RETE RURALE NAZIONALE 2014 2020

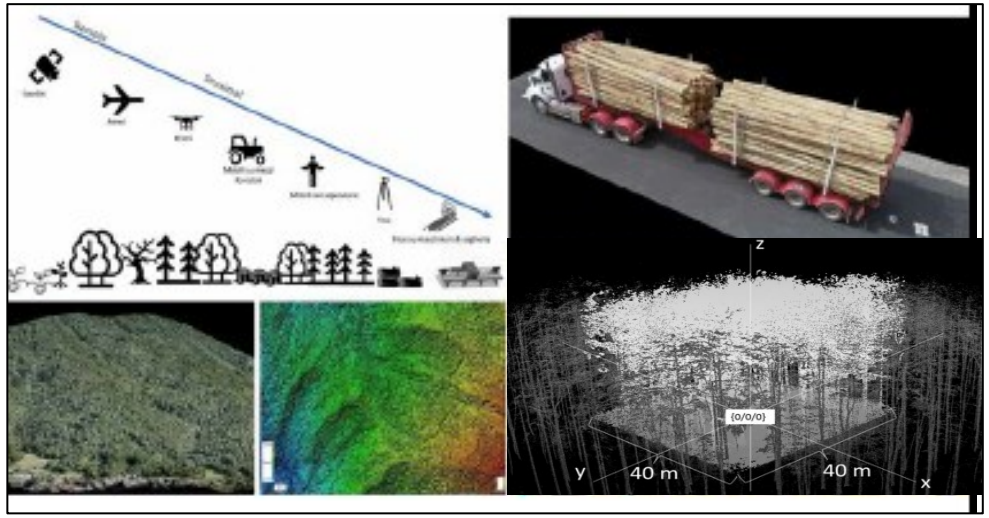
MINISTERO DELL'AGRICOLTURA DELLA SOVRANITÀ ALIMENTARE E DELLE FORESTE

UNIONE EUROPEA

crea
Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

ACCADEMIA ITALIANA DI SCIENZE FORESTALI
FIRENZE

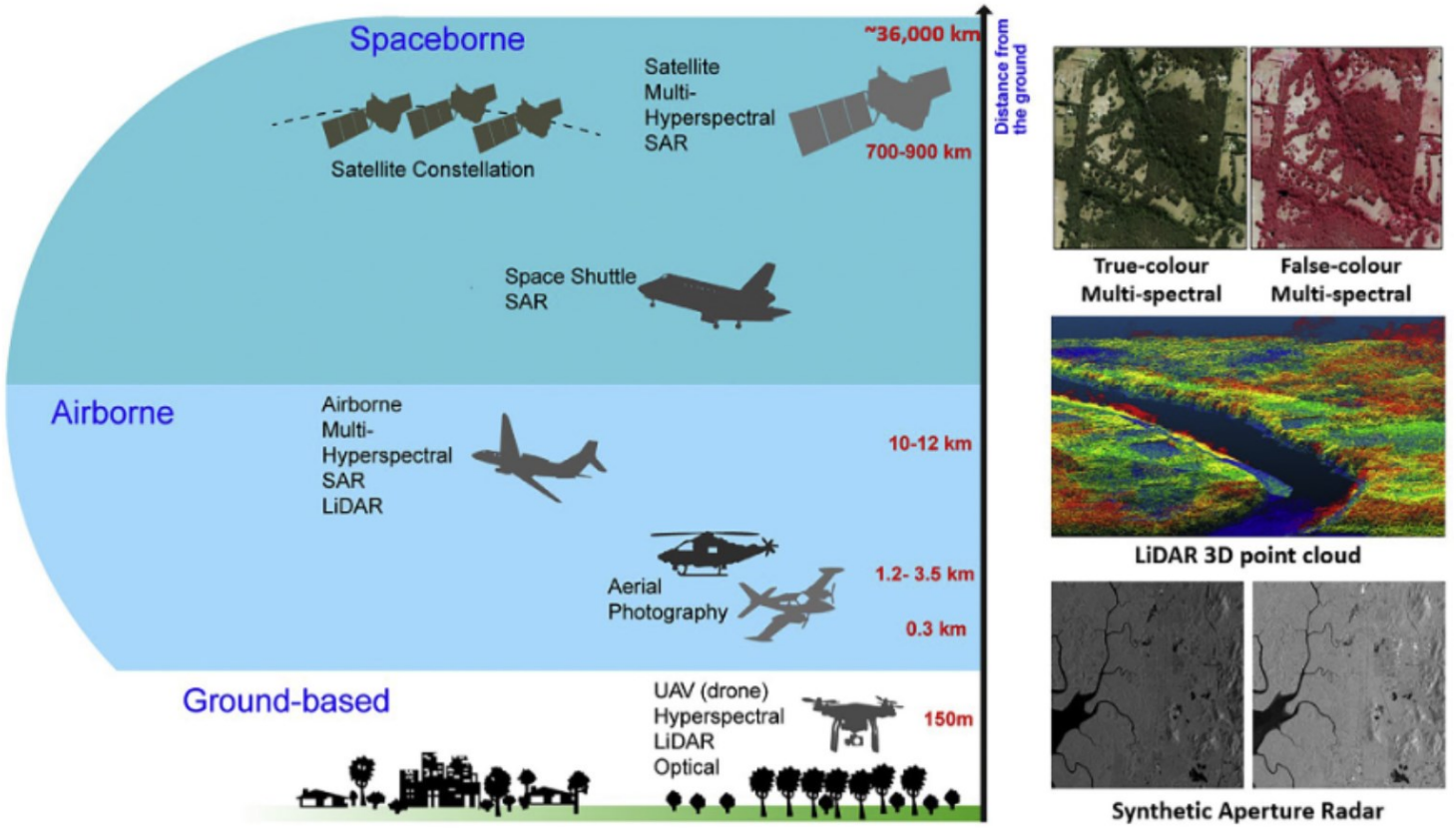
Innovazioni operative per il monitoraggio forestale mediante applicazioni di telerilevamento prossimale e remoto



SAPIENZA
UNIVERSITÀ DI ROMA

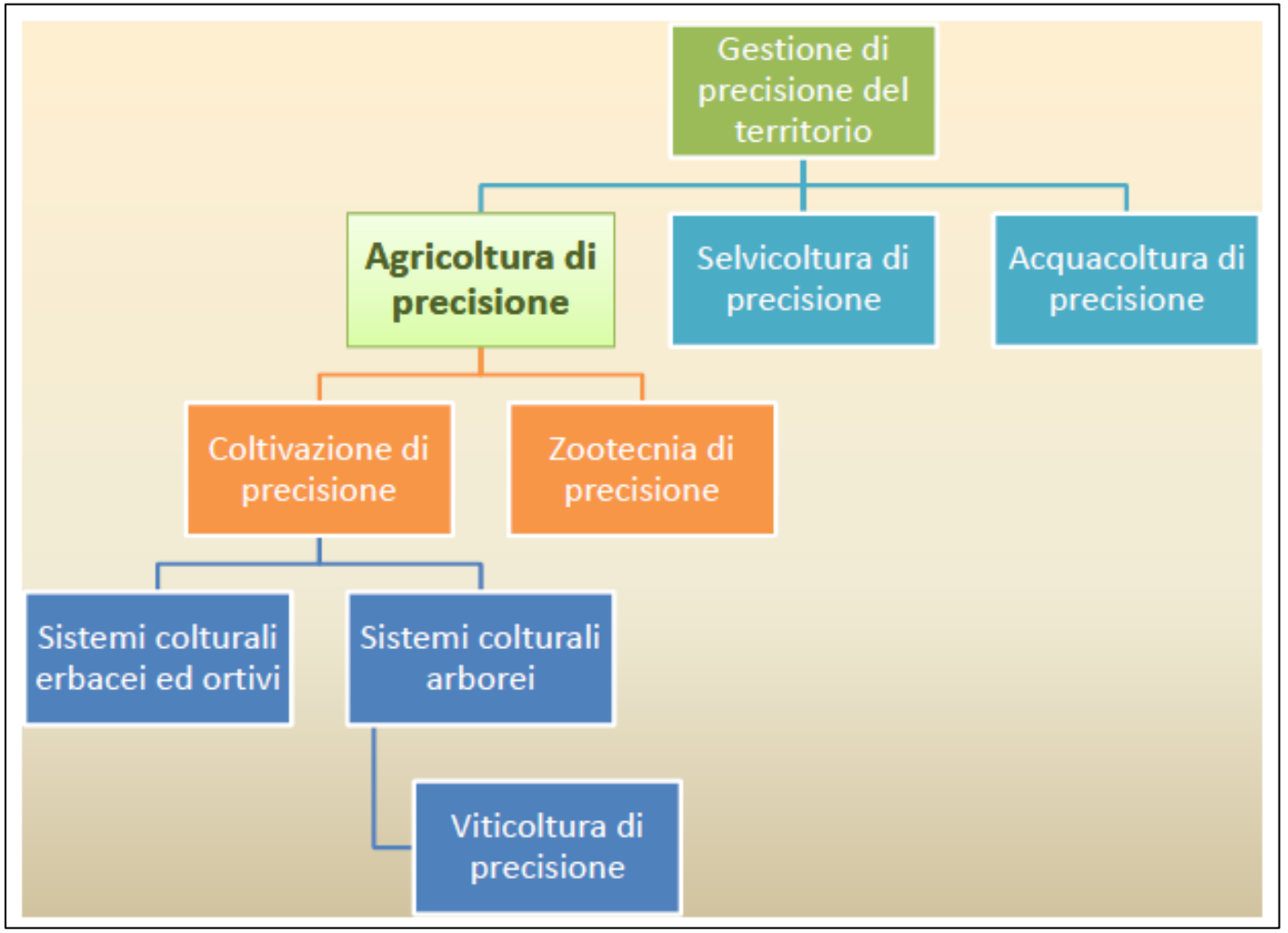
opernicus
Framework Partnership Agreement
for Copernicus User Uptake

implementazione e integrazione nel settore forestale delle più recenti applicazioni di **telerilevamento prossimale e remoto**, al fine di contribuire a rendere più efficiente la gestione dei boschi e delle piantagioni da legno, sotto il profilo sia economico che ambientale



AgriDigit

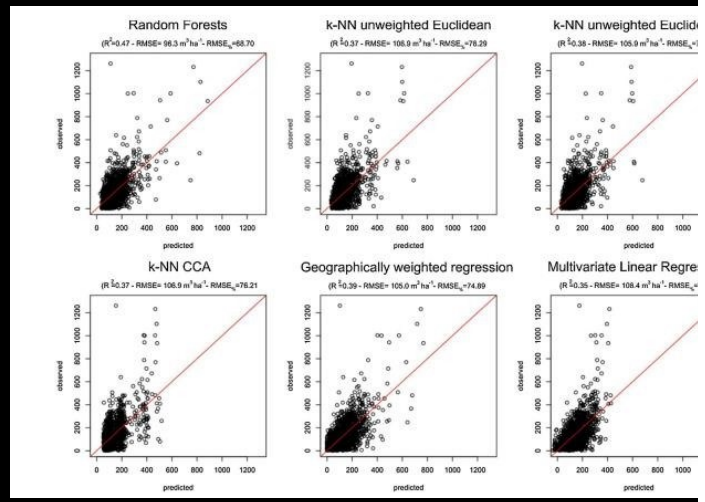
“selvicoltura di precisione” (*precision forestry*), nel quadro delle azioni a supporto della Digitalizzazione in Agricoltura

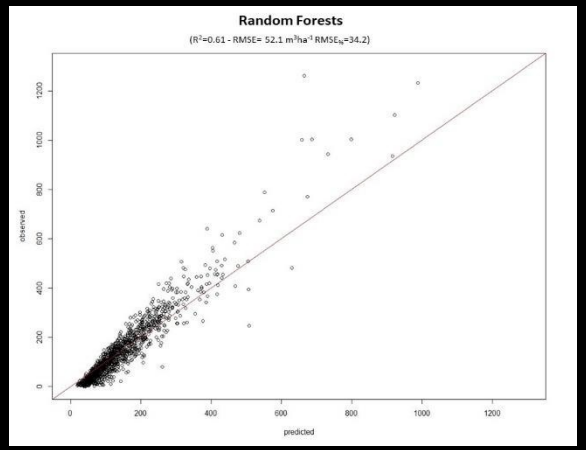


esempio di applicazione sul dato INFC

National application

LOO R^2 = 0.61 and RMSE □ 52 m³





Int J Appl Earth Obs Geoinformation 84 (2020) 101959

Contents lists available at ScienceDirect

Int J Appl Earth Obs Geoinformation

journal homepage: www.elsevier.com/locate/jag

Wall-to-wall spatial prediction of growing stock volume based on Italian National Forest Inventory plots and remotely sensed data

Gherardo Chirici[a], Francesca Giannetti[a], Ronald E. McRoberts[b,c], Davide Travaglini[a], Matteo Pecchi[a], Fabio Maselli[d], Marta Chiesi[d], Piermaria Corona[e]

[a] Dipartimento di Scienze e Tecnologie Agrarie, Alimentari, Ambientali e Forestali, Università degli Studi di Firenze, 50145, Firenze, Italy
[b] Department of Forest Resources, University of Minnesota, Saint Paul, MN, 55108, USA
[c] Northern Research Station, U.S. Forest Service, Saint Paul, MN, 55108, USA
[d] CNR-IBE, Via Madonna del Piano, 10, 50019, Sesto Fiorentino, FI, Italy
[e] CREA, Research Centre for Forestry and Wood, viale Santa Margherita 80, 52100, Arezzo, Italy

ARTICLE INFO

Keywords:
National Forest Inventory
Spatial estimation
Growing stock
Landsat
Italy
Growing stock volume

ABSTRACT

Spatial predictions of forest variables are required for supporting modern national and sub-national forest planning strategies, especially in the framework of a climate change scenario. Nowadays methods for constructing wall-to-wall maps and calculating small-area estimates of forest parameters are becoming essential components of most advanced National Forest Inventory (NFI) programs. Such methods are based on the assumption of a relationship between the forest variables and predictor variables that are available for the entire forest area. Many commonly used predictors are based on data obtained from active or passive remote sensing technologies. Italy has almost 40% of its land area covered by forests. Because of the great diversity of Italian forests with respect to composition, structure and management and underlying climatic, morphological and soil conditions, a relevant question is whether methods successfully used in less complex temperate and boreal forests may be applied successfully at country level in Italy.

For a study area of more than 48,657 km² in central Italy of which 43% is covered by forest, the study presents the results of a test regarding wall-to-wall, spatially explicit estimation of forest growing stock volume (GSV) based on field measurement of 1350 plots during the last Italian NFI. For the same area, we used potential predictor variables that are available across the whole of Italy: cloud-free mosaics of multispectral optical satellite imagery (Landsat 5 TM), microwave sensor data (JAXA PALSAR), a canopy height model (CHM) from satellite LiDAR, and auxiliary variables from climate, temperature and precipitation maps, soil maps, and a digital terrain model.

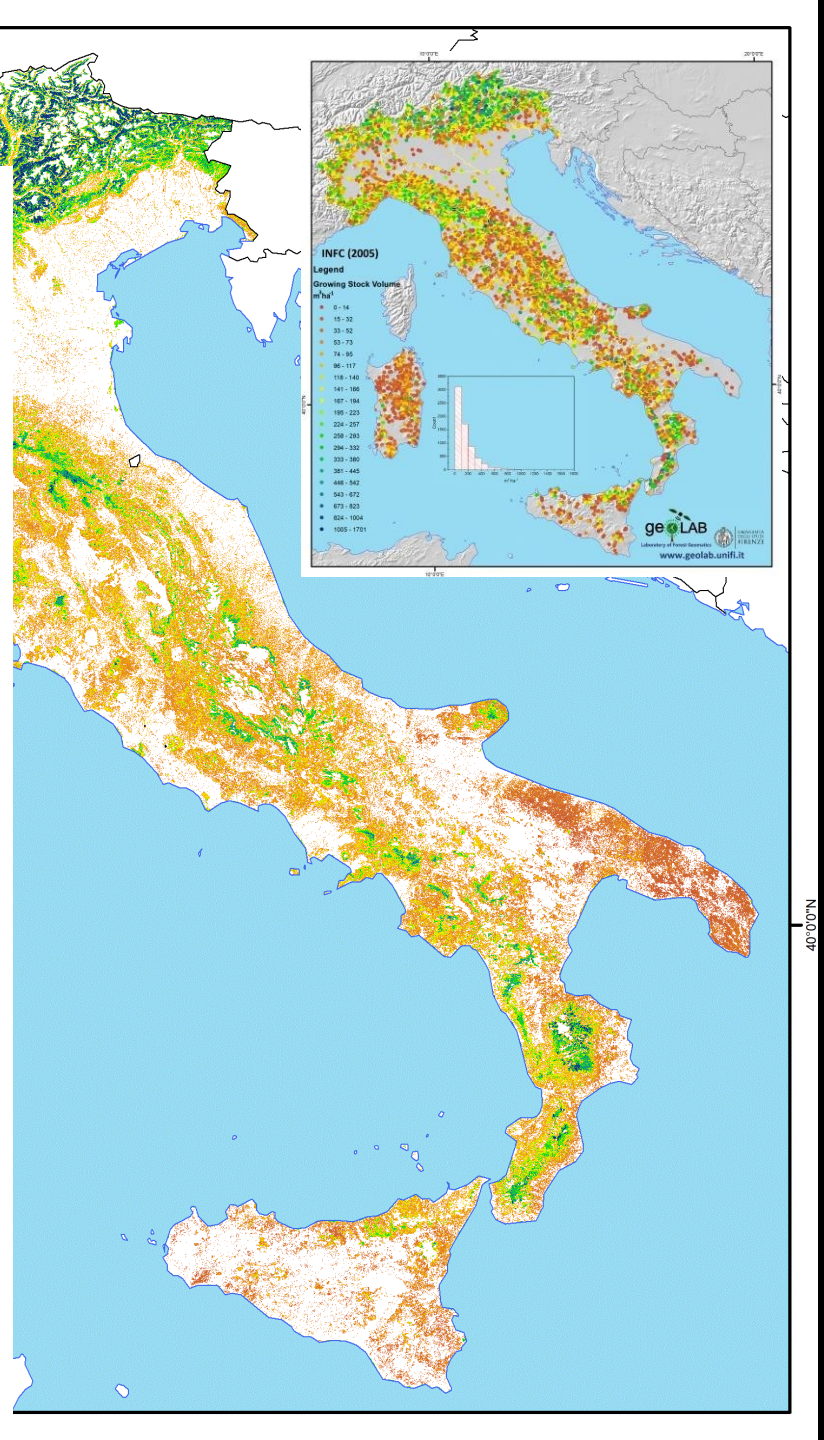
Two non-parametric (random forests and k-NN) and two parametric (multiple linear regression and geographically weighted regression) prediction methods were tested to produce wall-to-wall map of growing stock volume at 23-m resolution. Pixel level predictions were used to produce small-area, province-level model-assisted estimates. The performances of all the methods were compared in terms of percent root mean-square error using a leave-one-out procedure and an independent dataset was used for validation. Results were comparable to those available for other ecological regions using similar predictors, but random forests produced the most accurate results with a pixel level R^2 = 0.69 and $RMSE_{\%}$ = 37.2% against the independent validation dataset. Model-assisted estimates were more precise than the original design-based estimates provided by the NFI.

1. Introduction

Forest data are essential for multiple purposes including international and national forest monitoring programs, reporting and assessing forest resource distribution (e.g. Kyoto protocol) (Corona et al., 2011; FAO, 2010), monitoring biodiversity (Chirici et al., 2012; FOREST EUROPE, 2015), improving restoration programs (FAO and UNCCD, 2015; Smith et al., 2016) and managing at local scales to improve decision-making processes, silvicultural measures, harvesting and conservation activities.

Usually, in the context of international and national programs, this type of data is collected using sample-based National Forest Inventories (NFIs) that are designed to provide aggregated estimates of forest parameters such as forest area, growing stock volume, biomass, increments at national and regional levels (Brosofske et al., 2014; Kangas et al., 2018). These aggregated statistics are essential to support decision-making processes and to develop strategies over large areas only, because they just provide limited explicit geographic spatial detail, such as large sub-national regions. In these traditional NFIs, remote sensing is used for purposes such as initial stratification of sampling units

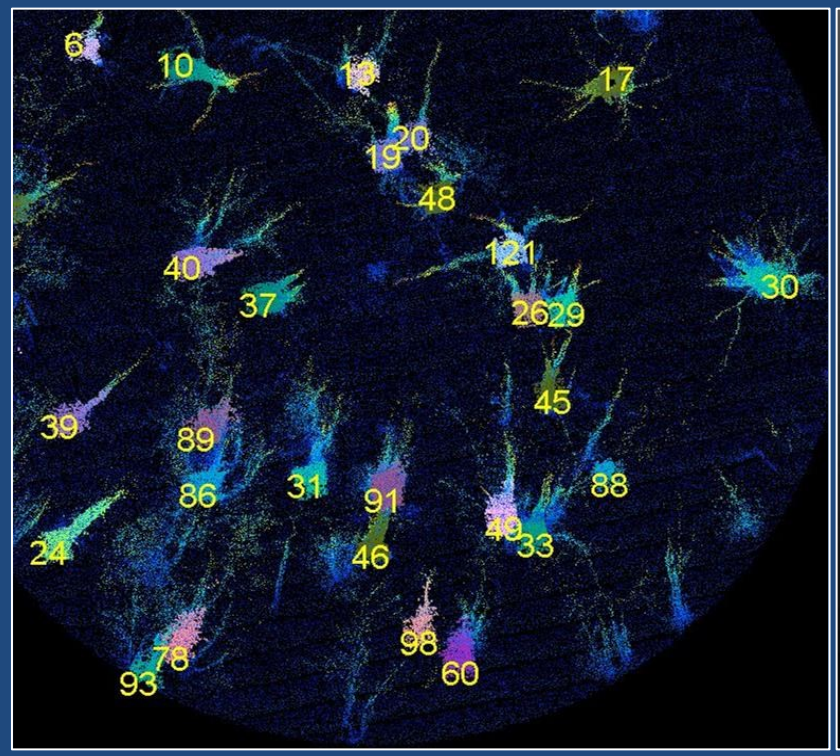
https://doi.org/10.1016/j.jag.2019.101959
Received 17 May 2019; Received in revised form 8 August 2019; Accepted 2 September 2019
Available online 03 October 2019

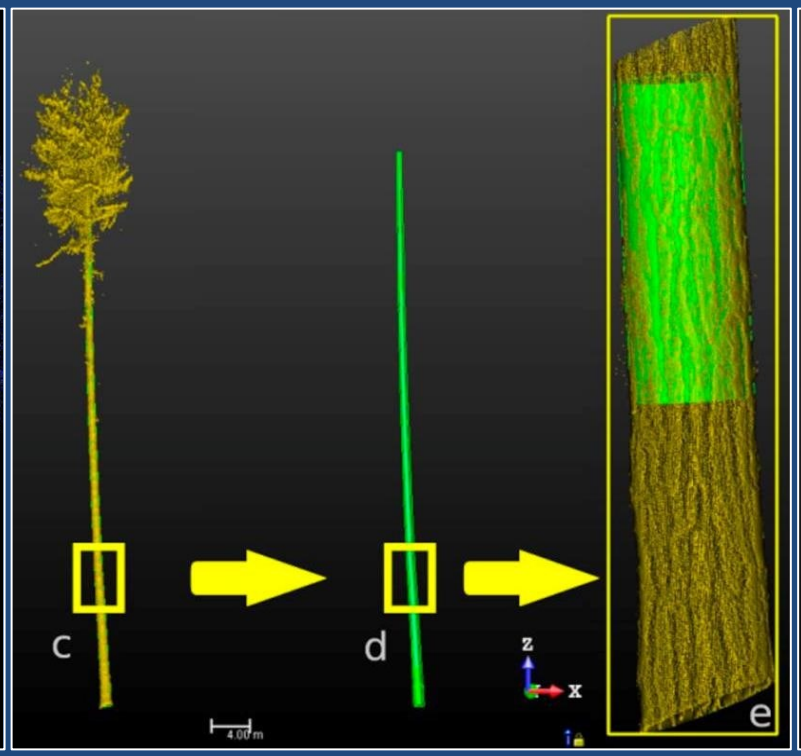


TLS per il settore forestale

dendrometria
pianificazione forestale
inventari forestali

- parametri dimensionali (D_{130} e altezza)
- funzioni di profilo e tavole di cubatura
- assortimentazione legnosa e *stem quality check*





Number of satellites	Purpose
3135	Communications
1030	Earth Observation
385	Technology development/demonstration
154	Navigation/positioning
22	Earth science
18	Other purposes

EU budget: A €16 billion Space Programme to boost EU space leadership beyond 2020

Space sector employs over **231.000** people

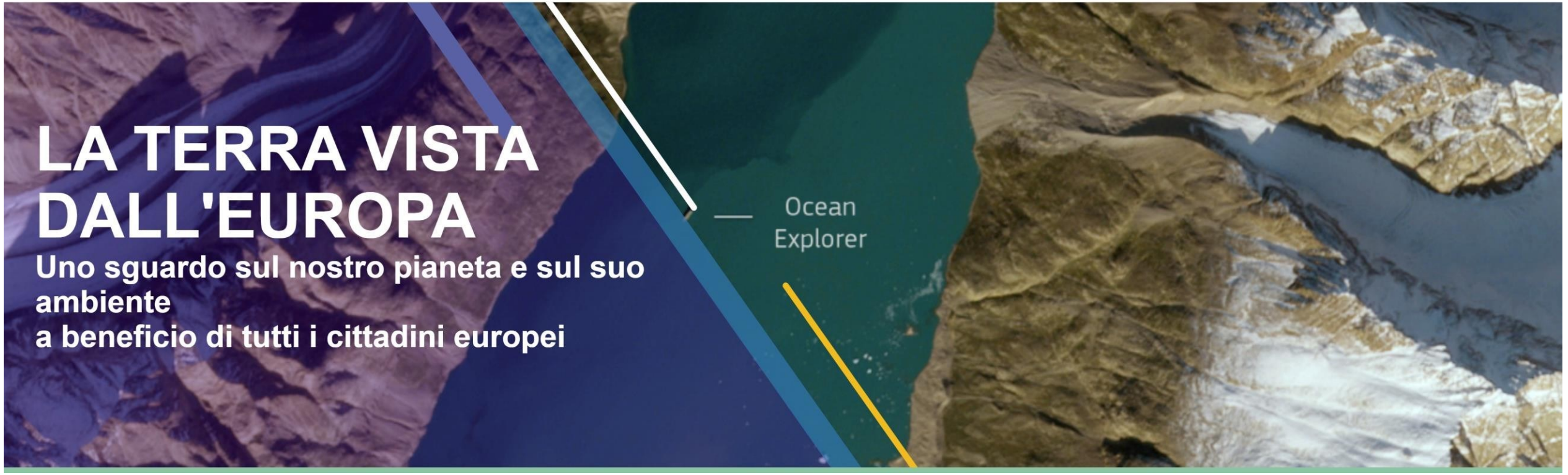
Its value is estimated at **€ 53-62** billion in 2017, 2nd largest in the world

A third of the world's satellites are made in Europe.

Sector keeps upgrading family of European launchers with next generation **Ariane 6** and **Vega C**

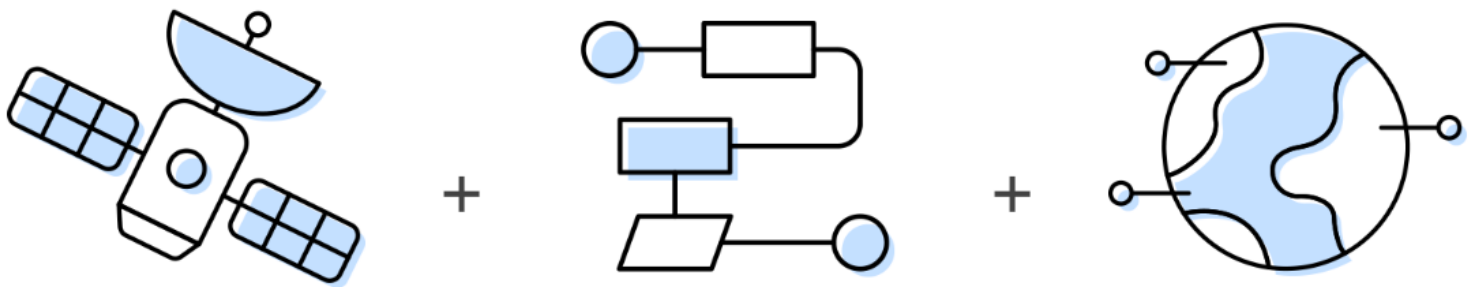
PROGRAMME OF THE EUROPEAN UNION

Info su Copernicus | Servizi | Opportunità | Accesso ai dati | Library | Casi d'uso



Meet Earth Engine

Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities. Scientists, researchers, and developers use Earth Engine to detect changes, map trends, and quantify differences on the Earth's surface. Earth Engine is now available for commercial use, and remains free for academic and research use.



Satellite Imagery + Your Algorithms + Real World Applications

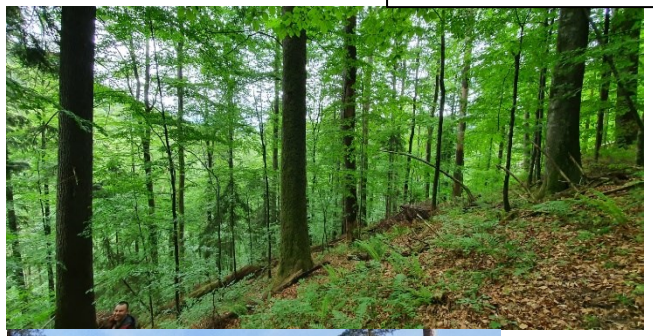
CARABINIERI

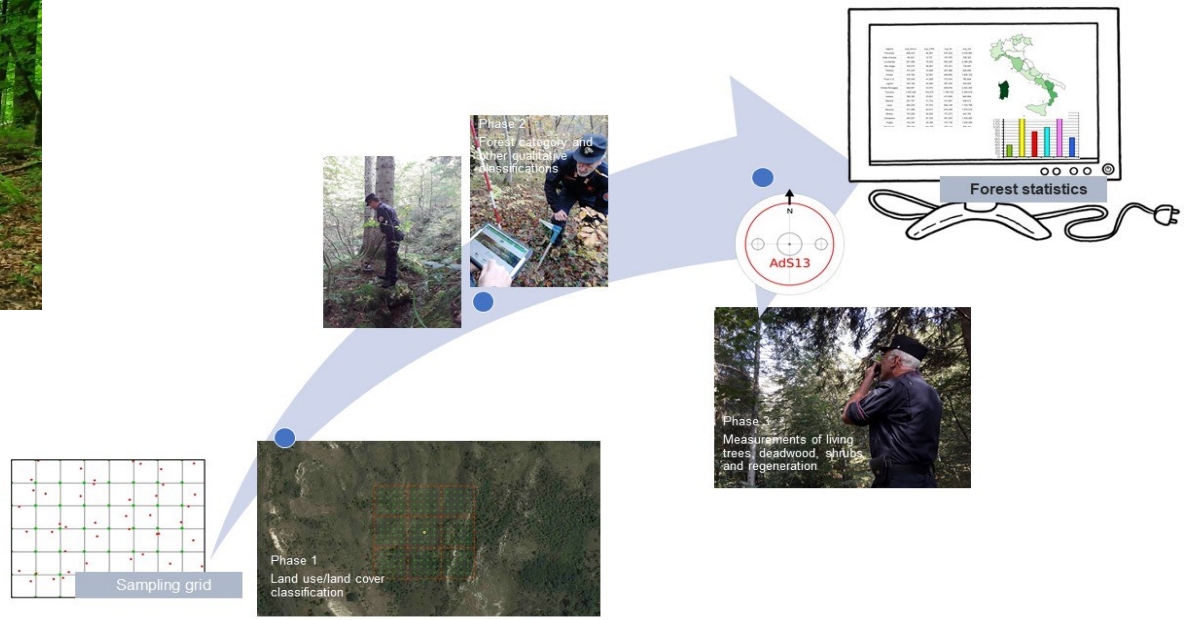
crea
Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

ACCADEMIA ITALIANA DI SCIENZE FORESTALI
FIRENZE

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

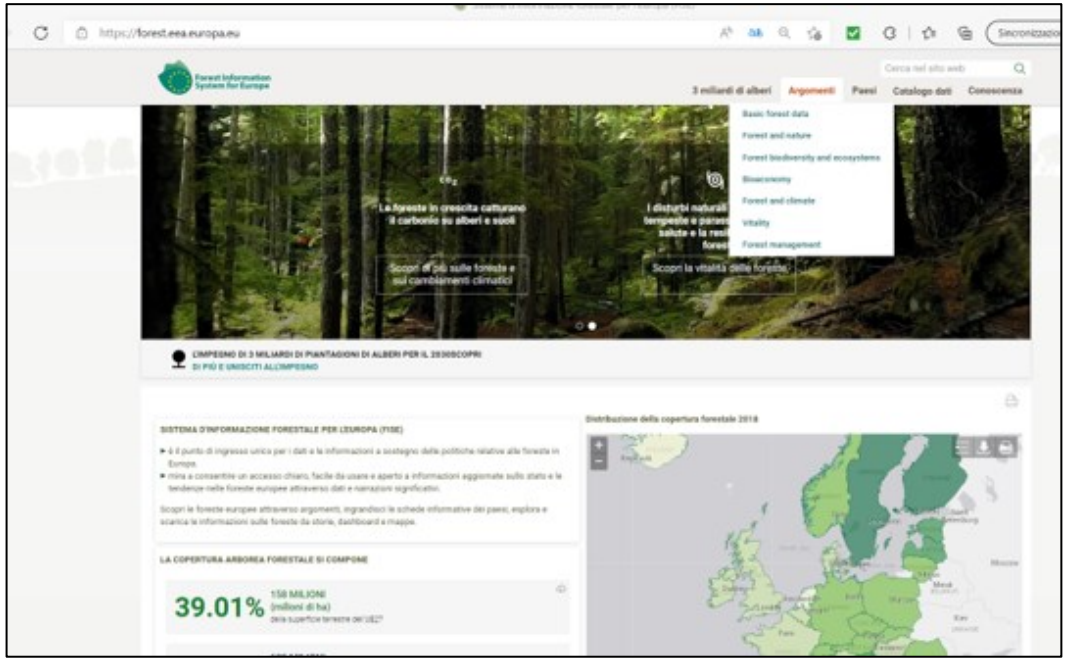
Inventario Forestale Nazionale





SINFOR: Sistema Informativo Nazionale Forestale

- è il **punto di ingresso unico per i dati e le informazioni** a sostegno delle politiche relative alle foreste e al settore forestale in Europa.
- mira a consentire un **accesso chiaro, facile da usare e aperto** a informazioni aggiornate sullo stato e le tendenze nelle foreste e nel settore forestale europeo attraverso dati e informazioni significative.



- **Basic forest data**
- **Forest and nature**
- **Forest biodiversity and ecosystems**
- **Bioeconomy**
- **Forest and climate**
- **Vitality**
- **Forest management**

MINISTERO DELL'AGRICOLTURA DELLA SOVRANITÀ ALIMENTARE E DELLE FORESTE

DOTTORATO DI RICERCA NAZIONALE IN OSSERVAZIONE DELLA TERRA

SAPIENZA
UNIVERSITÀ DI ROMA

Mattia Crespi
mattia.crespi@uniroma1.it
phd-dnot@uniroma1.it

UniBAS	UniPV	ASI
UniBO	UnivPM	CREA
UniBZ	UniROMA2	ISMEA
UniCA	UniROMA3	ISPRA
UniFI	UniTO	DPC
UniGE	PoliTO	OGS
UniMORE	IUAV	Fondazione CIMA
UniNA	IUSS-PV	Agricolus srl
UniCampania		Planetek srl
UniPD		Teamdev srl

RETERURALE NAZIONALE 20142020

MINISTERO DELL'AGRICOLTURA DELLA SOVRANITÀ ALIMENTARE E DELLE FORESTE

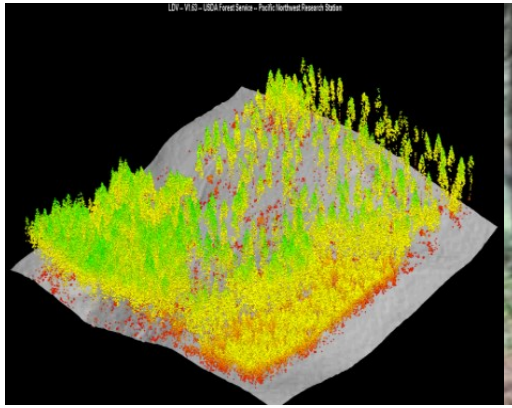
UNIONE EUROPEA

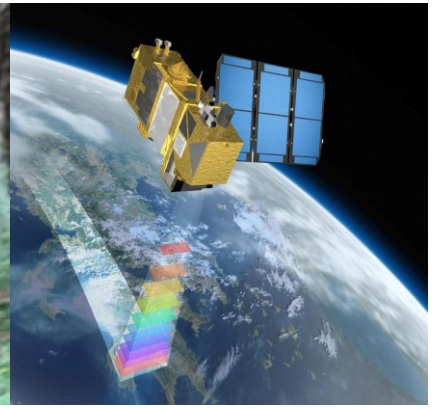
crea Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

ACCADEMIA ITALIANA DI SCIENZE FORESTALI FIRENZE

SAPIENZA UNIVERSITÀ DI ROMA

piermaria.corona@crea.gov.it





Copernicus Framework Partnership Agreement for Copernicus User Uptake