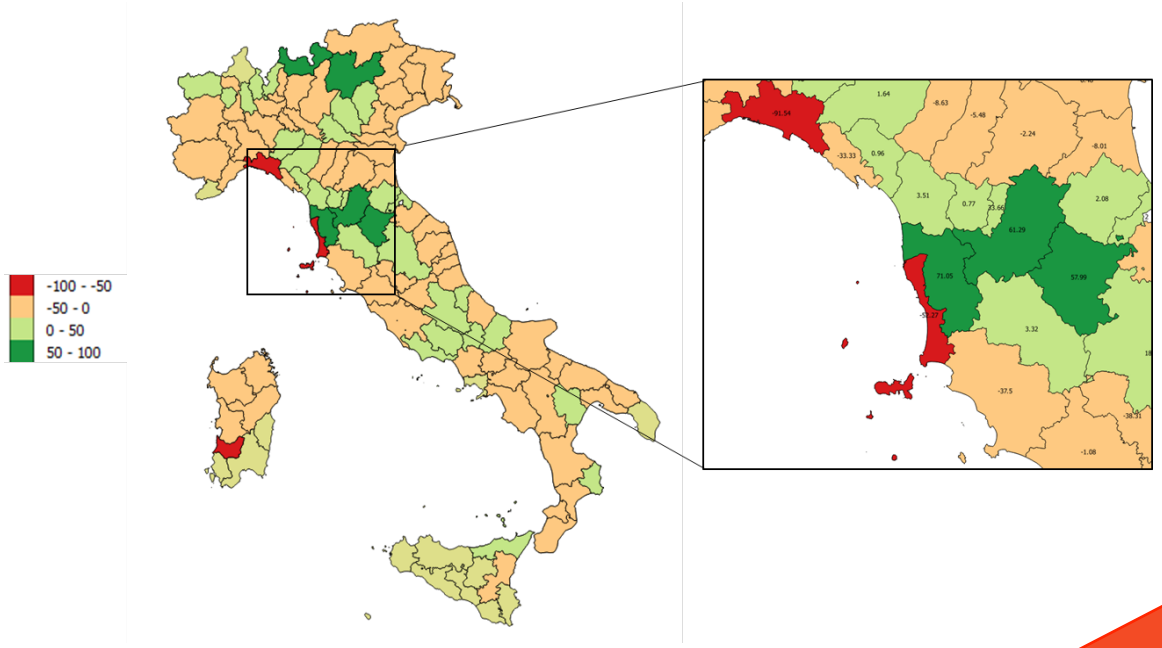
Quintals assured



Quintals affected

Rese basate su on TIPOLOGIA di COLTURA ed ANNO 2006 – 2017. Livello provinciale

Variazione di resa di grano (%) tra il 2016 ed il 2017

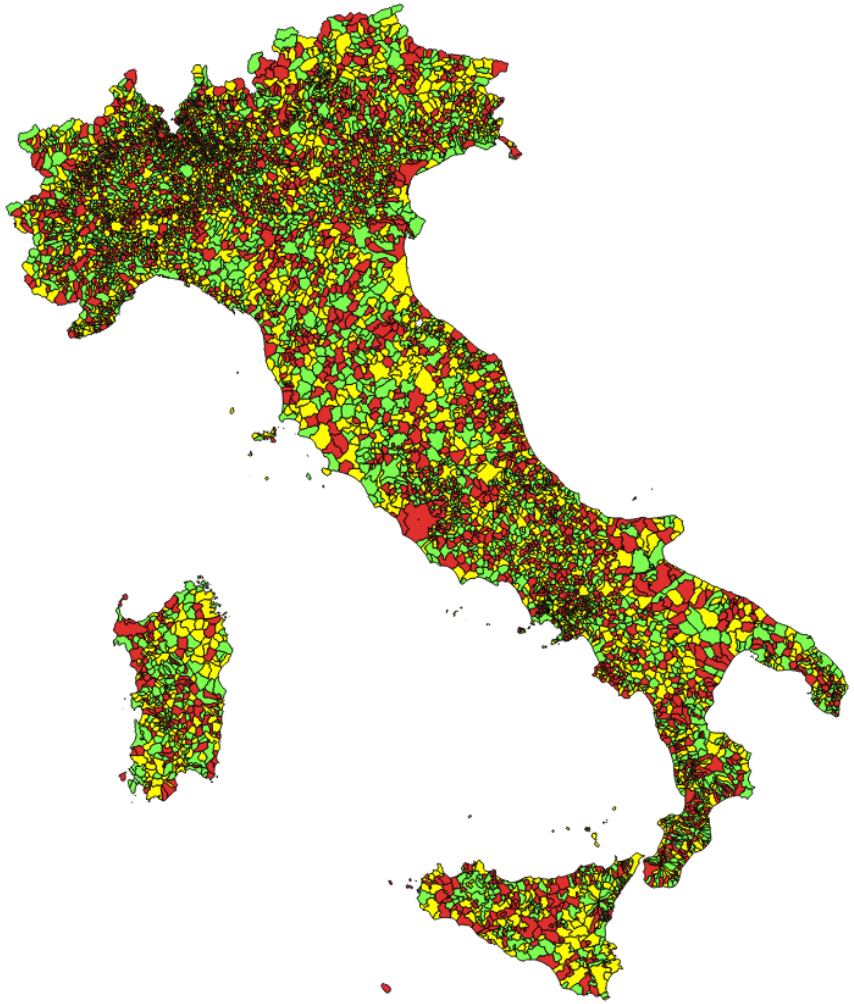


e-geos

PREMIA: Dati Assicurativi

PREMIA
Platform for Risk Evaluation & Management In Agriculture

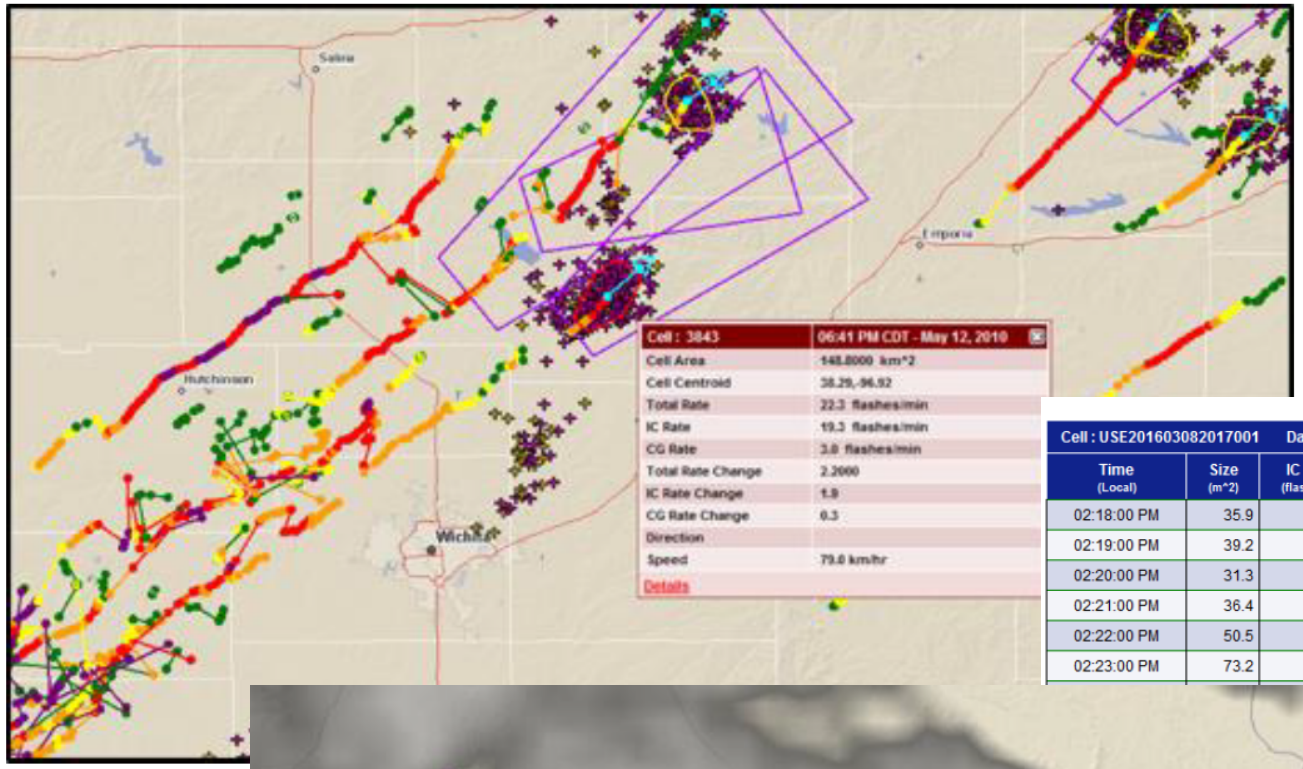
Policy rate based on CROP and YEAR. 2012-2017. Municipality level



ISTAT	Cod Provincia	Cod Comune	Cod Prodotto	Garanzia	Parametro 2014	CIAG	cod_com
001001	001	001	C03	4	5,940052	01060801	1001
001001	001	001	C31	2	3,089252	01060801	1001
001001	001	001	C03	2	5,049591	01060801	1001
001002	001	002	H11	4	2,359981	01061601	1002
001002	001	002	C03	4	4,037291	01061601	1002
001008	001	008	C29	3	8,920026	01061002	1008
001009	001	009	C03	4	1,890572	01061201	1009
001009	001	009	H11	4	2,35942	01061201	1009
001012	001	012	C03	4	2,129766	01061202	1012
001012	001	012	H11	2	4,159887	01061202	1012
001012	001	012	H11	4	2,359959	01061202	1012
001015	001	015	C03	4	4,910002	01060805	1015
001015	001	015	C03	3	7,600012	01060805	1015
001018	001	018	C29	2	3,513642	01061203	1018
001018	001	018	H11	2	3,659887	01061203	1018
001018	001	018	C03	2	2,239914	01061203	1018
001020	001	020	C03	2	2,74022	01060807	1020
001021	001	021	C03	4	5,065253	01060902	1021
001024	001	024	C03	2	2,079986	01061501	1024
001025	001	025	C07	2	11,290014	01061101	1025
001025	001	025	C01	4	9,117489	01061101	1025
001025	001	025	C10	3	9,739905	01061101	1025
001025	001	025	C05	3	14,809281	01061101	1025
001025	001	025	D69	3	7,495101	01061101	1025
001025	001	025	C04	4	20,208548	01061101	1025
001025	001	025	C04	2	14,794979	01061101	1025
001025	001	025	C01	2	8,589196	01061101	1025
001025	001	025	C09	3	13	01061101	1025
001025	001	025	C05	2	11,960015	01061101	1025
001025	001	025	C09	4	14,840046	01061101	1025
001025	001	025	C04	3	17,829646	01061101	1025
001025	001	025	C16	3	15,629935	01061101	1025
001025	001	025	D76	3	10,329985	01061101	1025

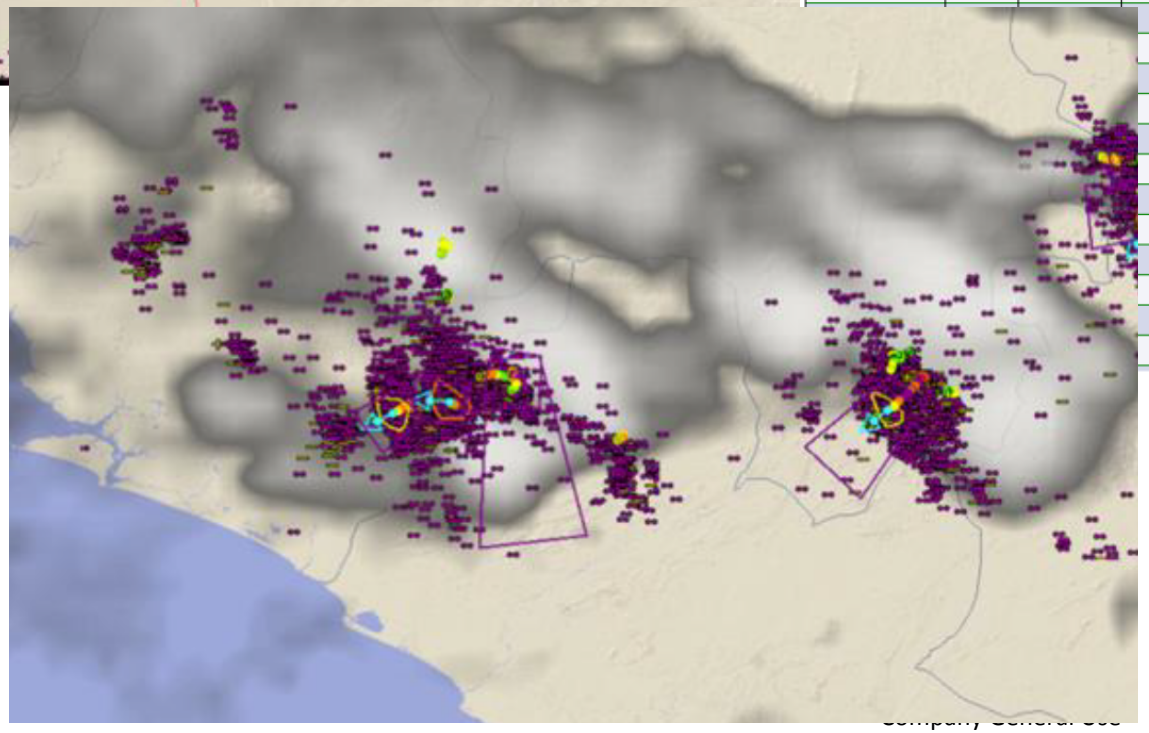
e-geos

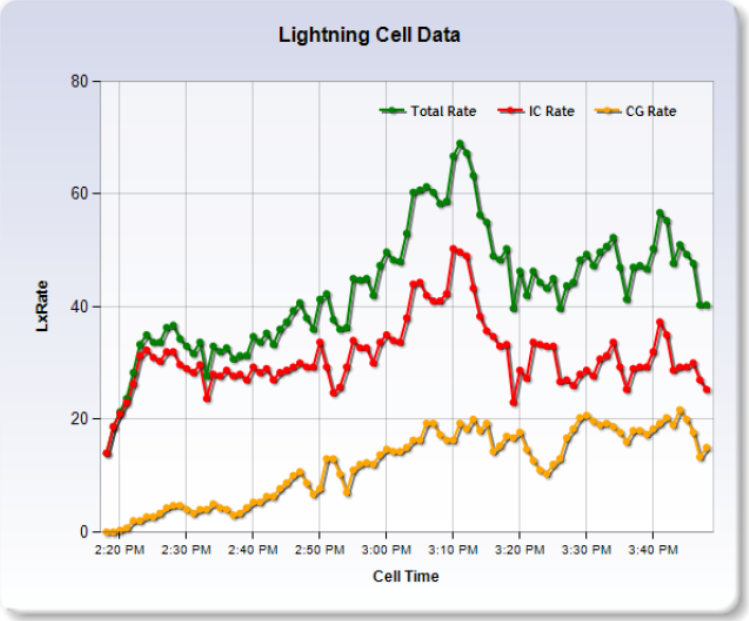
External data: Dati sulla densità e distribuzone di Fulmini…



Cell : USE201603082017001 Date 02:18 PM CST - Mar 08, 2016

Time (Local)	Size (m^2)	IC Rate (flash/min)	CG Rate (flash/min)	Total Rate (flash/min)
02:18:00 PM	35.9	14.0	0.0	14.0
02:19:00 PM	39.2	18.7	0.0	18.7
02:20:00 PM	31.3	21.0	0.3	21.3
02:21:00 PM	36.4	23.0	0.7	23.7
02:22:00 PM	50.5	26.3	2.0	28.3
02:23:00 PM	73.2	31.3	2.0	33.3
			2.7	35.0
			2.7	33.7
			3.3	33.7
			4.3	36.3
			4.7	36.7
			4.7	34.3
			4.0	33.0
			3.3	31.7
			4.0	33.7
			4.0	27.7
			5.0	33.0
			4.3	32.0





Servizi PREMIA

e-geos
AN ASI / TELESPAZIO COMPANY

PREMIA inputs

Satellite Data Optical and SAR
(Spatial res. 10m every 5 days)

Meterological Data
(Spatial res. 10m every 5 days)

Advanced Yield modelling for crop

In situ data of past critical events and losses (where available)

Big Data Platforms and Capability

Servizi PREMIA

Historical Analysis

Crop Zooning

PREMIA Risk Support Services

Crop Monitoring

Extreme weather Map

Extreme Impact Evaluation

PREMIA Damage Support Service

PREMIA
Platform for Risk Evaluation & Management In Agriculture

e-geos

SERVICES REGISTRATION - PARCEL UPLOAD

PREMIA

USERNAME Mario Rossi

User already logged

AREA OF INTEREST

DRAW

Activate drawing environment

FILE UPLOAD

Shp or kml

PARCEL INFO

CROP

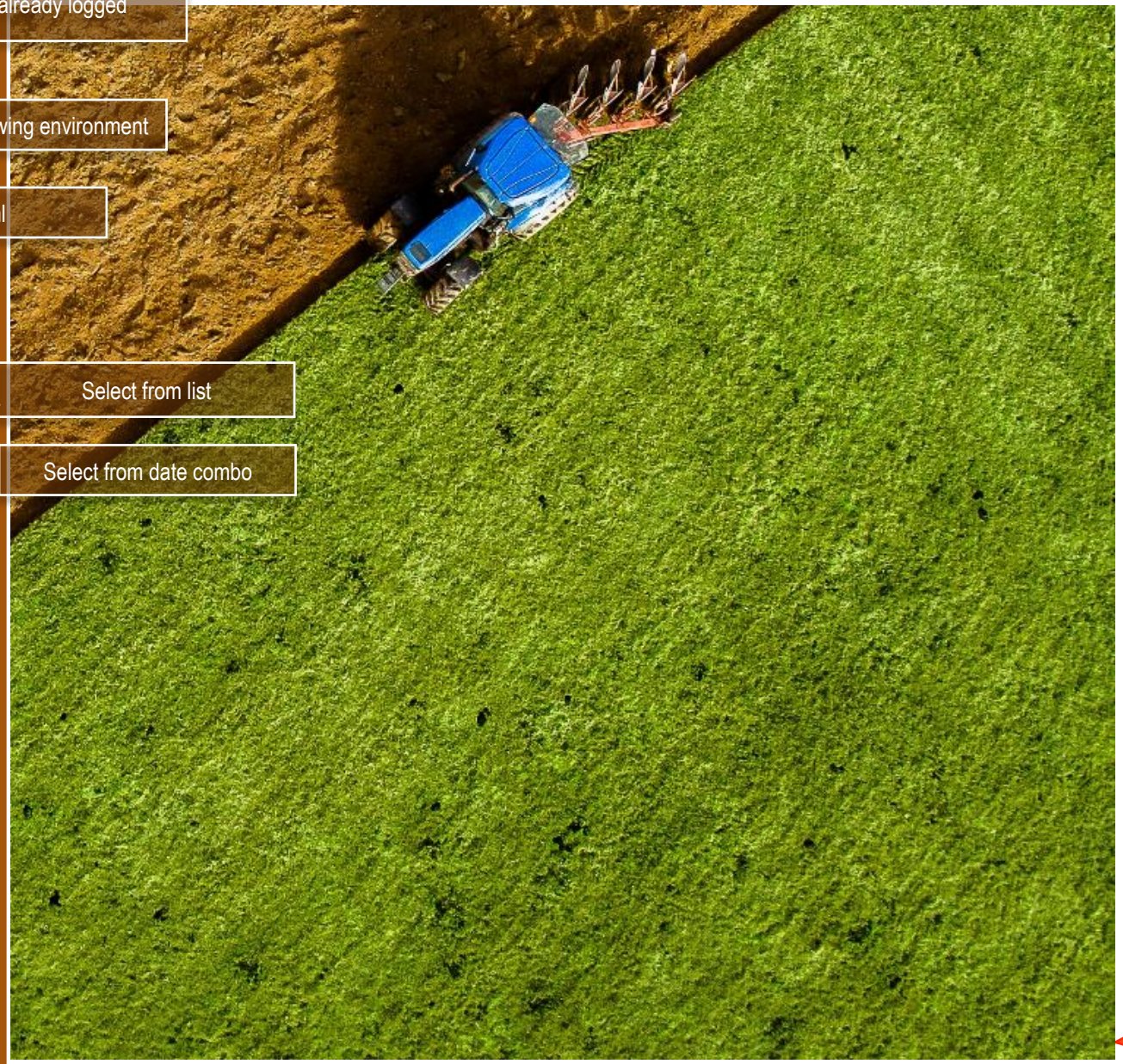
Select from list

SEED DATE

Select from date combo

PARCEL ID

ADDITIONAL INFO



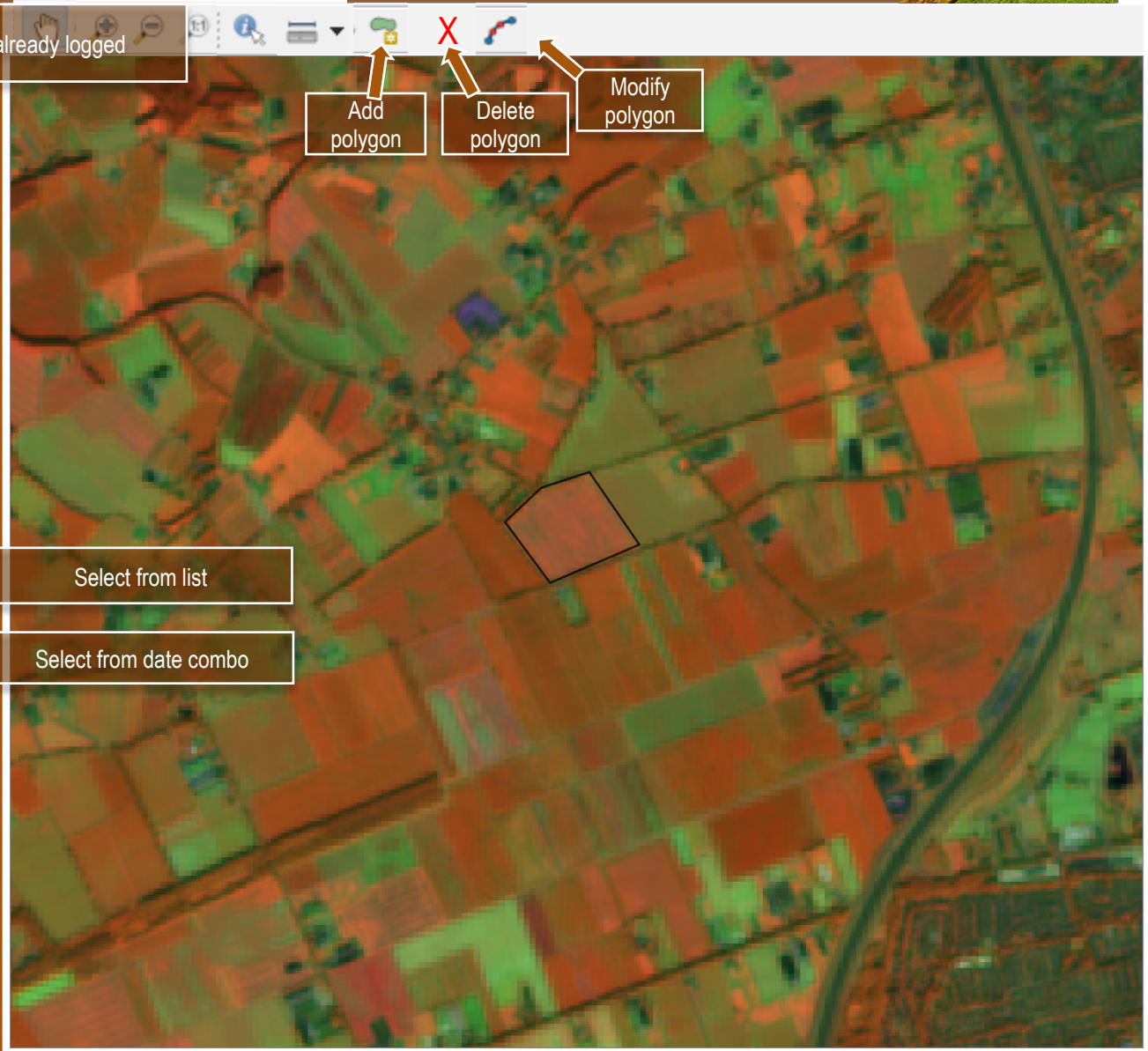
SERVICES REGISTRATION - PARCEL UPLOAD BY DRAWING

PREMIA

USERNAME Mario Rossi

User already logged

Layer selection console: RGB imge, NIR image, OSM, Cadaster



PARCEL INFO

CROP	
SEED DATE	
PARCEL ID	
ADDITIONAL INFO	

Select from list

Select from date combo

CONFIRM PARCEL

MAIN MENU

PREMIA

USERNAME Mario Rossi

User already logged

AREA OF INTEREST

DRAW | **SELECT FROM DB**

SERVICE PARAMETERS

DATE OF INTEREST

CROP

SEED DATE

To be provided

EVENT START DATE

EVENT END DATE

EVENT TYPE

Select from date combo

To filled if not selected from DB

Select from date combo (if not from DB

To be filled for PSC3 and PSC4 (date combo)

Select from event list

PREMIA SERVICE COMPONENT

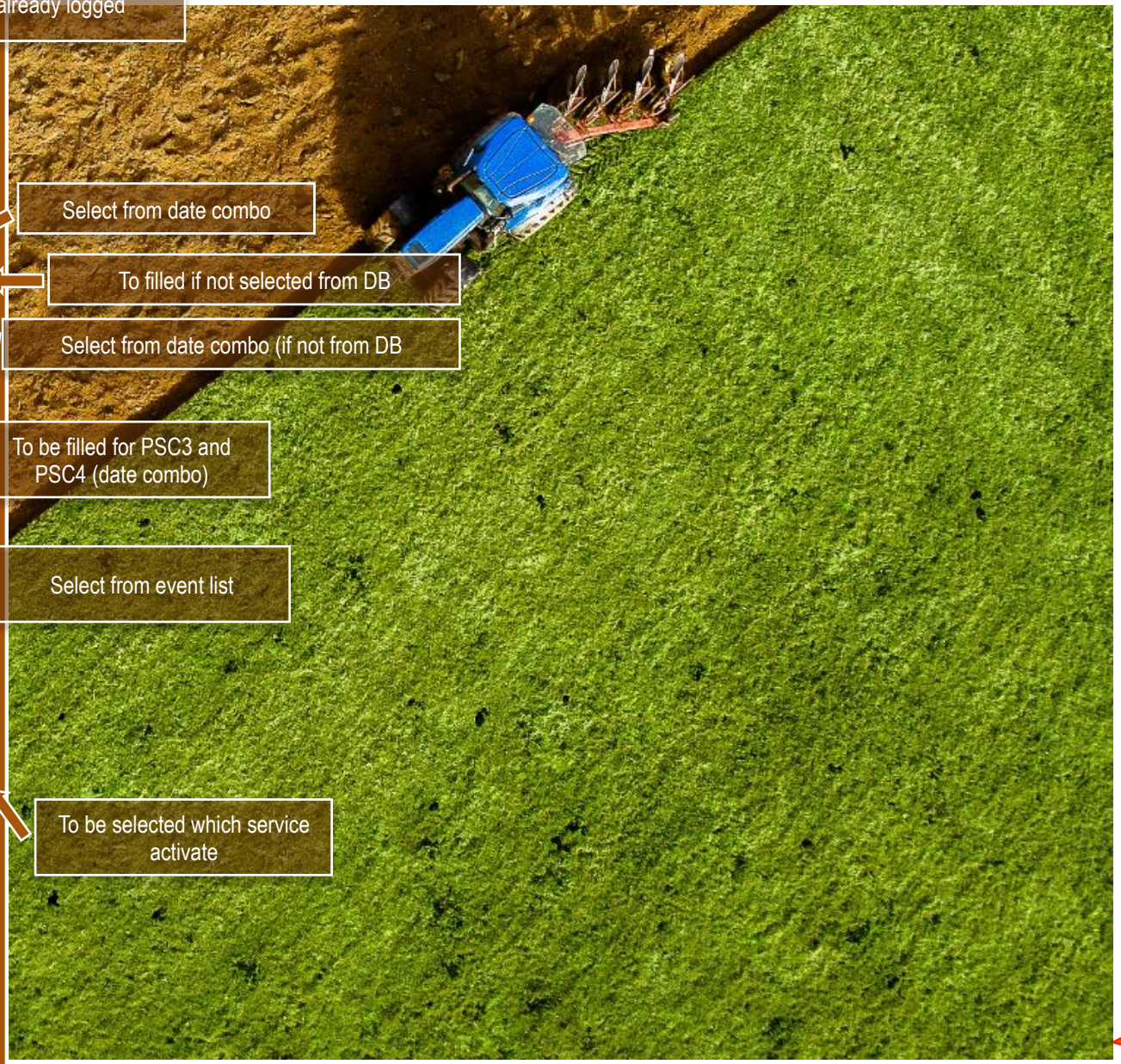
HISTORICAL ANALYSIS

CROP MONITORING

EXTREME WEATHER EVENT MAP

DAMAGE ESTIMATION SUPPORT

To be selected which service activate



e-geos

HISTORICAL ANALYSIS: SITE CHARACTERIZATION

Back

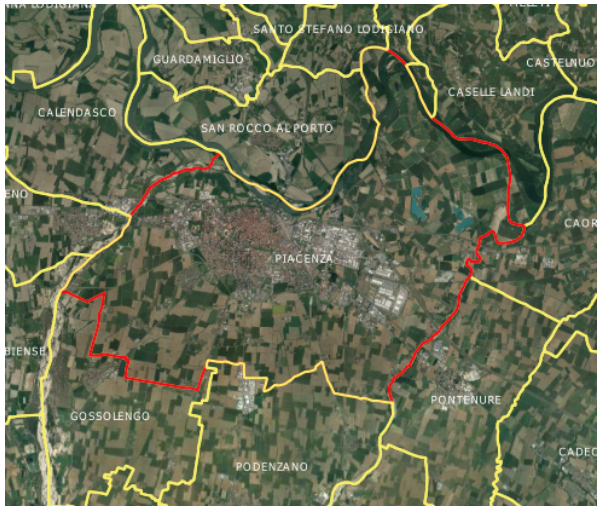
PREMIA

REFERENCE DATA

USERNAME	Mario Rossi
PARCEL ID	35934501
AREA (ha)	1,81
CROP	Wheat
SEED DATE	25/01/2018
ANALYSIS DATE	30/04/2018

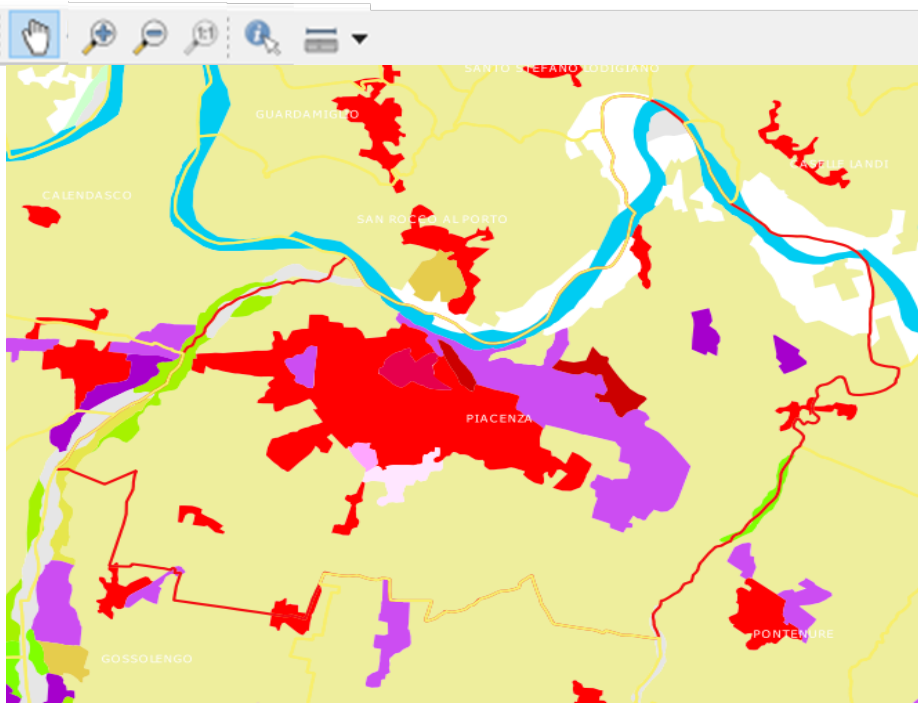
REFERENCE AREA

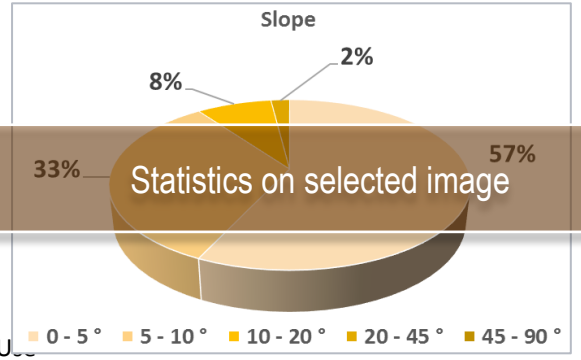
AREA	Piacenza Comune
AREA (ha)	



Console for: Land cover, Zoning, Elevation, Aspect, Slope

- Continuous urban fabric
- Discontinuous urban fabric
- Industrial or commercial units
- Road and rail networks and associated land
- Port areas
- Airports
- Mineral extraction sites
- Dump sites
- Construction sites
- Green urban areas
- Sport and leisure facilities
- Non-irrigated arable land
- Permanently irrigated land
- Rice fields
- Vineyards
- Fruit trees and berry plantations
- Olive groves
- Pastures
- Annual crops associated with permanent crops
- Complex cultivation patterns
- Land principally occupied by agriculture with signifi...
- Agro-forestry areas
- Broad-leaved forest
- Coniferous forest
- Mixed forest
- Natural grasslands





Statistics on selected image

Company General Use

e-geos

HISTORICAL ANALYSIS: YIELD STATS

Back

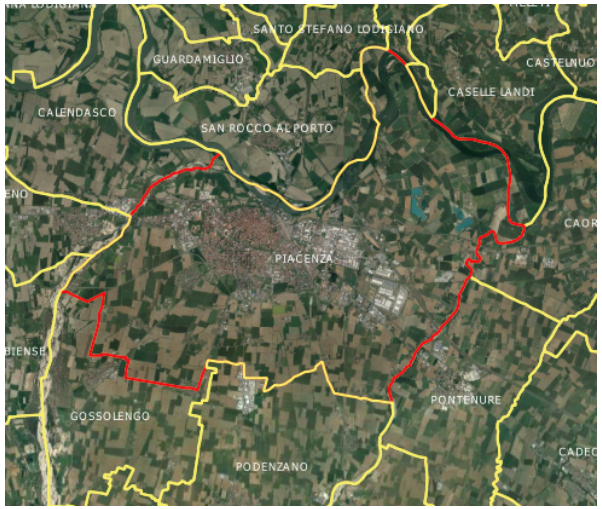
PREMIA

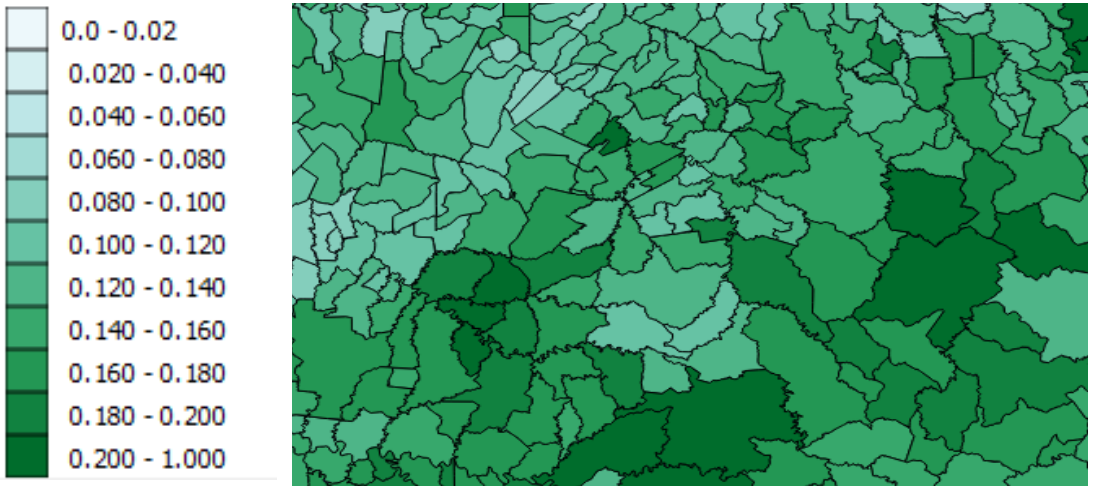
REFERENCE DATA

USERNAME	Mario Rossi
PARCEL ID	35934501
AREA (ha)	1,81
CROP	Wheat
SEED DATE	25/01/2018
ANALYSIS DATE	30/04/2018

REFERENCE AREA

AREA	Piacenza Comune
AREA (ha)	

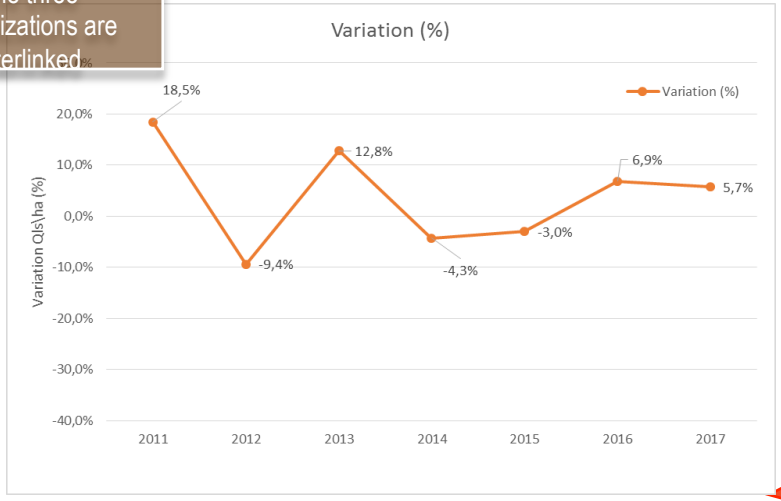




Console for: Year selection, Crop selection,

The three visualizations are interlinked

Wheat	Yield (Qls/ha)	Variation (%)
2010	63,0	
2011	74,6	18,5%
2012	67,6	-9,4%
2013	76,2	12,8%
2014	73,0	-4,3%
2015	70,8	-3,0%
2016	75,7	6,9%
2017	80,0	5,7%



Company General Use

HISTORICAL ANALYSIS: DAMAGE AND POLICY STATS

Back

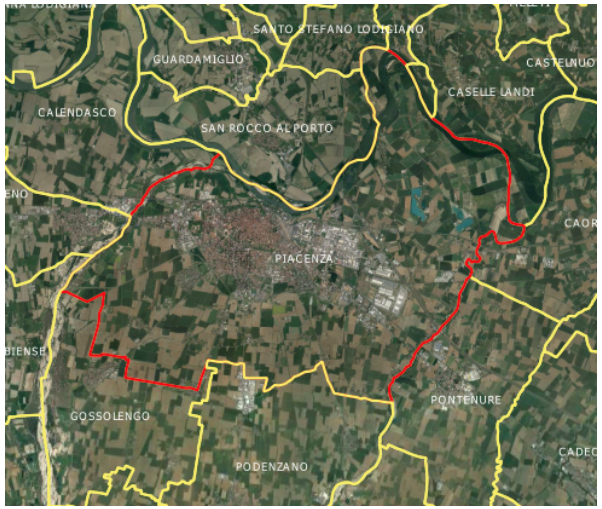
PREMIA

REFERENCE DATA

USERNAME	Mario Rossi
PARCEL ID	35934501
AREA (ha)	1,81
CROP	Wheat
SEED DATE	25/01/2018
ANALYSIS DATE	30/04/2018

REFERENCE AREA

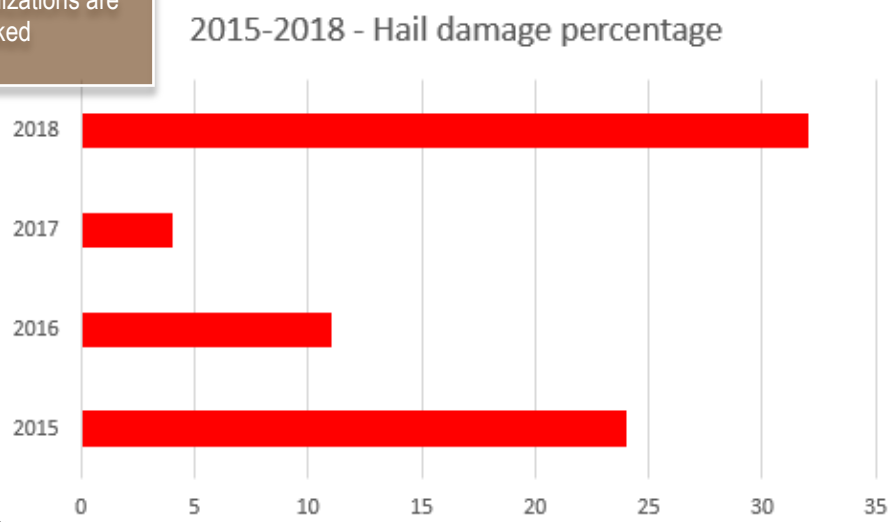
AREA	Piacenza Comune
AREA (ha)	



Console for: Reference unit selection, Year selection, Multiyear selection, Crop selection, type of even, policy rate

The three visualizations are interlinked

Year	% Damaged
2015	24
2016	11
2017	4
2018	32



Company Gene

e-geos

HISTORICAL ANALYSIS: SPECTRAL ANALYSIS

Back

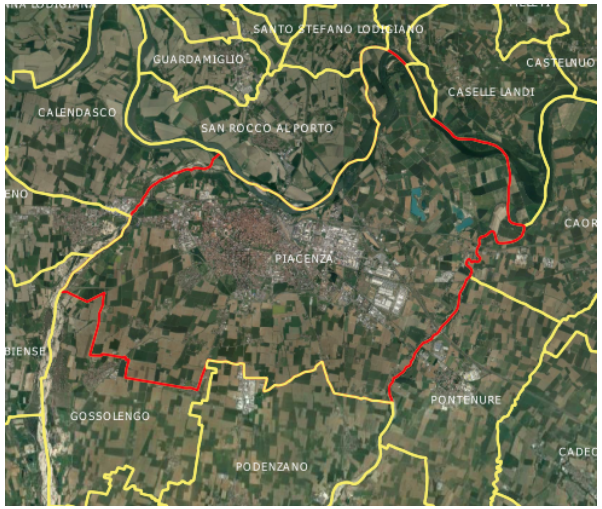
PREMIA

REFERENCE DATA

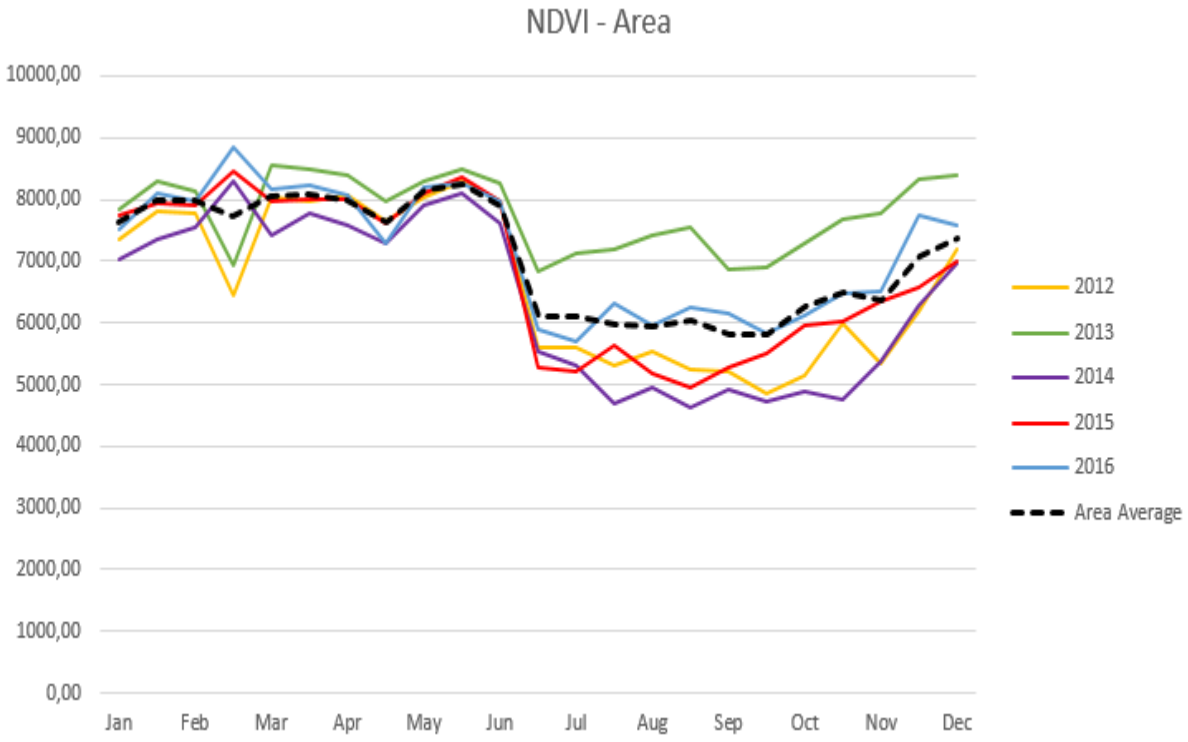
USERNAME	Mario Rossi
PARCEL ID	35934501
AREA (ha)	1,81
CROP	Wheat
SEED DATE	25/01/2018
ANALYSIS DATE	30/04/2018

REFERENCE AREA

AREA	Piacenza Comune
AREA (ha)	



Console for: Index selection, Year selection, Multiyear selection



Last Three years crop season (parcel)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015												
2016												
2017												

e-geos

HISTORICAL ANALYSIS: CROP FAILURE

Back

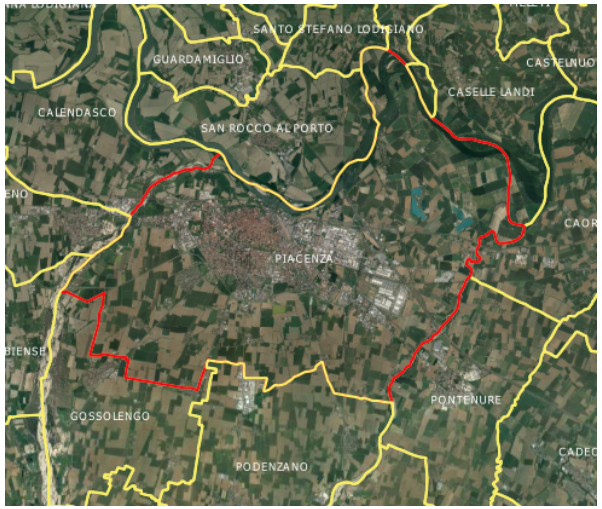
PREMIA

REFERENCE DATA

USERNAME	Mario Rossi
PARCEL ID	35934501
AREA (ha)	1,81
CROP	Wheat
SEED DATE	25/01/2018
ANALYSIS DATE	30/04/2018

REFERENCE AREA

AREA	Piacenza Comune
AREA (ha)	



Console for:, Year selection, Anomaly threshold

NDVI Image during crop growth with anomaly area in different color

Bare soil image (RGB)

NIR Image during crop growth

Last Three years crop season (parcel)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015												
2016												
2017												

e-geos

CROP MONITORING: MAIN

Back

PREMIA

REFERENCE DATA

USERNAME	Mario Rossi
PARCEL ID	35934501
AREA (ha)	3,59
CROP	Corn
SEED DATE	25/05/2018
ANALYSIS DATE	11/08/2018

Here could be added a «more info» button

SELECT MONITORING

INTRA-FIELD ANALYSIS

INTER-FIELDS COMPARISON

METEO SPECTRAL TREND

YIELD ANALYSIS

e-geos

CROP MONITORING: INTRA-FIELD ANOMALIES

Back

PREMIA

REFERENCE DATA

USERNAME	Mario Rossi
PARCEL ID	Custom area
AREA (ha)	948,24
CROP	Vineyard
SEED DATE	25/05/2018
ANALYSIS DATE	11/08/2018

SERVICE PARAMETERS

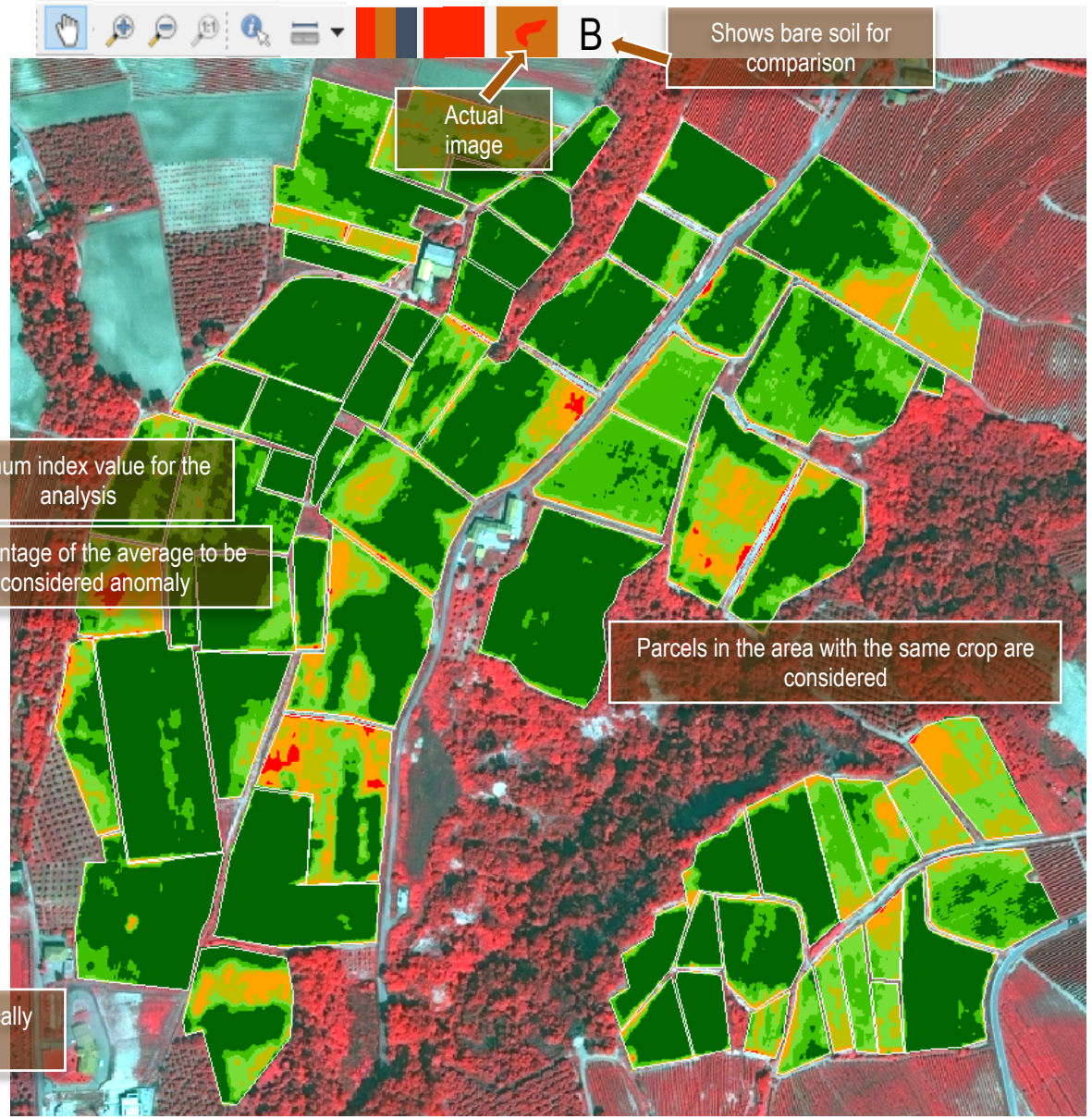
MINIMUM INDEX THRESHOLD	0,5
ANOMALIES THRESHOLD	50%

Values can be set interactively

LEGEND

- More than average
- Average
- Fair
- Below threshold
- Severe

Image palette dynamically updated



e-geos

CROP MONITORING: INTER-FIELDS COMPARISON

Back

PREMIA

REFERENCE DATA

USERNAME	Mario Rossi
PARCEL ID	Custom area
AREA (ha)	948,24
CROP	Vineyard
SEED DATE	25/05/2018
ANALYSIS DATE	11/08/2018

SERVICE PARAMETERS

MINIMUM INDEX THRESHOLD	0,5
ANOMALIES THRESHOLD	50%

CROP MONITORING: INTER-FIELDS COMPARISON

Back

PREMIA

REFERENCE DATA

USERNAME	Mario Rossi
PARCEL ID	Custom area
AREA (ha)	948,24
CROP	Vineyard
SEED DATE	25/05/2018
ANALYSIS DATE	11/08/2018

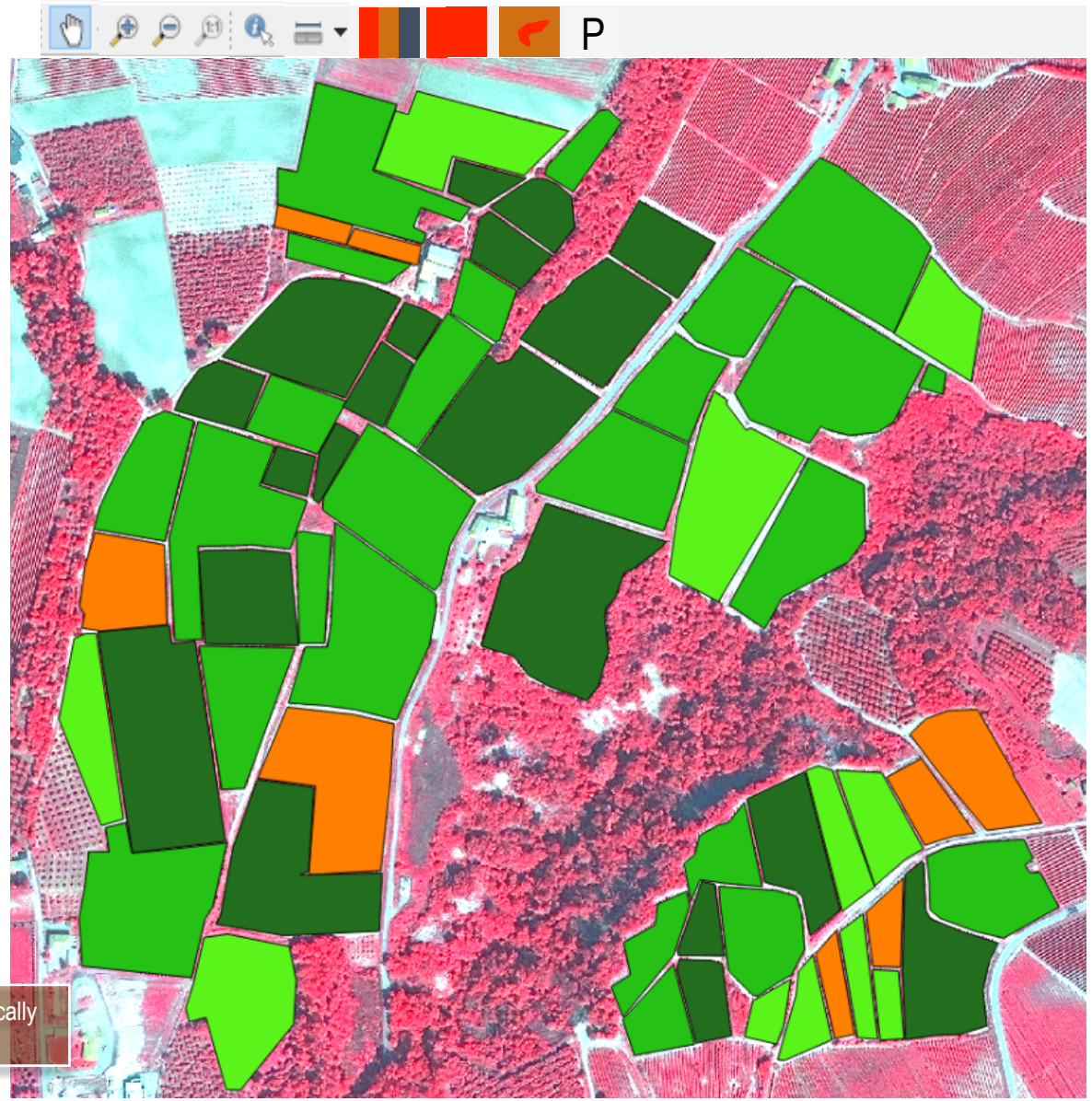
SERVICE PARAMETERS

ALARM THRESHOLD VS. AVERAGE	50%

LEGEND

- More than average
- Average
- Fair
- Below threshold
- Severe

Image palette dynamically updated



e-geos

CROP MONITORING - METEO-SPECTRAL TREND

Back

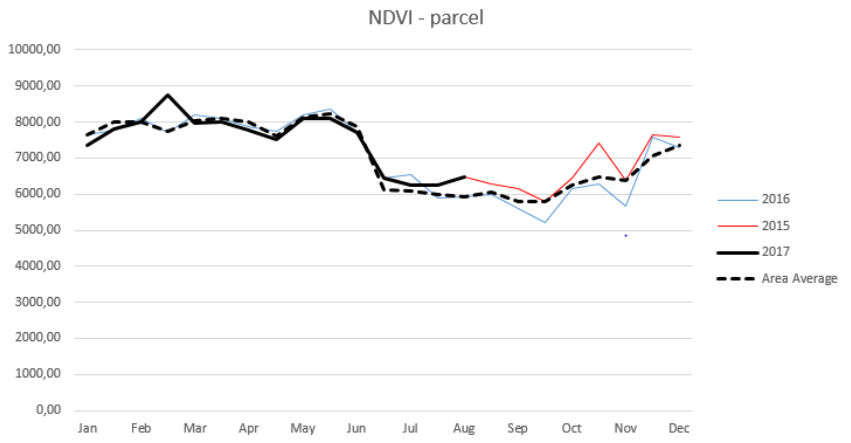
PREMIA

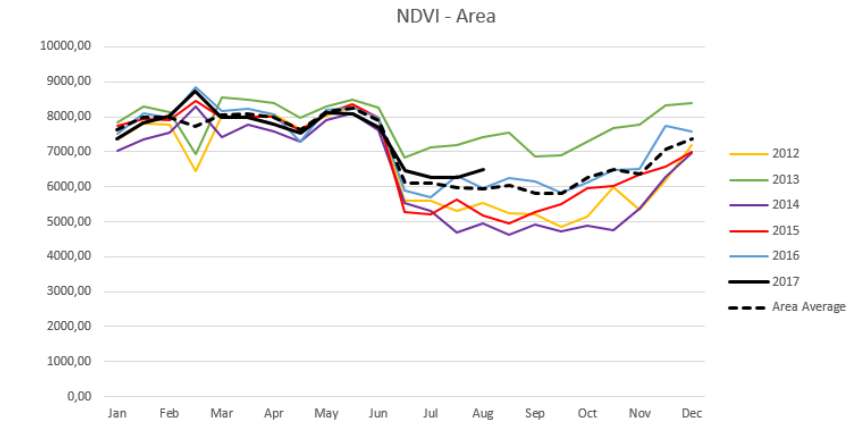
REFERENCE DATA						
	USERNAME	Mario Rossi	PARCEL ID	35934501	AREA (ha)	3,59
	CROP	Corn	SEED DATE	25/05/2018	ANALYSIS DATE	11/08/2018

SPECTRAL INFO

Console (parcel) for Comparison Year selection

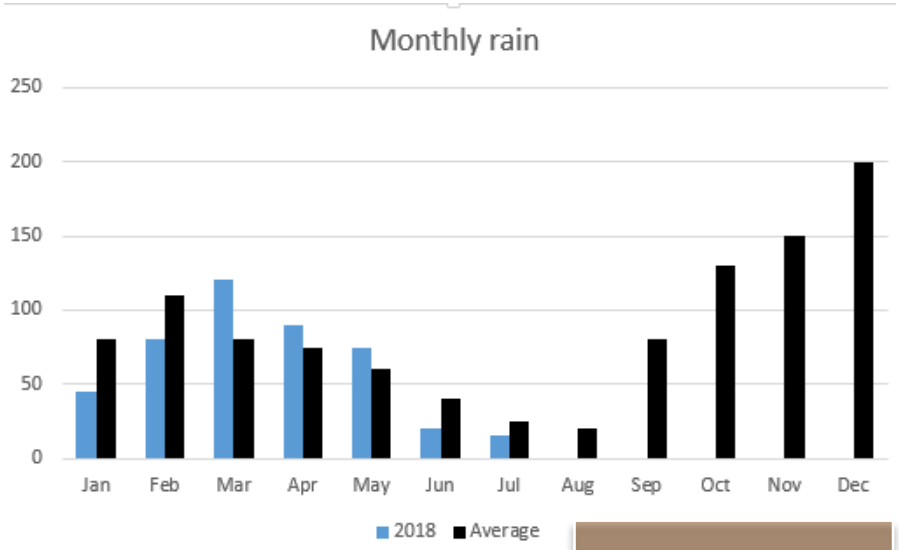
Console (area) for Comparison Year selection





METEO INFO

Console for: Year change,, Meteo variable change, Comparison with average historical trend



The two visualizations are interlinked

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	45	80	120	90	75	20	15					
Average	80	110	80	75	60	40	25	20	80	130	150	200

Company General Use

e-geos

CROP MONITORING - YIELD ANALYSIS

Back

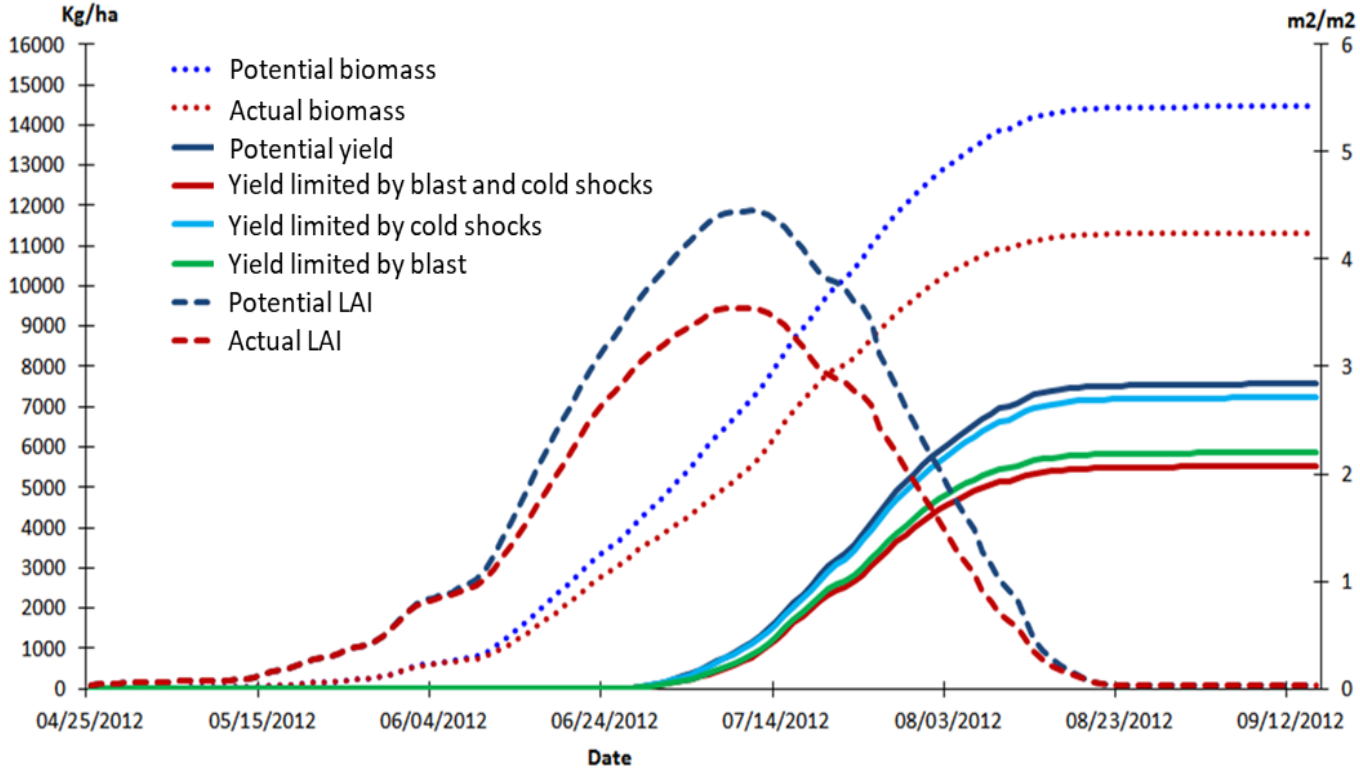
PREMIA

REFERENCE DATA

USERNAME	Mario Rossi
PARCEL ID	Custom area
AREA (ha)	3,59
CROP	Corn
SEED DATE	25/05/2018
ANALYSIS DATE	11/08/2018

YEAR	kg/ha	VS. ACTUAL
2015	4915	4,3%
2016	5012	2,4%
2017	5424	-5,6%
Average 3 years	5117	0,4%
Actual	**5135**	**0,0%**

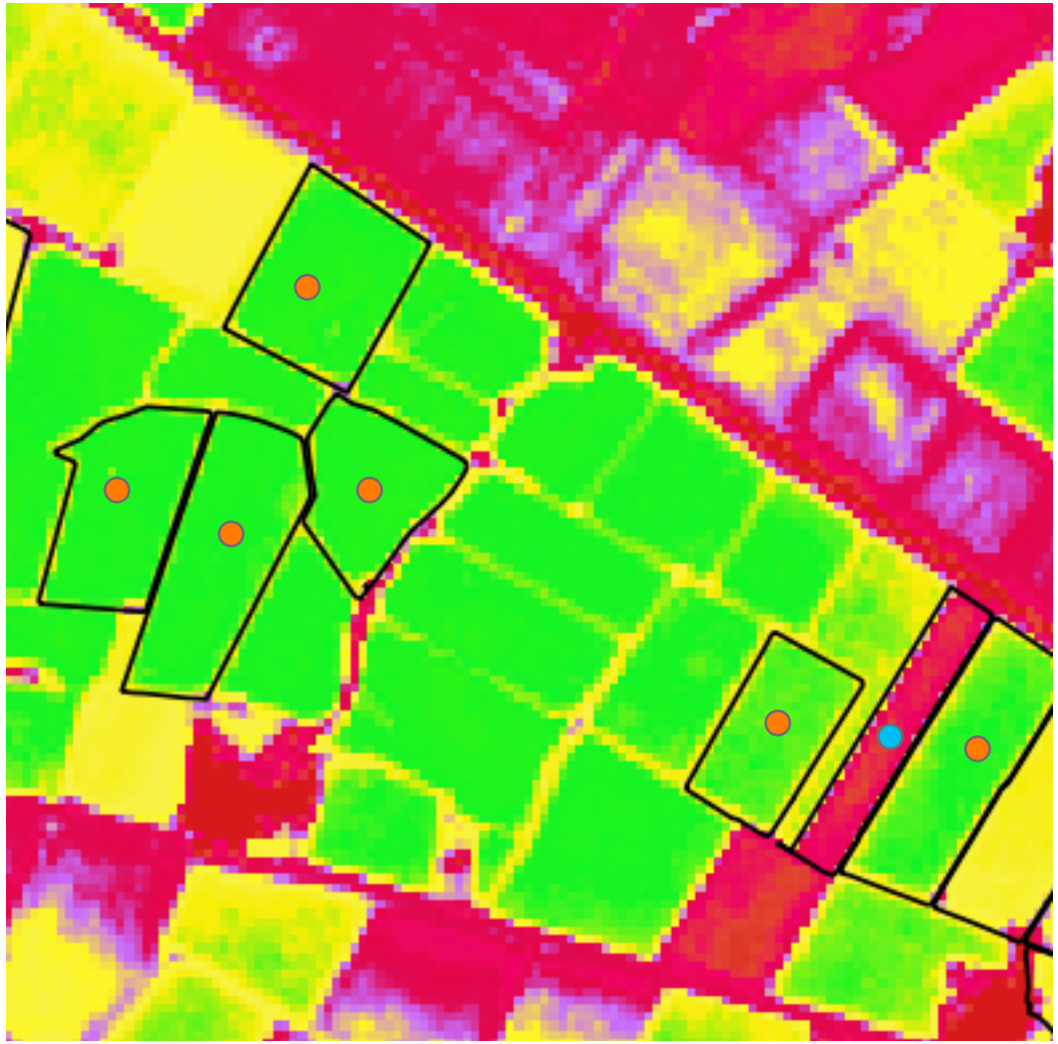
EXPECTED YIELD ANALYSIS



Servizi PREMIA: Crop Monitoring

Grassland mowing detection – Sentinel-2

Example of mowing detection based on Sentinel-2 NDVI analysis



Grassland parcels

NDVI Classification

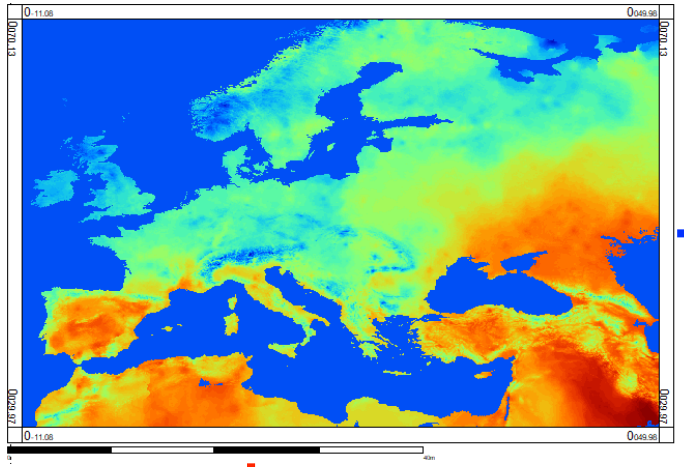
- RED = Mowing
- GREEN = No mowing

S-2A 16/05/2017

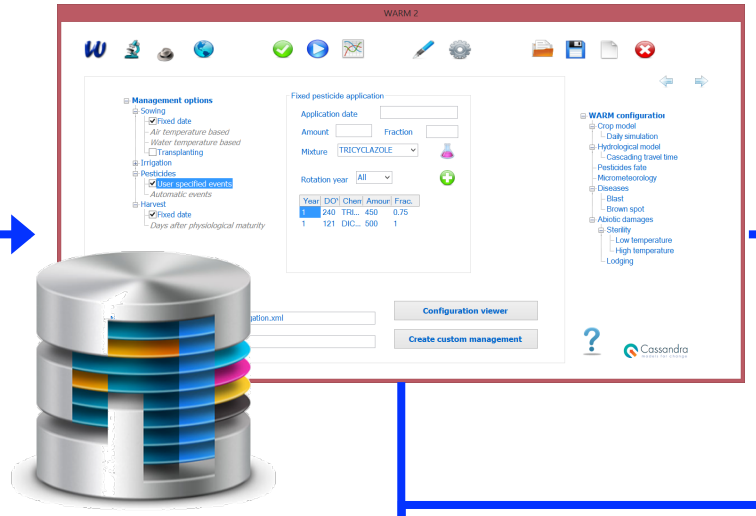
Servizi PREMIA: Crop Monitoring

PREMIA
Platform for Risk Evaluation & Management In Agriculture

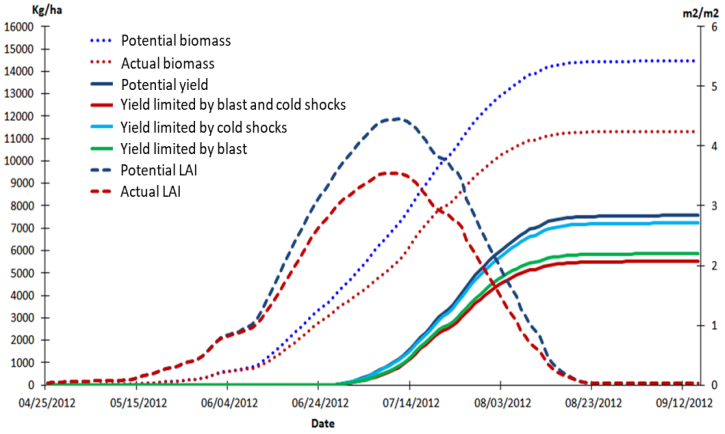
Weather data



Crop simulation model



Biophysical model outputs



Meta-model

Parametric/indirect index

e-geos

PREMIA inputs

Satellite Data Optical and SAR
(Spatial res. 10m every 5 days)

Meterological Data
(Spatial res. 10m every 5 days)

Advanced Yield modelling for crop

In situ data of past critical events and losses (where available)

Big Data Platforms and Capability

Servizi PREMIA

Historical Analysis

Crop Zooning

Crop Monitoring

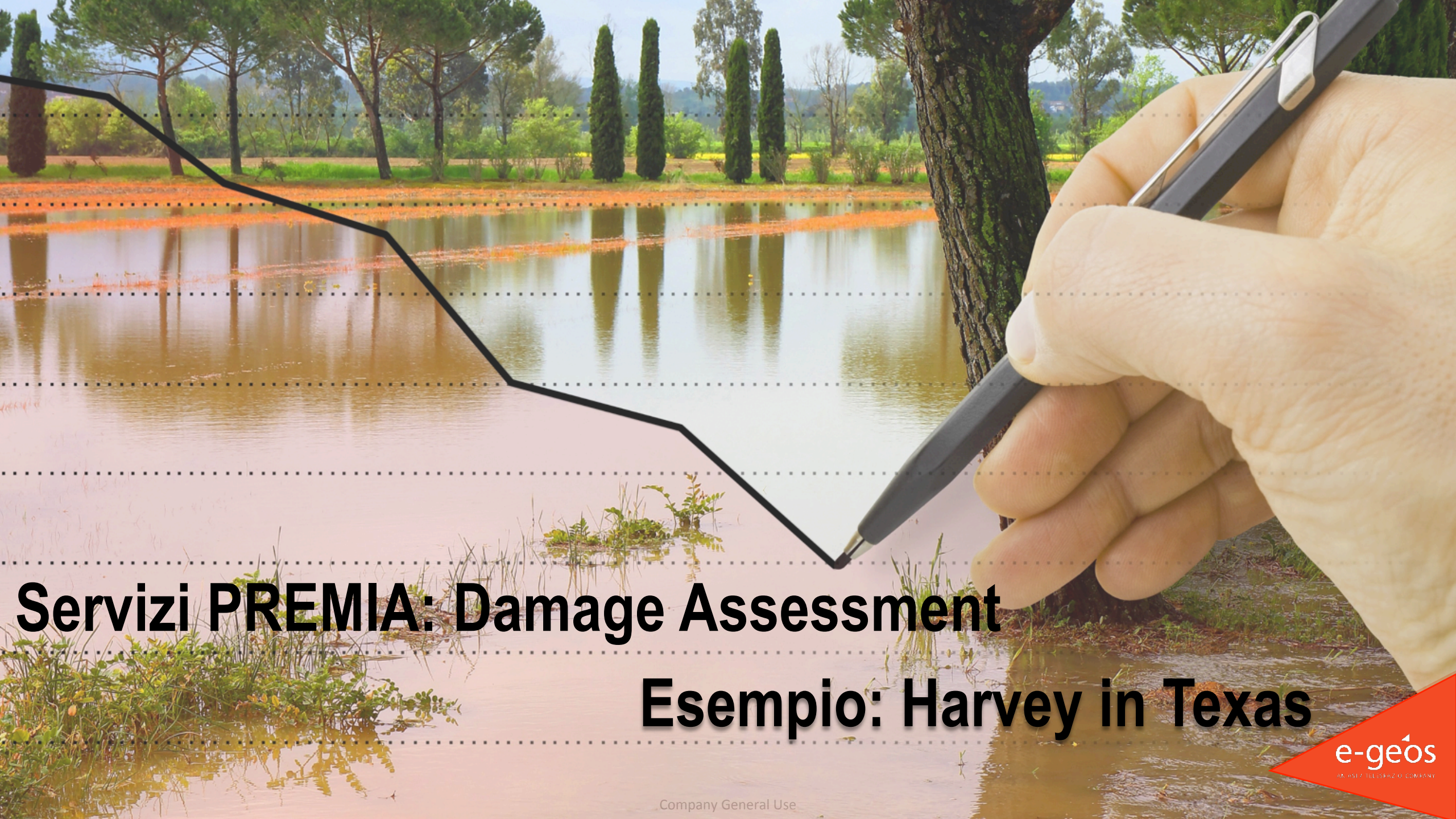
Extreme weather Map

Extreme Impact Evaluation

PREMIA Damage Support Service

PREMIA
Platform for Risk Evaluation & Management In Agriculture

e-geos



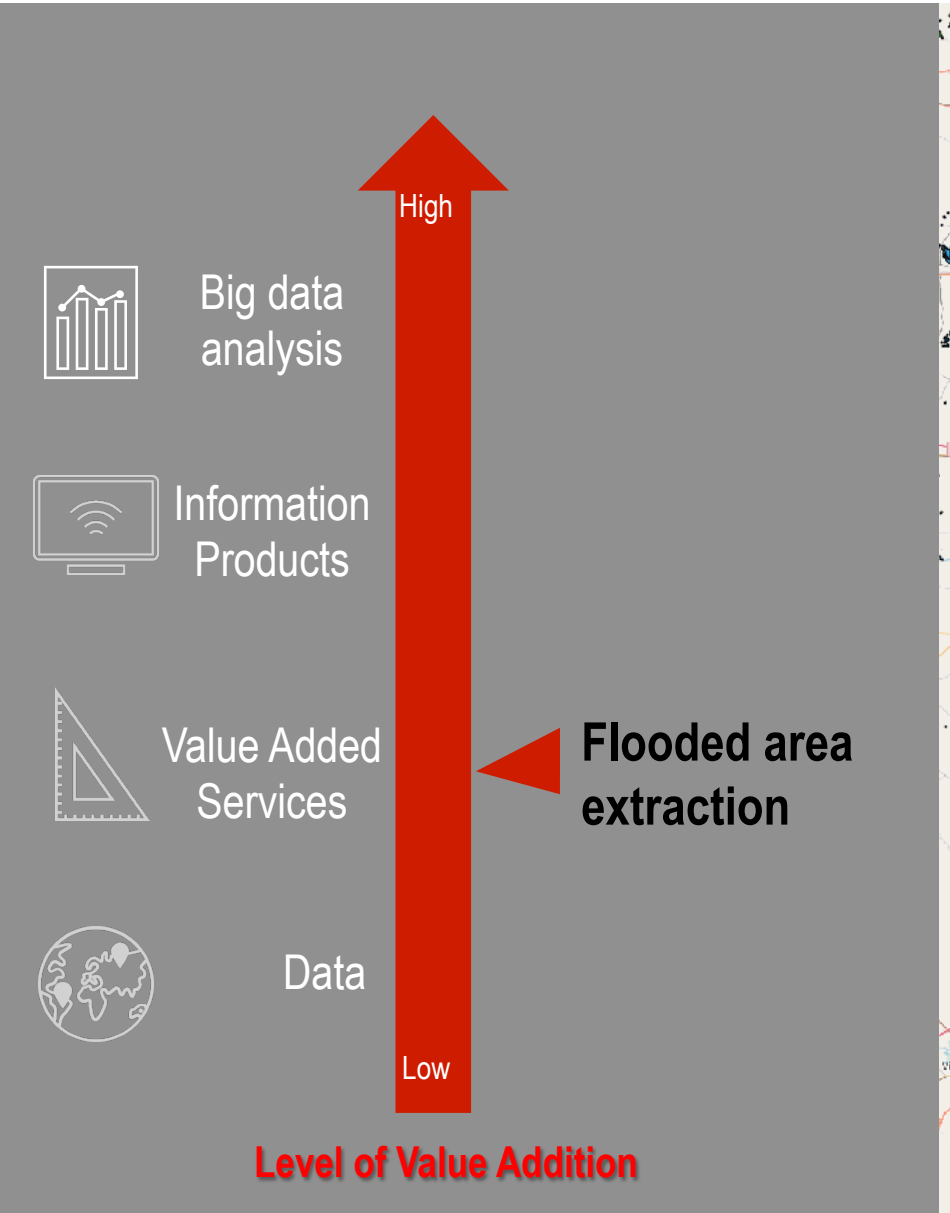
Servizi PREMIA: Damage Assessment

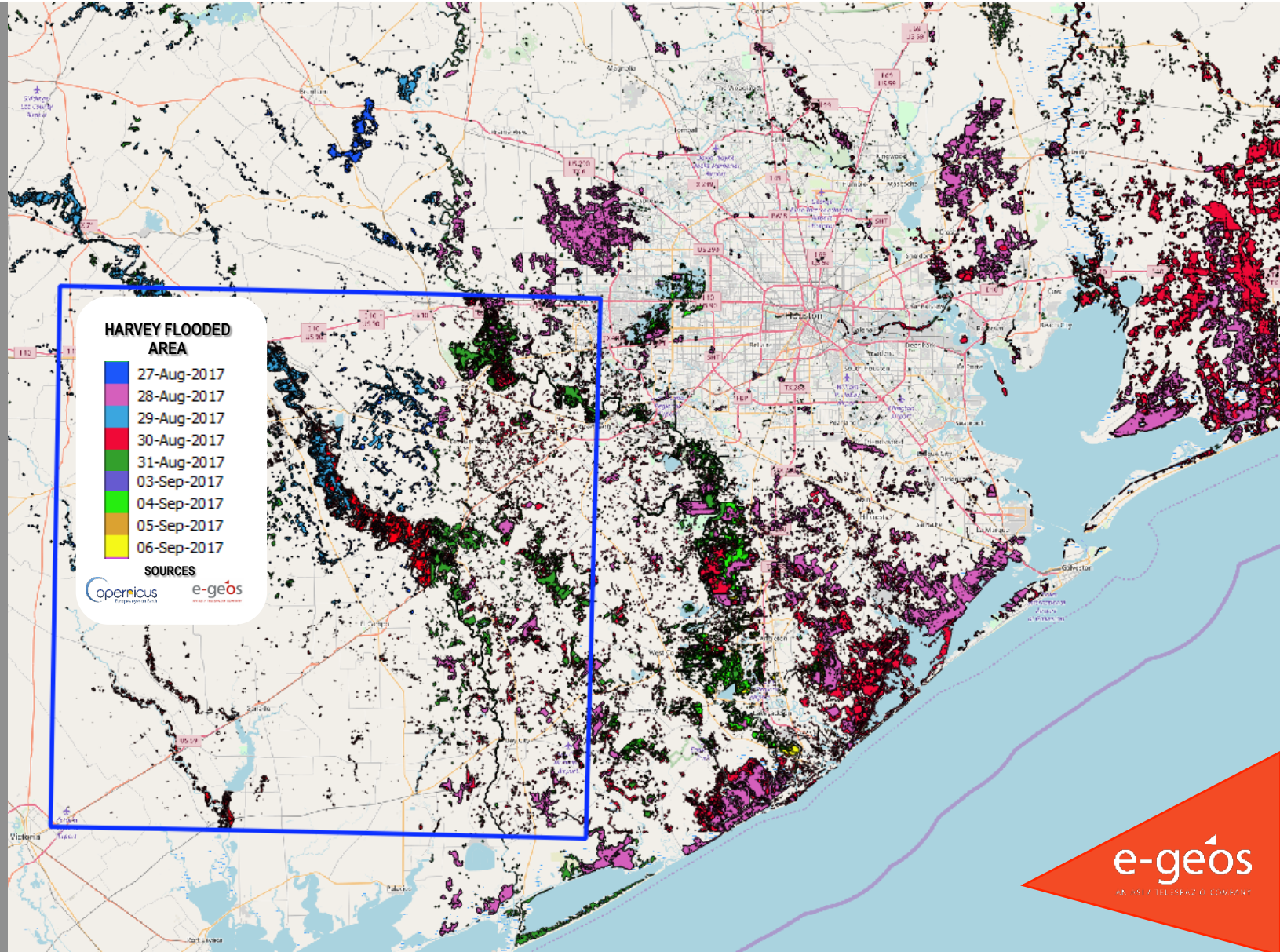
Esempio: Harvey in Texas

e-geos

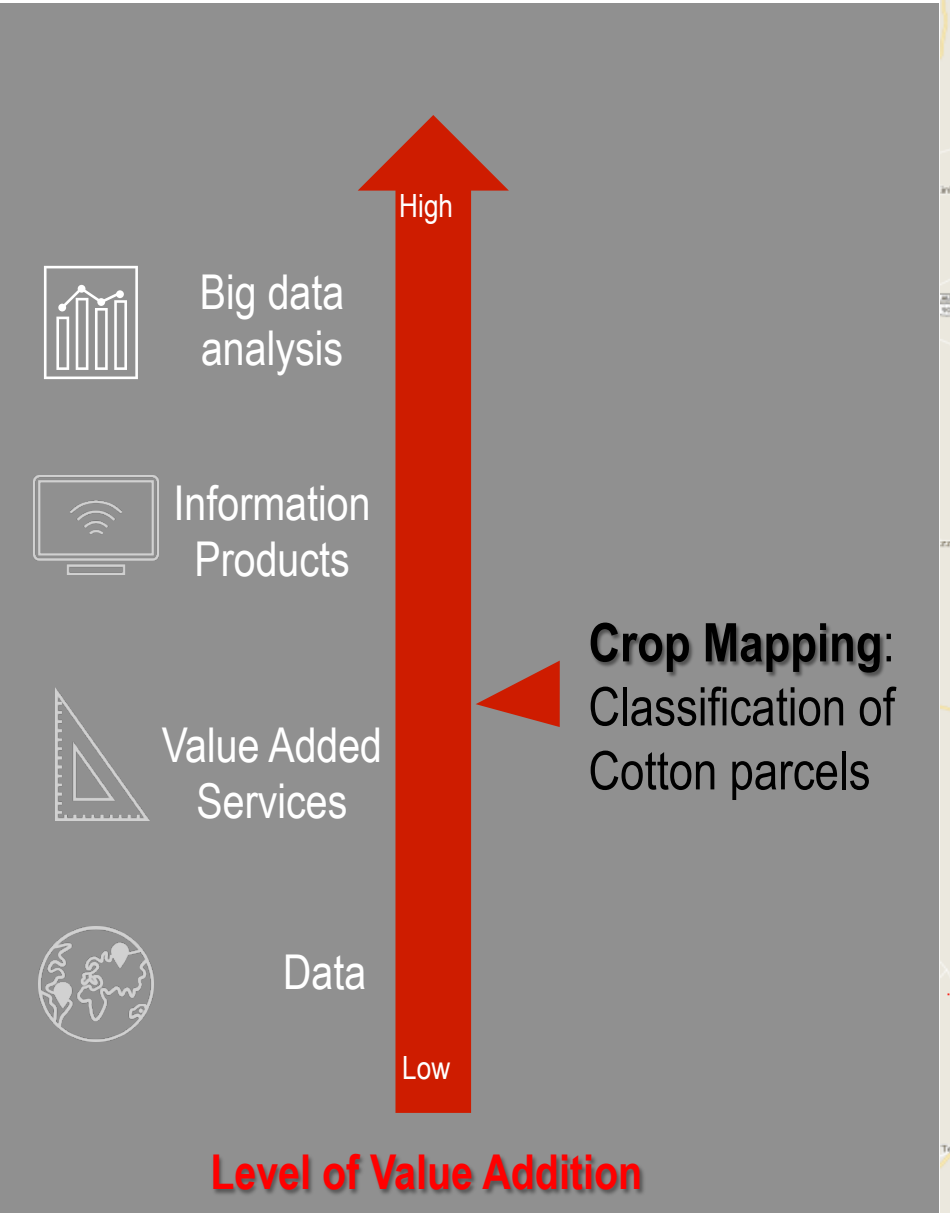
Company General Use

Harvey in US – Test area

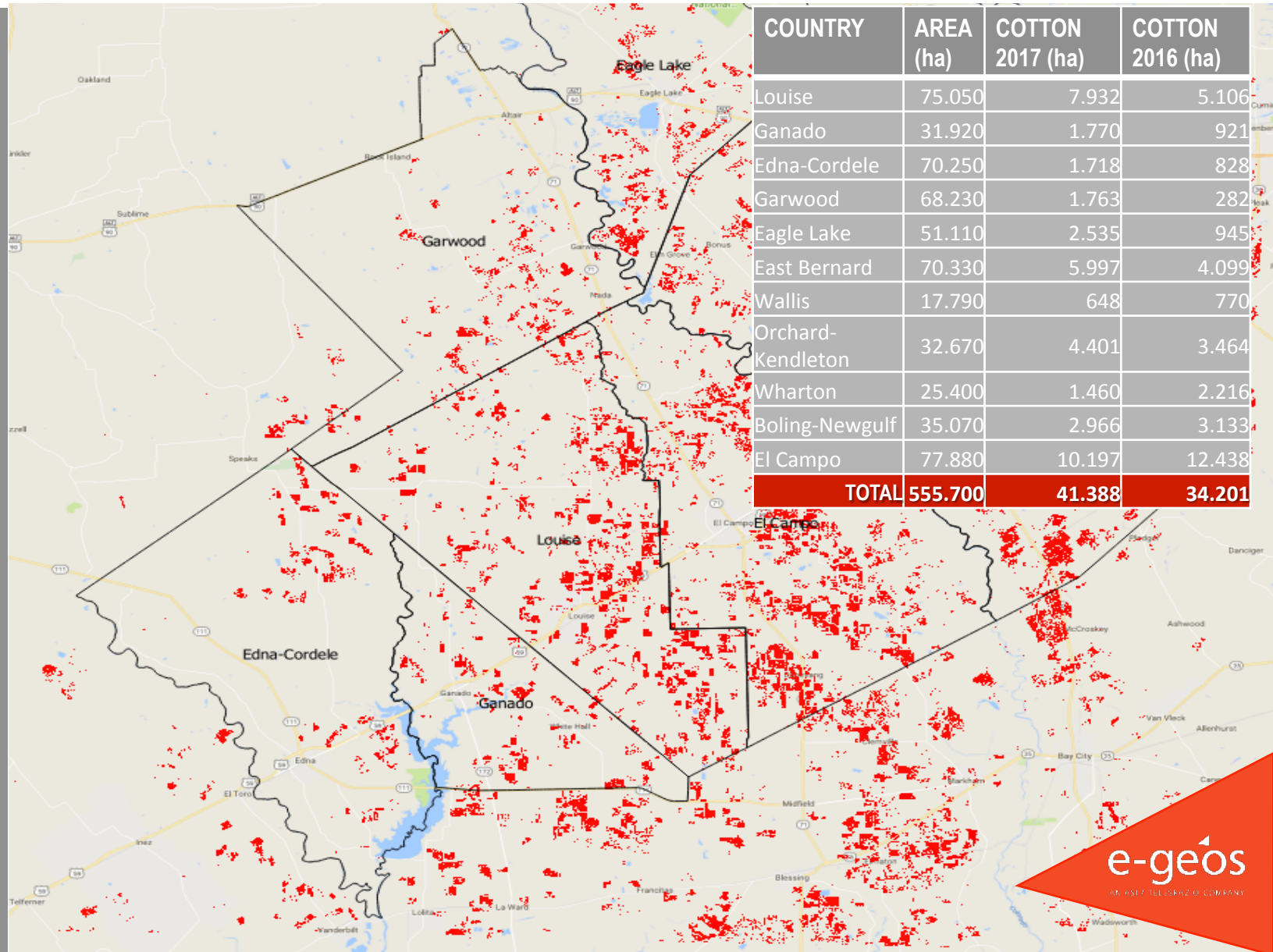




Harvey in US – Analytics from Cotton map



Crop Mapping: Classification of Cotton parcels



COUNTRY	AREA (ha)	COTTON 2017 (ha)	COTTON 2016 (ha)
Louise	75.050	7.932	5.106
Ganado	31.920	1.770	921
Edna-Cordele	70.250	1.718	828
Garwood	68.230	1.763	282
Eagle Lake	51.110	2.535	945
East Bernard	70.330	5.997	4.099
Wallis	17.790	648	770
Orchard-Kendleton	32.670	4.401	3.464
Wharton	25.400	1.460	2.216
Boling-Newgulf	35.070	2.966	3.133
El Campo	77.880	10.197	12.438
TOTAL	555.700	41.388	34.201

Harvey in US – Cotton growth stage

High

Big data analysis

Information Products

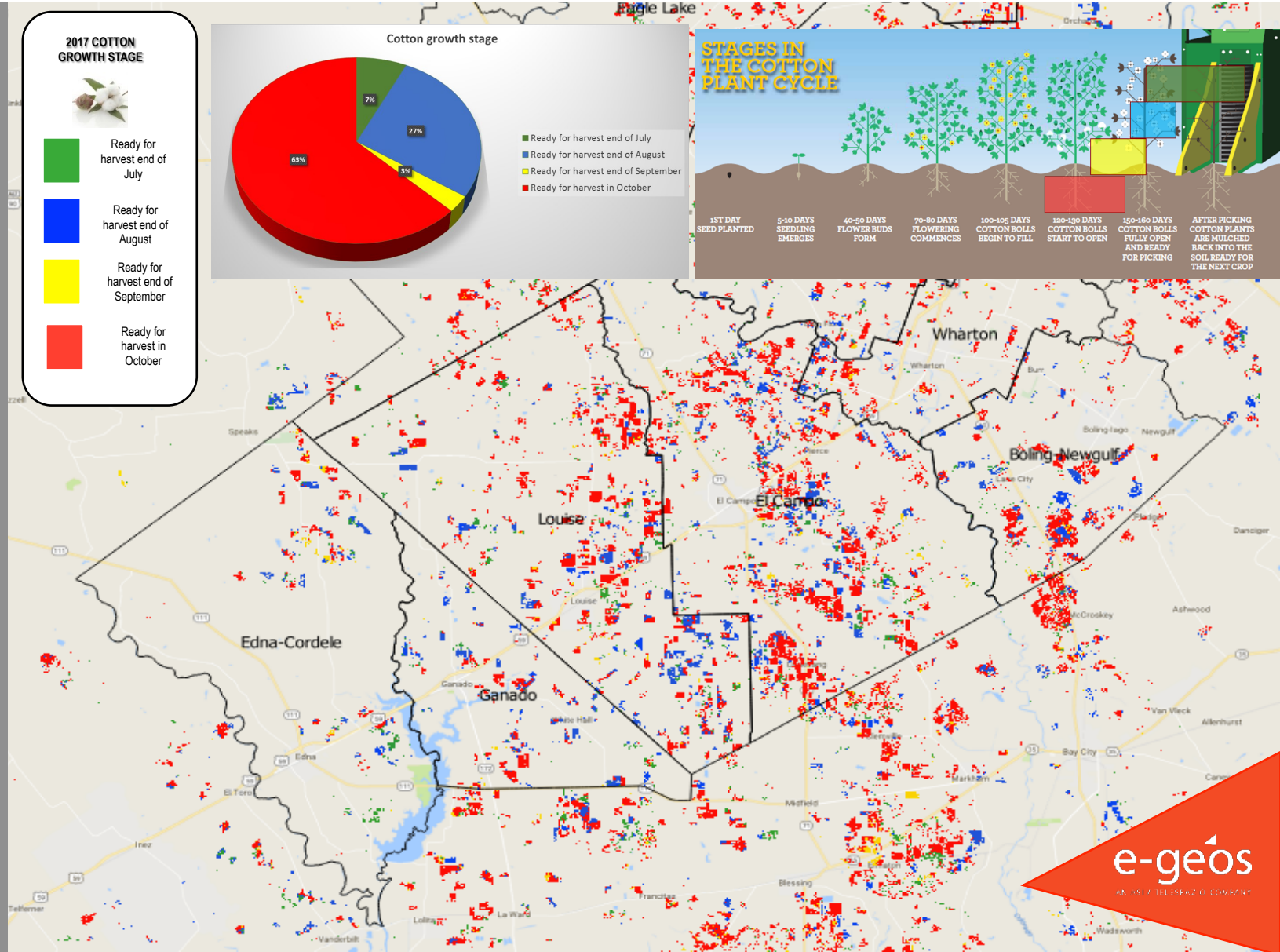
Value Added Services

Data

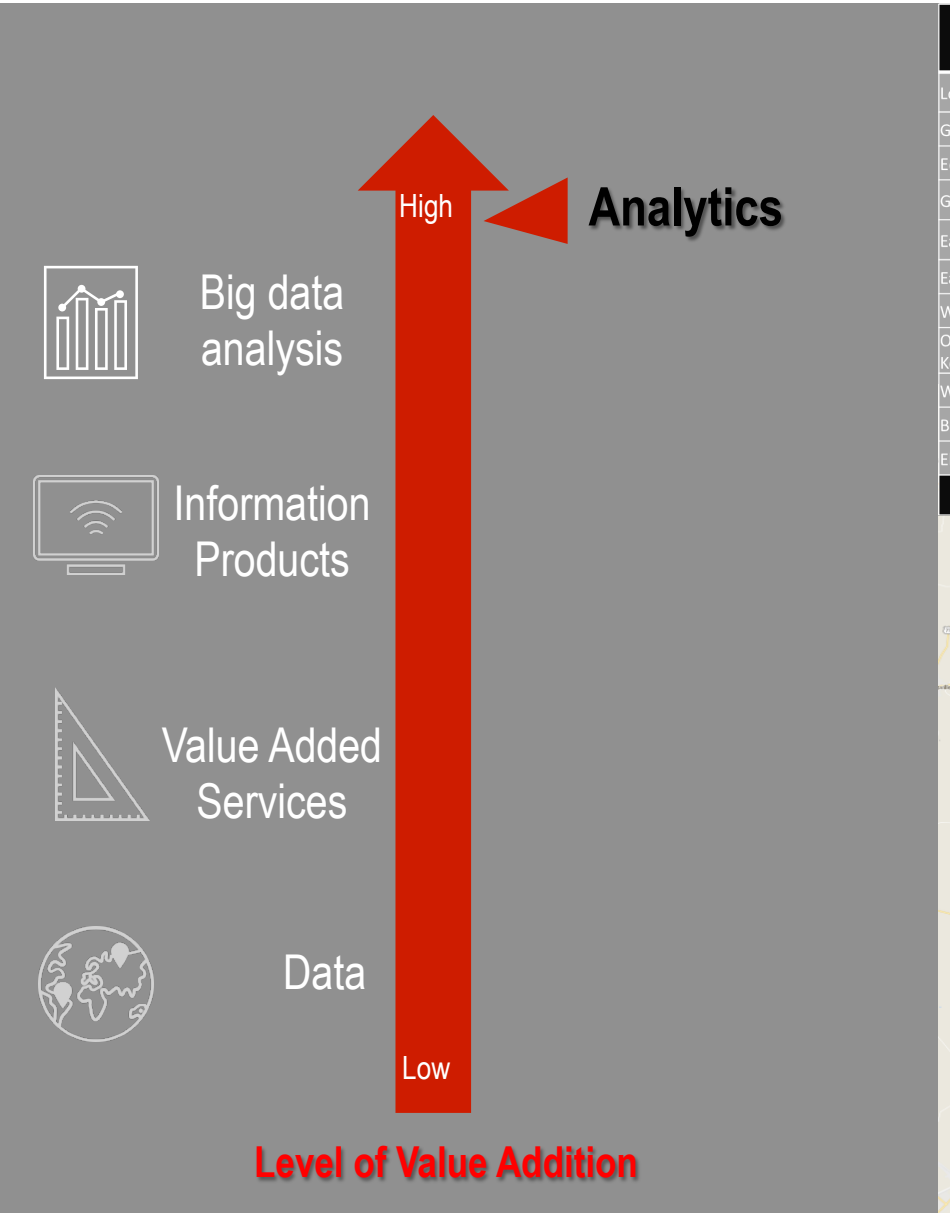
Low

Level of Value Addition

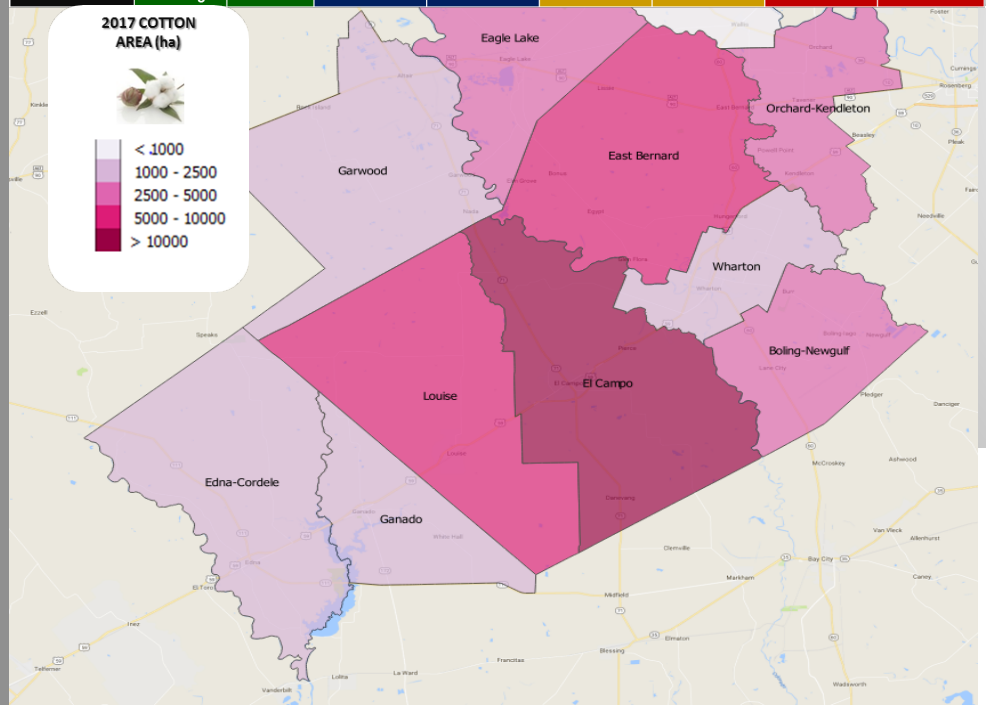
Crop Status
Identification of Phenological phases

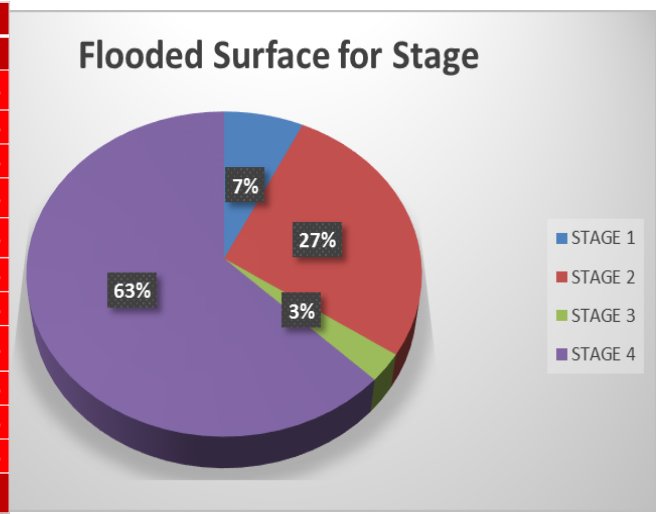


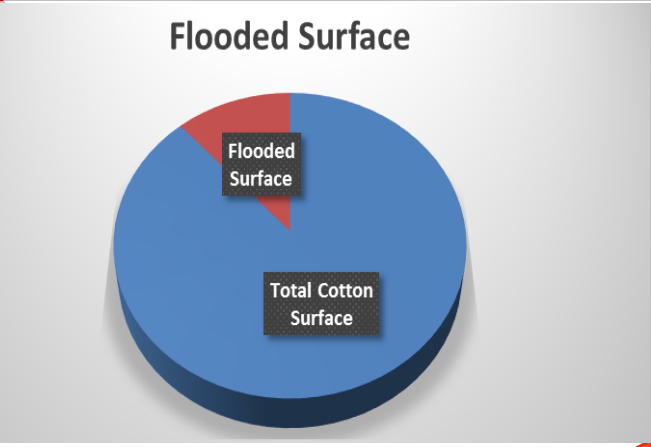
Harvey in US – Flooded cotton



COUNTY	STAGE 1		STAGE 2		STAGE 3		STAGE 4	
	ha	%	ha	%	ha	%	ha	%
Louise	593.10	11.65 %	1701.36	26.60%	197.82	3.09%	3904.28	61.04%
Ganado	121.28	8.50%	621.16	43.55%	41.50	2.91%	642.40	45.04%
Edna-Cordele	235.07	3.63%	439.04	6.79%	128.02	1.98%	5665.88	87.60%
Garwood	269.48	18.38 %	154.13	10.51%	65.80	4.49%	976.85	66.62%
Eagle Lake	320.15	15.30 %	251.59	12.02%	38.84	1.86%	1482.31	70.83%
East Bernard	308.68	6.32%	1268.32	25.95%	232.62	4.76%	3078.01	62.98%
Wallis	30.68	5.76%	111.41	20.92%	24.57	4.62%	365.76	68.70%
Orchard-Kendleton	176.85	4.99%	1034.47	29.17%	108.67	3.06%	2226.33	62.78%
Wharton	53.89	1.38%	3023.60	77.27%	61.59	1.57%	773.70	19.77%
Boling-Newgulf	138.91	5.76%	771.12	31.98%	50.07	2.08%	1450.90	60.18%
El Campo	706.78	8.57%	1968.89	23.87%	219.11	2.66%	5353.03	64.90%
TOTAL	2954.86	7.1%	11345.07	27.4%	1168.61	2.8%	25919.45	62.6%







e-geos

e-GEOS Innovative Activities

Fieldborne: geo-photo

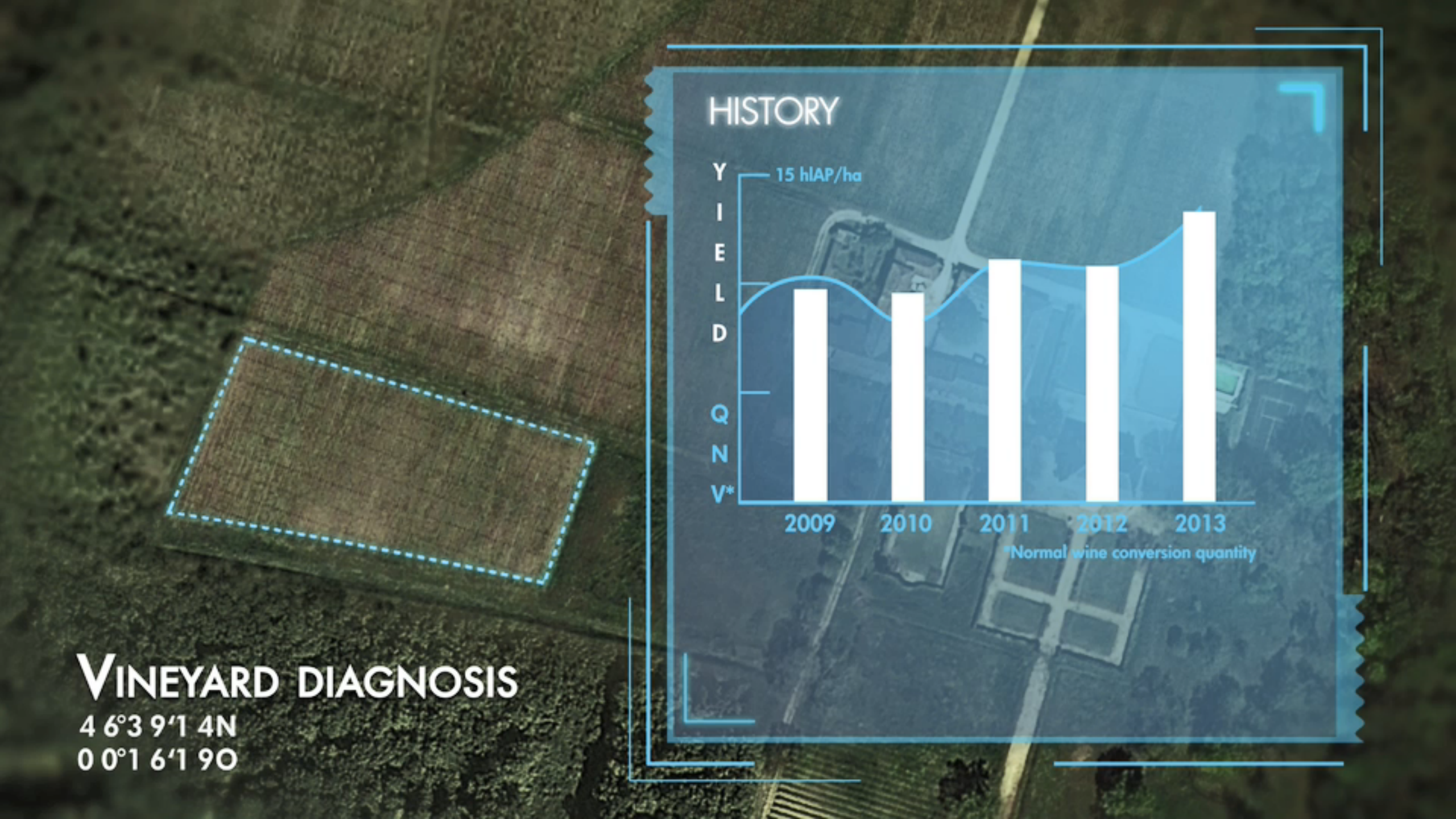
AGEA Geo-tagged Ground photos: Italian innovative System

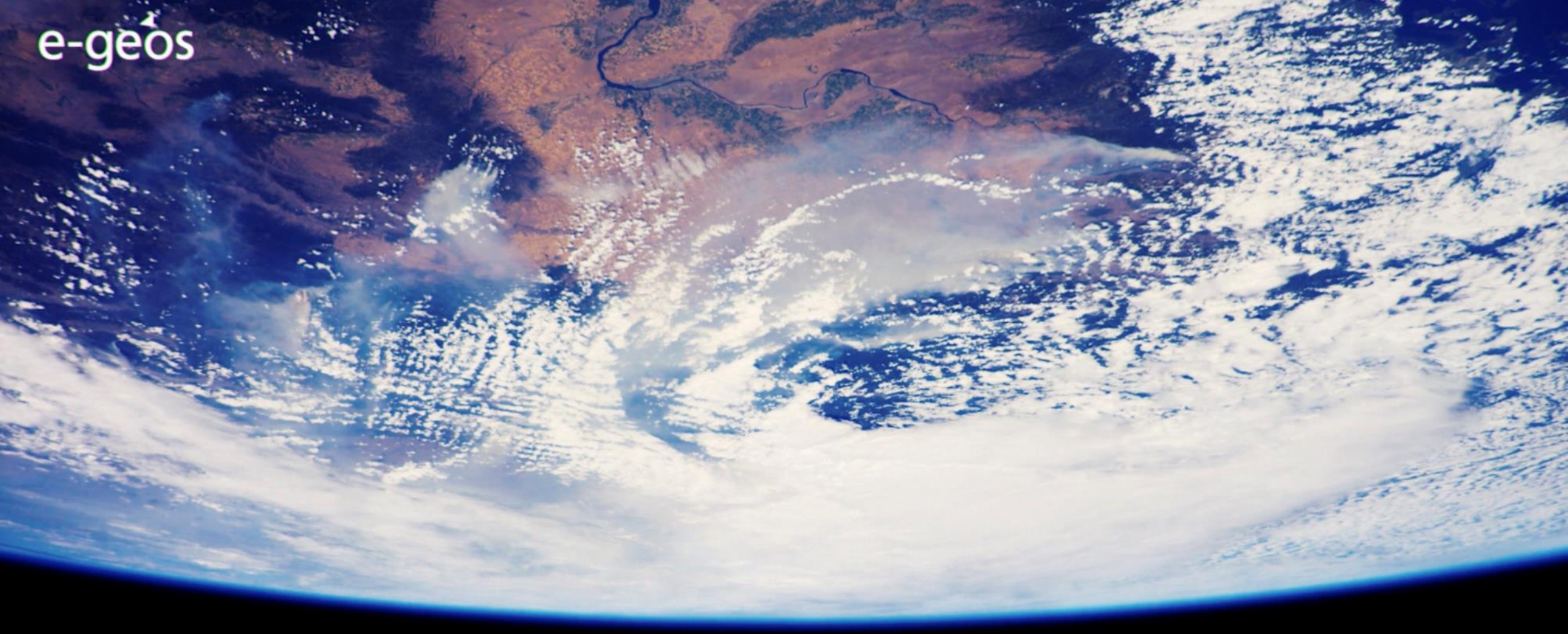
Mobile-enabled App for surveyors and/or farmers

- "Validated" pictures with anti-fraud control
- GPS tracking in different modes, including "walking"
- On-line and off-line (matching through sequential codes)

⇒**Suitable for: RFV, diversification, durum wheat detection, EFA, permanent crops change, RD measures, …**

Company General Use


HISTORY
YIELD QNV*
15 hlAP/ha
2009
2010
2011
2012
2013
*Normal wine conversion quantity
VINEYARD DIAGNOSIS
4 6°3 9'1 4N
0 0°1 6'1 9O



Thank you!

EYES ON THE EARTH

Product - Project Manager
Antonella Catucci
antonella.catucci@e-geos.it

e-geos