



Workshop del Tavolo Copernicus Agricoltura e Foreste

Il satellite a servizio delle foreste

Servizi di monitoraggio satellitare per la tutela e la valorizzazione delle risorse forestali

Sala Polifunzionale – Presidenza del Consiglio dei Ministri
Via di Santa Maria in Via, 37b - Roma

Roma 28/02/2018



Utilizzo delle immagini satellitari a supporto delle attività di gestione degli incendi boschivi

Prof. Giovanni Laneve, Lorenzo Fusilli, Pablo Marzialetti, Roberto Luciani
giovanni.laneve@uniroma1.it
eosial.psm@uniroma1.it



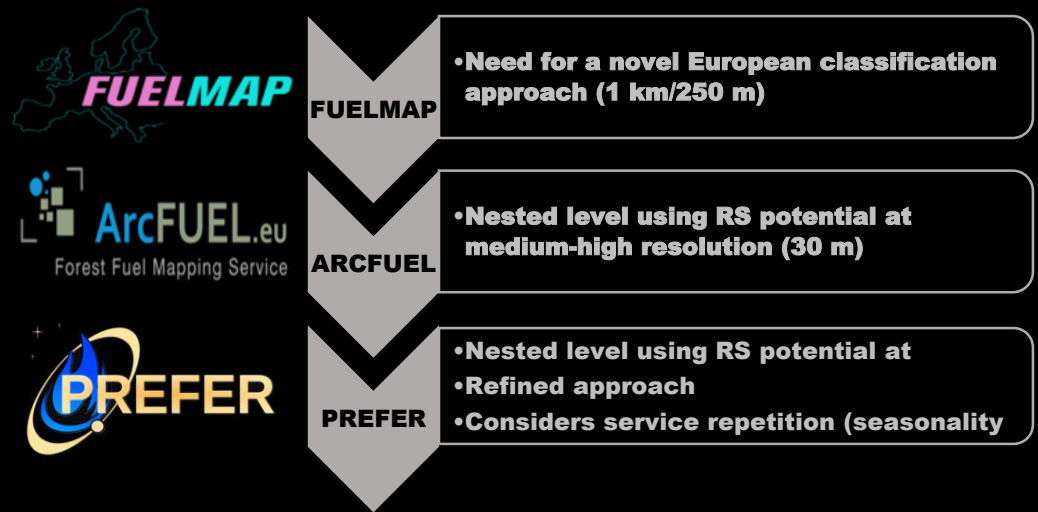
SAPIENZA
UNIVERSITÀ DI ROMA



Prevention	Detection/ Monitoring	Damage assessment/ Recovery
ARCFUEL	AFIS	EUFODOS
FIRESMART	EUMETSAT -FIR	FIREMONT
EFFMIS	AF3	AF3
PREFER	ODS3F	PREFER
SIGRI	SIGRI	SIGRI
FUELMAP	PYROS	PYROS
MOVE		ITALSCAR
FIREPARAD OX		SAFER
LADAMER		EFFIS
EFFIS		
SENSUM		

Prevention	Detection/Monitoring	Damage assessment/ Recovery
------------	----------------------	--------------------------------

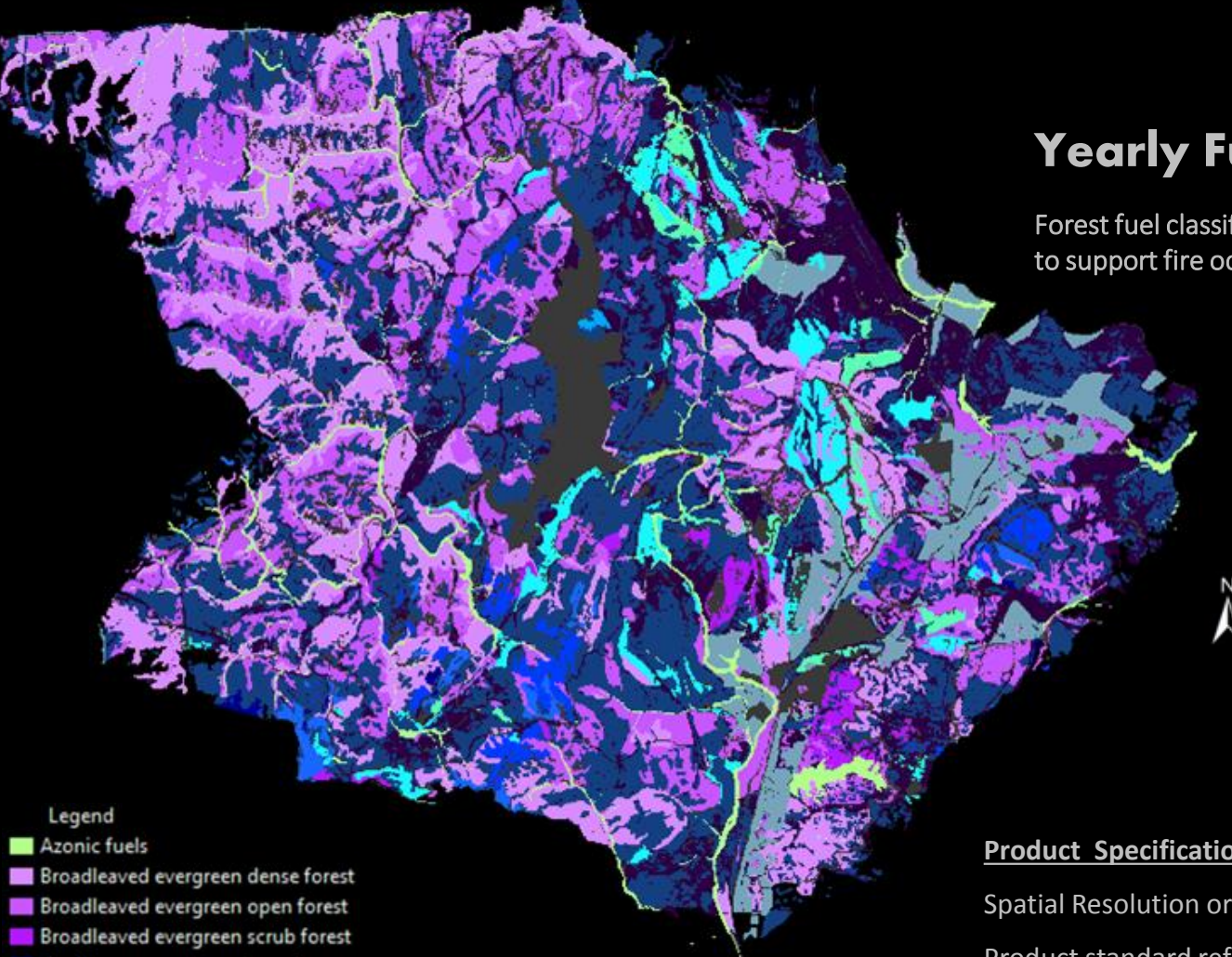
Vegetation fuel map	Early detection of wildfires	Burned areas estimate
Hazard map	Forest fires monitoring	Damage severity map
Vulnerability map	Estimate of Fire Radiative Power (fire intensity)	Burned biomass
Risk map	Estimate of the burned biomass and atmospheric emissions	Slope instability (landslide, debris flow)
Fuel reduction map and forecast of suitable conditions for prescribed fire practices		





Yearly Fuel Map

Forest fuel classification according to the assessed capacity to support fire occurrence and contribute to fire potential.



Legend

- Azonic fuels
- Broadleaved evergreen dense forest
- Broadleaved evergreen open forest
- Broadleaved evergreen scrub forest
- Coniferous evergreen dense forest
- Coniferous evergreen open forest
- Coniferous evergreen scrub forest
- Grasses
- Mixed evergreen dense forest
- Mixed evergreen open forest
- Mixed evergreen scrub forest
- Nofuels
- Non windland fuels
- Shrubs

Product Specification:

Spatial Resolution or Scale	5m/30m
Product standard refresh rate	Twice a year
Area covered by a single Product	500 km ²
Satellite sensor data Input	RapidEye/ Landsat
Standard Format	GEOTIFF



Seasonal Fire Hazard Map



Fire Ignition Probability



Seasonal Fire Hazard Map is a new danger index computed by considering: **natural factors**, distinguishable in static (fuel map, slope, aspect, climatic zone) and dynamic (vegetation index, (e.g NDVI), meteo data, updated fuel map with burnt areas, daily fire hazard index); **human factors**, distinguishable in static (urban areas, roads, fire statistics, cultural factor) and dynamic (actual fire season statistics).

The natural factors take into account the morphological characteristics (slope, aspect) and the vegetation stress (based on a daily hazard index averaged on 15 days).

The human factors consider the accessibility factor, the cultural factor and the seasonal factor. The **cultural factor** is based on the fire occurrences for the last 5-10 years. The **seasonal factor** is based on the actual season fires trend respect to the average of the 5-10 previous years. The actual fires occurrence trend could be evaluated, at present, by using satellite based fire detection systems (FIRMS or SFIDE).

Product Specification:

Spatial Resolution or Scale	250 m
Product standard refresh rate	4 – 8 times a year
Area covered by a single Product	500 km ²
Satellite sensor data Input	RapidEye/ Sentinel 2
Standard Format	GEOTIFF



1st August

Daily Fire Hazard Index (DFHI)

Daily Fire Hazard Map provides a medium spatial resolution fire danger index for the present day and the following two. The index is based on MODIS images, and meteorological data acquired daily and on fuel map.

Product Specification:

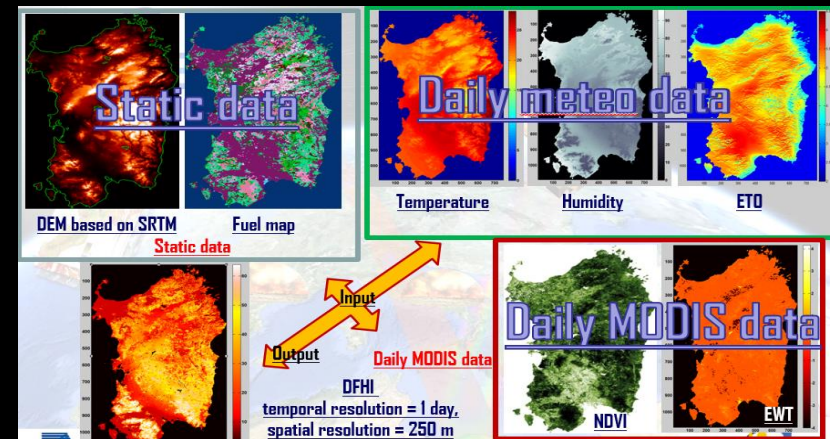
Spatial Resolution or Scale	250 m
Product standard refresh rate	Daily
Area covered single Product	Regional scale
Satellite sensor data Input	MODIS
Standard Format	GEOTIFF



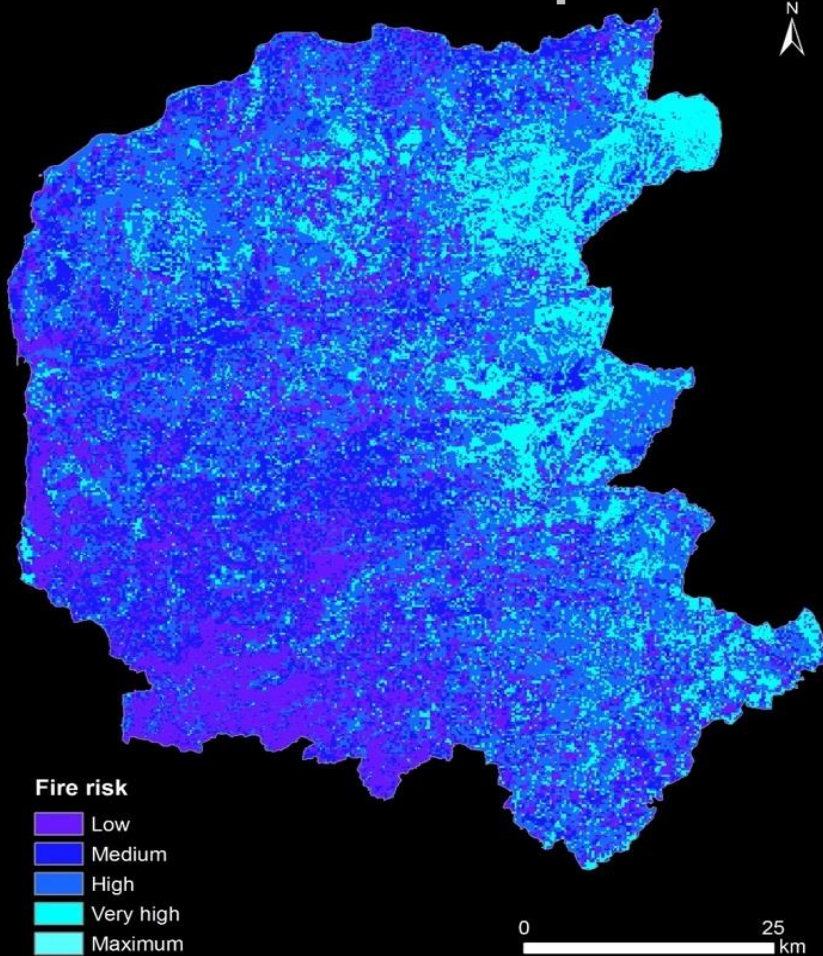
31st August

Null Very High

Example of daily hazard index map computed for the Sardinia region. The maps, refer to the whole month of August 2017.



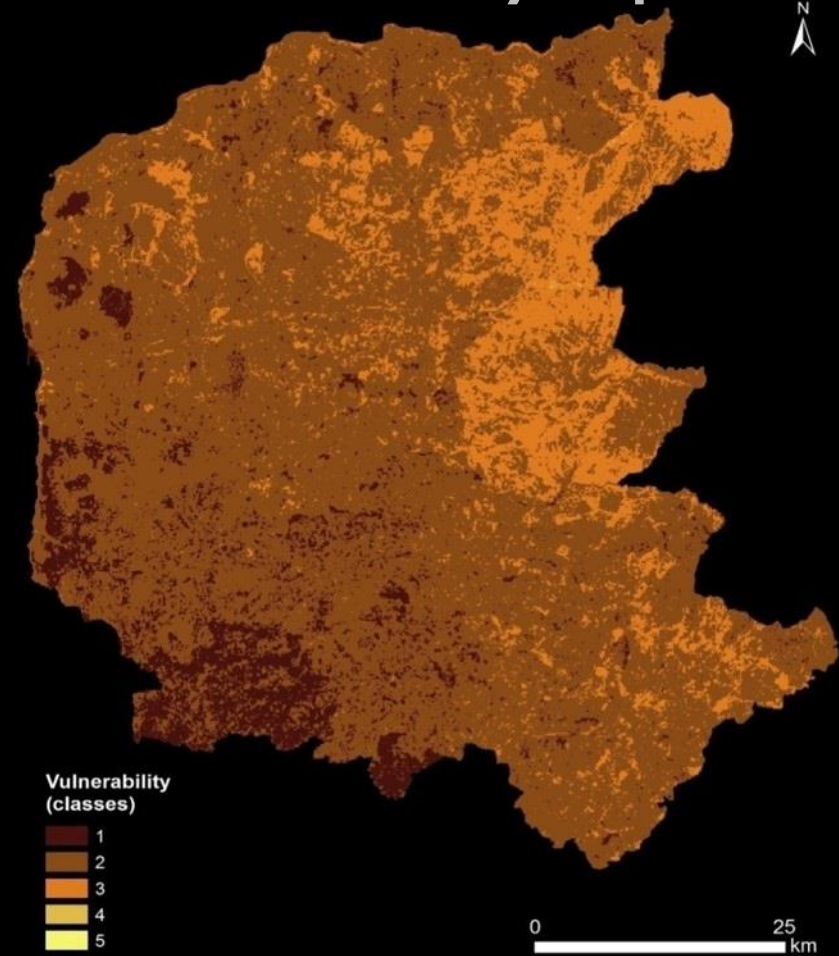
Fire Risk Map



The fire risk map represents the likelihood that a fire may occur and cause losses. It results from the combination of fire hazard (probability of fire occurrence) with vulnerability (potential losses).

Risk = fire hazard x vulnerability

Vulnerability Map



Vulnerability map represents a relative measure of the potential of loss of an area, including:

- Type, number and density of exposed elements
- Level of coping capacity
- Economic value

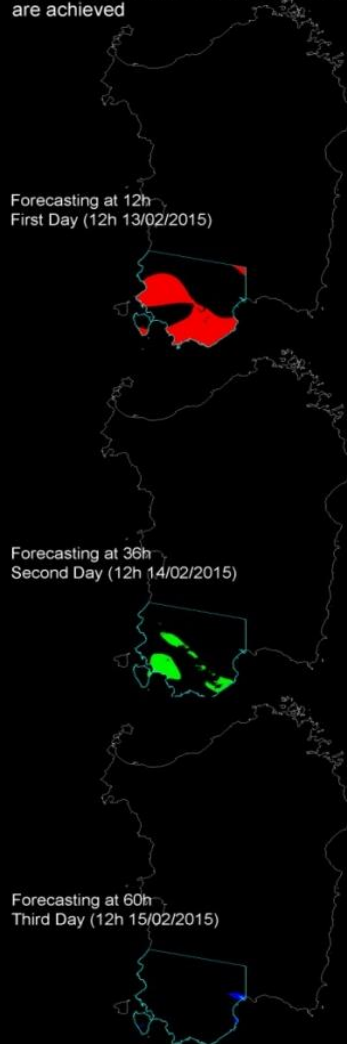
Forecasting at 12h First Day (12h 13/02/2015) Forecasting at 36h Second Day (12h 14/02/2015) Forecasting at 60h Third Day (12h 15/02/2015)

Prescribed Fire Conditions

Prescribed Fire Conditions are a daily forecast product providing three spatial and temporal map of the areas "Where" and "When" the fuel load can be reduced by using the Prescribed Burning. This practice can be performed under specific conditions.

Prescription elements	Range
Burn season	Nov - Feb
Wind speed (km hr-1)	2 - 8
Air temperature (°C)	6 - 15
Relative humidity (%)	35-65
N. days since rain	2

Areas "Where" and "When" the Prescribed Fire Conditions are achieved

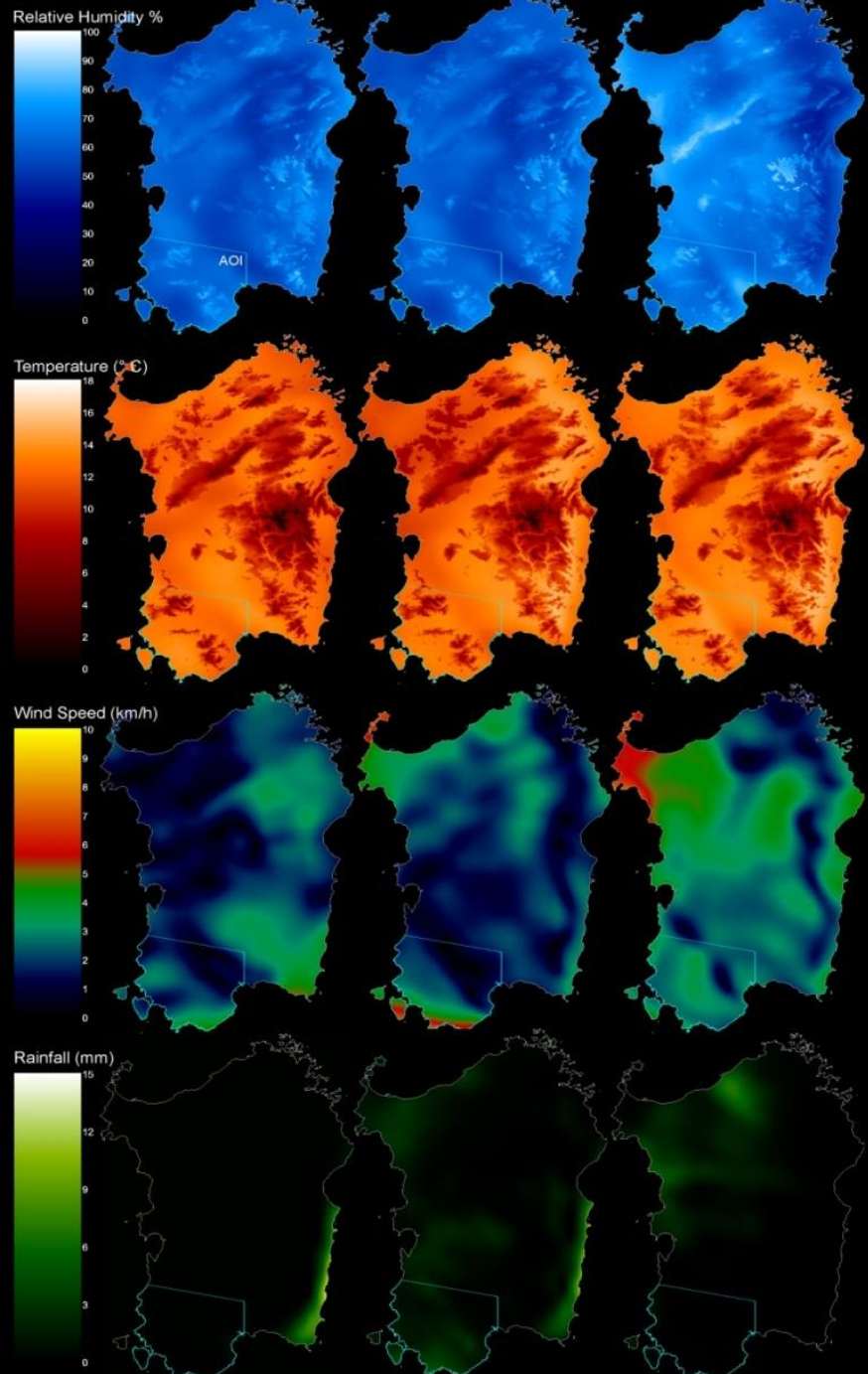


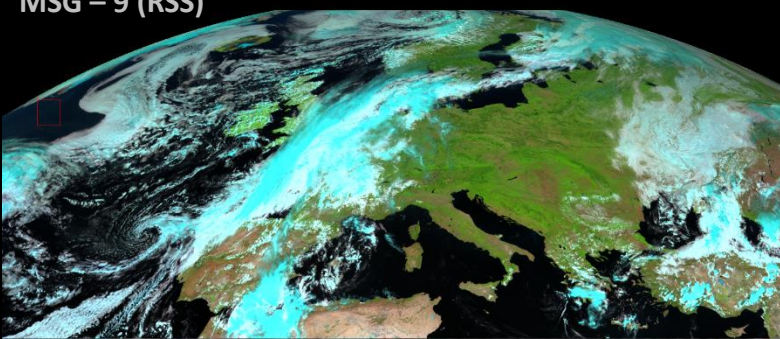
Prescribed Fire Map, based on the intersection between the Fuel Reduction Map and Weather Conditions, provides spatial-temporal indications of the areas where it would be useful to apply the prescribed fire practice.

The final products are a set of forecasting daily masks containing only the areas where the climate conditions for the prescribed fire practice are satisfied.000

Product Specification:

- Spatial Resolution or Scale 1: 10 000 to 1: 25 000
- Product standard refresh rate Daily winter season (November/March)
- Area covered by a single Product Product computed on: Portuguese, Spanish, Italian AOI
- Satellite sensor data Input VHR satellite images
- Standard Format GEOTIFF





Hot spots detected in Near-Real-Time (NRT) by SFIDE by using the MSG-2 (or 9)/SEVIRI images (5 min revisit frequency) of the 20th August 2017

Burn Scar Map HR



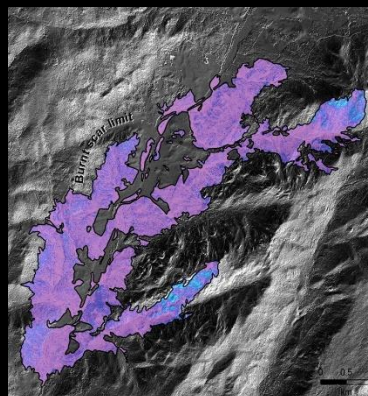
Burn Scar perimeters at scale 1/25.000-1/50.000 obtained through multi-temporal and multispectral analysis of High Resolution Optical EO data. In red , an example of Burn Scar map obtained through multi-temporal analysis of Landsat 8 images acquired on 20140627 and 20140713, overlaid on the final data Landsat8 20140713 .

Burn Scar Map VHR



Burn Scar perimeters at cadastral scale (1/1.000-1/4.000) obtained through contextual analysis of Very High Spatial Resolution Optical EO data . An example of Burn Scar Map VHR Optical extracted through contextual analysis of very high spatial resolution Kompsat-2 image, is represented in white.

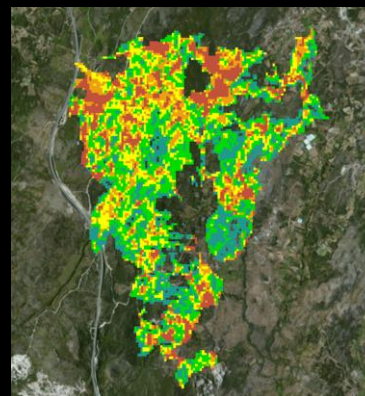
Soil Erosion Susceptibility



Soil erosion susceptibility is described through indicator(s) based on soil erosion model of the Universal Soil Loss Equation (USLE) family (RUSLE, G2).



Damage Severity Map



The Damage Severity Map provides the degree of damage in a burned areas. The algorithm for the determination of post-fire damage severity is based on a multi-temporal analysis of vegetation spectral index. The damage severity is represented by a scale of damage from 0 to 5 indicating the degree of damage. The index is based on pre and post-event L8 images and makes use of the PREFER product 'HR Burn scars'.



Thank you for your attention!

**EOSIAL Earth Observation
Satellite Images Application Lab.
eosial.psm.uniroma1.it**

**S2IGI: Sistema satellitare integrato gestione incendi
Nurjana Technologies, CNR IBIMET, SIA Università La
Sapienza**

POR FESR Sardegna 2014-2020

**Asse I – Ricerca Scientifica, Sviluppo Tecnologico e
Innovazione**

**Azione 1.2.2 – Supporto alla realizzazione di progetti
complessi di attività di ricerca e sviluppo.**