



https://youtu.be/uzF_ftCeZ5Y



Urban Geo Big Data @ MI Digital Week

... Copernicus e la nuova agenda urbana ...

Bernardo De Bernardinis

Coordinatore nazionale Copernicus Academy

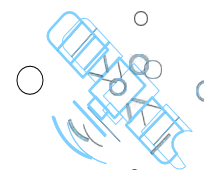


COPERNICUS IN BREVE

N°1 al mondo nel monitoraggio ambientale e degli ecosistemi terrestri

Contribuisce al soft power dell'UE a livello globale

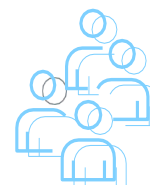
È uno strumento per lo sviluppo economico, chiave per l'economia digitale



Accesso ai dati libero, totale e gratuito



3° più grande fornitore di dati



+300,000 utenti registrati

... Il Programma Copernicus: l'architettura e gli obiettivi ...



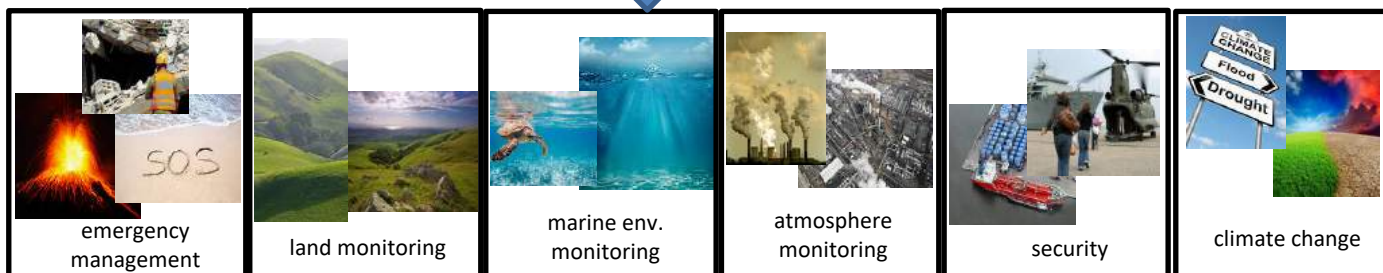
**Componente
DATI IN SITU
nazionali**

**Componente
SERVIZI**

**Componente
SPAZIO**



... i Servizi operativi europei di OT: i "Core Services" di Copernicus ...



Italia

... i Servizi operativi nazionali di OT:
i "Downstream Services"

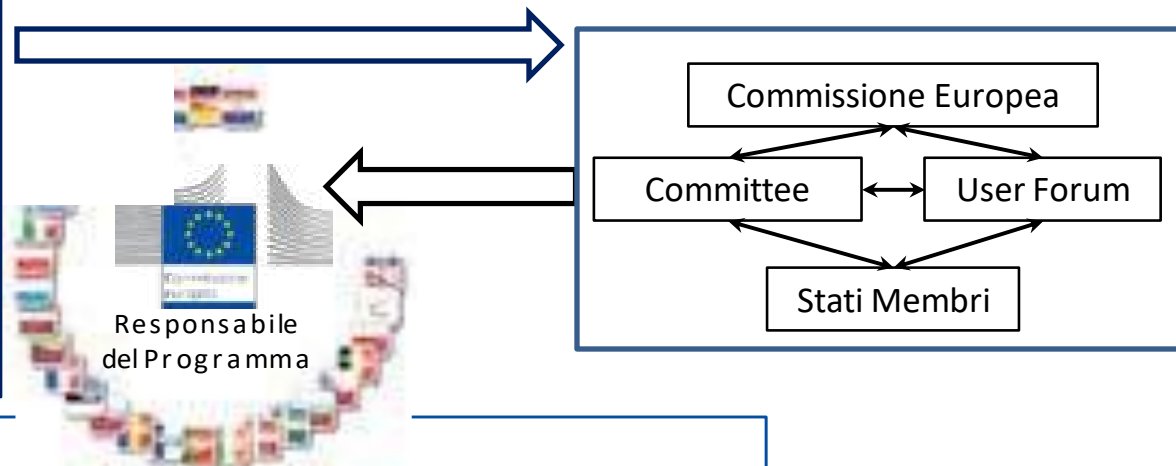
"... L'obiettivo di Copernicus è quello di **fornire informazioni precise ed attendibili relative all'ambiente e alla sicurezza, adeguate alle esigenze degli utenti e a sostegno di altre politiche dell'Unione**, riguardanti in particolare il mercato interno, i trasporti, l'ambiente, l'energia, la protezione civile e la sicurezza civile, la cooperazione con i paesi terzi e gli aiuti umanitari ..."



**APPROCCIO BASATO SUI
BISOGNI DELL'UTENTE**

... La Governance, le Componenti “Spazio” e “Servizi” di Copernicus ...

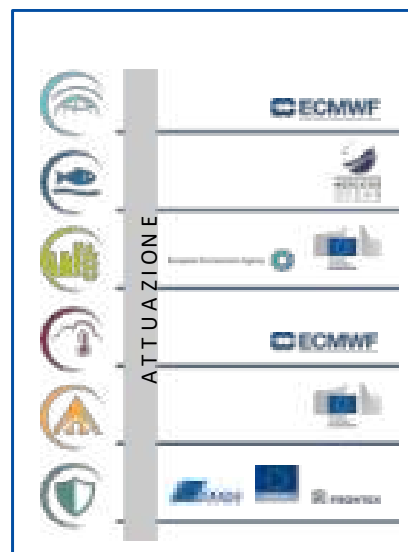
Il Programma Copernicus è governato dalla Commissione con il concorso degli Stati membri, ma è guidato dagli Utenti finali, organizzati in Comunità, attraverso le Rappresentanze degli Stati Membri partecipanti allo User Forum ed al Committee



SPAZIO

SERVIZI

INSITU



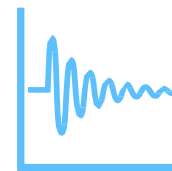
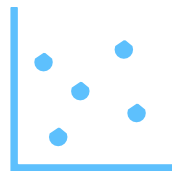
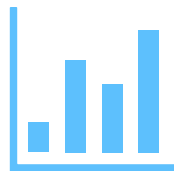
COPERNICUS DATA POLICY

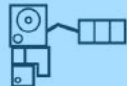
972.343.516.863 TB

DIVERSI TIPI DI DATA POLICY:

- DATI SATELLITI SENTINELLE (ACCESSO LIBERO, TOTALE E GRATUITO)
- INFORMAZIONI PRODOTTE DAI SERVIZI COPERNICUS (ACCESSO LIBERO, TOTALE E GRATUITO)
- DATI MISSIONI CONTRIBUTRICI (ACCESSO SOTTOPOSTO ALLE DIVERSE POLICY)

L'ACCESSO AI PRODOTTI DEL SERVIZIO SICUREZZA È LIMITATO A UTENTI AUTORIZZATI PER PROTEGGERE GLI INTERESSI DELL'UE E DEGLI STATI MEMBRI





SENTINEL-1

Radar - Permette di osservare la Terra in tutte le condizioni climatiche sia di notte che di giorno

- sorvegliamonitoraggio dei ghiacci
- anza in mare
- identificazione di imbarcazioni
- rilevamento di movimenti della superficie terrestre
- mappatura di aree forestali
- gestione di crisi umanitarie ...

SENTINEL-2

Ottico – 13 bande spettrali per monitorare

- attività agricole e tipo di vegetazione
- copertura del suolo
- gestire le risorse forestali
- sorvegliare i confini
- identificare attività illecite in mare
- supportare in caso di emergenze (inondazioni, incendi)...

SENTINEL-3

Diversi strumenti permettono di monitorare oceani, terra, superfici ghiacciate e atmosfera della Terra per comprendere le dinamiche globali su larga scala.

- altezza della superficie marina
- Colore della superficie
- Flussi carbonici
- Livello di fiumi e laghi

SENTINEL-4

Monitoraggio continuo della composizione atmosferica focalizzato su

- qualità dell'aria
- monitoraggio di Ozono (O3), diossido di azoto (NO2), anidride solforosa(SO2), Formaldeide (HCHO) ecc

SENTINEL-5

Monitoraggio quotidiano globale di gas inquinanti (CH4 and O2 NO2 CO2 HCHO, SO2) e gas a effetto serra (CH4 and tropospheric O3)

SENTINEL-5P

Osservazione quotidiana **clima, qualità dell'aria e superficie Ozono**

SENTINEL-6

Previsioni marine, **topografia oceanica in real time** : altezza onde, superficie oceanica, velocità del vento

... già in orbita ...

Sentinel-1A è stato lanciato il 3 aprile 2014 !!!



Contributing Missions

CONTRIBUTING MISSIONS

3d PARTY DATA

NO COMPETITION BUT COMPLEMENTARITY



ATMOSPHERIC MISSIONS

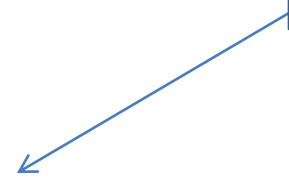
MetOp
Meteosat 2nd Generation

ALTIMETRY MISSIONS

Jason
Cryosal

SAR MISSIONS

COSMO Skymed
Radarsat
TerraSAR-X
Tandem X



OPTICAL MA & LA MISSIONS

SPOT (VGT)
PROBA-V

OPTICAL HA & VH MISSIONS

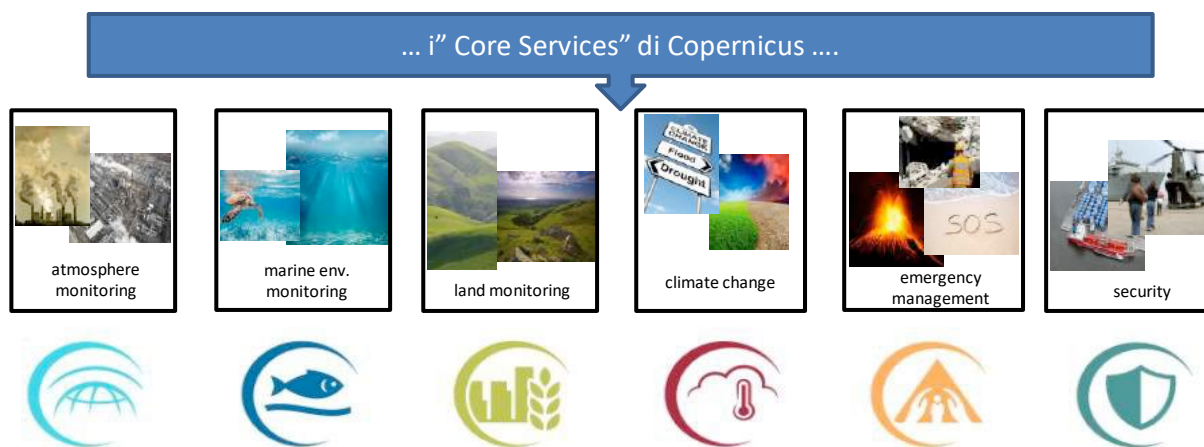
SPOT (HRS)
RapidEye
Deimos-2
Pléiades
DMC



... ma l'obiettivo primario di Copernicus sono Servizi "Core" ...

"Copernicus dovrebbe fornire **informazioni sullo stato dell'atmosfera**, anche a livello locale, nazionale, europeo e mondiale; **informazioni sullo stato degli oceani**, anche mediante l'istituzione di un raggruppamento europeo specifico **per il monitoraggio marino**; informazioni **per il monitoraggio del territorio a sostegno dell'attuazione di politiche locali, nazionali ed europee**; informazioni **a sostegno delle politiche di adattamento e mitigazione dei cambiamenti climatici**; informazioni **geospaziali a sostegno della gestione delle emergenze**, anche attraverso attività di prevenzione, e della sicurezza civile compreso il sostegno all'azione esterna dell'Unione."

(REGOLAMENTO (UE) N.377/2014)

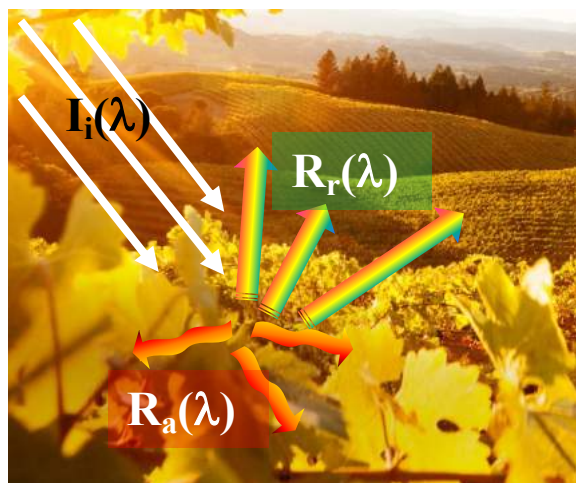


I Servizi "Core" di Copernicus **trasformano i dati**, raccolti da satelliti ed in situ, **in informazioni a valore aggiunto**: analizzandoli ed elaborandoli, integrando gli stessi con altre fonti e infine convalidando i risultati ottenuti. Le serie di dati acquisiti nel corso di anni e decenni, sono indicizzate e rese comparabili garantendo così il monitoraggio dei cambiamenti; i modelli strutturali sono esaminati e utilizzati per aumentare la capacità di previsione, ad esempio, nell'analisi degli oceani e dell'atmosfera.

Dai dati satellitari, associati ed integrati con altri dati sono create mappe, identificate caratteristiche ed anomalie degli eventi e dei processi in atto ed elaborate informazioni, anche statistiche.

**... TRA LA COMPONENTE SPAZIALE
E LA COMPONENTE DEI SERVIZI IL
PRIMO LEGAME È DETERMINATO DAI
PRINCIPI, DAI METODI E DAGLI
STRUMENTI DI TELERILEVAMENTO,
DALLA MODELLISTICA DEI
FENOMENI E DALL'INTEGRAZIONE
CON I DATI IN SITU ...**

TELERILEVAMENTO: metodo di indagine non distruttivo che consente di descrivere alcune proprietà delle superfici osservate sulla base del loro comportamento riflettivo specifico nelle diverse lunghezze d'onda (firma spettrale) della radiazione solare incidente.



TELERILEVAMENTO

ATTIVO → (sensore e sorgente coincidono attraverso un segnale RADAR)

PASSIVO → sensori OTTICI MULTI e IPER-SPETTRALI (la sorgente del segnale è esterna al sensore)

Nel **telerilevamento passivo**, si procede a misurare la quantità di energia riflessa dalle superfici nelle diverse bande dello spettro elettromagnetico (tipicamente tra 400 e 2500 nm – VIS/IR) → RIFLETTANZA

$I_i(\lambda)$ = energia incidente (solare o da sorgente artificiale)

$R_r(\lambda)$ = energia riflessa

$R_a(\lambda)$ = energia assorbita

$$\rho_\lambda = \frac{R_r(\lambda)}{I_i(\lambda)} \quad \text{Riflettanza}$$

$$\alpha_\lambda = \frac{R_a(\lambda)}{I_i(\lambda)} \quad \text{Assorbanza}$$

$$\rho_\lambda + \alpha_\lambda = 1$$

Spettro Elettromagnetico

Un fascio di radiazione EM è un insieme più o meno esteso di onde aventi differenti lunghezze d'onda.

La **SORGENTE** di energia EM è costituita da qualunque superficie (di corpo) avente temperatura superiore alle ZERO ASSOLUTO ($0^\circ \text{K} = -273.15^\circ \text{C}$).

Le bande di interesse del Telerilevamento ottico passivo sono:

VISIBILE :

400-700 nm

NIR (Near Infrared) :

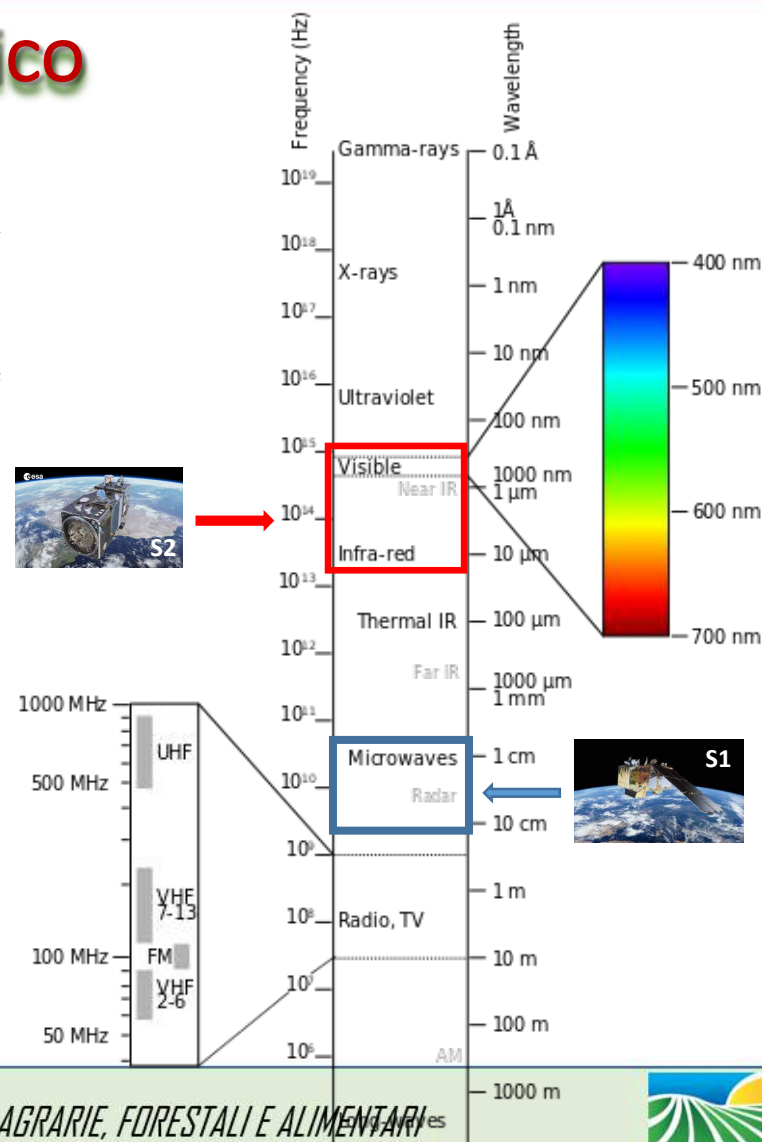
700-1000 nm

MIR/SWIR

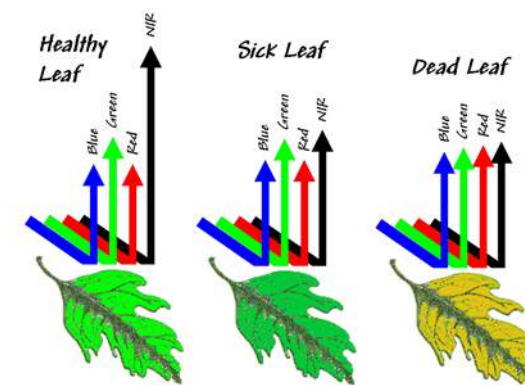
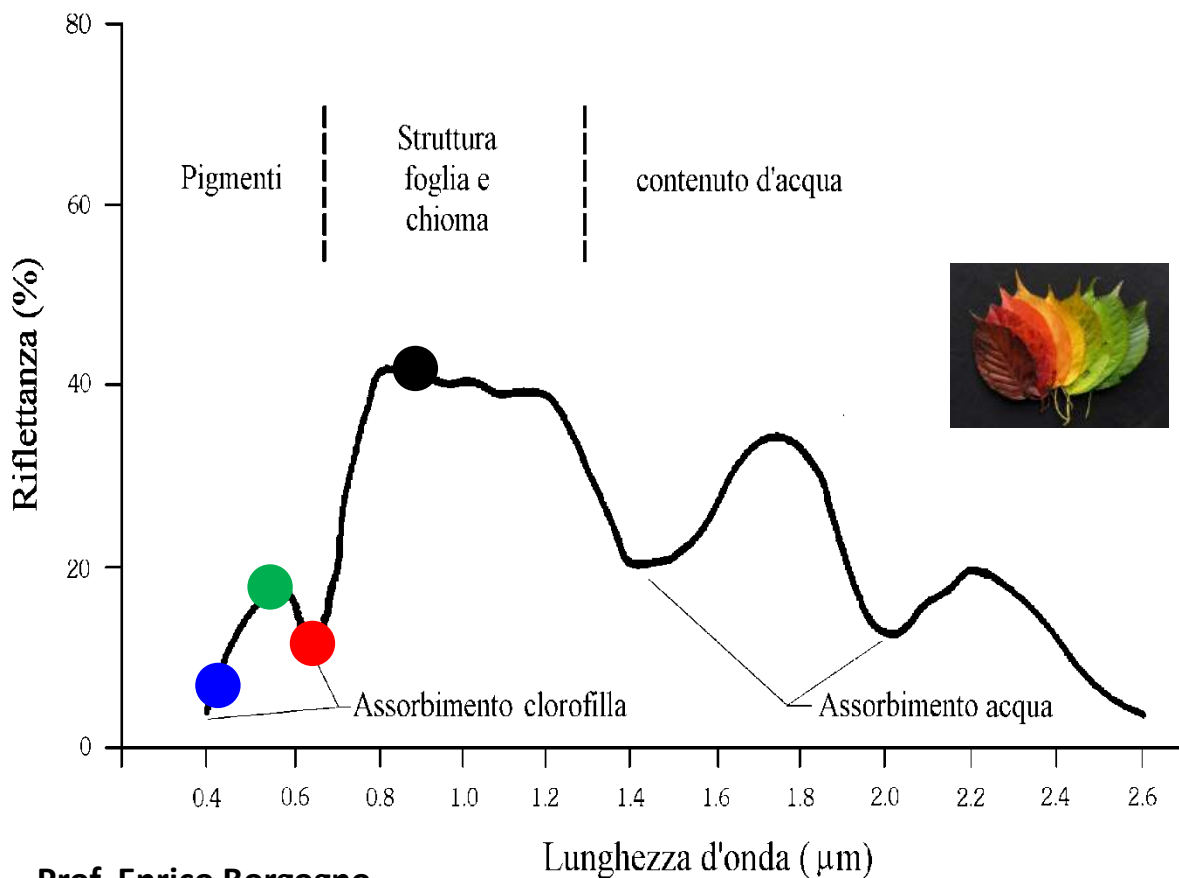
1000-2500 nm

(medio Infrarosso o
Shortwave Infrared)

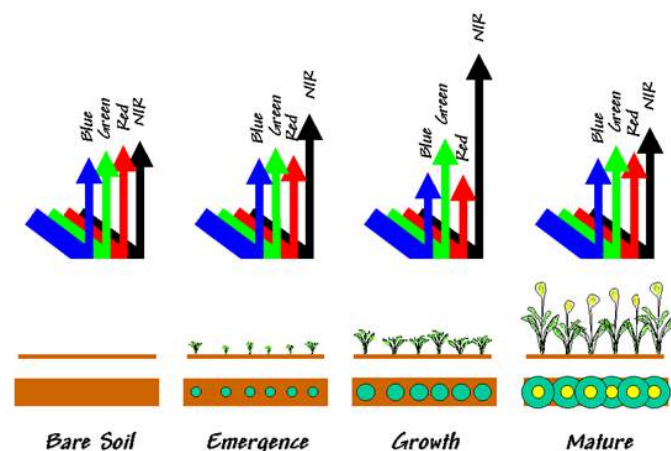
Prof. Enrico Borgogno



Firma spettrale della vegetazione



<http://educationally.narod.ru/gis39photoalbum.html>



<http://educationally.narod.ru/gis39photoalbum.html>

Prof. Enrico Borgogno



UNIVERSITÀ DEGLI STUDI DI TORINO - DIPARTIMENTO DI SCIENZE AGRARIE, FORESTALI E ALIMENTARI

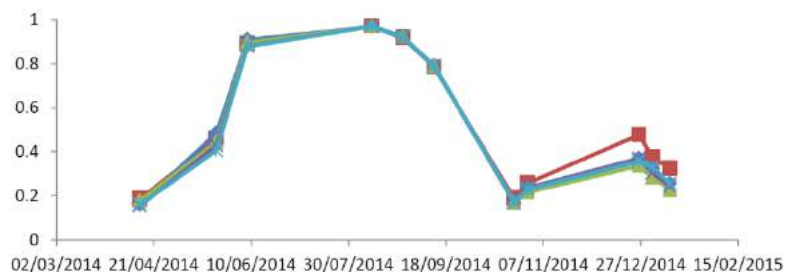
Gruppo di Geomatica - GEO4Agri



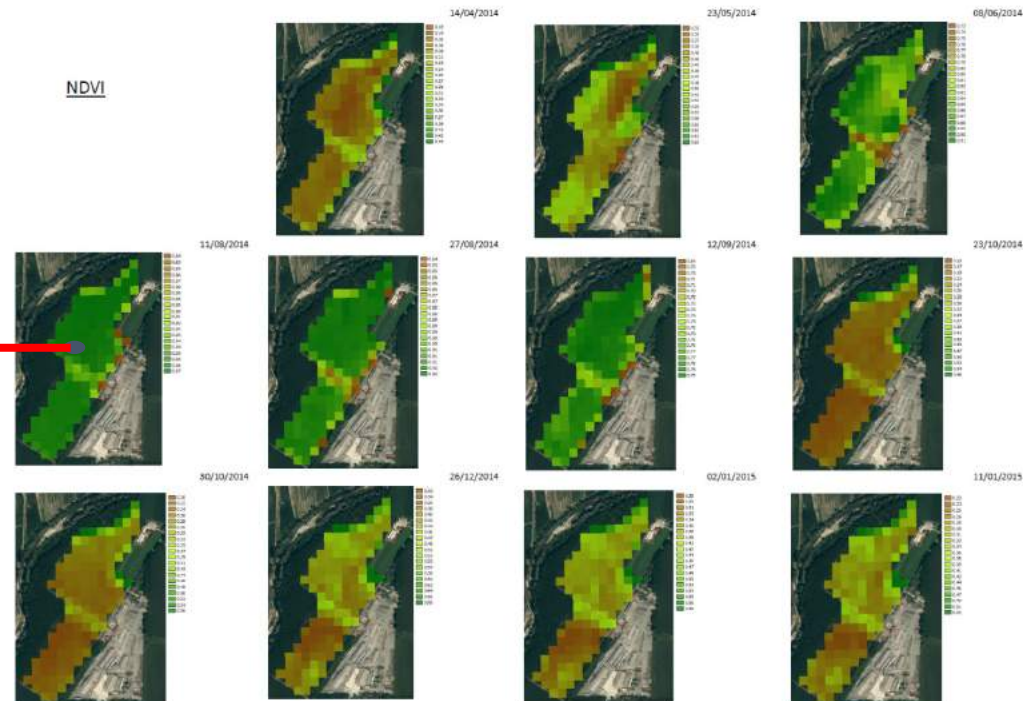
ASTI – 23-25 Settembre 2019

(Macro) Fenologia

$$NDVI = \frac{(NIR - RED)}{(NIR + RED)}$$



NDVI



Prof. Enrico Borgogno

Indici spettrali

Indice		Formula	Parametro stimato
NDVI	Normalized Difference Vegetation Index	$\frac{\rho_{NIR} - \rho_{RED}}{\rho_{NIR} + \rho_{RED}}$	LAI
SR	Simple Ratio Index	$\frac{\rho_{NIR}}{\rho_{RED}}$	LAI
PVI	Perpendicular Vegetation Index	$\sqrt{(\rho_{NIR_{soil}} - \rho_{NIR_{vege}})^2 + (\rho_{NIR_{soil}} - \rho_{NIR_{vege}})^2}$	LAI
MTVI	Modified Triangular Vegetation Index	$1.2 \cdot [1.2 \cdot (\rho_{800} - \rho_{550}) - 2.5 \cdot (\rho_{670} - \rho_{550})]$	LAI
RDVI	Renormalized Difference Vegetation Index	$\frac{\rho_{800} - \rho_{670}}{\sqrt{\rho_{800} + \rho_{670}}}$	PAR
TVI	Triangular Vegetation Index	$0.5 \cdot [120 \cdot (\rho_{750} - \rho_{550}) - 200 \cdot (\rho_{670} - \rho_{550})]$	LAI
OSAVI	Optimized Soil Adjusted Vegetation Index	$(1 + 0.16) \cdot \frac{\rho_{800} - \rho_{670}}{\rho_{800} + \rho_{670} + 0.16}$	Leaf Chlorophyll Content

Indice		Formula	Parametro stimato
MCARI	Modified Chlorophyll Absorption in Reflectance Index	$[(\rho_{700} - \rho_{670}) - 0.2 \cdot (\rho_{700} - \rho_{550})] \cdot \frac{\rho_{700}}{\rho_{670}}$	Leaf Chlorophyll Content
TCARI	Transformed Chlorophyll Absorption in Reflectance Index	$3 \cdot [(\rho_{700} - \rho_{670}) - 0.2 \cdot (\rho_{700} - \rho_{550})] \cdot \frac{\rho_{700}}{\rho_{670}}$	Leaf Chlorophyll Content
ZM	Zarco-Miller	$\frac{\rho_{750}}{\rho_{710}}$	Leaf Chlorophyll Content
PRI	Photochemical Reflectance Index	$\frac{\rho_{531} - \rho_{570}}{\rho_{531} + \rho_{570}}$	Efficienza fotosintetica
RGI, BGI, BRI	Blue, Red, Green Indices	$\frac{\rho_{690}}{\rho_{550}}, \frac{\rho_{400}}{\rho_{550}}, \frac{\rho_{400}}{\rho_{690}}$	Leaf Chlorophyll Content
WDRVI	Wide Dynamic Range Vegetation Index	$\frac{a \cdot \rho_{NIR} - \rho_{RED}}{a \cdot \rho_{NIR} + \rho_{RED}}$	LAI

... ed il metodo multispettrale ci consente di identificare e mappare le colture ...



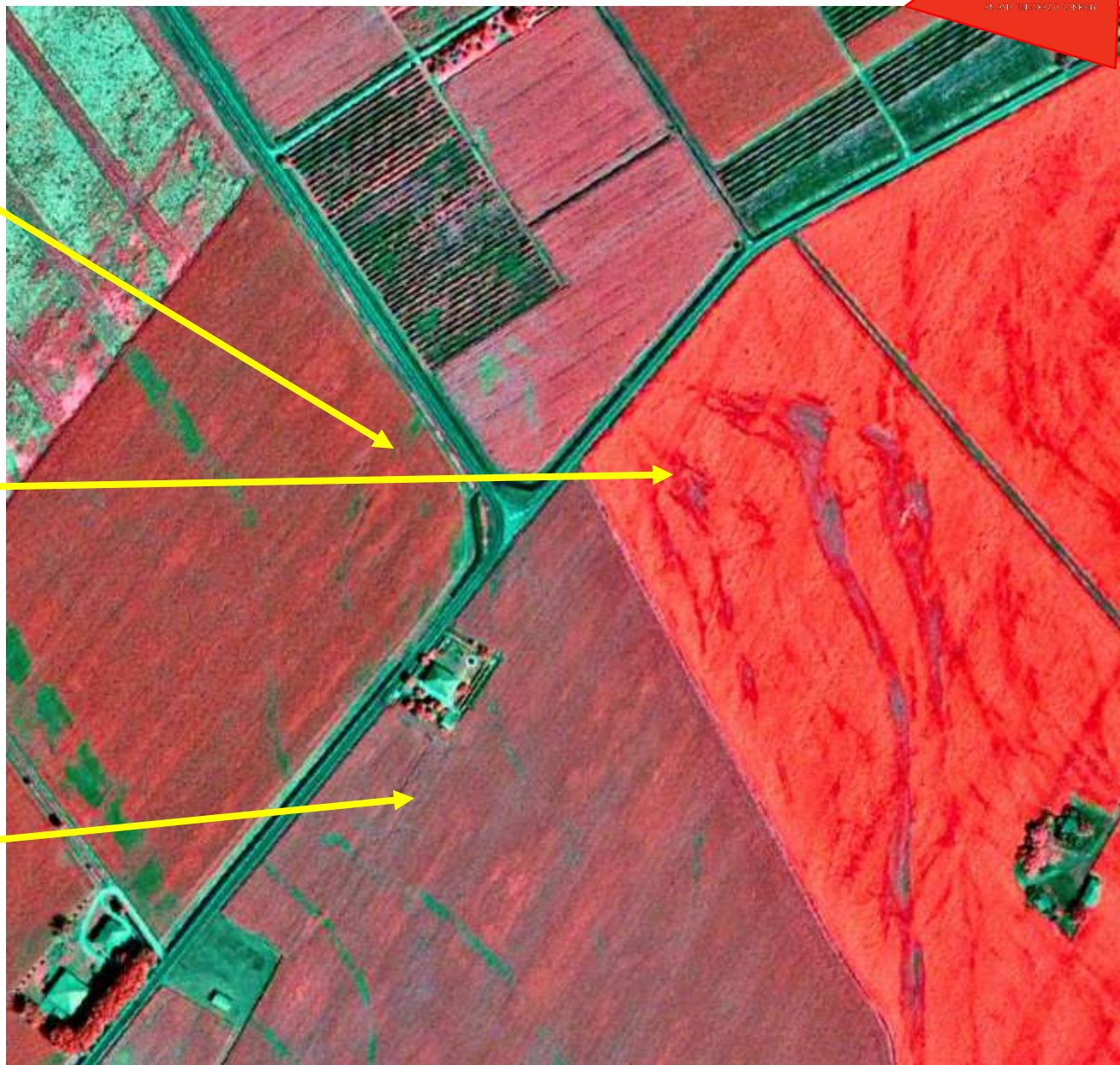
mais



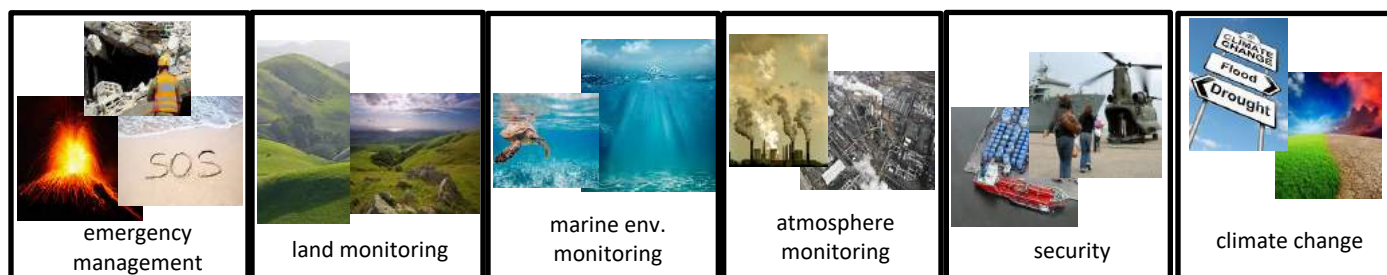
prato



barbabietola

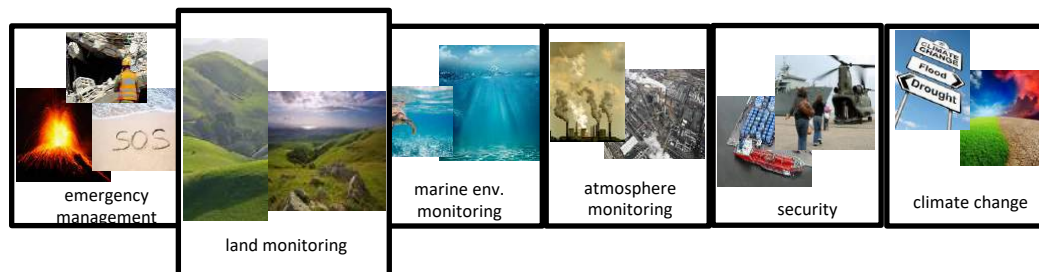


... I CORE SERVICES CHE POSSONO, ANZI, SONO DI INTERESSE PER L'AGENDA URBANA E LA SUA GESTIONE ...



... SONO CERTAMENTE IL LAND, IL CLIMATE CHANGE, L'EMERGENCY E L'ATMOSPHERE ...

... UN ESEMPIO SONO I DATI E LE INFORMAZIONI PRODOTTE E RESE DISPONIBILI ATTRAVERSO COPERNICUS LAND MONITORING SERVICE (CLMS) ...



Global

provides a series of biogeophysical products on the status and evolution of the land surface at global scale at mid and low spatial resolution



Pan-European

provides information about the land cover and land use (LC/LU), land cover and land use changes and land cover characteristics



Local

focuses on different hotspots, i.e. areas that are prone to specific environmental challenges and problems



Reference data

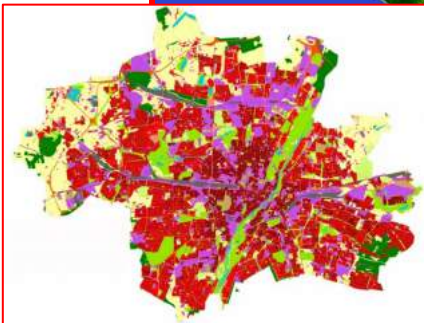
All of the Copernicus services need access to in-situ data in order to ensure an efficient and effective use of Copernicus space-borne data

Copernicus Land Monitoring Service (CLMS)

- Example of products available :

- Land Use / Land Cover (CORINE)
- Hydrology
- Digital Elevation Model (DEM)
- Urban Atlas
- Natura 2000,
- etc...

- URL : <http://land.copernicus.eu/>



Global <http://land.copernicus.vgt.vito.be/PDF/portal/Application.html#Home>

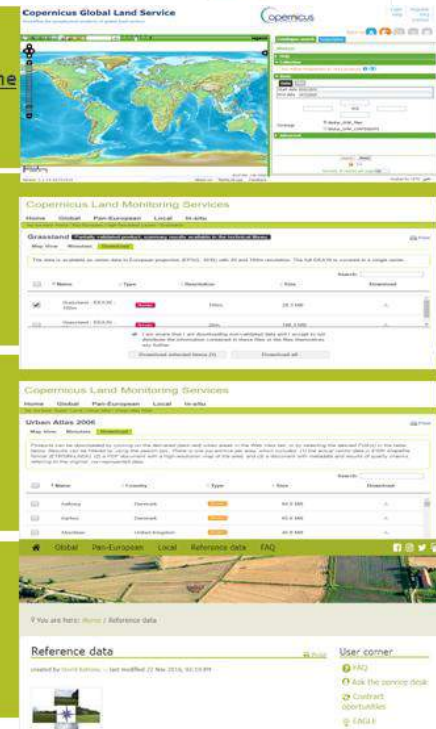
Pan-European <http://land.copernicus.eu/pan-european>

Local <http://land.copernicus.eu/local>

Reference Data <http://land.copernicus.eu/in-situ>



The screenshot shows the Copernicus Land Monitoring Services website. At the top, there's a navigation bar with links: Home, Global, Pan-European, Local, In-situ. Below this, a banner reads "Copernicus - The European Earth Observation Programme". There are four small map thumbnails. A text block describes the service: "Copernicus is a European system for monitoring the Earth. Data is collected by different sources, including Earth observation satellites and in-situ sensors. The data is processed and provides reliable and up-to-date information about six thematic areas: land, marine, atmosphere, climate change, emergency management and security. The land theme is divided into four main components: 1. **Global**: The Global Land Service provides a series of bio-geophysical products on the status and evolution of the land surface at global scale at mid and low spatial resolution. The products are used to monitor the vegetation, the water cycle and the energy budget. 2. **Pan-European**: The Pan-European component provides information about the land cover and land use (LC/LU), land cover and land use changes and land cover characteristics. The latter includes information about imperiousness, forests, natural grasslands, wetlands, and permanent water bodies. 3. **Local**: The local component focuses on different hotspots, i.e. areas that are prone to specific environmental challenges and problems. This includes detailed LC/LU information for the larger EU cities (Urban Atlas), riparian zones along European river networks and NATURA 2000 sites. It will also include maps of coastal areas. 4. **In-situ**: All of the Copernicus services need access to in-situ data in order to ensure an efficient and effective use of Copernicus space-borne data. Next to data provided by participating countries, Earth observation from space also yields pan-European reference datasets, such as a Digital Elevation Model." Below this, there's a "User corner" section with links: Ask the service desk, Contact opportunities, EAGLE, Events, Land use cases, News, Partners, Publications, Technical library. At the bottom, there's a "Partners" section with logos for the European Commission and EEA.



The screenshot shows the Copernicus Global Land Service interface. It features a world map with a search bar and filters. Below the map, there's a table of products with columns for Name, Type, Description, Date, and Download. The table lists several products, including "Global Land Use and Land Cover (GLULC)" and "Global Land Use and Land Cover (GLULC) - 2010". The interface also includes a "User corner" section with links: Ask the service desk, Contact opportunities, EAGLE, Events, Land use cases, News, Partners, Publications, Technical library. At the bottom, there's a "Reference data" section with a map and a table of reference data.

Copernicus Global Land Service
Providing bio-geophysical products of global land surface

About | Contact us

Home Products Use cases Product Access Viewing Library Get Support

Overview

- Versioning
- Development stages
- Quality assessment
- > **Vegetation**
 - Burnt Area
 - Dry Matter Productivity
 - Fraction of Absorbed Photosynthetically Active Radiation
 - Fraction of green Vegetation Cover
 - Leaf Area Index
 - Land Cover
 - Normalized Difference Vegetation Index
 - Surface Soil Moisture
 - Soil Water Index
 - Vegetation Condition Index
 - Vegetation Productivity Index
- > **Cryosphere**
 - Lake Ice Extent
 - Snow Cover Extent
 - Snow Water Equivalent
- > **Energy**
 - Land Surface Temperature
 - Surface Albedo
 - Top Of Canopy Reflectances
- > **Water**
 - Lake Surface Water Temperature
 - Lake Water Quality
 - Water Bodies
 - Water Level

Burnt Area

Matter Prod.

FAPAR

FCOVER

af Area Index

Land Cover

NDVI

Soil Water Index

Surf. Soil Moisture

VCI

VPI

NDVI product updates

Update to vegetation products switching from PROBA-V to Sentinel-3 OLCI and SLSTR sensors
Fri, 17 Apr 2020
NDVI Long Term Statistics (1999-2017) available
Tue, 02 Apr 2019
Collections in tiled HDF5 format to be suppressed
Fri, 09 Nov 2018
[Read more](#) or [Subscribe](#)

NDVI characteristics

NDVI 300m NDVI 10m

Access Algorithm Quality Application Technical Documents Gallery

Product version	Access	Sensor	Temporal coverage	Spatial information	Timeliness
1	Product	PROBA-	Feb 2016 - present	Global. 300m	Within 3 days after synthesis

Copernicus Global Land Service
Providing bio-geophysical products of global land surface

Copernicus
Europe's eyes on Earth

Home Products Use cases Product Access Viewing Library Get Support

Vegetation

Energy

Water

Cryosphere

Hot Spots

Groundbased

Home

The Copernicus Global Land Service (GLS) is a component of the Land Monitoring Core Service (LMCS) of Copernicus, the European flagship programme on Earth Observation. The Global Land Service systematically produces a series of qualified bio-geophysical products on the status and evolution of the land surface, at global scale and at mid to low spatial resolution, complemented by the constitution of long term time series. The products are used to monitor the vegetation, the water cycle, the energy budget and the terrestrial cryosphere.

[Read more](#)

Latest news

Lake Ice Extent products delayed due to hardware failure
Fri, 27 Feb 2020

Surface Water Bodies product transitions from a PROBA-V based knowledge to Sentinel-3 based product
Fri, 06 Feb 2020

Demonstration 100m Lake Water Quality production suspended
Fri, 06 Feb 2020

Update to vegetation products switching from PROBA-V to Sentinel-3 OLCI and SLSTR sensors
Fri, 02 Apr 2019

Water Level products now include Sentinel-3B observations
Fri, 06 Feb 2020

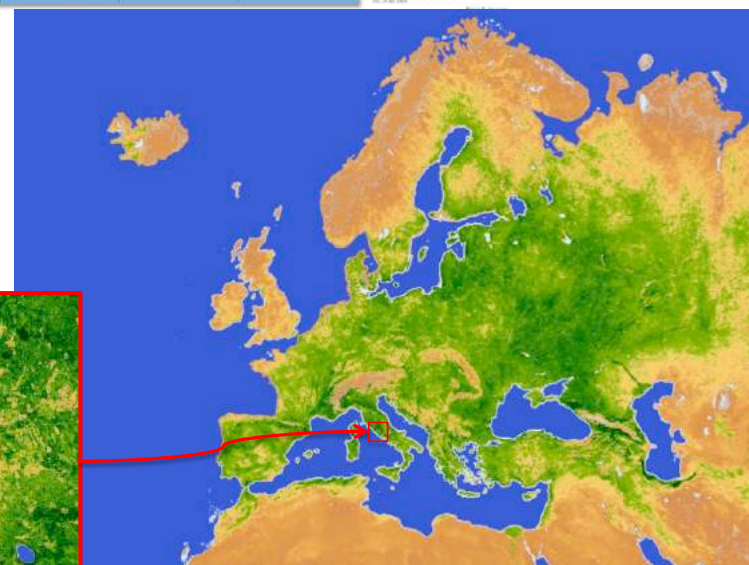
In the picture

15 degrees warmer than average

Drought surveillance in Sri Lanka by CGIAR's IWMI

37 TB downloaded in 4th quarter 2019

6000th user registered for online access

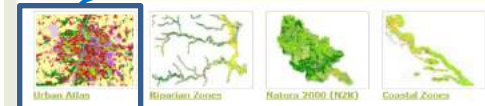


... CLMS: all'Urban del Local ...



You are here: Home / Local

Local



The local component is coordinated by the European Environment Agency and aims to provide specific and more detailed information that is complementary to the information obtained through the Pan-European component. The local component focuses on different hotspots, i.e. areas that are prone to specific environmental challenges and problems. It will be based on very high resolution imagery (2,5 x 2,5 m pixels) in combination with other available datasets (high and medium resolution images) over the pan-European area.

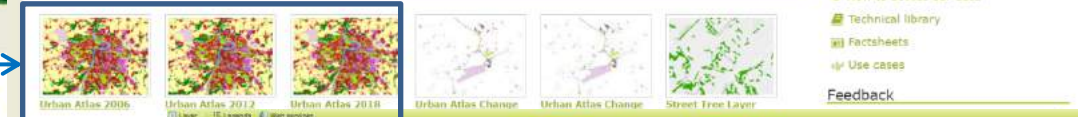
- **Urban Atlas:** EU regional policy justifies the production and maintenance of detailed land cover and land use information over major EU city areas. The Urban Atlas provides pan-European comparable land cover and land use data covering a number of Functional Urban Areas (FUAs). In 2012, an additional layer (Street Tree Layer - STL) was produced for a selection of FUAs as well as a building height dataset covering currently the capital cities. The latest update (proposed) refers to the 2010 reference year and accounts for the update of the land cover and land use product (including a revision of the 2012 reference year).
- **Riparian Zones:** The local component is providing information on the 'blue' infrastructures in the EU.
- **Natura 2000:** The Natura 2000 dataset is a selection of grassland, grassland habitat types and other habitats of high conservation value.
- **Coastal Zones:** This layer provides information on coastal zones in the EU, which are of high conservation value and are subject to protection and the basis for coastal management.

also to access some preference settings and you wish but then our site may not work correctly.

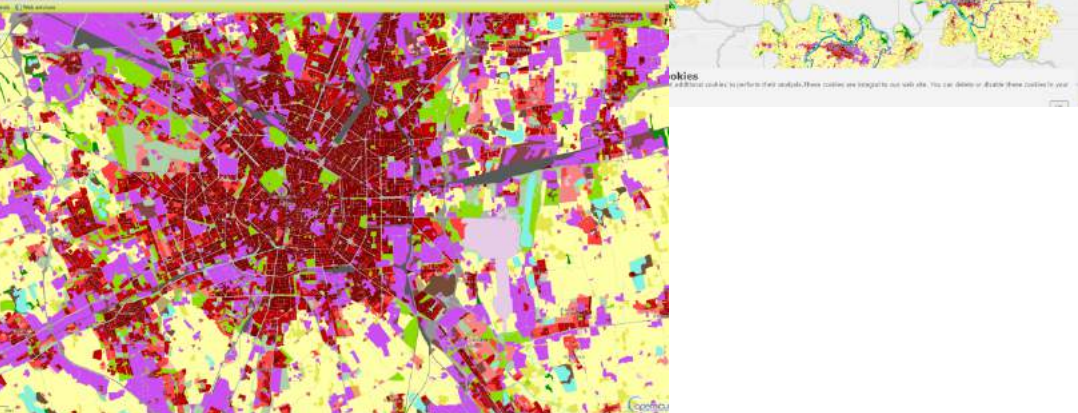
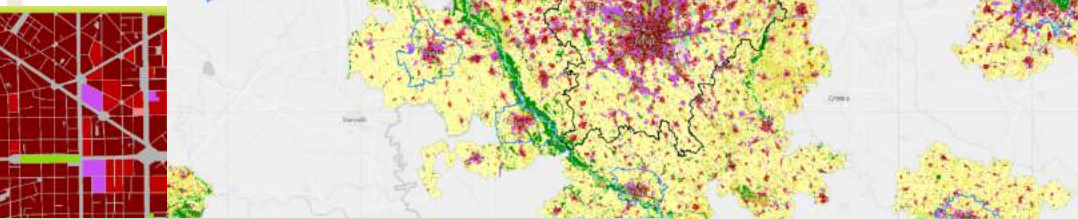


You are here: Home / Local / Urban Atlas

Urban Atlas



The Urban Atlas provides



The screenshot displays the Copernicus Land Monitoring Service website, specifically the Urban Atlas section. The interface includes a top navigation bar with links for Global, Pan-European, Local, and Imagery and reference data. A sidebar on the left lists the Local component's sub-products: Urban Atlas, Riparian Zones, Natura 2000 (N200), and Coastal Zones. The main content area shows the Urban Atlas 2018 and the Street Tree Layer (STL) 2018. A blue line with arrows traces the navigation path from the Local component to the Urban Atlas, then to the Street Tree Layer, and finally to a detailed map view of the Street Tree Layer.

Urban Atlas

You are here: Home / Local / Urban Atlas

Local

Urban Atlas, Riparian Zones, Natura 2000 (N200), Coastal Zones

The local component is coordinated by the European Environment Agency and aims to provide specific and more detailed information that is complementary to the information obtained through the Pan-European component. The local component focuses on different hotspots, i.e. areas that are prone to specific environmental challenges and problems. It will be based on very high resolution imagery (2,5 x 2,5 m pixels) in combination with other available datasets (high and medium resolution images) over the pan-European area.

- Urban Atlas:** EU regional policy justifies the production and maintenance of detailed land cover and land use information over major EU city areas. The Urban Atlas provides pan-European comparable land cover and land use data covering a number of Functional Urban Areas (FUA). In 2012, an additional layer (Street Tree Layer - STL) was produced for a selection of FUAs as well as a building height dataset covering currently the capital cities. The latest update (ongoing) refers to the 2018 reference year and accounts for the update of the land cover and land use product (including a revision of the 2012 reference year) as well as an update of the Street Tree Layer.
- Riparian Zones:** The next local component addresses land cover and land use in areas along rivers, i.e. the riparian zones. The rationale for this local component is provided by the need to monitor biodiversity at European level, amongst other in the framework of improving the "green" and "blue" infrastructures in the European Union.
- Natura 2000:** The Natura 2000 (N200) areas are also important hotspots for consideration. The aim of the first N2K project has been to map LC/LU in a selection of grassland rich sites and to assess whether those selected sites are being effectively preserved as well as, if a decline of certain grassland habitat types is being halted.
- Coastal Zones:** This LC/LU product maps from the European baseline a 10 km landward coastal zones in the need to coordinate an economic growth that maintains a resilient protection and the basis for human wellbeing.

Urban Atlas 2006:

- Contains 319 FUAs with n each urban area covered

Street Tree Layer (STL) 2018

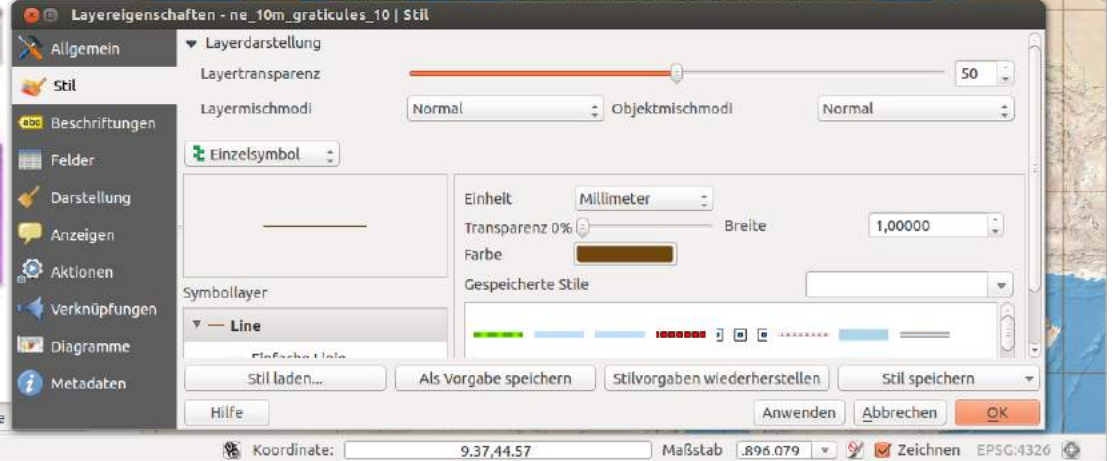
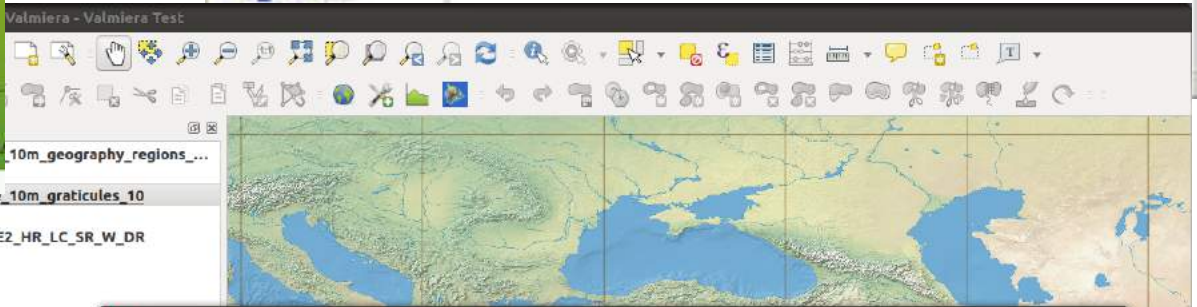
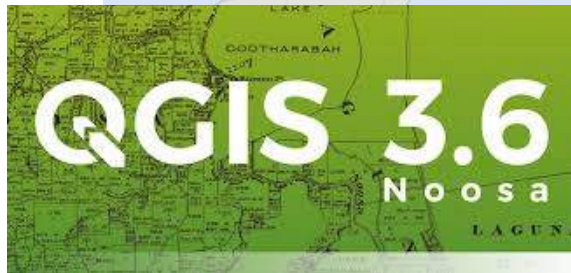
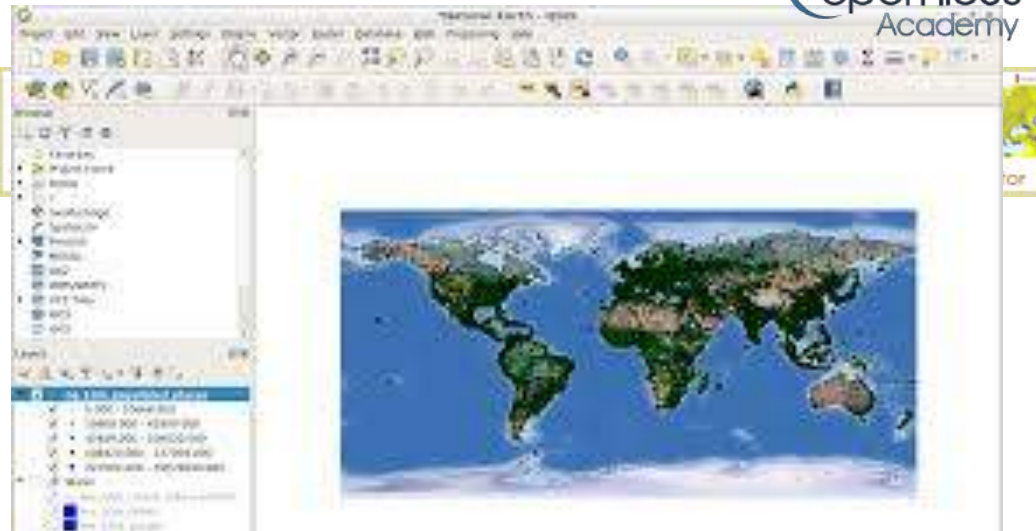
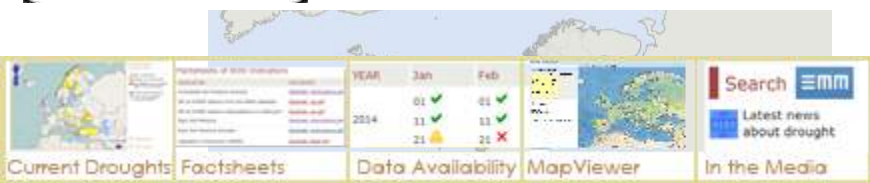
The Urban Atlas provides pan

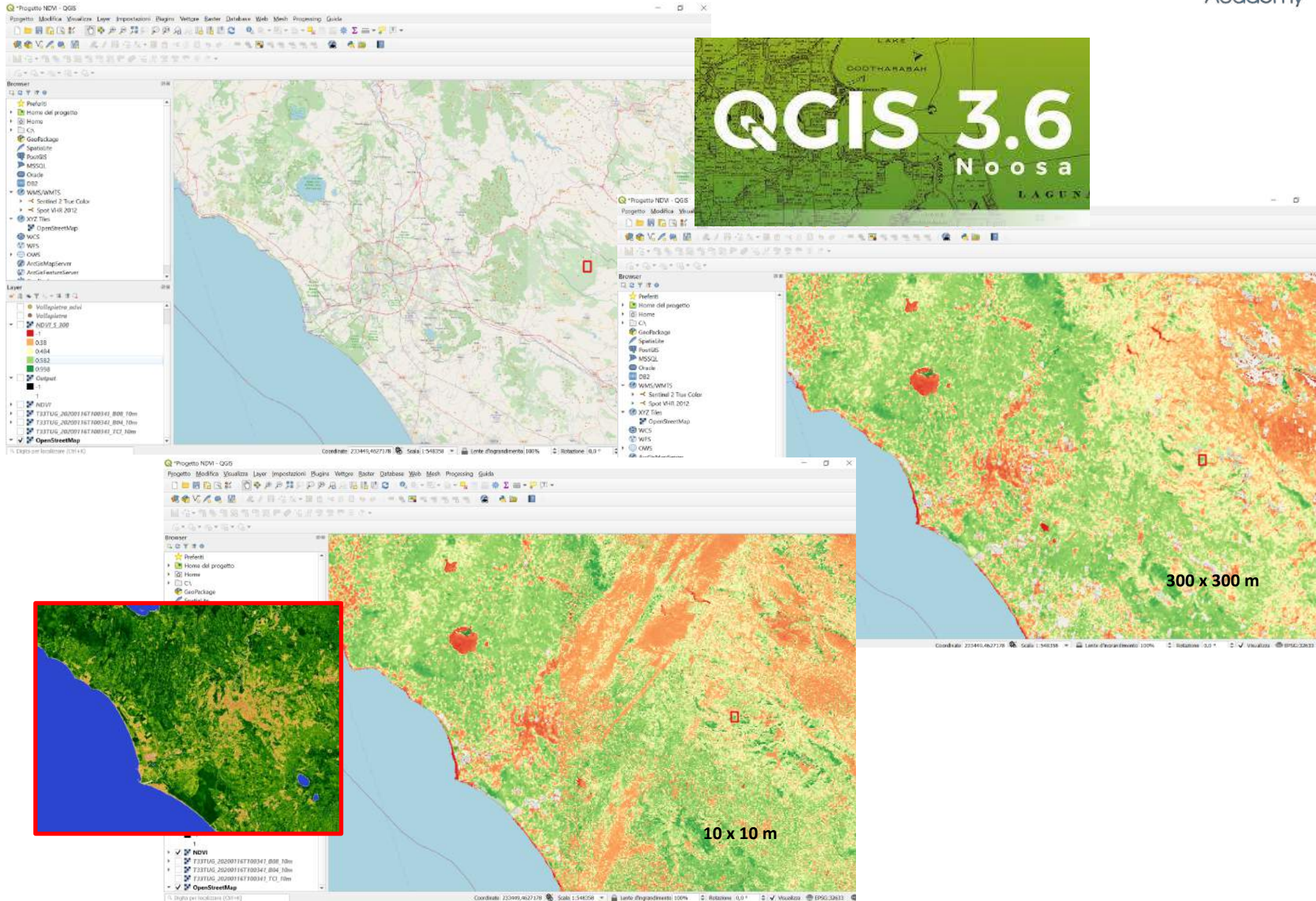
This Site

also to record some preference settings and to analyse how you use our web site, we may also use external analysis services. You wish but then our site may not work correctly.

**... MA PER POTER UTILIZZARE E
NON SOLO “AMMIRARE” I PRODOTTI
SONO ALTRESÌ NECESSARI
STRUMENTI E CONOSCENZE DI
GEOMATICA E GEOINFORMAZIONE**

...





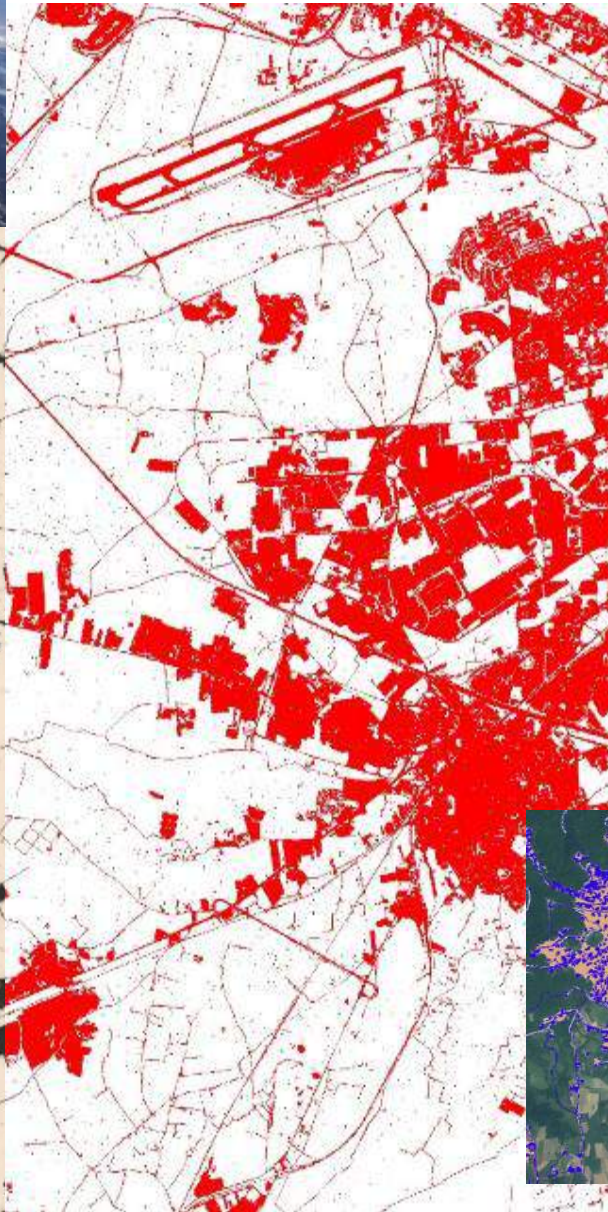


Very high resolution layer
based on RapidEye images

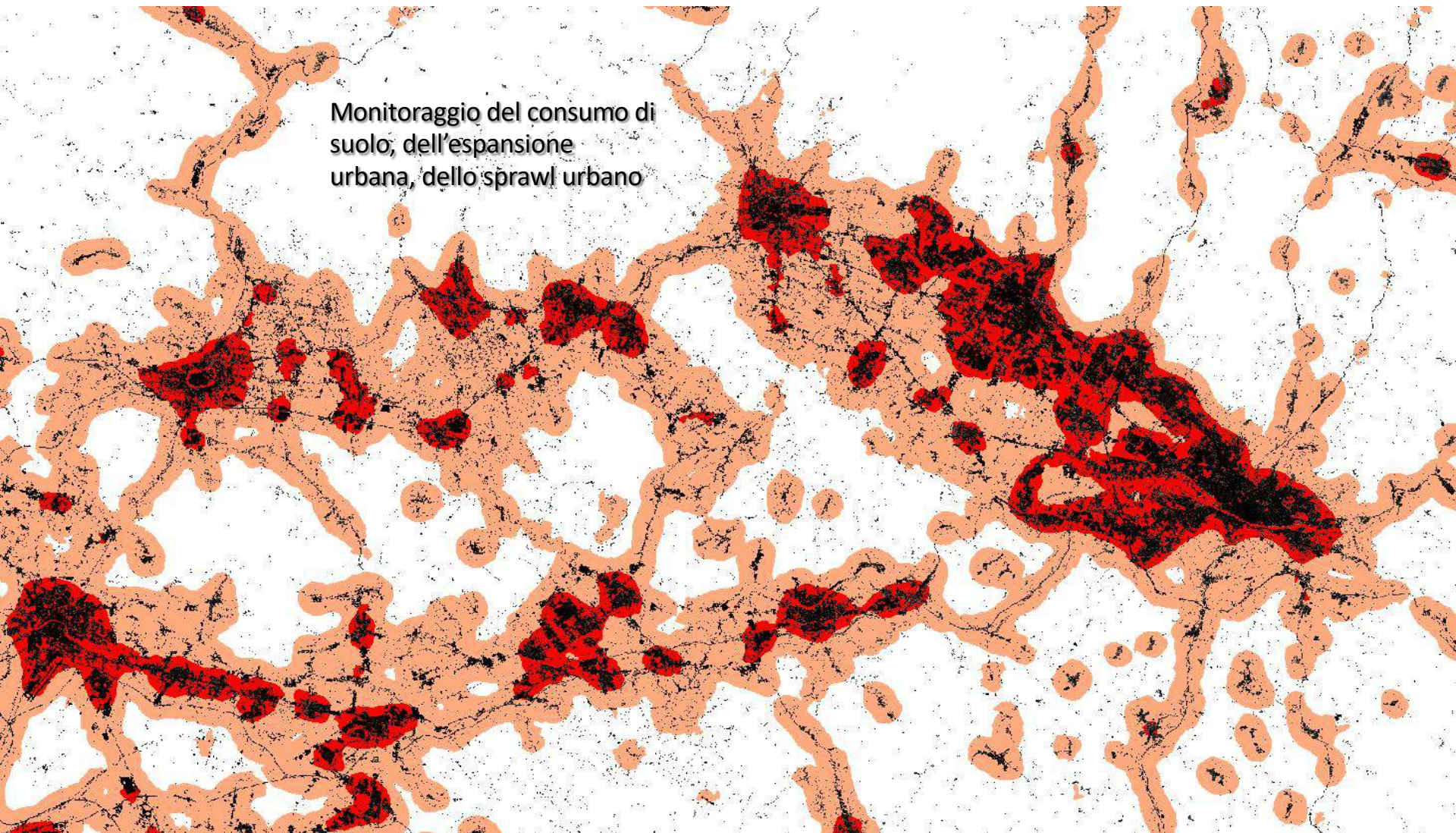
Copernicus EU map
20m x 20m

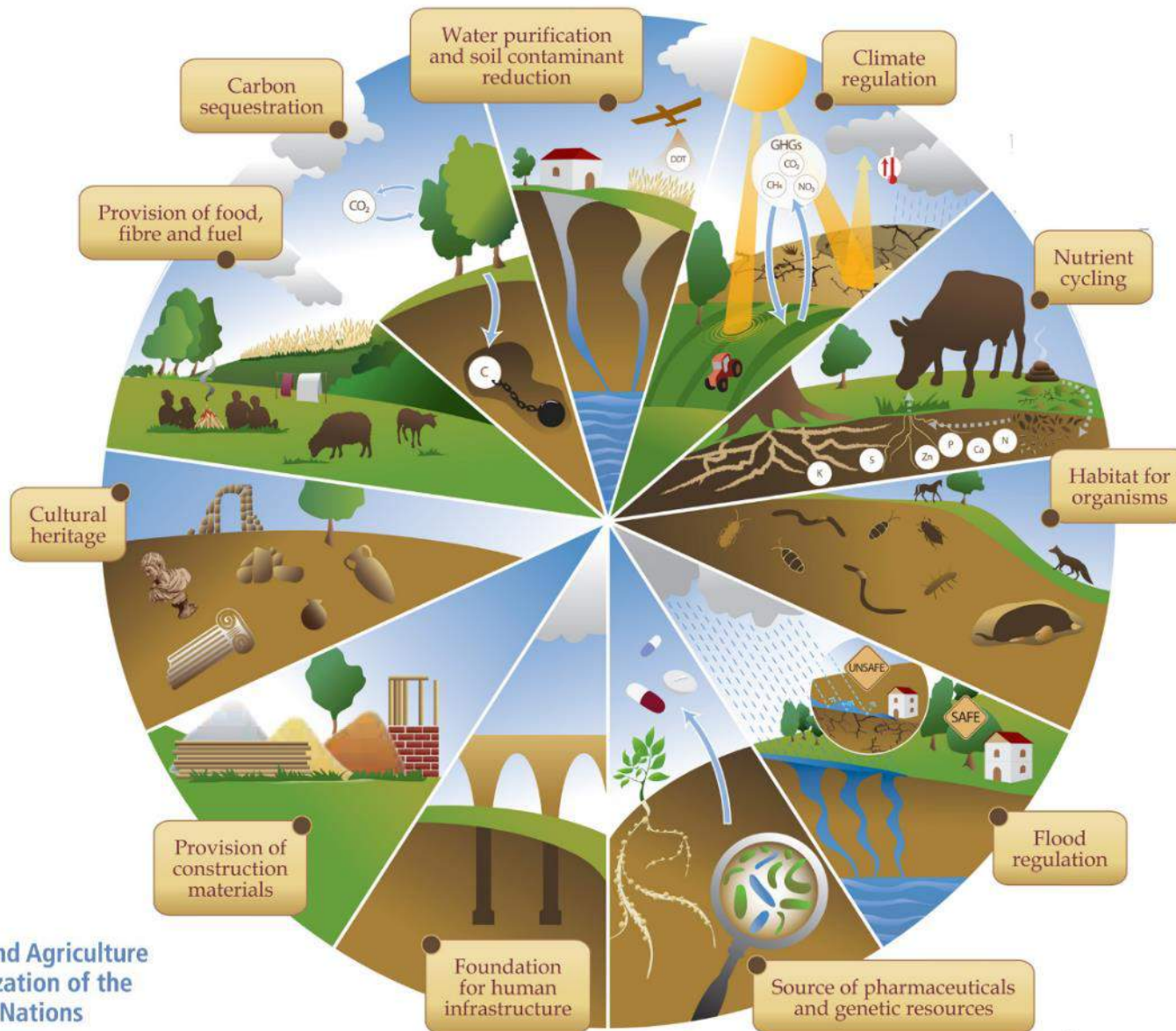
National map
5m x 5m (ISPRA)

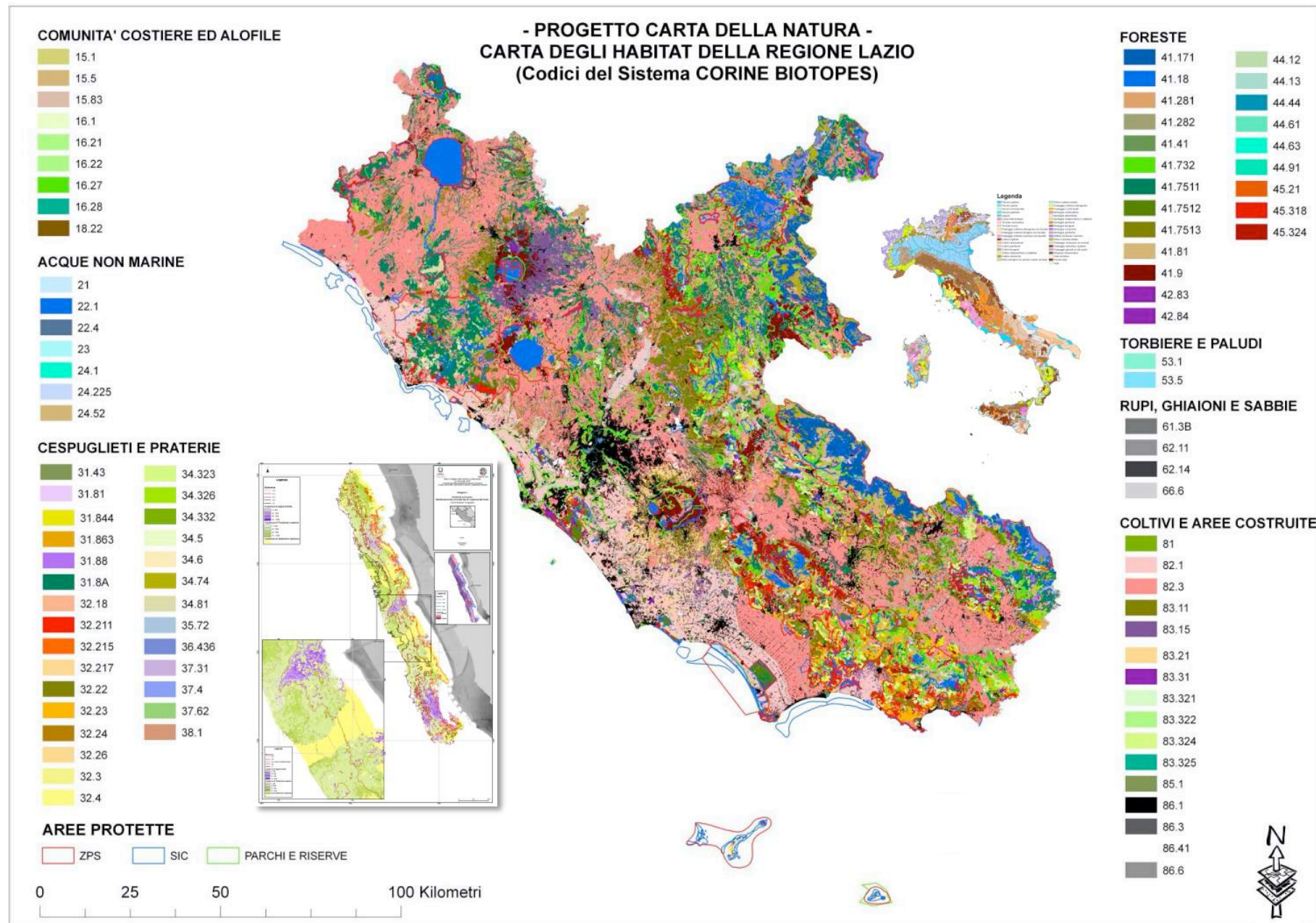
This is a substantial improvement of spatial resolution which allows for better identification of sparse urban areas, thus increasing the precision of the assessment of soil consumption area.

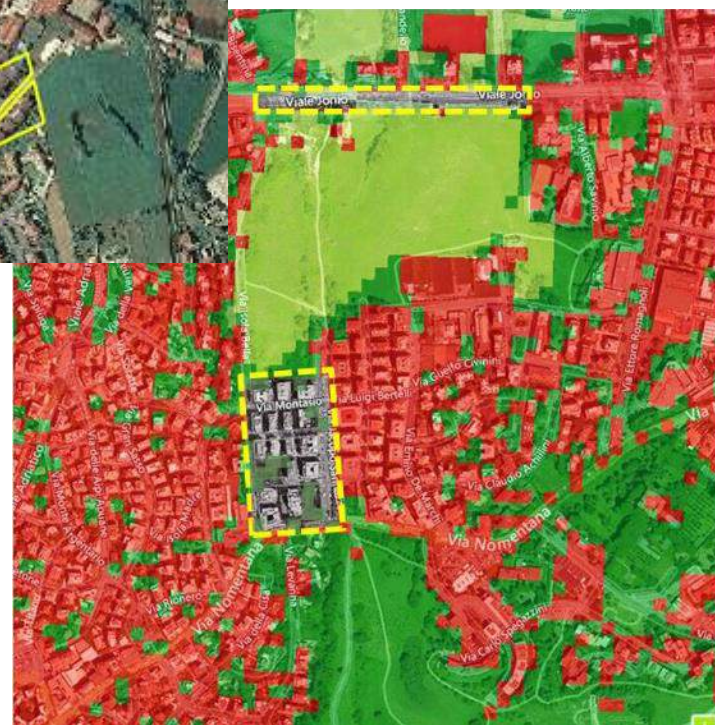
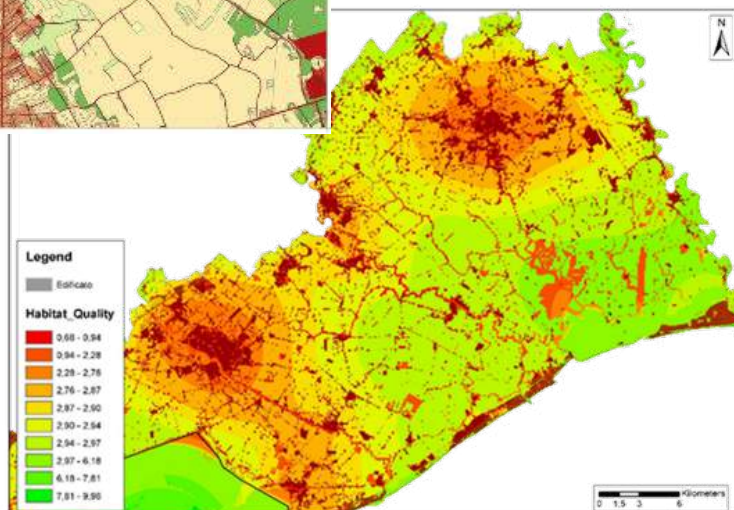


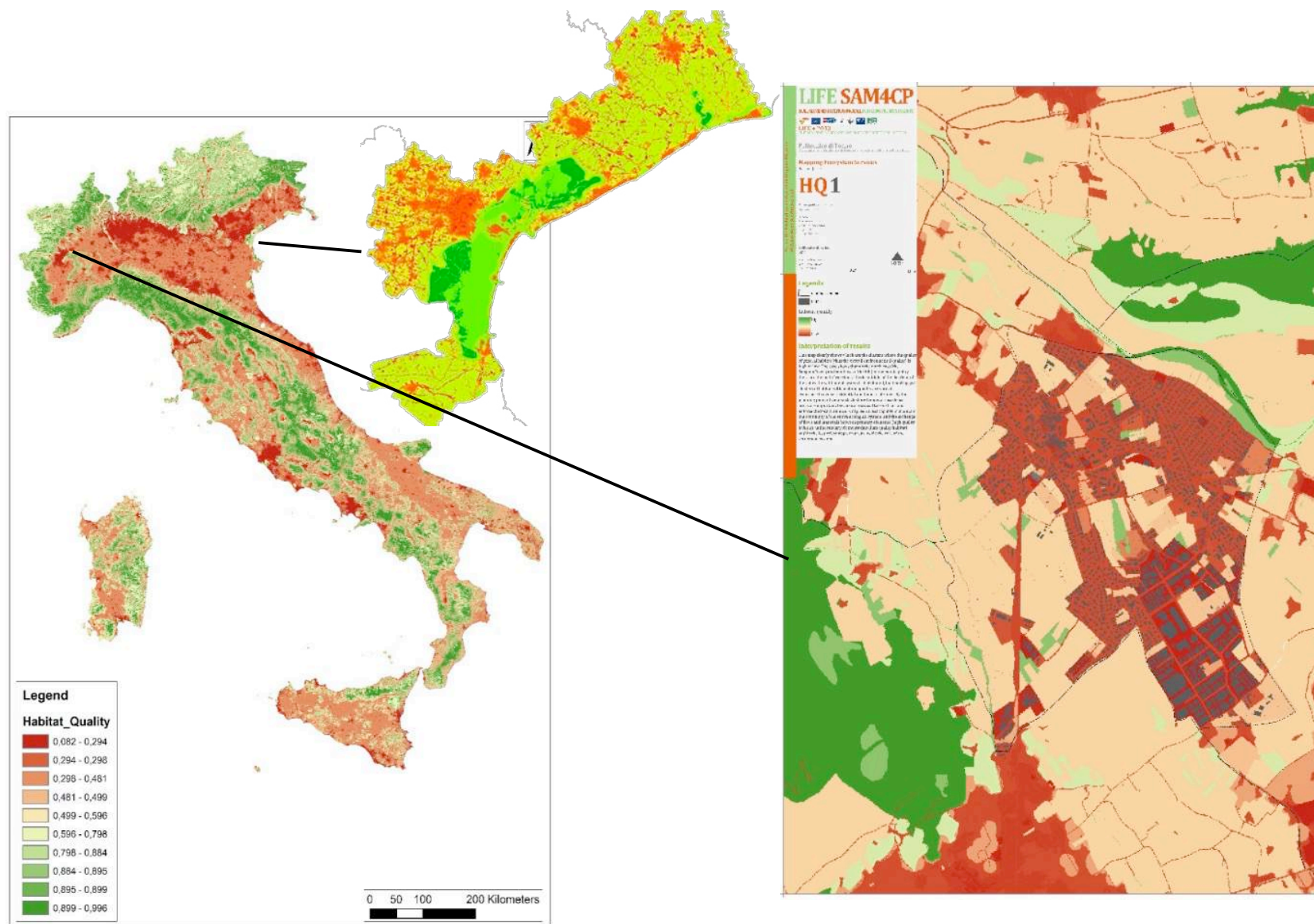
Monitoraggio del consumo di
suolo, dell'espansione
urbana, dello sprawl urbano

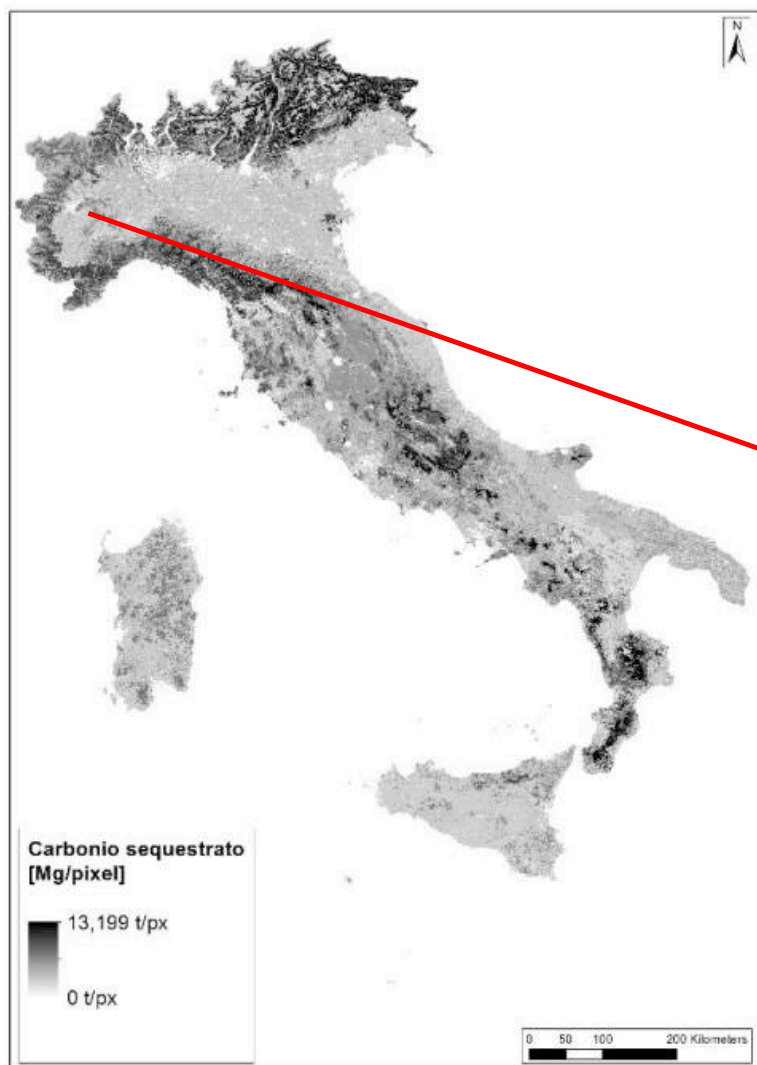


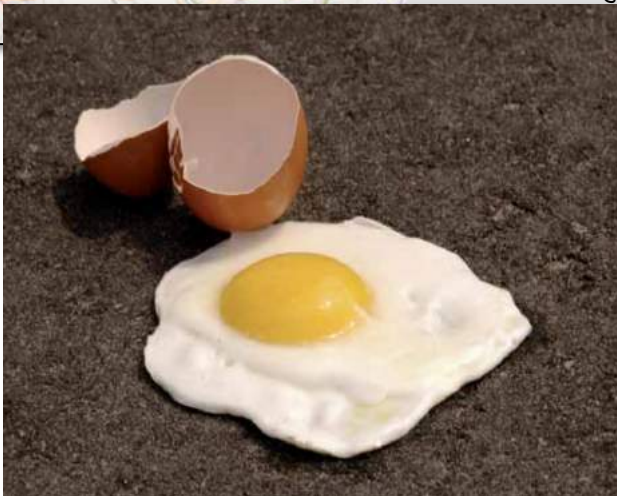
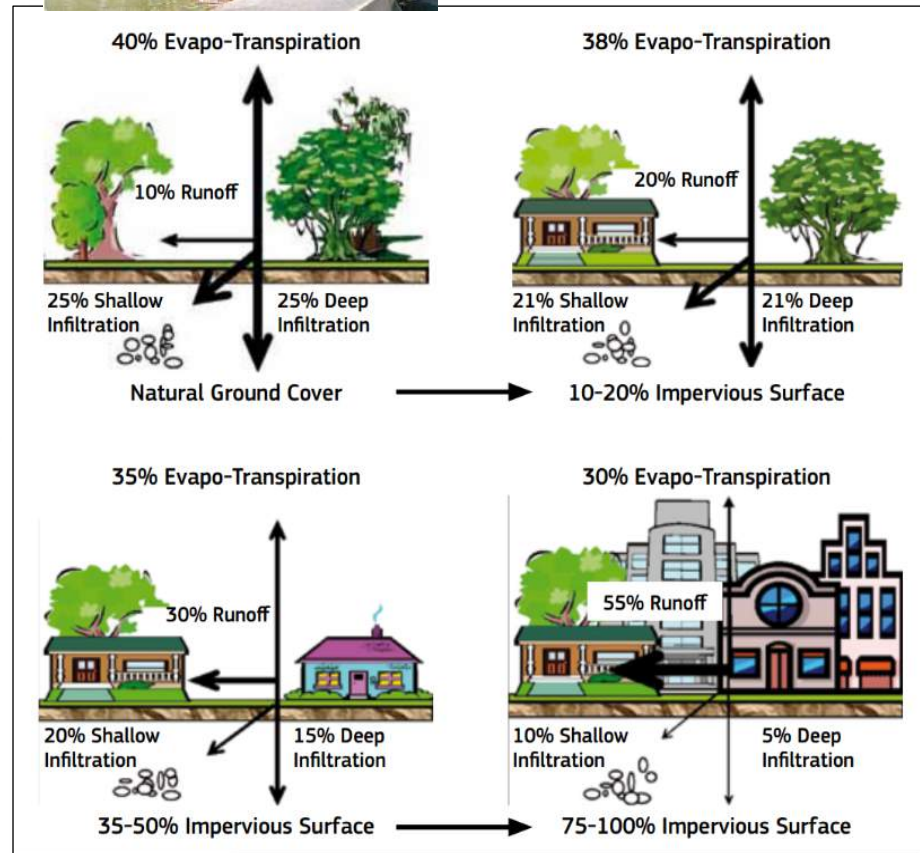
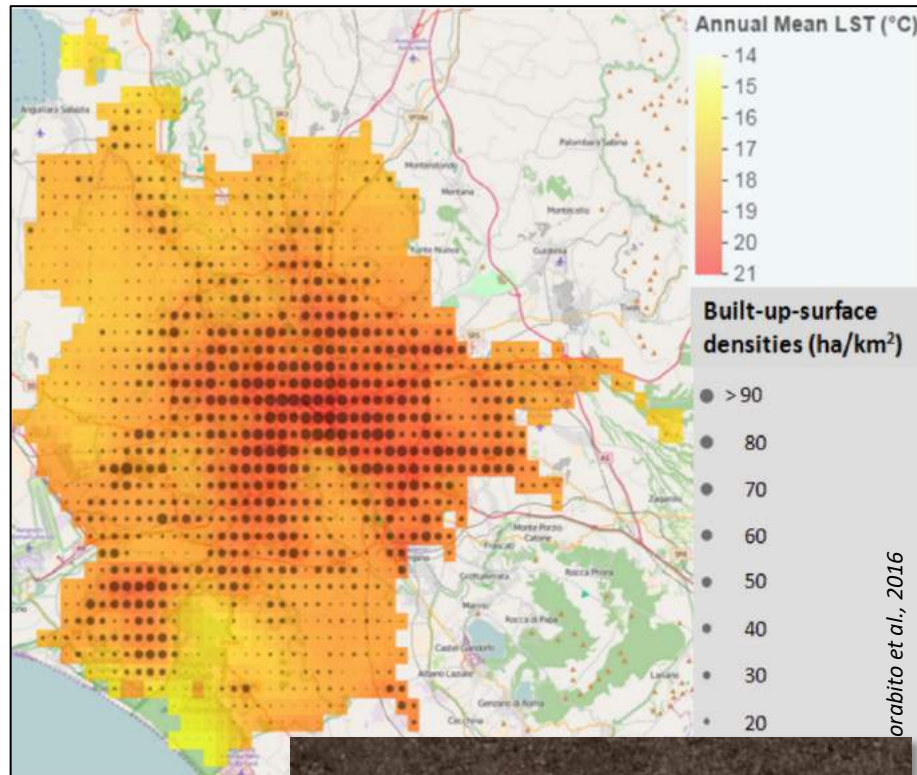


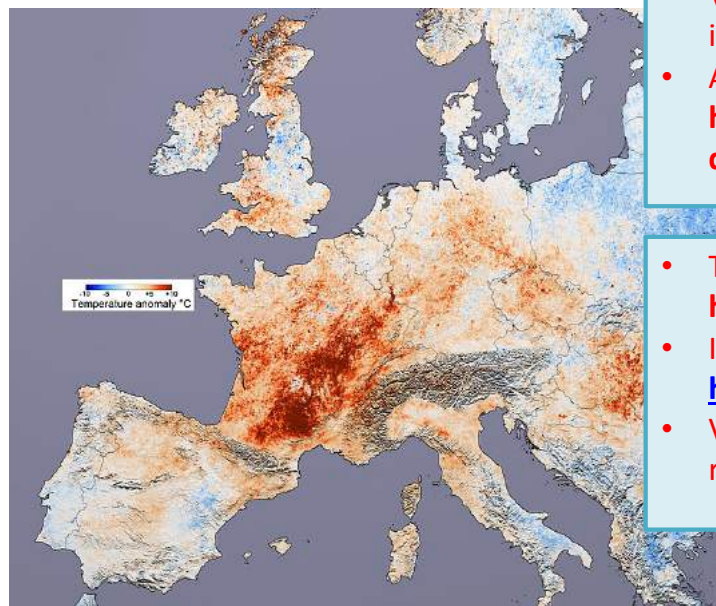
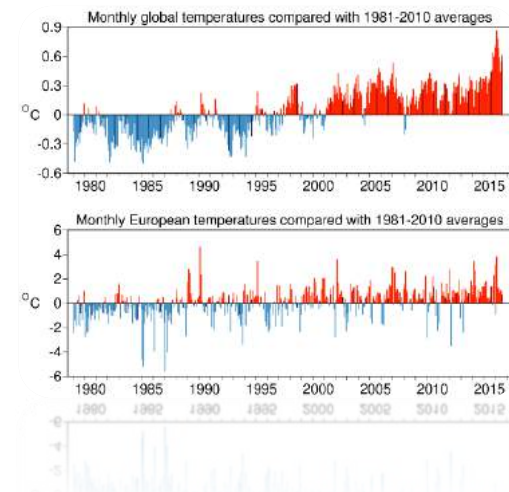
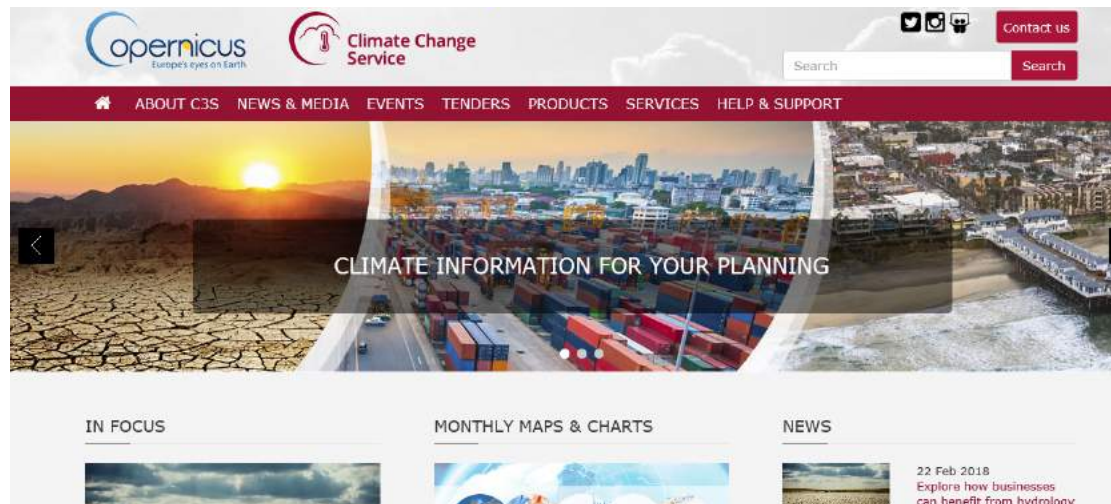




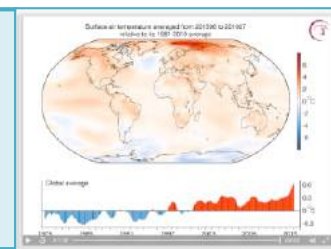








- Visit <https://climate.copernicus.eu> and visualize data of interest
- Access to C3S data on ECMWF website at <http://apps.ecmwf.int/datasets/data/interim-full-daily/>



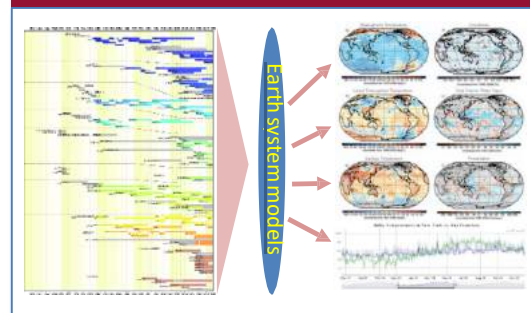
- To access the **ECMWF public datasets**. You will need to have an account on ECMWF web site
- If you **don't have an account**, please self register at <https://apps.ecmwf.int/registration/>
- **Very simple**: the user writes a request, submits it and retrieves a file





Climate
Change

C3S portfolio: Access to past, present and future climate information



Observations, climate data records, ECVs and climate

Reanalyses

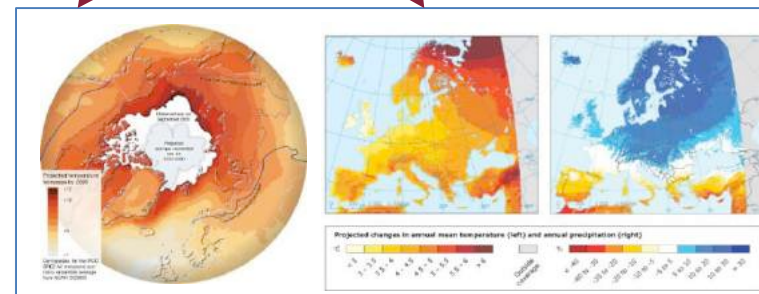
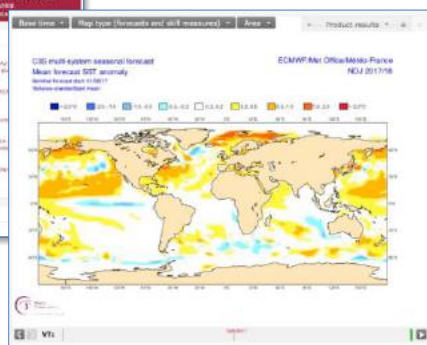
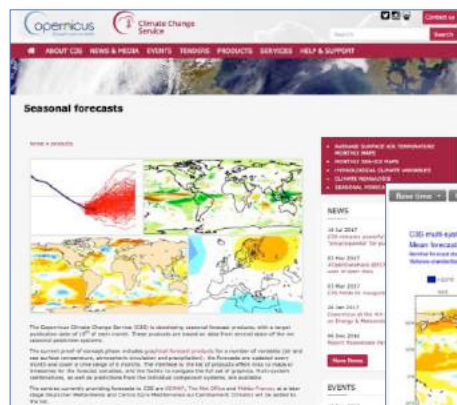
Seasonal forecast data

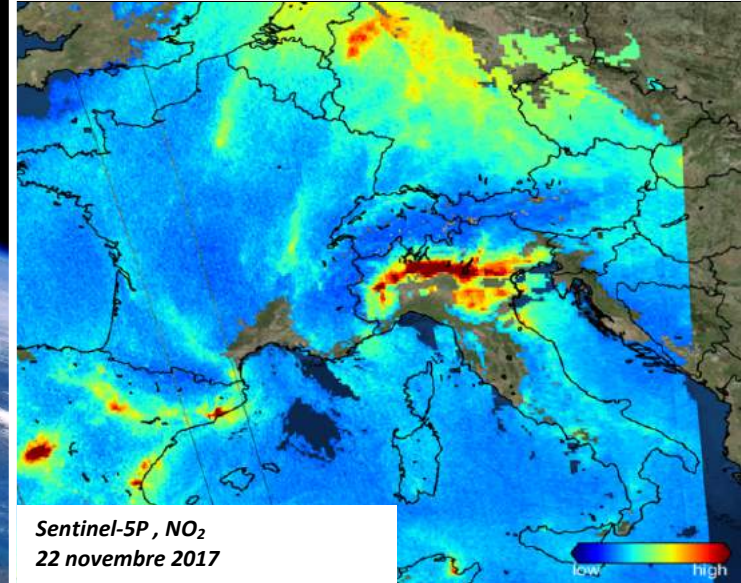
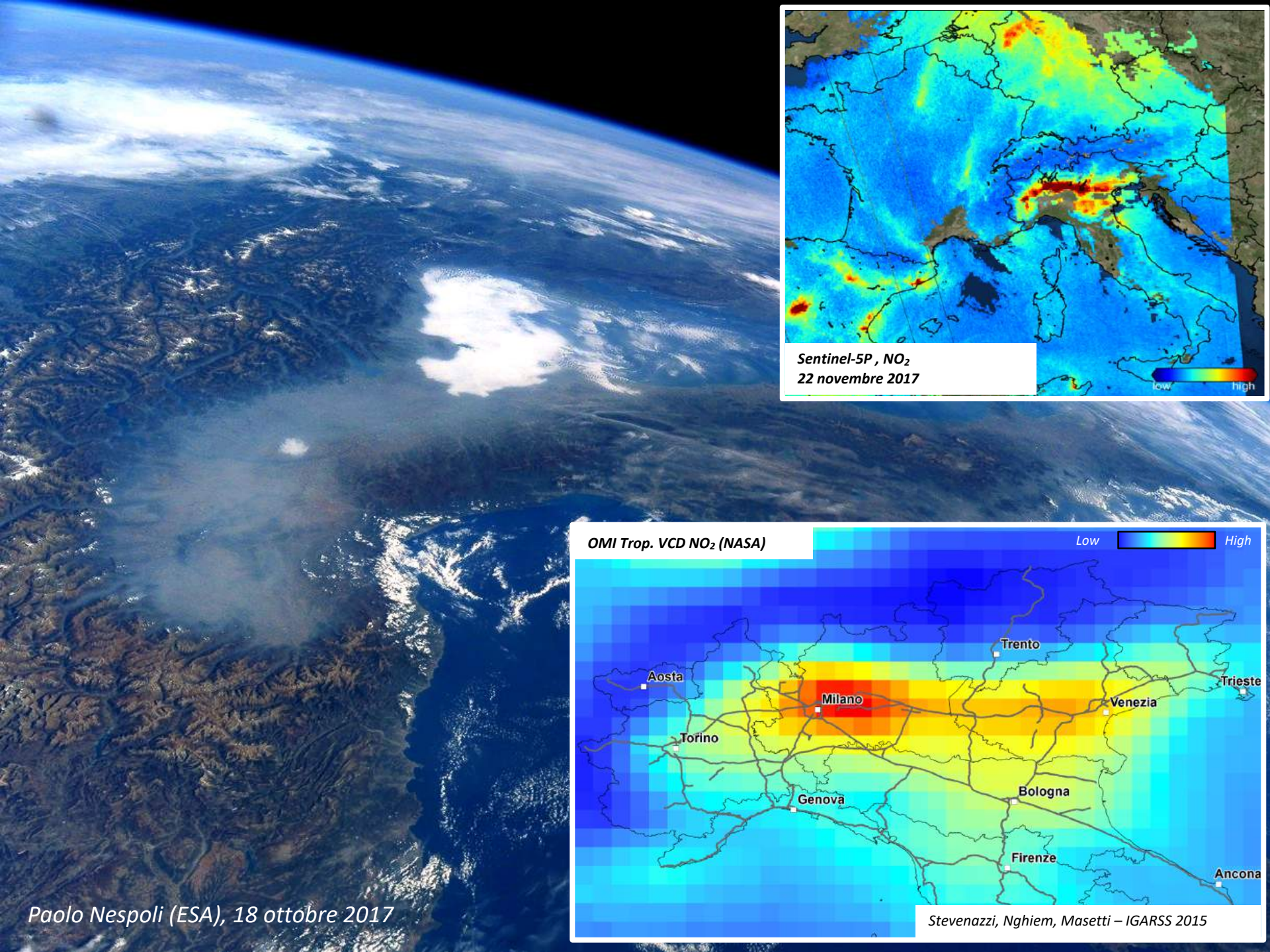
and products

Climate model simulations

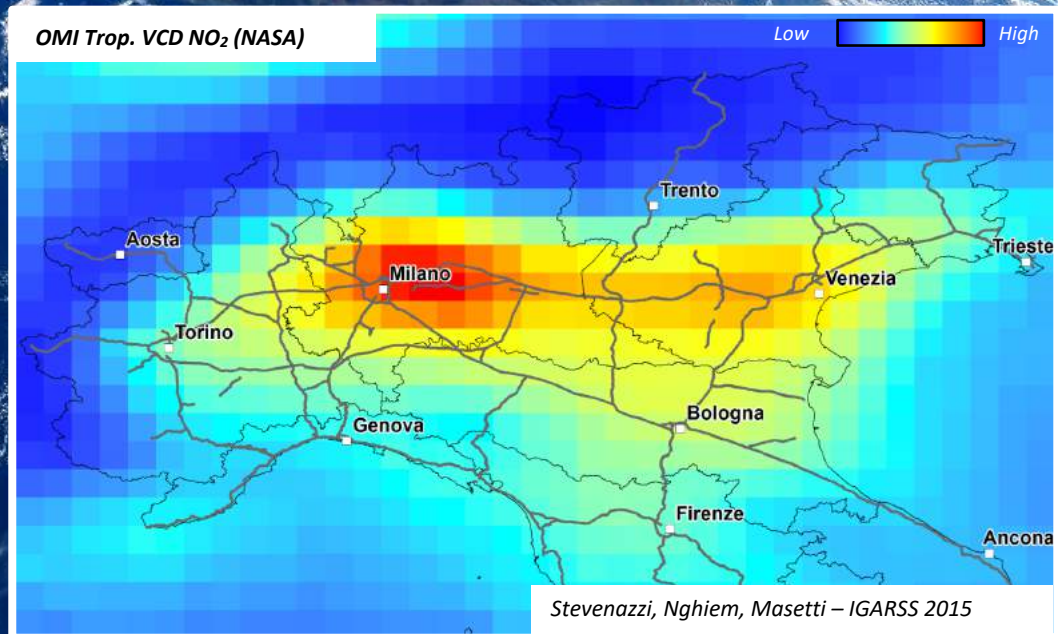
Sectoral climate impact indicators

Courtesy:
Philip
Brohan





Sentinel-5P , NO₂
22 novembre 2017



OMI Trop. VCD NO₂ (NASA)

Paolo Nespoli (ESA), 18 ottobre 2017

Stevenazzi, Nghiem, Masetti – IGARSS 2015

Air Quality & Atmospheric Composition

Home

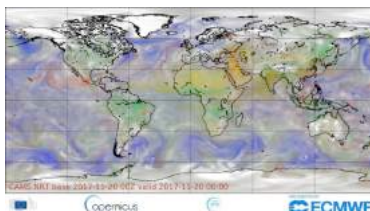
Air quality is defined as the quality of the air that one directly breathes at the surface. It directly affects lives of most European citizens. It forms a significant risk factor for various health conditions and can also aggravate existing health conditions, such as respiratory disease. On a larger scale, atmospheric composition represents the full state of the global atmosphere covering phenomena such as desert dust plumes, long-range transport of atmospheric pollutants and ash plumes from volcanic eruptions, but also variations and long-term changes in the background concentrations of trace components.



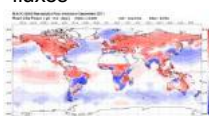
Atmosphere
Monitoring

Copernicus Atmosphere Monitoring Service

Global products



Greenhouse gas
fluxes



Radiative
forcing



Fire
emissions



Regional products



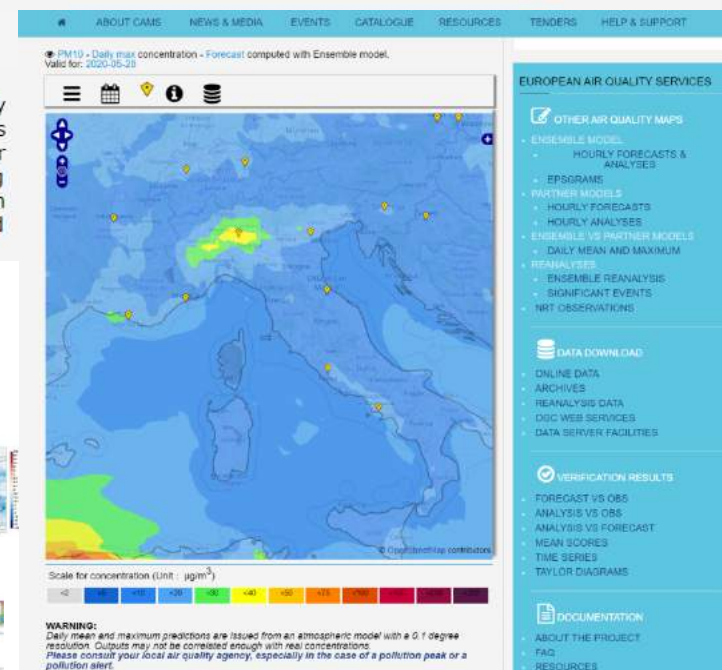
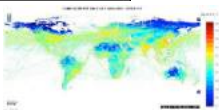
Solar radiation



Policy tools



Emissions



<http://atmosphere.copernicus.eu>



Atmosphere
Monitoring

Air Quality and COVID-19

In the context of the worldwide COVID-19 crisis,
there is increased interest in changing air quality.

The main reasons are:

- air quality, being partly determined by emissions of pollutants from **human activities** (and partly by changes in weather), is **an indicator of the level of these activities**. In situations of prolonged lockdown and over time, the expectation is that average levels of air pollution will go down.
- COVID-19 is an infectious respiratory disease and **air quality (including pollens) affects respiratory health**. Therefore, air quality information is especially important during this period.
- there is a **debate** among the epidemiological research community as to whether the **virus SARS-CoV-2 (coronavirus) can remain viable on aerosols for three hours or more**. Our data can support this research by providing information about the distribution and evolution of fine particulate matter just above the surface.

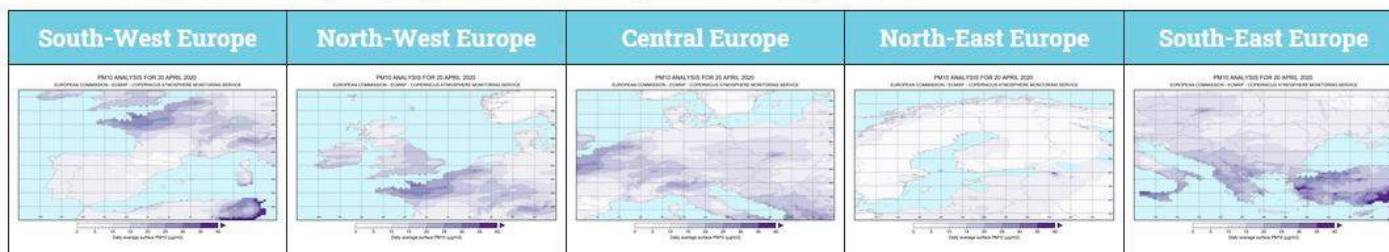
20/04/2020 concentration maps

Daily average surface NO₂ and PM₁₀ concentrations based on the latest CAMS regional analyses

NO₂ – Nitrogen Dioxide - 20/04/2020



PM₁₀ – Particulate Matter with diameter smaller than 10 micrometres - 20/04/2020



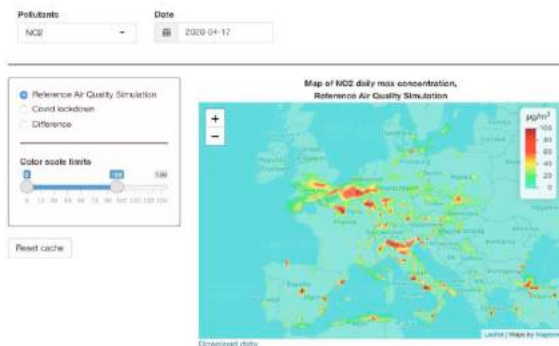
Spatial resolution of 10 km x 10 km. Combines over 1000 surface observations across Europe, acquired at country level and gathered by the European Environment Agency, with detailed information from the CAMS air quality forecast models.



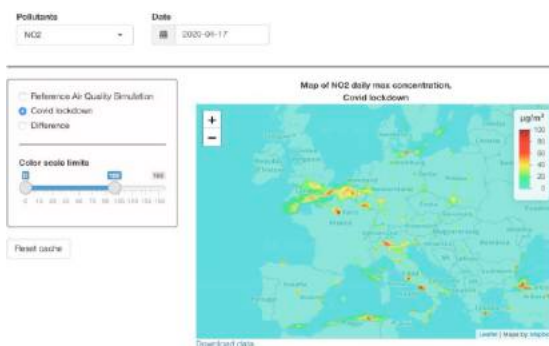
Atmosphere
Monitoring

Emissions scenarios

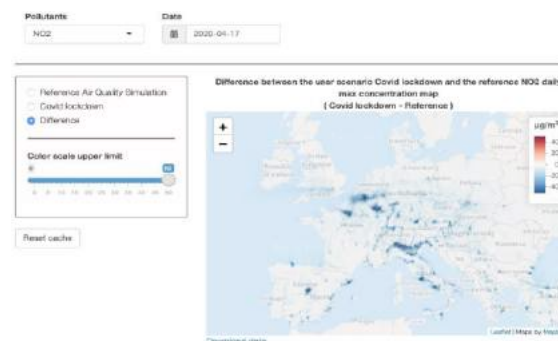
In order to assess the expected impact of the estimated emissions changes induced by **lockdown measures** on European air quality, one of the models providing CAMS regional air quality analyses and forecasts is run using **two different emissions data sets**.



What would be today's forecast of NO₂ (PM₁₀, PM_{2.5}) under normal circumstances?



What would be today's forecast of NO₂ (PM₁₀, PM_{2.5}) with emissions changed because of COVID-19 related measures?



What is the difference between the two?

Crude hypotheses at this stage: -60% for road traffic, -30% for industrial, +20% for residential, and no change for agricultural activities or maritime shipping as well as for natural sources.

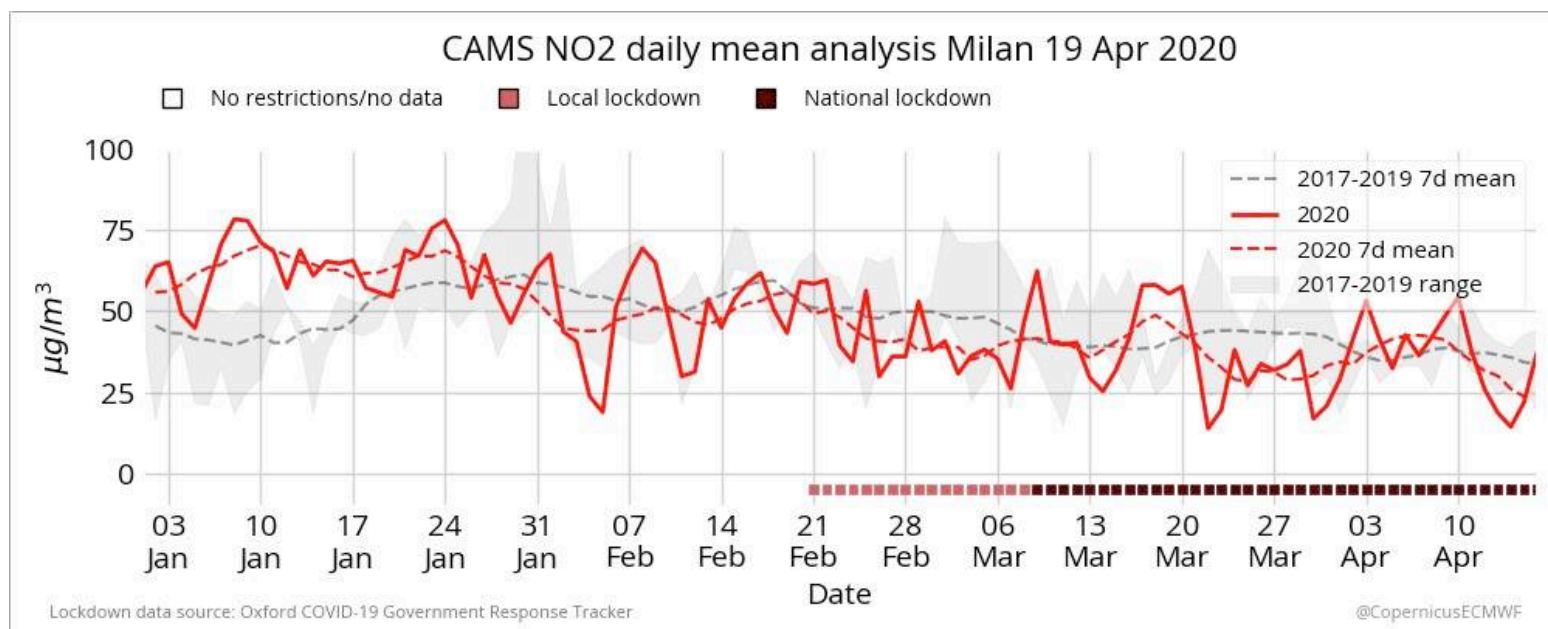
Powered by Ineris (France).



Atmosphere
Monitoring

CAMS and COVID-19: upcoming updates

Automatized and improved timeseries based on **current regional analyses** combined with information about **2017-2019** and an **indication of the lockdown situation** (datasets from the University of Oxford).



Miha Razinger, ECMWF

... Grazie per l'attenzione...

Bernardo De Bernardinis

