Associazione Italiana di Cartografia | Italian Association of Cartograhy

Cartography in Italy 2019-2022

National Report for the 19th General Assembly of ICA 2023 in Cape Town, South Africa

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Table of contents

Part One.
The Production of the Official State Cartographic Agencies

Italian Geographic Military Institute – Istituto Geografico Militare

General

The origins of the Italian Geographic Military Institute (IGM) can be traced to the cartographic agencies of the states that preceded the unification of Italy. The Institute's history began in 1861, at the time of Italian unification, under the name of Technical Office of the Army General Staff, located in Turin. When Florence became the capital in 1865, the office was transferred there, later becoming the Military Topographical Institute. In 1882, it acquired its current name of Military Geographic Institute. Today the Institute is under the aegis of the Capital Military Command in Rome. Its purpose is to meet the country's military and civil needs in the field of geomatics. Since 1 October 2014, it has carried out the functions of the disbanded Army Military Command of the Region of Tuscany. In particular, the Institute is a State cartographic agency. As per Law no. 68 of 2 February 1960, it constitutes an operative, technical, scientific, productive, educational, cultural, archival and commercial pole in the field of geospatial information, as understood in all its components:

- Geodesy
- Tele-surveying
- Photogrammetry
- Cartography
- Geographical information systems

Operative Pole

The Institute has the mission of providing geospatial support for the State's civil and military needs. In particular, with regard to geospatial support that it must guarantee to the Armed Forces, it performs the following tasks:

- Geospatial support to forces on assignment (and/or conducting manoeuvres) by means of the deployment of Geographical Tactical Print (GTP) units;
- Deployment of units to provide geospatial support to forces on high alert;
- Organization, maintenance and management of materials relative to geospatial information, data and products, in both traditional and digital formats;
- Creation of geospatial databases and production of cartography on different scales for international areas of military interest;
- Support to agencies, commands and units of the Armed Forces and Defence Administration for training and operational needs on the national territory;
- Participation in projects of NATO, the United Nations and the European Union regarding collaboration and standardization, and in national and international technical meetings in the geospatial field;
- Archiving and distributing foreign cartography;
- Management of archives for NATO standardization documentation of interest;
- Updating, publication and verification of the availability and obtainability of geospatial information in areas of particular interest, as defined by the Armed Forces and the High Command, by means of the production of catalogues.

Technical, Scientific and Productive Pole

The Geographical Information Department is responsible for performing the following tasks:

- Creating, updating, managing and maintaining national geodetic networks through land surveying and measurement processing;
- Maintaining, measuring and materialising national borders by means of periodic on-site geo-topographical operations, in respect of current international bilateral agreements, and participating in activities of cross-border commissions and groups of experts created on the basis of bilateral agreements with bordering countries;

- Carrying out measures pertaining to geophysics and geodetic astronomy necessary for the scientific verification of geodetic activities, including collaboration with universities and research institutes;
- Preserving and managing geodetic archives, databases and the geodetic portal;
- Geophysical measurements: magnetic, gravimetric, and those regarding geodetic astronomy;
- Providing necessary geospatial support to the Ministry of Defence, the Armed Forces, and the Public Administration by carrying out annual missions aimed at performing geodetic operations on the national territory;
- Developing and maintaining transformation parameters among the various systems about the country;
- Creating, certifying, producing, and performing quality control of databases and cartography for international areas of military interest;
- Acquiring, deriving, and integrating data for the constitution, updating and management of geographical databases;
- Producing and performing quality control of special thematic cartography databases regarding national areas;
- Contributing to the provision and certification of geospatial data for systems of command, control, and simulation;
- Producing, updating, and sunsetting basic official cartography of the State (on medium- and small-scale – 1:50,000, 1:250,000, and 1:1,000.000 – and on other cartographic scales derived from these), in agreement and collaboration with other Public Administration agencies when necessary;
- Promoting and coordinating basic cartographic production on the part of regional and local agencies and creating, updating, and integrating the databases of all public agencies operating in the geo-topographical field;
- Periodically realizing aero-photogrammetric imaging of the national territory, in agreement and in collaboration with other Public Administration agencies when necessary;
- Study, research, experimentation, and scientific information, in collaboration with national universities, other national informational services and national and international scientific bodies; coordinating and finalizing scientific research of specific interest within the field.

Educational Pole

The Institute is involved in disseminating its knowledge of geography and other fields, through initiatives to:

- Offer training, qualification and refresher courses to military and civil personnel of the Ministry of Defence and the Public Administration with specific instruction in the geospatial field;
- Collaborate with national universities, other national informational services and national scientific bodies to carry out specialized educational activities.

Archival and Cultural Pole

The Institute is active in these fields through:

- The Historical Museum of Italian Cartography, which includes the Attilio Mori Library and the Museum of Instruments;
- Cartographic, photogrammetric, and geodetic archives;
- Publication of the journal *L'Universo* and of volumes of a technical, cultural, normative, and historical-cartographic nature.

Commercial Pole

The Institute's commercial pole organizes the sale of all its institutional, historical, and current products through its website, the chain of authorized vendors, and its own shop near the Fortezza da Basso in Florence. Sales and exchanges of its goods and services contribute to financing the Institute; these derive from:

- The diffusion and marketing of cartographic, photogrammetric, geodetic and similar products, for which the Institute makes use of public commerce channels as well as its online shop to guarantee a wide distribution;
- Execution of contracted services for public agencies or private companies when related to activities of public interest or of particular scientific relevance, within the limits of the availability of personnel in light of the priority of institutional obligations;
- Upon request, consulting services to agencies of the Public Administration and other public and private entities;
- Control, calibration and compliance verification of geodetic instrumentation for third parties;
- Realization of high-precision measurements for the stability control of historic buildings of particular importance and for monitoring crustal or surface movement in situations of national importance or environmental risk.

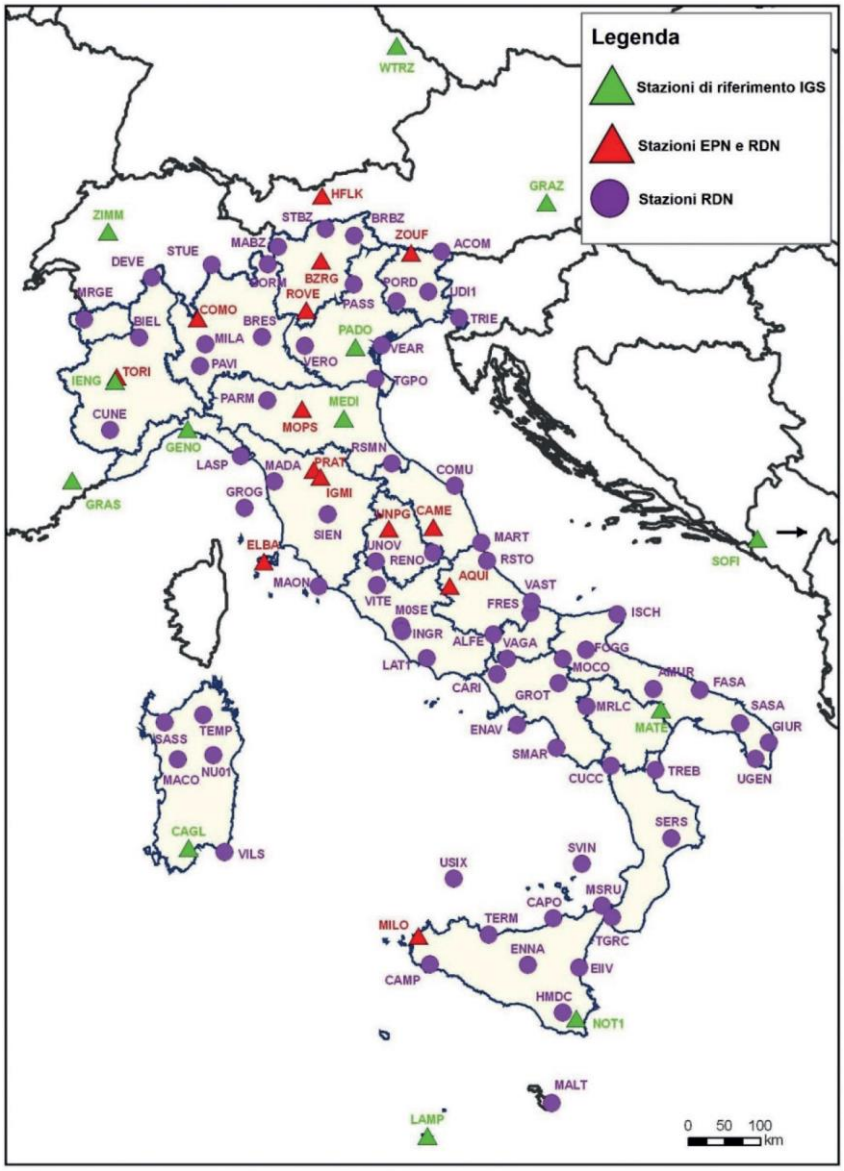

Figure 1 - Distribution diagram of the permanent stations which form part of the National Dynamic Network, with identification of IGS reference stations, EPN and RDN stations, and RDN stations

Figure 2 - Physical and political map of Italy, scale 1:1,250,000

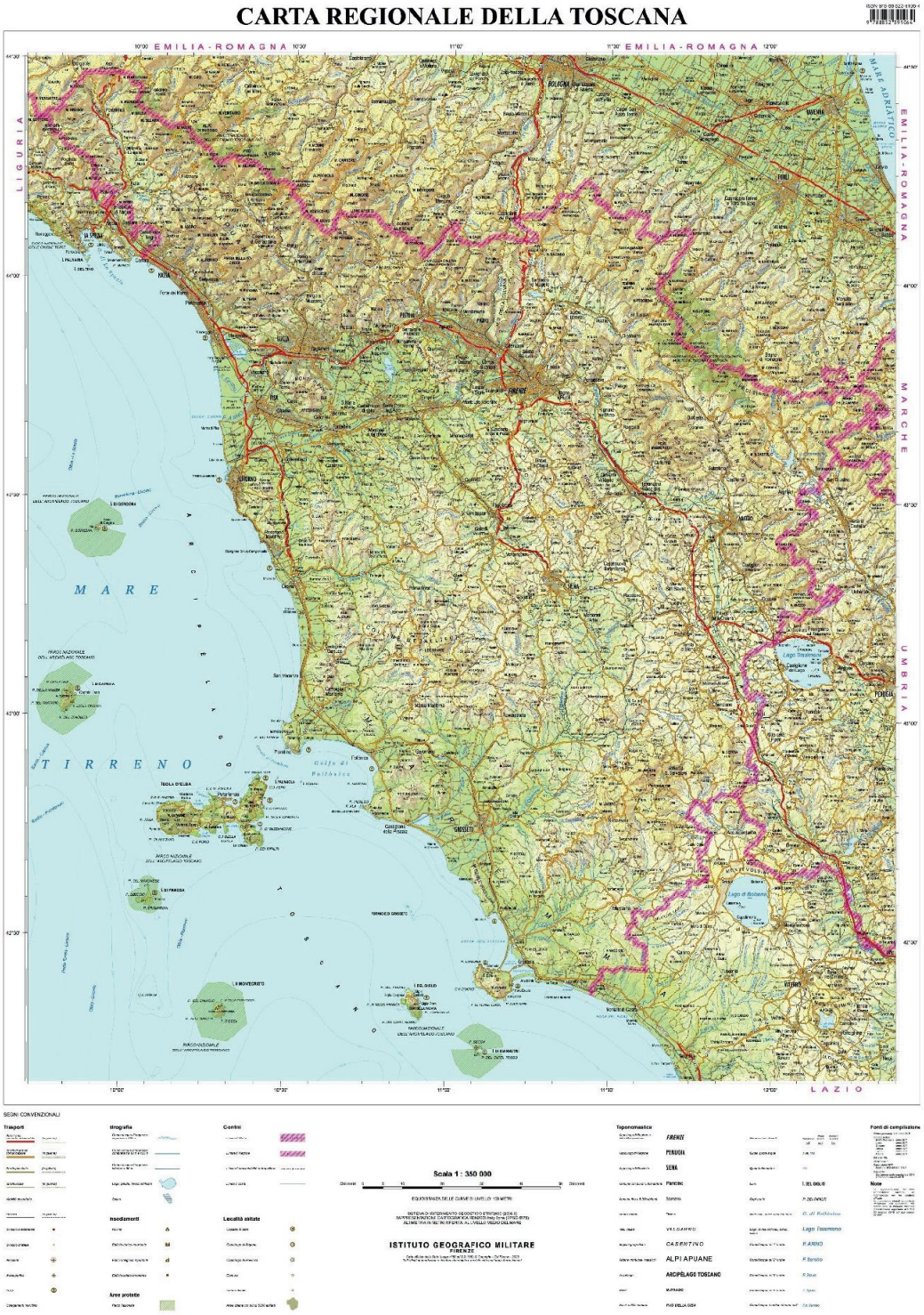

Figure 3 - Physical and political map of the Region of Tuscany, scale 1:350,000

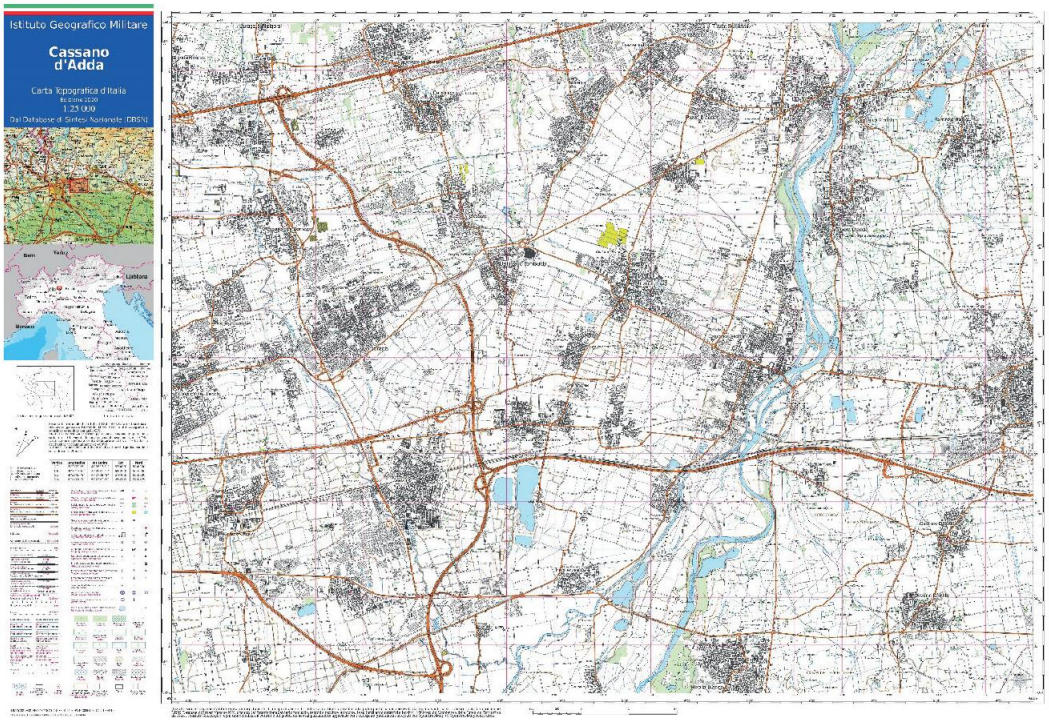

Figure 4 - Topographical map of Italy, scale 1:25,000, from the National Summary Database (DBSN) - Cassano d'Adda.

Figure 5 - Topographic map of Italy, detail of sheet of Alessandria

Italian Hydrographic Institute – Istituto Idrografico della Marina

General

Established in Genoa in 1872, the Institute is a State cartographic agency which contributes to the safety of military, mercantile and recreational navigation. Responsible for mapping over 7,800 km of coastline and 550,00 km^2 of sea, it guarantees the production and updating of official nautical documentation: 370 traditional nautical charts, 264 electronic charts, 13 nautical chart kits for recreational boating, 8 pilot books for Italian seas, lists of lights and port lighting, navigation radio services, tide charts, nautical ephemerides and many other publications.

The Institute is headquartered in Genoa, in the historic Forte San Giorgio, where roughly 220 military and civil employees operate. To conduct research necessary for producing and updating the charts and publications, the Institute makes use of three hydro-oceanographic ships – the Magnaghi, the Galatea and the Aretusa – and two manned NATO research ships – the Leonardo and the Alliance – sailing under the flag of the Italian Navy. The ships are equipped with state-of-the-art instrumentation, such as single- and multi-beam echo sounders to collect bathymetric data and map the seabed, side-scan sonar, and remote-operated vehicles to identify submerged obstacles. Aerial telesurveying systems are also employed by means of air-transported laser systems and drones, which allow for the simultaneous mapping of the sea and the coast. The Institute collaborates with various Italian universities to offer several training programmes, including a level-2 Master's degree in Hydrography and Oceanography in collaboration with the University di Genoa, which is recognized by the International Board for Standard of Competence of the FIGICA- IHO and required for becoming a category 'A' hydrographic surveyor. It further offers a specialization course in category 'B' hydrography, which is held at the Institute.

The Naval Hydrographic Institute represents Italy in the International Hydrographic Organization (IHO). It takes part in numerous international work groups and cooperates in developing the hydrographic capabilities of many countries, both in the Mediterranean area and in other regions of the world. Since 2017, the Institute has coordinated High North, the long-standing research programme in the Arctic, in collaboration with important national and international research agencies. In this context, it collects geophysical marine data from the atmosphere, water masses, the seabed, and layers beneath the seabed, which it shares with the international scientific and hydrographic community. The Institute operates in the Antarctic as well, in the context of the National Research Programme in the Antarctic (PNRA). Here it has produced and maintains three nautical charts for the area of Terra Nova Bay, where the Italian base is located.

To meet the needs of recreational boating, which has grown tremendously over the last few years (there are in fact nearly 600,000 registered boats in Italy today), the Institute has recently launched the Magnaghi project, which in the spirit of its founder retraces the routes that the first director of the Institute traveled to map the Italian seas a century and a half ago. As a result, the new line of high-density electronic cartography will take its place alongside the Institute's regular production, which is normally created for the use of mercantile ships.

Traditional nautical charts (240)

Traditional nautical charts are large, paper documents produced in accordance with the requirements of SOLAS norm 74/78. The term 'full sheet' and its derivatives 'double sheet' and 'half sheet' traditionally indicate the formats of nautical charts, with 'full sheet' referring to the size that could be fit into the drawers of the chart table on ships without needing to fold the chart; a 'full sheet' indeed covered the entire surface of the chart table.

Based on definitions adopted on an international level, nautical charts published by the Institute are differentiated as new charts, new editions, new technical editions, reprints, and circulations. Nautical charts are commonly subdivided according to their scales. Scale varies according to the purpose of the chart, the characteristics of the represented area and the quantity of information that must be reproduced. Navigators should always use nautical charts in accordance with their aims: for example, they will use larger-scale charts for navigating coastlines and approaching ports.

Some charts produced by the Institute are distributed abroad and may be reproduced by other hydrographic institutes. Such charts are identified by the letters INT followed by their national numbers. The INT prefix indicates that the chart forms part of a worldwide protocol adopted internationally by countries which participate in the IHO.

Electronic Navigational Charts (262)

Electronic Navigational Charts (ENCs) are the equivalent digital versions of official traditional charts. ENCs make up a digital database whose content, structure and format are standardised and interactive. For ENCs to attain legal recognition and be used in place of traditional nautical charts, an Electronic Chart Display and Information System (ECDIS) must be present on board ships and boats, as required by SOLAS norm 74/78. When viewed on an ECDIS, the electronic chart much resembles a traditional one, although it contains all information relative to every single element and allows navigators to view the descriptive and spatial characteristics of the represented objects. In addition to information strictly necessary for safe navigation, which traditional nautical charts also contain, ENCs allow navigators to access information that is normally available in other nautical publications, such as pilot books, lists of lights and fog signals, and navigation radio services.

The extension of ENCs does not always correspond to that of corresponding traditional paper charts, in that data overlapping occurs only between ENCs with different navigational aims. In addition, the scales of ENCs may vary with respect to corresponding paper charts.

Nautical Chart Kits (277)

Nautical Chart Kits (CNIKs) are nautical charts used only on board smaller boats, such as those used for recreational purposes. Their multi-colour design allows for easy consultation on the part of recreational boaters. They are usually printed two-sided on special nautical paper resistant to atmospheric elements and water, in a format that can be readily used on small chart tables. These nautical charts are sold in kits covering certain specific areas. Each kit includes a different number of charts, depending on the section of represented coastline. The various kits and the geographic extension covered are viewable in map form in the dedicated section of the General Catalogue of Charts and Nautical Publications. The numbering of the Nautical Chart Kits begins with the number 7000 and follows a geographical sequence.

Nautical publications

Official nautical publications are documents that contain information pertaining to the security of maritime navigation which because of its nature (descriptive, presented in tabular form, etc.) cannot be shown on nautical charts. These publications should be used in conjunction with navigational charts. All official nautical publications are produced and provided to navigators in two formats, traditional paper or electronic. Official nautical publications include:

- General Catalogue of Charts and Nautical Publications
- Pilot books
- Navigation radio services
- Nautical ephemerides
- Tide charts
- Nautical tables
- Safety information booklets for navigators

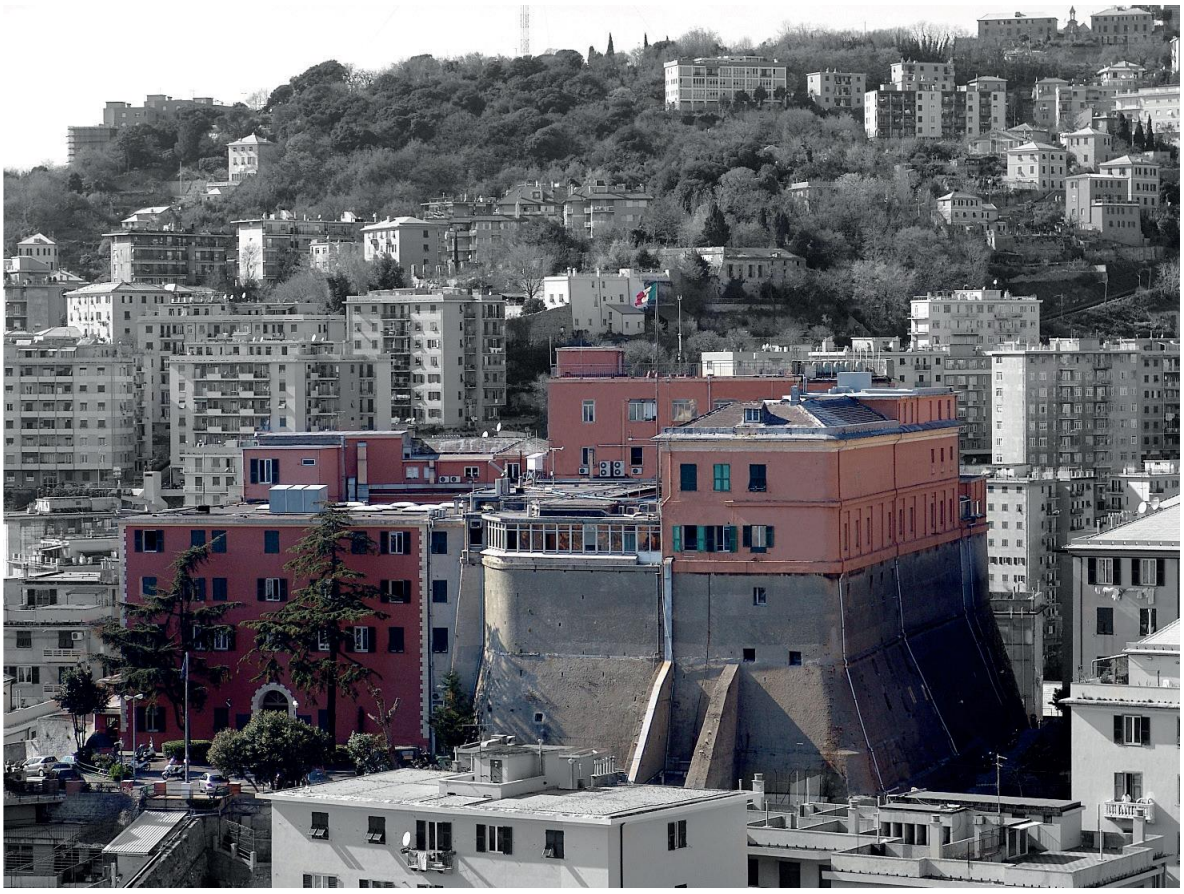

Figure 1 - Italian Hydrographic Institute, Genoa, Passo dell'osservatorio, 4

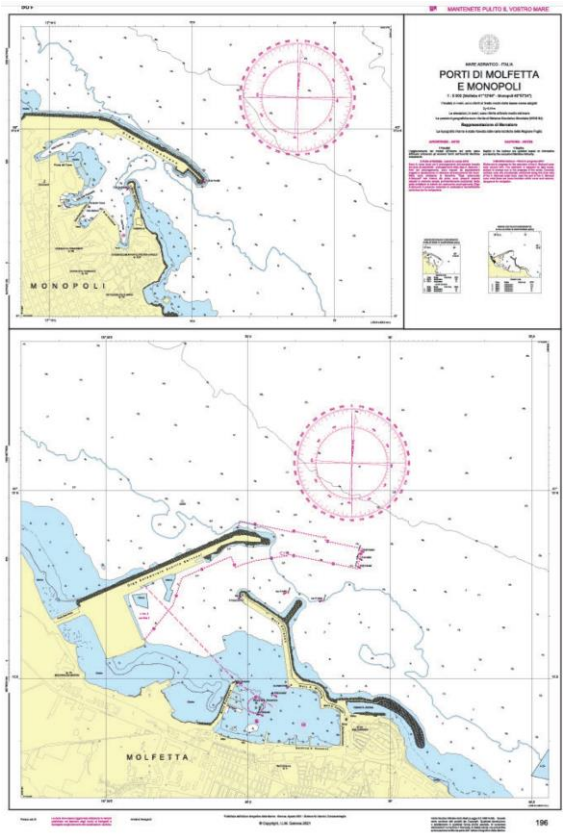

Figure 2 - Ports of Molfetta and Monopoli

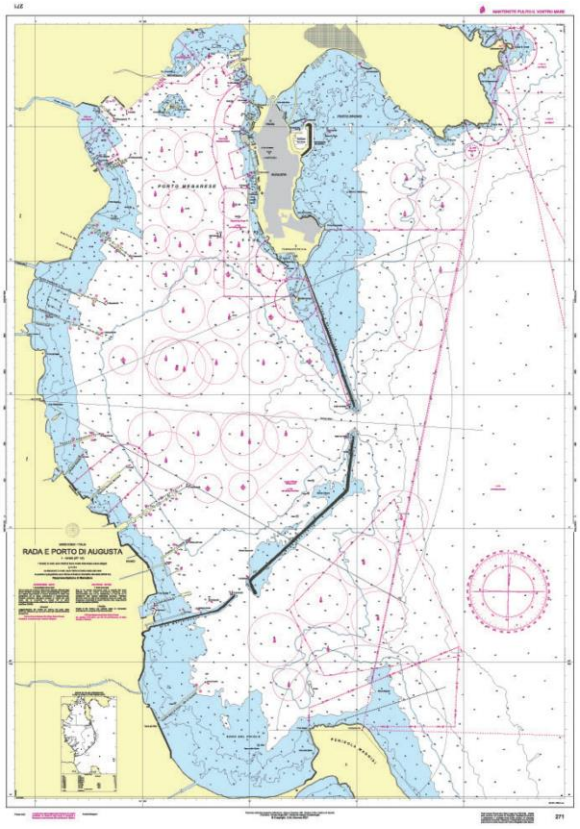

Figure 3 - Rada and Port of Augusta

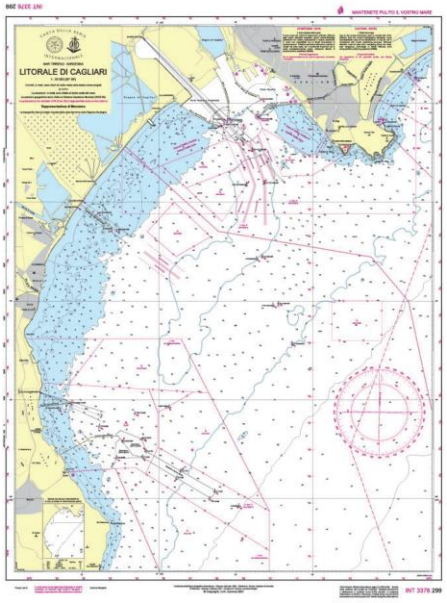

Figure 4 - Coast of Cagliari

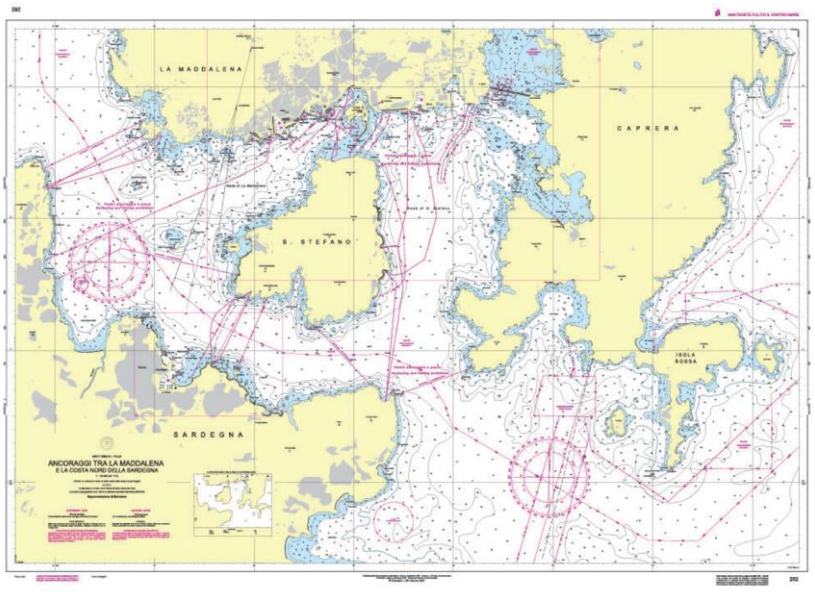

Figure 5 - Anchorages between La Maddalena and the north coast of Sardinia

The Centre for Aeronautic Geo-topographic Information – CIGA

History

Since the beginning of flight, operators have required a cartography suitable for the use of aeroplanes; as a result, the first maps were produced to meet this need. As early as 1923, a 1:250,000-scale aeronautical map was published in Italy, which was certainly among the first of its kind in the world.

However, it was not until 1941 that aeronautical cartography truly came into being, with the creation of the Photo-cartographic Agency of the 4th Division of the High Command of the Italian Air Force. This office was established by Royal Decree no. 437 of 29 March 1943 and was recognised as an official State Cartographic Agency by law no. 68 of 2 February 1960. It was responsible for carrying out tasks in the field of photo-cartography and for producing and updating aeronautical maps. Following the introduction of ever more sophisticated weapons systems, such as the Tornado aircraft, requests for data and products increased, such that the Armed Forces was spurred to create an agency that could specifically devote its efforts to aeronautical cartographic production. The Centre for Aeronautical Geo-topographic Information (CIGA) was thus established on 15 February 1976, on a trial basis. This office was first located in the Palazzo A.M., the headquarters of the Italian Air Force, and was placed under the direct supervision of the 4th Division of the Air Force High Command. The following year (1977), the Centre was temporarily relocated to the Pratica di Mare Air Base, where it was housed in several rooms of an old building of the airport, known as the, or small fort, for its shape. Here were established two laboratories for photo-interpretation as well as three units for managing aeronautical information, compiling cartography, and arranging the printing of matrices. In parallel to the Pratica di Mare agency, a second unit, called the Geo-topographic Information Sub-office (SDIGA), began operating at the historic location of the Italian Geographic Military Institute in Florence, such that communication and coordination with that Institute could be guaranteed.

During those first years, the foundations for the Centre's future development were laid. For example, an important programme was begun to develop the Air Force's aerial photography capabilities with the purchase of new aeroplanes (P166 DL3 - APH), which were assigned to the 303rd Autonomous Flight Group of Guidonia, today the 71st Flight Group of the 14th Squadron of Pratica di Mare. Developing this programme was of great importance for CIGA, as it guaranteed the supply of a significant quantity of geo-topographic data (in this case aerial photos) necessary for the advancement of the international programme Digital Land Mass System (DLMS). This initiative involved the cartographic agencies of ten NATO countries (with CIGA representing Italy) in the creation of a database for radar simulation and prediction, which are necessary for developing aircraft such as the Tornado. One of the needs that immediately became evident in the Air Force's new cartographic context was a suitable physical location. For this reason, on 14 October 1980 construction work was officially begun on the new headquarters at the Pratica di Mare Air Base, in the presence of Deputy Chief Ferri of the Air Force High Command. Nearly four years later, on 30 August 1984, the new headquarters was inaugurated and the connection between the new Centre and the staff of the Florence sub-office was reconfirmed.

In later years, the Centre acquired other operational capabilities. In particular, in the wake of the reorganization of the Armed Forces in 2006, which saw the closing of the Air Space Brigade, CIGA became responsible for the Air Space Service and Flight Procedures (SSAP) as well as the Aeronautical Information Service (SIA).

The pressing needs of current operative scenarios require the availability of more timely, relevant, and accurate geospatial information and ISR capabilities. In the context of NATO requirements, geospatial information (GI) has become essential for planning, evaluating, and conducting procedures for operations from the outset, insofar as it provides a quantitative and qualitative description of the environment in which units are called upon to operate. These developments triggered the establishment of the Operative Image Analysis Group (GrAIO) within the Centre in 2012. The group is responsible for operative analysis and procedure management for the Processing, Exploitation, and Dissemination (PED) of images acquired from sensors used by the Armed Forces for the ends of Intelligence, Surveillance, Target Acquisition & Reconnaissance (ISTAR). The Centre's mission is to "ensure support for aerial operations by means of the production, processing, and dissemination of geo-topographic and aeronautical information and of image

data transmitted from recognition, surveillance and target acquisition sensors of the Armed Forces, while simultaneously promoting the technical-scientific and technical-operative development of the field".

Aeronautical cartography

EN-ROUTE (ENR) CHART SERIES, 1:1,350,000 SCALE

TYPE: Chart created by CIGA on a 1:1,350,000 scale on two sheets, Standard ATS Route Network (below FL305) and Free Route Airspace (above FL305); North and South printed back to front.

PURPOSES: Provide flight crews with navigation information along Air Traffic Service (ATS) routes in compliance with air traffic procedures, as required by ICAO standards and recommendations. **CHARACTERISTICS:** Most important coastlines, bodies of water and other waterways are indicated. Airports are represented by conventional symbols. Information is provided relative to FIR/UIR, to FIC/ACC, TMA and CTR sectors, and to regulated, danger and prohibited zones, airways, radio assistance and isogonic lines. The legend lists controlled airspace frequencies, activation times of the regulated zones present on the chart, and waypoint coordinates.

SIZE: 98 cm x 57 cm.

SQUARING: Geographic, based on prime meridian.

DATUM: Ellipsoid and WGS 84 orientation.

PROJECTION: Lambert conformal conic. Standard parallels: 37°20′- 46°40′.

GRID: Geographic.

UPDATING: Every four months.

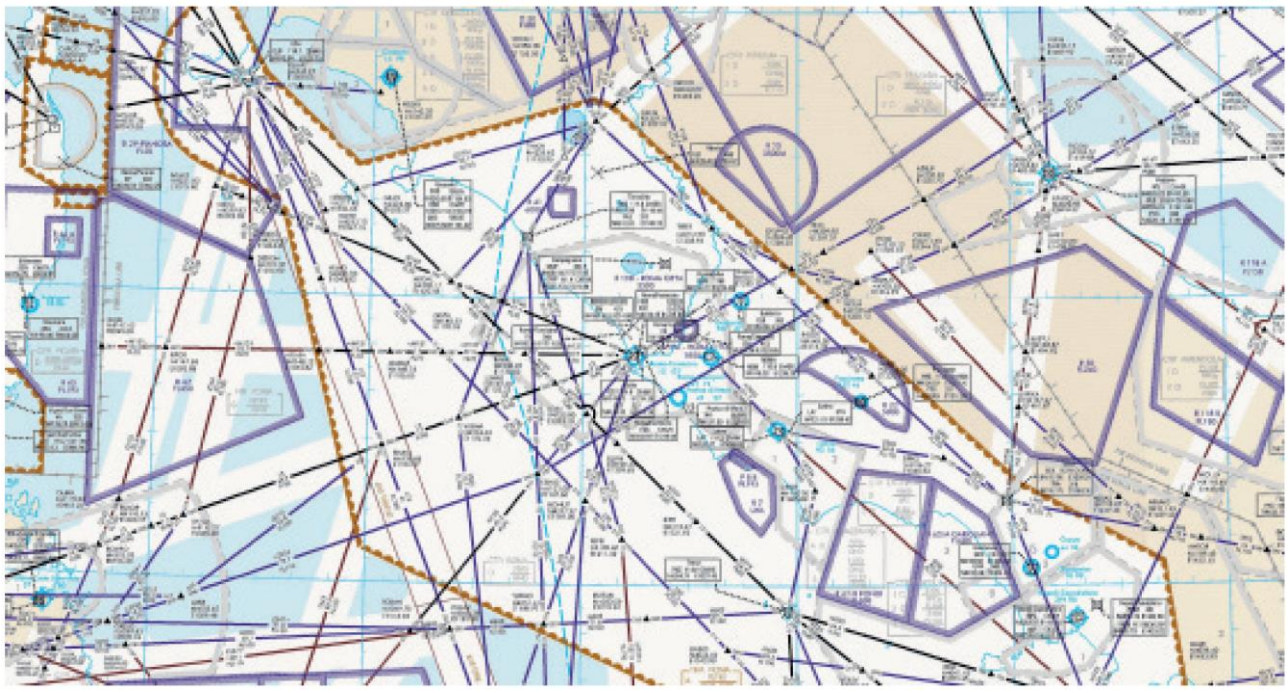

Figure 1 - ENR Series

LOW FLYING CHART ITALY SERIES (LFC-ITA), 1:500,000 SCALE

TYPE: Chart created by CIGA. Made up of seven sheets covering national territory.

PURPOSE: Provide support for air tactical operations at low and very low altitudes.

CHARACTERISTICS: Altimetry and bathymetry expressed in feet with indications of maximum elevation figures of natural or artificial obstacles (MEF). Curved orography, isometric colouring and shading. Shows national boundaries. Significant inhabited areas represented by their perimeters. Road network classified according to importance. Airports indicated by runway diagrams when these are paved and at least 3000 feet in length. Chart shows controlled airspaces and inferior airspaces (FIR, TMA, CTR, ATZ, regulated zones and

airways), radio assistance, VFR navigation information within TMA and BBQ navigation information, vertical and linear obstacles greater than 200 feet (61 metres) in height, main power lines and isogonic lines.

SIZE: 98 cm x 68 cm

SQUARING: Geographic, based on prime meridian.

DATUM: Ellipsoid and WGS 84 orientation.

PROJECTION: Lambert conformal conic; standard parallels: 38° and 46°.

GRID: Geographic and UTM.

UPDATING: Aeronautical Information: yearly.

Figure 2- LFC-ITA Series

OACI-CAI SERIES, AERONAUTICAL CHART OF ITALY-OACI, 1:500,000 SCALE

TYPE: Chart created by CIGA. Made up of ten sheets covering national territory.

PURPOSE: To satisfy Visual Flight Rules, in application of ICAO standards and recommendations.

CHARACTERISTICS: Altimetry expressed in feet. Orography represented by isometric shades. Shows national boundaries. Significant inhabited areas represented by their perimeters. Road network classified according to importance. Airports indicated by conventional symbols. Chart shows controlled airspaces (FIR, TMA, CTR, ATZ, regulated zones and airways), VFR navigation information, radio assistance and vertical obstacles to air navigation greater than 61 metres in height and linear obstacles greater than 45 metres in height, main power lines and isogonic lines.

SIZES: These vary in longitude for each latitude range, per 2°45′ of latitude. No margins on north and east sides of sheets, where printed area extends by circa 2 cm beyond squaring.

SQUARING: Geographic, based on prime meridian.

DATUM: Ellipsoid and WGS 84 orientation.

PROJECTION: Lambert conformal conic.

GRID: Geographic.

UPDATING: Geographical Base: every two years; Aeronautical Information: yearly.

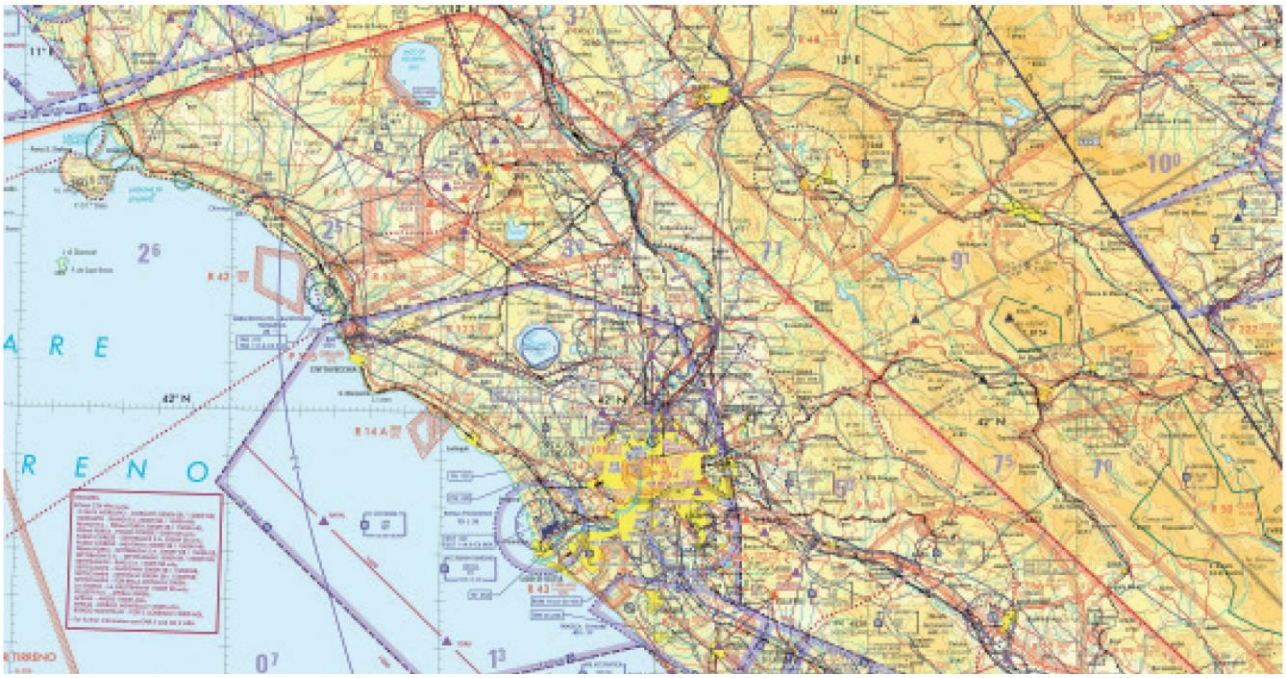

Figure 3 - OACI-CAI SERIES

1501 SERIES – AIR JOINT OPERATIONS GRAPHIC (JOG) – AIR, 1:250,000 SCALE

TYPE: World chart created by various international cartographic agencies. Two versions are produced for the national territory: GROUND by IGMI and AIR by CIGA, each consisting of 39 sheets.

PURPOSE: The 1501 AIR series supports international tactical and joint air force operations. **CHARACTERISTICS:** Altimetry and bathymetry expressed in feet with indications of maximum elevation figures of natural or artificial obstacles (MEF). Curved orography, isometric colouring and shading. Shows national and regional boundaries. Road network classified according to importance and type of roadbed. Airports indicated by runway diagrams. Chart shows radio assistance and vertical obstacles to air navigation greater than 200 feet (61 metres) in height and linear obstacles greater than 148 feet (45 metres) in height, main power lines and isogonic lines.

SIZES: 2° (north of 40°N) or 1°30′ (south of 40°N) in longitude per 1° of latitude. No margins on north and east sides of sheets, where printed area extends by circa 2 cm beyond squaring.

SQUARING: Geographic, based on prime meridian.

DATUM: Ellipsoid and WGS 84 orientation.

PROJECTION: Universal Transverse Mercator (UTM).

GRIDS: UTM geographic and kilometric.

UPDATING: Aeronautical Information: every three years.

Figure 4. 1501 JOG-AIR Series

AIRPORT OBSTACLE CHART. SCALE: 1:15,000 AND VERTICAL 1:5,000 FOR TYPE 'A'; 1:20,000 FOR TYPE 'B'

TYPE: Thematic chart, monochrome, produced according to ICAO international specifications. Planimetric chart (Type 'B') or plano-altimetric (Type 'A') which indicate obstacles in spaces surrounding airports of a represented rectangular area of circa 6 x 9 km.

PURPOSES: The Airport Obstacle Chart provides a training instrument for defining take-off and landing procedures and circling airports using Instrument Flight Rules.

CHARACTERISTICS: Two types are produced: • Type A indicates runway planimetry and relative take-off and landing lanes as well as vertical section of runway axis with vertical obstacles included in planimetry; • Type B shows a planimetric study of the entire airport area, extending circa 9 x 6 km around the point of reference of the airport. Horizontal and vertical accuracy to 0.5 m. Altimetry expressed in metres with indications of maximum elevation figures of obstacles interfering with limiting surfaces (approach surface, ascent surface upon take-off, transition surface, inner horizontal surface, conical surface and outer horizontal surface). Obstacles divided into three categories: buildings, trees and vertical elements (trellises, chimneys, bell towers, etc.). Airport Obstacle Charts show significant radio aids both within and outside airport structures. Curved orography, indication of hydrographic elements. Significant inhabited areas represented by their names and perimeters. Indication of road network classified according to size, representation of rail network and power lines near airports. In addition, data are shown relative to the north magnetic pole, magnetic variation and annual magnetic variation. On Type 'A' chart, distances of runways considered fundamental are also given.

SIZES: 'B' Obstacle Charts do not have definite sizes; nonetheless, they generally represent an area of maximum 10' in longitude and 10' in latitude.

SQUARING: Geographic, based on prime meridian.

DATUM: Ellipsoid and WGS 84 orientation.

PROJECTION: Universal Transverse Mercator (UTM).

GRID: Geographic.

UPDATING: Periodically, according to need. Visual Approach Chart (VAC), 1:250,000 scale

TYPE: Aeronautical chart on 1:250,000 scale, as required by ICAO norms for all military airports used for civil air traffic.

PURPOSE: Provides flight crews with information that allows for passing from navigation phase to runway approach phase when landing is intended with VFR.

CHARACTERISTICS: For the area around the destination airport, chart indicates main orographic and artificial elements, aeronautical information necessary for Visual Flight Rules, flight obstacles and power lines. Altimetry expressed in feet.

SIZE: 98 cm x 68 cm

SQUARING: Geographic, based on prime meridian.

DATUM: Ellipsoid and WGS 84 orientation.

PROJECTION: Lambert conformal conic; standard parallels: 38° and 46°.

GRID: Geographic and UTM.

UPDATING: When necessary, based on AIRAC cycles.

Central Direction for Cadastral and Cartographic Services and Real Estate Information of the Ministry of Finance[1]

Background information

The Italian Cadastre, an inventory of the real property present throughout the national territory, was implemented through the subsequent establishment of two distinct subsystems: the first – called Catasto Terreni (Land Cadastre) – comprising the list of all rural properties and unbuilt land plots, the second – called Catasto Edilizio Urbano (Urban Building Cadastre) – including buildings for civil, industrial and commercial use.

The "establishment" of the Land Cadastre, provided by Law n. 3682 of 1 March 1886, was completed in 1956. The regulation for the "maintenance" of the Land Cadastre was approved with Royal Decree n. 2153 of 8 December 1938.

The Land Cadastre is geometrically configured in parcels, as it includes information on both the geometric nature (topography – shape and consistency) and on the technical and economic features (technical-physical characteristics and incomes) of the minimum inventory item represented on the map, the "cadastral parcel".

The "establishment" of the Urban Building Cadastre, which followed the Land Cadastre, was provided by Law n. 1249 of 11 August 1939, approving the Royal Decree-Law n. 652 of 13 April 1939, subsequently amended by Legislative Decree n. 514 of 8 April 1948. The relative implementing regulation was later approved with Presidential Decree n. 1142 of 1 December 1949. The Urban Building Cadastre went into the "maintenance" phase on the 1st of January 1962 with homogeneous regulations throughout the Italian State[2].

The Catasto dei Fabbricati (Cadastre of Buildings), established by Decree-Law n. 557 of 30 December 1993, passed with amendments into Law n. 133 of 26 February 1994, is an evolution of the Urban Building Cadastre; it concerns all the buildings, both urban and rural. Nowadays, the Cadastre of Buildings doesn't still replace the Urban Building Cadastre, but completes it and extends its scope. The founding objectives of the cadastre are to survey and register real properties, track their changes, and prepare the ground for fair taxation. The management of cadastral databases and the provision of related services were entrusted to Agenzia del Territorio, established by Legislative Decree n. 300 of 30 July 1999, which reformed the Finance Administration, transferring to the new Agency the duties previously charged to Dipartimento del Territorio of the Ministry of Finance.

As from the 1st December 2012, Agenzia del Territorio was incorporated in Agenzia delle Entrate (the Agenzia delle Entrate) according to art. 23-quater, paragraph 1, of Decree-Law n. 95 of 6 July 2012, passed, with amendments, into law by art. 1, paragraph 1, of Law n. 135 of 7 August 2012. A decree of the Minister of Economy and Finance dated 8 November 2012 implemented the related transfer of functions, equipment, and human and financial resources, with effect from the 1st December 2012.

The contents of the cadastral information system

The cadastral information system comprises four archives which are different in nature (alphanumerical or graphic), but closely inter-correlated:

- The Cartographic Archives;
- The Land Cadastre Archives (alphanumerical);
- The Urban Building Cadastre Archives (alphanumerical);
- The Real Estate Urban Units Plans Archives.

The system also includes the following new archives:

- The Archives of Buildings (currently being implemented);
- The National Archives of Urban Streets and House Numbers (ANNCSU).

[1] The present report is based on official sources of the Italian Revenue Agency, i.e. *The Italian Cadastral System. Edition 2020*, and *The Italian Cadastral System. Edition 2022*.

[2] Except for the Province of Trieste, where the Urban Building Cadastre went into the "maintenance" phase on the 1st of January 1966.

The basic inventory item of the Land Cadastre is the cadastral parcel, legally defined as a continuous piece of land located in a single Municipal area, owned by one or more natural or legal persons, planted with a homogeneous type of crop and having a uniform degree of productivity (class). The basic inventory item of the Urban Building Cadastre is the real estate urban unit, legally defined as a portion of a building (for example, a dwelling, a shop, an office, etc.), a whole building (for example, a hospital, a hotel, etc.), or a set of buildings (for example, an industrial plant), or an urban area that is independent in terms of its functions and profit capacity.

The Cartographic Archives

The Cartographic Archives, through the cadastral maps, defines the shape, area and position on the territory of the cadastral parcels. The specific objective of cadastral cartography is, therefore, to represent real properties consistently with the different rights existing on them, an aspect that, among all the official cartographies held by the State, can only be found on cadastral maps. Cadastral maps were normally drafted referring to municipal territories[3] and subdivided into sheets, identified through progressive cardinal numbers. Cadastral cartography may be defined as a "large scale" representation, as it was originally created mostly on a scale of 1:2000[4].

The Italian cartographic archive, which covers the whole national territory[5] (roughly 300,000 Km^2), consists of about 300,000 cartographic files. Cadastral cartography is one of the official maps of the Italian State[6]. Agenzia delle Entrate, as one of the Italian State Cartographic Bodies, takes part in national and international technical boards, such as the National Council for Territorial and Environmental Information, the United Nations Committee of Experts on Global Geospatial Information Management in Europe (UN-GGIM Europe), the Permanent Committee on Cadastre in the European Union (PCC) and EuroGeographics (Today the Cadastral Cartography is available for the whole national territory in vector format and in the National Reference System[7]; this allows the full interoperability with other geographic databases, becoming a fundamental element in the land information systems of the central and local Public Administrations. Cartographic data are managed by Agenzia delle Entrate through a single GIS application, called WEGIS (Web Enable Gis), for the whole national territory, which operates in a web environment. This application software's functions make it possible to query cartographic databases, provide users (technical professionals, citizens) with abstracts of cadastral vector maps upon request, update cadastral cartography in vector format either through its digitalization functions or by supplementing updating documents submitted by technical professionals.

Since 2016 the cadastral information system is integrated with new-generation high-resolution ortho-images (GSD 20 cm/pix), provided by Agea (Agency for disbursements in Agriculture) every year for one-third of the national territory. In addition to the fiscal purposes (agricultural and real estate cadastral incomes are used for determining the taxable base of direct and indirect taxation), cartographic and cadastral information has progressively taken relevance also for civil and legal purposes (identification of real estate and legal value of the cadastral information), for the land management (civil protection, determination of municipal areas, fire cadastre, investigations of environmental crimes, etc.) and for historical aspects (reconstruction of natural and anthropic land evolution).

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[3] In some cases, municipal territories are subdivided into census sections and the cadastral map is formed on the basis thereof.

[4] Cadastral cartography also includes, to a lesser extent, maps in different scales (1:4000, 1:1000 and 1:500).

[5] With the exception of the territories in which the Cadastre is managed, by delegation of the State, by the Autonomous Provinces of Trento and Bolzano.

[6] Law n. 68 of 2 February 1960 established the Administration of the Cadastre and of Technical Revenue Services (now, Agenzia delle Entrate) as one of the five cartographic bodies of the Italian State. The function is held by the Central Director for Cadastral, Cartographic and Land Registration Services (see Decision of the Director of Agenzia delle Entrate n. 36936 of 13 February 2018).

[7] Decree of the Prime Minister of 10 November 2011, art. 2: "… ETRF2000" – at the time 2008.0 – of the European geodetic reference system ETRS89, …"

The Land Cadastre Archives

The Land Cadastre Archives registers technical-physical, juridical and economic data, linked to each cadastral parcel, including:

- **Cadastral identification** (name of the Municipality, Section code, map sheet number, parcel number);
- **Place** (address or name of the location area);
- **Type of crop** for cultivated land parcels, or permitted use for parcels not used for agricultural production (the information is codified and refers to a General Table of the cadastral types of crop and permitted uses);
- **Class of productivity** (codified information expressing different potential degrees of soil production levels);
- **Consistency** (expressed in hectares, ares and centiares of surface area);
- **Cadastral incomes** (subdivided into landlord income[8] and agrarian income)
- **Cadastral holder** (tax code number and personal data of natural persons, or corporate name of legal persons, holding title to the land parcel, supplemented with information on the type of right held and on the share of interest in it).

Additionally, each parcel is provided with identification data of the deeds that determined a change in the status of the holders (for example, transfer of title), or in the technical-physical state of the property. By tracking these changes, data relative to cadastral parcels are time-linked for subsequent phases. This makes it possible to browse them also referring to a previous time period. As at 31 December 2019, the Land Cadastre Archives comprised more than 85.7 million cadastral parcels; out of these, approximately 60 million producing a cadastral income[9].

The Land Cadastre Archives is now completely computerized and organized into an Oracle database.

The Urban Building Cadastre Archives

Analogously to the Land Cadastre, the Urban Building Cadastre Archives registers technical-physical, juridical, and economic data, linked to each real estate urban unit, including:

- **Cadastral identification** (name of the Municipality, Section code, map sheet number, parcel number, sub-parcel number);
- **Address** (usually referring to the official street guides provided by Municipal Authorities and included in the National Archives of urban streets and house numbers, managed by the Agency and Istat - the Italian National Institute of Statistics);
- **Typology** (coded information, linked to the permitted use of the real estate urban unit, which refers to a general classification currently listing different typologies organized into 5 groups identified as letter A - residential use and offices, B - public use, C - commercial use and outbuildings, D - industrial and special commercial uses and E - uses of community interest. In the Urban Building Cadastre properties that do not have the capacity of producing a cadastral income because of their nature (real estate portions that are a common utility of several real estate urban units) or state of construction (unbuilt urban areas, units under construction, units in a state of collapse, etc. - organized into "fictitious" categories of the group F) are also registered;
- **Class of productivity** (this is expressed only for the real estate urban units registered under a typology of groups A, B, and C and is coded information outlining different levels of possible income);
- **Consistency** (this is expressed differently according to the typology under which the real estate urban unit is listed. For units listed under group A, it is expressed in several main rooms. For units

[8] Which takes into account possible "deductions to the landlord income tariffs due to permanent works for protection, drainage and reclamation, and to irrigation costs".

[9] The remaining parcels concern areas containing buildings registered in the Urban Building Cadastre (more than 21.8 million) and other areas that are exempt from cadastral income valuation (about 3.8 million). Source: DWH Agenzia delle Entrate (as at 31 December 2019). Da estimo catastale (circa 3,6 milioni). Fonte dati: DWH Agenzia delle Entrate (al 31 dicembre 2019).

listed under group B, it is expressed in m3, while for units listed under group C, it is expressed in m2 of net area. Consistency is not expressed for units listed under groups D and E. In addition to the consistency data originally provided for in the founding law of the Urban Building Cadastre, concerning the provisions of Presidential Decree n. 138 of 23 March 1998, for the real estate units listed under groups A, B, and C consistency of the gross area in m2 has also been determined);

- **Cadastral income** (defined as the ordinary before-tax income that can be potentially produced from the real estate urban unit, after having detracted ordinary maintenance expenses and eventual losses).

The indication of the holders, of the type of right held and the share of interest in it, as well as the registration of changes in rights and state of real estate urban units, occur according to the very same procedures described above about cadastral parcels registered in the Land Cadastre.

The Urban Real Estate Stock

The real estate stock registered in the Italian cadastral archives[10] as of 31 December 2019 consists of more than 74.4 million buildings or parts of them. Out of these, about 64 million are registered under "ordinary" and "special" cadastral typologies, bearing an indication of cadastral income (total cadastral income amounting to about 36.7 billion euros).

More than 6.7 million properties are "common properties unsuitable for registration" (namely properties with shared use by several real estate units, that do not independently produce an income). More than 3.5 million properties are registered under cadastral typologies of group F, as real estate units that do not have the capacity of producing income (unbuilt urban areas, paved roofs, real estate urban units under construction or still lacking an assigned use, units in a state of collapse).

Categorie catastali	Stock (%)
Group A (dwellings, offices, professional studios)	52,0%
Group C (commercial/artisan business, outbuildings)	40,1%
Group D (special use)	2,3%
Group E (specific use)	0,1%
Group B (public use)	0,3%
Group F (particular units – fictitious typologies	5,1%

Most of the Italian real estate stock is registered under group A (dwellings, offices, professional studios - more than 52%) and group C (commercial/ artisan business, outbuildings – about 40.1%). 69.8% of the total cadastral income (24.5 billion euros) refers to properties from groups A and C. Properties of group D, though only 2.3% of the total real estate stock, produce a relevant part of real estate income, equal to 28.1% (about 10.3 billion euros). Properties under group E (specific use) account for a share of the total cadastral income equal to 2.1% (about 0.8 billion euros).

[10] With the exception of the data concerning the territories in which the Cadastre is managed, by delegation of the State, by the Autonomous Provinces of Trento and Bolzano.

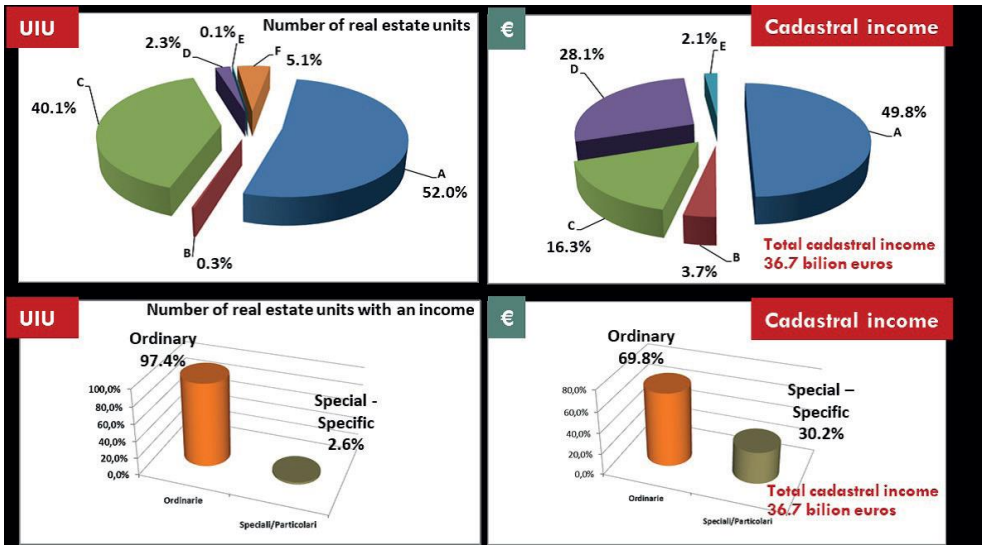


Figure 1 - As in the case of the Land Cadastre, also the Urban Building Cadastre Archives is now wholly computerized and organized into an Oracle database

About the inventory of rural buildings, the legislation has undergone substantial changes over the years about tax and cadastral profiles and, according to the recent regulation, supervision about the existence of the requirements of rurality of buildings falls under the remit of the Revenue Agency. The art. 13, paragraph 14 and following, of Decree-Law n. 201 of 6 December 2011, innovated the previous rules both with the provision of adding a specific "side note" concerning the existence of the rurality mark[11] on the cadastral records and, at the same time, with the obligation of declaring rural buildings to the Urban Building Cadastre.

As part of the activities aimed at the emersion of situations of tax avoidance and evasion in the real estate sector, after an extensive process of information, since 2016 a massive assessment campaign has been carried out about rural buildings still listed only in the Land Cadastre with no cadastral income. At the time of the entry into force of Law Decree n. 201/2011, the number of rural buildings, or portions of them, amounted to over 3.2 million real estate units. Since 2011, this number has progressively decreased, with acceleration after the aforementioned activities of the Agency, until reaching, at the end of 2019, approximately 725 thousand units still undeclared to the Urban Building Cadastre. Of such buildings, at present, approximately 315 thousand are still under verification.

[11] At 31 December 2019, real estate units of the Urban Building Cadastre with the side-note of rurality amounted to a total of 438,99, of which 318,723 are related to the submission of the relating "applications". At the same date, real estate units recorded in category D/10 (Buildings for productive functions connected to agricultural activities) of the Urban Building Cadastre database were 411,135. Following the submission of applications, accompanied by the required self-declaratons provided by applicants, pursuant to Presidential Decree n. 445 of 2000, the Provincial Offices-Territorio of the Agency verify, on a sample basis, the existence of the subjective and objective requirements of rurality. For the check of the related requests, the Agency has started exchanges of information with data held by other Administrations. In particular, the exchange of information with Local Authorities is carried out through the "Portal for Municipalities", an IT platform created to manage the exchange of data on the real estate assets related to every Municipality.

Department for Geological Services of Italy – Higher Institute for Environmental Protection and Research (ISPRA)

General

The Geological Service of Italy is one of the departments of the Higher Institute for Environmental Protection and Research (ISPRA), a public research agency under the supervision of the Ministry for Ecological Transition (MiTE). As per Law 68/1960, the Geological Services of Italy is the State cartographic agency for geology. Since its establishment in 1873, the Service has been responsible for producing geological and geo-thematic cartography, both small- and large-scale. The series of geological cartography on a 1:100,000 scale was realized during the period between 1884 and 1989, a part of which was republished in a second edition; it covers the entire national territory. Today, this cartographic production is available in both print and digital versions, as well as in both raster and vector formats. It is the source of a database that has been standardized according to the rules of the European Union directive INSPIRE.

In 1988, the Service began producing the geological cartographic series on a 1:50,000 scale (the CARG project); to date, 281 out of 652 sheets have been created, covering roughly 44% of the national territory. Geological cartography is supplemented by geo-thematic charts about geomorphology, geo-hydrological hazards, hydrogeology, and geophysics. 1:50,000-scale cartography is produced in both print and digital formats. In addition, as part of the CARG initiative, a project was developed for marine geological cartography for the Adriatic on a 1:250,000 scale. The purpose is to characterize the Italian continental shelf and the main geological structures of the seabeds. All cartography produced in digital format is available on the ISPRA website (https://www.isprambiente.gov.it/it), which can be viewed on a dedicated cartographic portal (http://portalesgi.isprambiente.it/it). To ensure viewing and sharing on geographic information systems, the cartography is also available through Web Map Services (WMS).

Small-scale Geological and Geo-thematic Maps

In 2011, the Geological Service of Italy published the 5th edition of the Geological Map of Italy on a 1:1,000,000 scale. The map was produced from information from regional and 1:100,000 scale cartography and data generated in the CARG project. As a result, it presents a summary of the most recent state of geological knowledge in the country. The Geological Map of Italy was prepared for printing through a digital process; it is the source of a database that was processed for use in international cartography projects, such as OneGeology Europe, the results of which have been incorporated into the European Geological Data Infrastructure (EGDI - http://www.europe-geology.eu/).

In 2018, a geological relief map of the entire national territory was produced on a 1:1,250,000 scale. Incorporating geological data into a relief model allows correlations to be identified between the geological and geomorphological characteristics of the territory.

Of particular interest is the relief representation of the seabed, which allows researchers to reconstruct the morphology of structures present in the area above sea level and their continuity with the continental shelf. It further permits the identification of important underwater reliefs, present above all in the Tyrrhenian area, and of their relationship with structural elements (Figure 1).

Production of small-scale geological maps is a preparatory stage for the realization of large-scale cartography. Small-scale maps also illustrate the state of the country's geological knowledge.

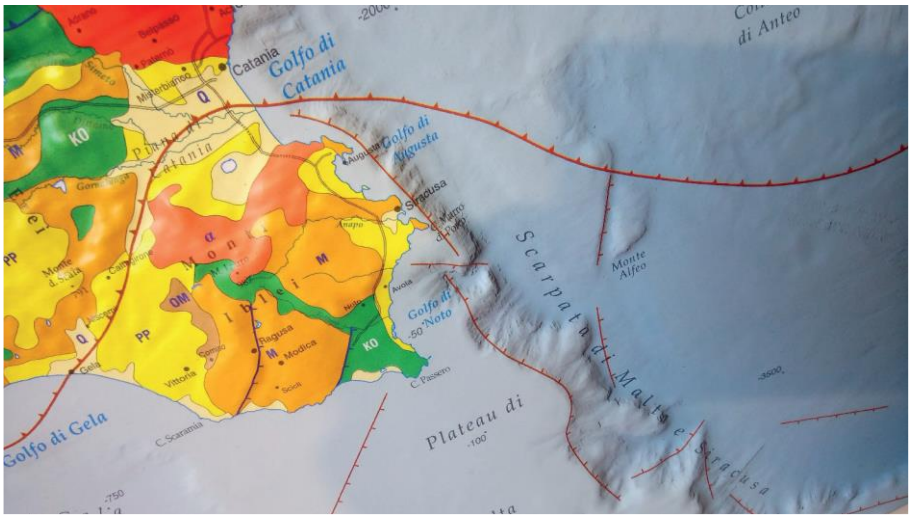


Figure 1 - Detail of plastic relief map 'Italy – geology in relief' on 1:1,250,000 scale, created in 2018

Geological Map of Italy on 1:100,000 scale

The Geological Map of Italy on a 1:100,000 scale was begun in 1884 and completed in 1989 with the production of 277 sheets, 132 of which appeared in a second edition. In 2004, the map was transformed into vector format, while a dedicated database was developed. In 2021, the database covering the national territory was created based on the guidelines and data specifications of the INSPIRE directive (https://inspire.ec.europa.eu/), which provides the infrastructure for spatial data in support of European Union environmental policies (Figure 2). The dataset has been codified in Geography Markup Language (GML), which allows data to be downloaded through metadata files contained in the catalogue of the portal of the Geological Service of Italy and the National Catalog for Spatial Data (RNDT). In addition, an Atom file has been produced which contains a GeoPackage dataset, allowing users to download more quickly. All of the work was carried out in the national context of open data to allow for distribution under the CC BY 4.0 license.

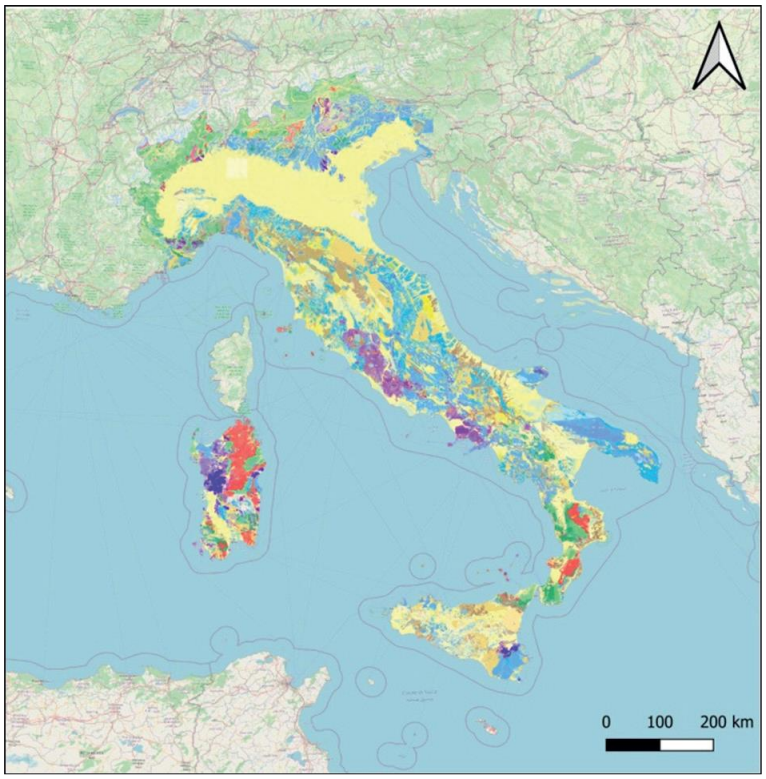


Figure 2 - GIS representation of the Geological Map of Italy on a 1:100,000 scale, standardized according to INSPIRE indications and organised in accordance with the LithologyValue1 parameter

Geological Map of Italy on 1:50,000 scale

The production of the Geological Map on a 1:50,000 scale (CARG project) began on a trial basis in 1977. Following the production of several sheets by the Geological Service of Italy, the initiative was recognised as a national project in 1988. To date, 281 sheets have been produced of a total of 652, through the collaboration of the Geological Service, the Regions and Autonomous Provinces, national universities and the National Research Council (CNR). The Geological Service of Italy is responsible for coordinating the project and carrying out guidance and control operations. In addition to the measurement of lands above sea level, data is collected on those below sea level on the coastal map sheets, which is of fundamental importance for protecting coastlines. Each geological sheet is supported by an explanatory note which collects information pertaining to the stratigraphy, structure, hydrogeology and geology of the area in question (Figure 3). Other aspects of the CARG project include drafting and updating guidelines for measurement, cartographic representation and the computerisation of both geological and geo-thematic sheets.

All geological data are entered into the project database, allowing for the storage, management and processing of a great quantity of digital data and the possibility of updating the geological maps in real-time.

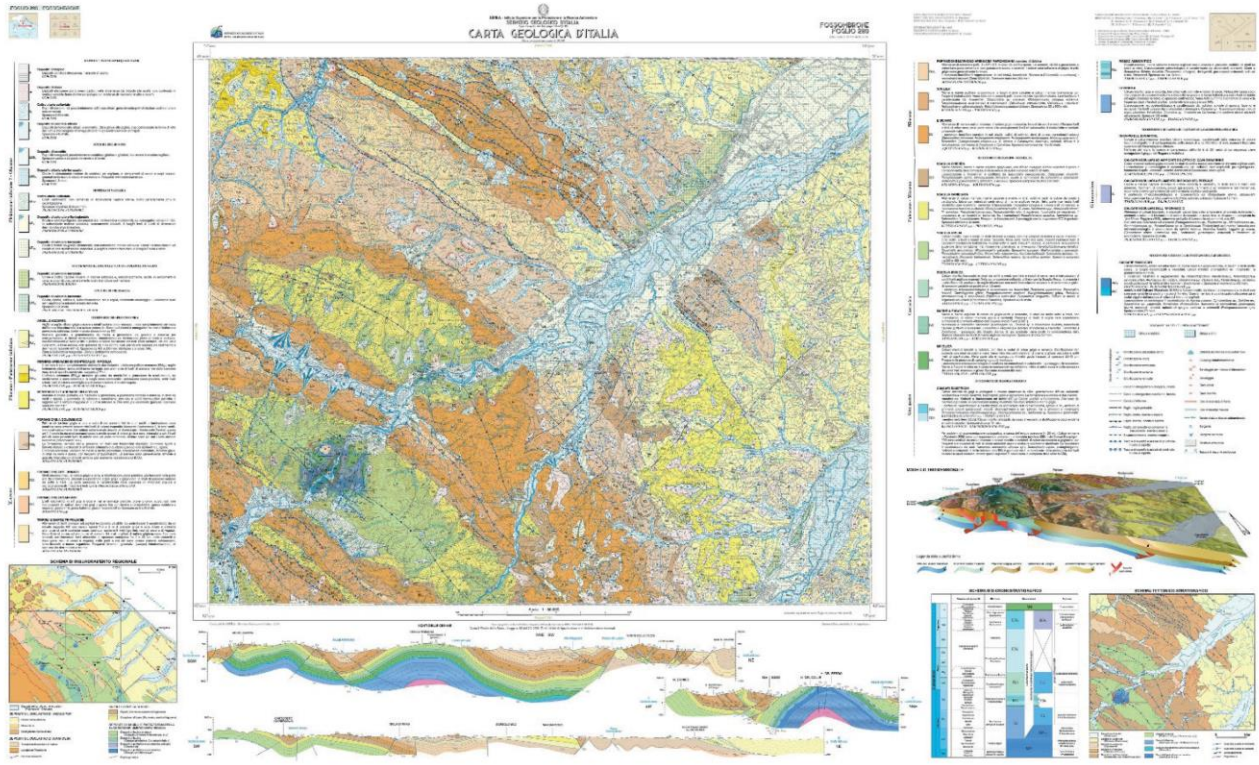


Figure 3 - Geological sheet 280 Fossombrone, from the Geological Map of Italy on 1:50,000 scale, published in 2016

Geo-thematic Map on 1:50,000 scale

In parallel with geological cartography, experiments in geo-thematic cartography are also conducted. These regard the fields of geomorphology, geo-hydrological hazards, hydrogeology, and geophysics.

Geomorphological Maps

Geomorphological maps show forms of relief accumulation and erosion, indicating morphographic and morphometric characteristics and identifying chronological sequence, in particular distinguishing between active and inactive forms. Knowledge of a territory's morphology is of fundamental importance for management and planning purposes, both in urban and uninhabited areas. To date, eight sheets dedicated to geomorphological themes have been produced, beginning with the experiments conducted during the 1990s and including the most recent sheets realized in particular settings: sheets 624 Mount Etna and 328 Elba.

Hydrogeological Maps

Three maps on a 1:50,000 scale have been produced on this theme, all of them as experiments conducted in the 1990s. The 1:50,000-scale hydrogeological map realized in the context of Sheet 348 Antrodoco has been included in the series entitled *Memorie Descrittive della Carta Geologica d'Italia*. The area under examination regards a section of the carbonate Apennine chain, which boasts a wealth of high-quality subterranean water. This project, therefore, represents an important study model, such as for the preservation of drinking water. Of particular importance for its potential applications is the Hydrogeological Map of Rome (Figure 4), realized on a 1:50,000 scale, the fruit of collaboration between the Geological Service of Italy – ISPRA, INGV, the Municipality of Rome, Roma Tre University, CNR – IGAG, and the Sapienza University of Rome – CERI.

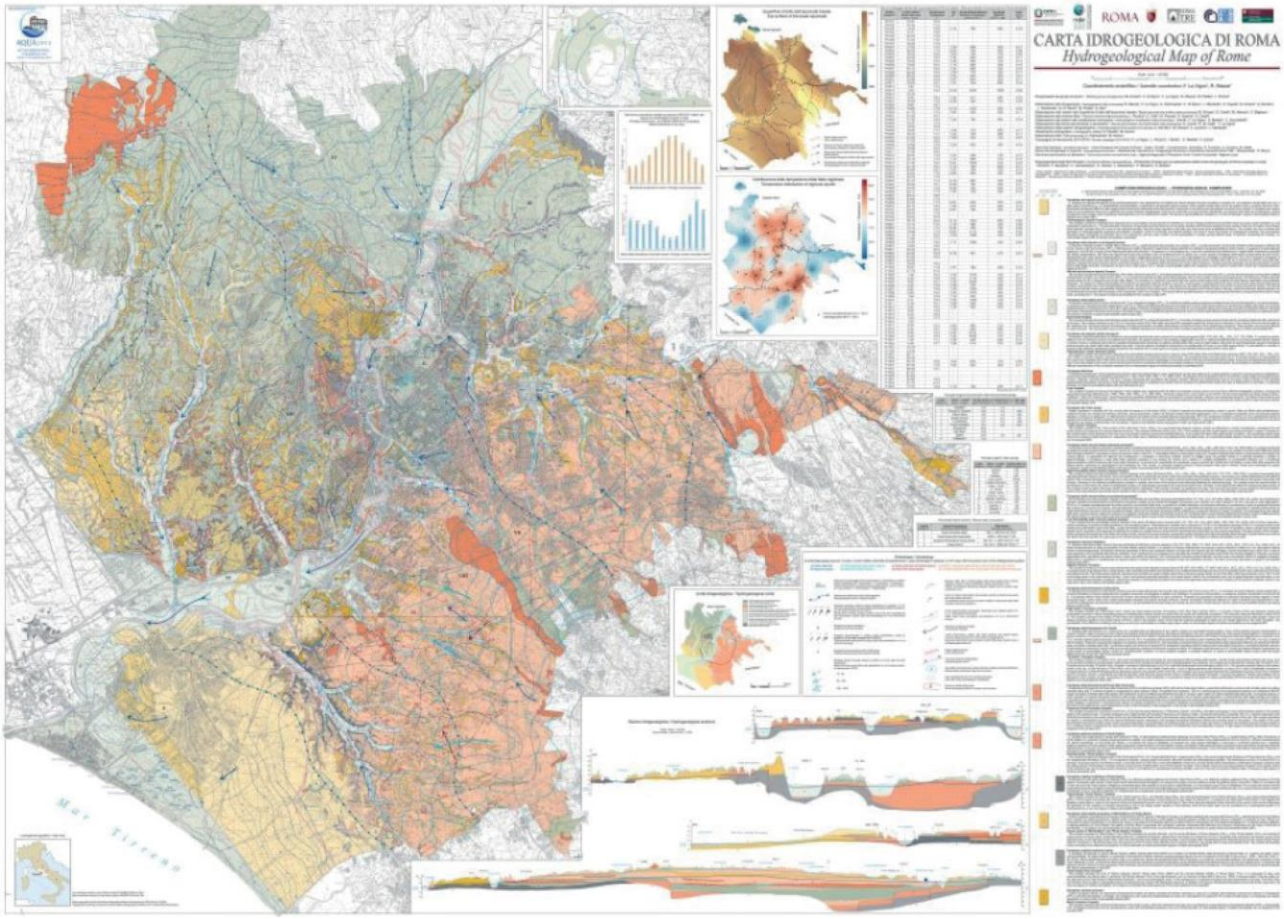


Figure 4 - Hydrogeological Map of Rome, 1:50,000 scale, produced in 2015

Geohydrological Hazard Maps

Among the topics treated within the CARG project, we should mention about geohydrological hazards. This theme was developed through maps of floods, which were produced, for example, in the wake of the 1994 flood in the Region of Piedmont. In addition, maps of mountain slope stability have been produced. These were realized as experiments in the 1970s and regard the areas of the Dolomites and the regions of Piedmont, Tuscany, Umbria, and Molise.

Geophysical Maps

Data from measurements of gravimetric anomalies have been carried over to simplified geological bases, which include main structural elements, to the end of identifying correlations between these gravimetric anomalies and geological structures. To date, three 1:50,000-scale gravimetric-structural maps have been produced for the area surrounding Rome and the north-central Apennines.

Geological map of Italian seas on 1:250,000 scale

This represents a further aspect of the CARG project, aiming to develop geological knowledge of the deep geological structures of the seabeds of the Italian continental shelf. Conducted in collaboration with the Institute of Marine Geology of the Bologna office of CNR – ISMAR, this research resulted in the production of six 1:250,000-scale geological sheets for the Adriatic region.

Geological maps on different scales

In recent years, the Geological Service of Italy has produced several geological and thematic maps dedicated to the geological characterization of national park territories. The **Geological Map of the Cilento, Vallo di Diano, and Alburni National Park** was produced in 2013 on a 1:110,000 scale. The map was the result of collaboration between the Park Agency, which is part of the UNESCO's European and Global Geopark Network, and the Geological Service of Italy. The map provides an overview of the park's geology to the end of enhancing, safeguarding, and promoting the geological heritage, in addition to raising awareness about environmental issues. It was produced by processing data from the 1:50,000-scale geological map, which was supplemented with important geomorphological and hydrogeological elements. Of particular interest is the extension of the cartography to include the marine area facing the natural park.

Geological Map of the Monti Simbruini Regional Natural Park. This map was produced in 2019 on a 1:35,000 scale by reprocessing the original data available from 1:50,000-scale cartography and adding original measurements for an area that had not yet been surveyed. This map aims to disseminate geological knowledge of the park's territory, highlighting the presence of particular sites of geological and geomorphological interest; these are easily reached, thanks to QR codes that indicate the coordinates of their locations. The reprocessing of geological data from official cartography represents the most interesting example of using basic geological information for developing specific themes.

The **Geological Map of the Maiella**, produced in 2021 on a 1:25,000 scale, was realised on the basis of original data acquired in the period between 1986 and 2007 by an inter-university work group sponsored by AGIP within the Task Force Majella research project. These maps are the result of specific forms of data processing. One of the purposes behind their production is to support and facilitate management operations on the part of agencies responsible for these territories.

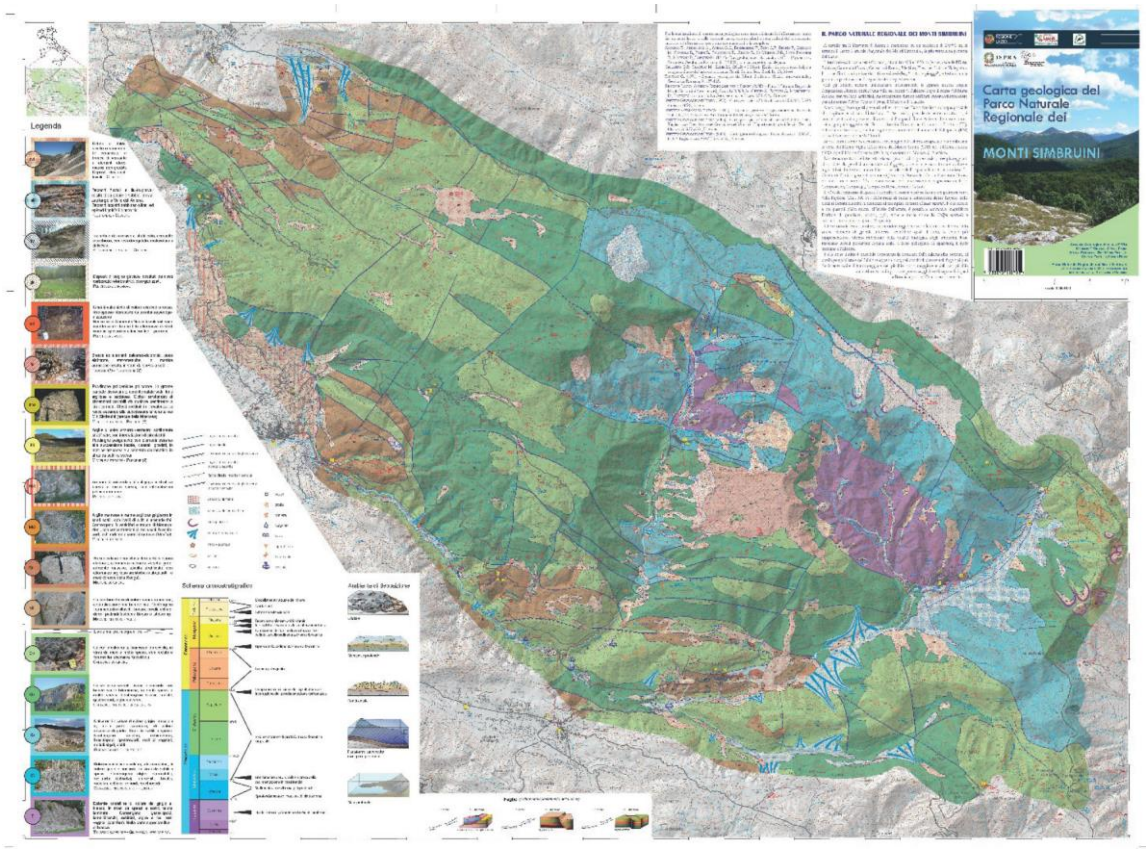


Figure 5 - Geological Map of the Monti Simbruini Regional Natural Park, published in 2019

Part Two
Innovation in Institutional Activities

Agency for Digital Italy. The activities for Geographic Information

Introduction

In Italy specific provisions on spatial data, namely establishing the national catalogue and the process for the definition of technical specifications, had been encompassed in a national law known as "Code for Digital Administration"[12] (CAD), two years before the adoption of the INSPIRE Directive[13] in 2007.

This has been the path traveled with the actions carried out by the Agency for Digital Italy (AgID), where INSPIRE has represented the guiding and regulatory framework for spatial data which both policy and technical documents (such as the Three-Year Plan for ICT in Public Administration[14] or the guidelines for specific issues) deeply anchored onto. The aim, on one hand, is to improve the discoverability and the accessibility of public information resources, including spatial data, by ensuring and facilitating their access and use to an ever wider and diversified audience, and, on the other side, to support public administrations, spatial data and services providers, to foster and improve the process of definition, availability and interoperability of these resources, needed to enable what described above.

Activities

Art. 59 and art. 71 of the CAD have established the procedure for the definition of the technical rules for spatial data. Until 2010, the Committee for the technical rules on spatial data (set up by paragraph 2 of the mentioned Art. 59, repealed in 2016), that AgID performed the role of the technical secretariat, operated in order to define and propose technical regulations (to be adopted with special measures) for the collection of spatial data sets, its documentation, availability, accessibility and the sharing of data between the central and local governments.

In addition, the Committee was also responsible for proposing rules and costs for the use/reuse of spatial data, in a coherent and harmonized manner with the relevant legislation and with the objectives of e-Government policies. In the first three years of activity (from 2007 to 2010), the Committee has issued the following technical specifications, still in force:

1. Use of cadastral data between the information systems of all the public administrations;
2. Definition of the content and procedures for setting up and updating the National Catalogue for spatial data, with the simultaneous identification and definition of the data of general interest that need to be documented in the Catalogue itself;
3. Collection, documentation, and sharing of digital ortho-imagery at a nominal scale of 1:10000, with reference to applications such as mapping and thematic scopes;
4. Adoption of the National Geodetic Reference System, in line with the European reference system;
5. Collection and definition of the content of the geo-topographic Database (DBGT), for a consistent and structured representation of the main layers of geographic information.

The technical specification referred to in point (1) has been adopted by the Decree of the Director of the territory on November 13, 2007; those referred to in points (2), (3), (4), and (5) have been adopted by the decree of the Minister for Public Administration and innovation on November 10, 2011, in consultation with the Minister of the Environment, Land and Sea.

After 2010 the Committee was no longer renewed due to the repeal of the law provision that had established it. It can be said that its role is currently covered by the National Committee for the Spatial and Environmental Information[15], established for the implementation of the INSPIRE Directive in Italy, where AgID is one of the members.

AgID has further supported data interoperability by ensuring that the definition of new thematic data models is consistent with the national and European reference specifications (i.e. INSPIRE data specifications

[12] Legislative Decree no. 7 March 2005 n. 82, https://docs.italia.it/italia/pianotriennale-ict/codice-amministrazione-digitale-docs/it/v2017-12-13/index.html

[13] https://inspire.ec.europa.eu/

[14] https://pianotriennale-ict.italia.it/

[15] http://www.pcn.minambiente.it/mattm/inspire-la-consulta-nazionale-per-linformazione- territoriale-ed-ambientale/

and the national rules on the geo-topographic database, DBGT, mentioned above) and by promoting the INSPIRE data and services in domains and projects beyond the environment, wherever possible. This is the case of the data models defined for the information system of the physical infrastructures (SINFI)[16], under the activities carried out for the national implementation of the EU Directive 2014/61/EU, and for the digital platform for the smart management of the public lighting under the PELL (Public Energy Living Lab) project[17]. This last project is also included in the ELISE[18] Energy & Location Applications also to check the feasibility of a formal extension of the INSPIRE data specifications on Utility and Government Services. Furthermore, AgID and ENEA have started a collaboration with the JRC (Joint Research Centre of the European Commission), through one of the use cases of the energy pilot project, executed within ELISE. This collaboration aims at contributing to provide a European perspective of the benefits of using digital platforms for the smart management of public lighting infrastructures.

Discoverability and accessibility of spatial data have been pursued and enabled mainly through the implementation and the maintenance of the National Catalogue for Spatial Data (Repertorio Nazionale dei Dati Territoriali – RNDT) [19], established by art. 59 of the CAD and managed by AgID.

Figure 1 - Some search functions in the National Catalogue for Spatial Data (RNDT).

The Catalogue collects metadata for spatial data sets and spatial data services managed by the public authorities, in order to facilitate their discoverability and availability through the discovery service related to the implementation of the INSPIRE Directive (Directive 2007/2/EC). The National Catalogue is consistent with the technical requirements defined in the Decree of the Italian Minister for Public Administration and with the INSPIRE Regulation and technical guidelines as regards metadata and interoperability of network services. The Catalogue is also declared as a database of national interest and represents the reference national discovery service harvested by the INSPIRE Geoportal. The Catalogue is part of the so-called national PSI infrastructure, referring to the European framework of public sector information. That infrastructure is composed of the following resources:

- The open data portal (dati.gov.it);
- The PA's Databases catalogue;
- The catalogue for spatial data (geodati.gov.it).

In that context, the national Catalogue for spatial data has been also harvested by the official portal for European Data (data.europa.eu). Several actions are implemented or are being implemented linked to RNDT.

Those actions include, *inter alia*:

[16] https://sinfi.it

[17] https://www.pell.enea.it/

[18] ELISE (European Location Interoperability Solutions for e-Government) action of the EC ISA[2] Programme.

[19] https://geodati.gov.it

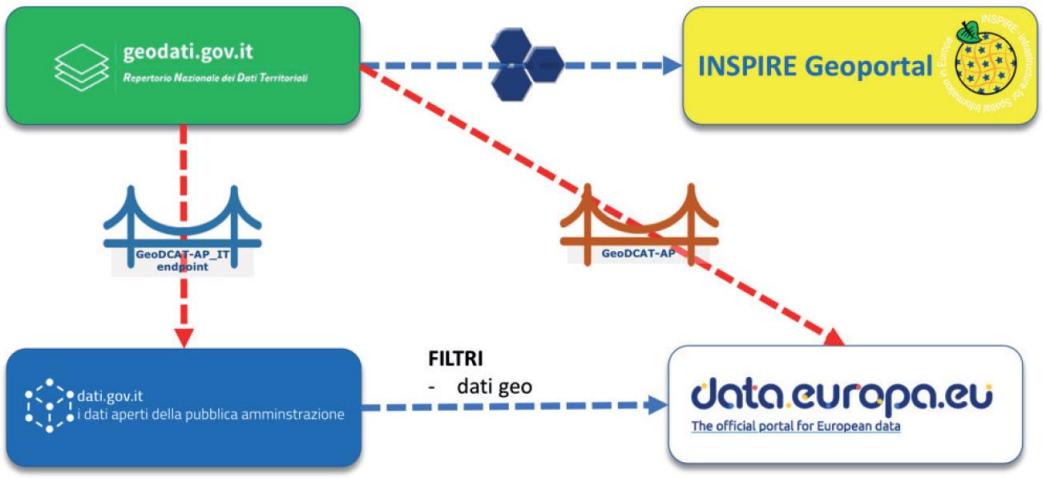


Figure 2 - The coordination between national and European portals (GeoDCAT-AP implementation).

a. Support to improve the accessibility of spatial data through network services in the context of the similar INSPIRE action;
b. Revision of national metadata guidance including requirements and recommendations to cover the issues linked to open data;
c. Pre-defined views of spatial open data in the national catalogue in addition to the usual tools for data discovery (i.e. general search functions);
d. Discoverability of spatial data through the mainstream search engines, such as Google Dataset Search[20].

An issue addressed was the integration of the national catalog for spatial data (based on ISO/INSPIRE/national standards, profiles and rules) and that one of open data (based on DCAT-AP specification), both managed by AgID.

The Public Administrations provide to document the information resources they hold in those catalogs to make them discoverable to the users. That documentation activity has produced an overlapping of the two scopes (spatial data and open data), precisely represented by the open spatial data. That led, for example, to a duplication of the descriptions in the two reference catalogs, with the risk that they are not aligned and/or updated, and in some cases are even conflicting, compromising the reliability of the information itself. In order to overcome the duplication, the misalignment, or even the lack of relevant information in the two catalogs, it has become necessary to provide specific rules with the definition of national guidelines and implement specific tools.

The GeoDCAT-AP implementation guidelines[21] can be considered the national extension of the European specification (named GeoDCAT-AP_IT) in order to take into account the Italian extensions to INSPIRE metadata profile and to DCAT-AP. The document also defines some organizational rules for PAs in order to avoid the double burden to document the open spatial data in both catalogues (spatial data and open data) and to overcome the above-highlighted criticalities.

When implementing those guidelines, some relevant tools are developed, i.e. a customized and extended API and XSLT[22] with respect to those ones available within the ISA programme.

Another important tool is the INSPIRE Italia Registry[23], which provides a central access point to a number of nationally managed registers (means to assign identifiers or 'reference codes' to items and their labels, definitions, and descriptions, also in different languages, and consistently manage different versions of

[20] https://datasetsearch.research.google.com/search?query=site%3Ageodati.gov.it
[21] https://geodati.gov.it/geoportale/images/struttura/documenti/GeoDCAT-AP_IT-v1.0.pdf
[22] https://geodati.gov.it/geodcat-ap_it/
[23] https://registry.geodati.gov.it/registry

resources), both in order to comply with INSPIRE requirements regarding the publication of extensions to the code lists set out in Regulation (EU) No. 1089/2010 on interoperability of spatial data sets and services and for identified and nationally defined purposes (e.g., for objects defined in the DBGT under Decree 10/11/2011).

The Registry has been published under the coordination activities carried out together with the National Institute for Environmental Protection and Research (ISPRA) and the Ministry of Environment.

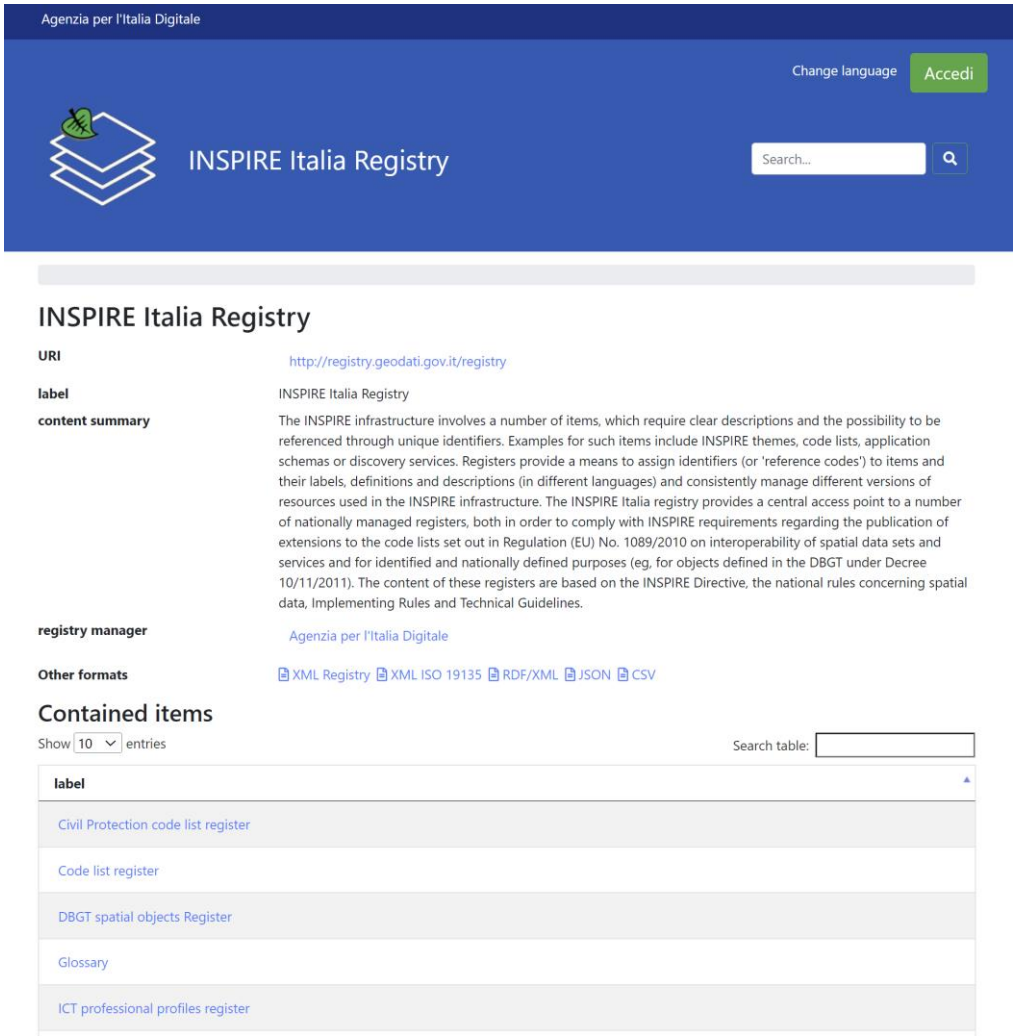


Figure 3 - The INSPIRE Italia Registry.

Part Three
Experiences in Cartographic Research and Production in Thematic Areas

Cartography and Geomatics in Italy. The Federation of Scientific Associations for Territorial and Environmental Information (ASITA)

Geographical information has always been a fundamental tool for planning and knowing the territory. Cartography is probably one of the first scientific disciplines that needed to be developed because, since ancient times, the mapping of the territory was necessary for people to explore and manage the territories they occupied. In all scientific missions of the British Empire in the 19th century there was a cartographer who on the one hand supported navigation, and on the other, when in unexplored territories, had the task of drawing up new maps. These maps were initially distorted and not without gross errors, but then, with the refinement of topographic and representation techniques, they became increasingly more accurate, resolute and precise, and fundamental for many applications. Obviously, all the above aspects consider cartography from a purely geometric point of view and in this sense, in order to underline the importance of the subject, the most famous scientists in history have tried their hand at this discipline such as Eratosthenes, Ptolemy, Mercator, Cassini, up to Gauss and Bessel, to name but a few.

Today, the technologies available are increasingly more powerful and in addition to methods of surveying from the ground, which are increasingly accurate and easy to use, the use of artificial satellites has made it possible to map and monitor the territory both geometrically and thematically, allowing analyses that are increasingly capable of understanding the evolution of our planet.

Cartography is generally one of the possible products of a topographical survey or a satellite image, but various disciplines have joined this field in the aim of allowing a correct and complete management of all the information in our possession.

In particular, topography, aero-photogrammetry, remote sensing and territorial information systems deal with subjects that contribute in a synergic way to the production of correct geo-topo-cartographic information that can be used by everyone. While each of these disciplines has peculiar elements that justify their autonomous development, it is evident that it is only through a combined and cohesive vision that the greatest benefits can be derived.

Historically, the above subdivision has seen the birth in Italy of different associations focused on single fields. Following a purely chronological order, the four main Italian associations that historically deal with geo-topo-information are SIFET, AIC, AIT and AMFM.

Since 1951, the SIFET (Italian Society of Photogrammetry and Topography) has been a free association of scholars, technicians, and public and private organizations interested in the processes of acquisition, processing, management, and dissemination of spatial information, with specific reference to photogrammetric, topographic and geodetic methodologies and technologies related to these processes. Since 1963, the AIC (Italian Association of Cartography) "has been a cultural association with the aim of promoting technical and scientific development among its members in all fields of cartography, of illustrating on a national level the cultural, social and economic importance of cartographic activity and promoting awareness of the Association's aims and potential in the appropriate fora, and of documenting developments in national activity in the sector on an international level". The Association was founded in 1963 in Florence at IGMI thanks to the far-sighted initiative of Gen. Traversi.

Since 1986, the primary objective of the AIT (Italian Association of Remote Sensing) has been the development and diffusion of Remote Sensing through actions aimed at bringing together people interested in research, development, and application of remote sensing methods and techniques; encouraging the exchange of knowledge and scientific and technical-application collaboration among members; promoting, supporting and coordinating initiatives to develop and apply methods and technologies in Italy and Europe, also through the organization of congresses, study conventions, conferences, working groups, national and international thematic courses representing and taking care of the scientific-cultural interests in the field of remote sensing for similar bodies, agencies, companies and associations at a national and international level.

The AM/FM/GIS Italia (Automated Mapping/Facilities Management/ Geographic Information Systems Italia Association), founded in 1989 in Rome, aims at fostering the exchange of knowledge and experiences and at promoting collaboration relationships between public and private operators in the Italian sector in the field of Geographic Information Systems (GIS) and Geographic Information (GI) in general, at representing the national community of operators in the GI sector in the European and international contexts, to promote

the contributions of the operators and experts in the sector towards the public administration, for the planning and development policies of the survey, processing and management systems of the GI, for the government and management of the territory, to promote the dissemination of methodologies and processes of standardisation, communication and sharing, aimed at facilitating the exchange of data and interoperability between different systems, in particular between public administration systems and within systems interested in the management of services and infrastructures on the territory.

Since 1997, these four associations have considered it strategic to form a federation in order to create a single body capable of encompassing all the skills and sensibilities of the four associations. Thus, ASITA (Scientific Associations for Territorial and Environmental Information) was born which has organized annual Conferences at a national level with the intention of facilitating dialogue, sharing, and collaboration between researchers, public bodies, public administrations, professionals, and private companies. Somehow this vision captures a correct perception that sees the boundaries between the various disciplines now less and less marked. ASITA is, therefore, a natural interlocutor for researchers, organizations, and public administrations that use this information on a daily basis and are interested in the novelties that scientific research is able to offer. The birth of ASITA, however, has not caused the associations and societies that generated it to fall into disrepute. In fact, ASITA is a Federation of Associations that maintain their own level of autonomy even within the context of International Associations such as:

- IAG (International Association for Geodesy),
- FIG (Federation International de Geomètres),
- ICA (International Cartographic Association),
- EUROGI (European Umbrella for Geographic Information)
- Etc...

Participating in these associations (or federations) are national associations that are different in terms of subject matter and history.

Looking for example at the International Cartographic Association in the section related to Working Groups and Commissions, it is evident how some topics are central not only in the AIC, but also in other Italian associations. Furthermore, observing the members of other countries associated with the ICA it is evident that many countries have associations very similar to the Italian one (e.g., France, Germany and Australia) while others have associations of a different nature. Canada, for example, belongs to the ICA with the Canadian Institute of Geomatics, while the United States of America belongs to the CaGIS (Cartography and Geographic Information Society). All this is useful for underlining how, with the passing of time, disciplines historically very well characterized and perimeterized in their fields and competencies undergo an influence that allows mutual contamination and an added value for everybody, and in this context, ASITA has grasped this tendency perfectly. Geographical data, useful for the representation, planning, and control of the territory, must be acquired in a correct manner, with traditional techniques such as topography and photogrammetry, or with more recent techniques such as laser scanning, satellite-positioning systems, and remote sensing techniques, managed in a complex and organic way within archives and territorial information systems that are natural collectors of such information and represented or studied. The boundaries between the various fields are well defined in terms of competencies, but the general context is however common and must be shared for the purpose of spreading the culture of territorial information, geomatics, and cartography in a synergic manner.

Aspects of Remote Sensing in Italy

e GEOS

Since the last 20 years e-GEOS (a Geo-Information company of Telespazio and Italian Space Agency –ASI) has been involving in cartographic products for civilian uses, environmental protection and defense/intelligence based on both remote sensing satellite and airborne data, in compliance with the requests and the specifications of different users and clients

Client: EU – DG JRC Copernicus Emergency Management Service (EMS) – Rapid Mapping

The Emergency Mapping Service-EMS Rapid Mapping of the European Earth Observation program Copernicus, is managed by the EU Commission and aims to rapidly provide satellite maps of areas affected by natural or man-made disasters. A consortium of companies and research centers has been providing the service since 2012 to respond in an operational way to natural and non-natural emergencies, in a very short time. E-GEOS, which has been leading since the beginning, federates six production centers of European partners to always be able to respond in a timely manner. The number of requests received over 10 years is several hundred, with thousands of maps released a few hours after the request for intervention, such as the floods in central Europe in 2013, the typhoon Haiyan that hit the Philippines, and the typhoons that devastated Texas in 2017 or the most recent devastating Mediterranean fires in summer 2021.

The activation process is very fast, the On Duty Operator receives new activation requests via email from the European Response Coordination Center (ERCC), the 24/7 operations room of the European Civil Protection in Brussels. These requests contain information on the event, the areas of interest, and the type of analysis useful for the User, usually from local civil protections. The service is activated by national focal points, generally the central Civil Protection, the delegations of the European Union, or the UN agencies that request intervention by describing its severity.

The EMS Team led by e-GEOS acts immediately: in the first two hours, the details of the production are defined directly with the User, in order to finalize the order of the available satellite acquisitions as soon as possible. Once the images are received, data about the pre, during, and post-crisis situation are produced in a few hours. Every day of the year, therefore, for 24 hours a day, EMS Rapid Mapping is able to provide worldwide support to rescue teams with satellite maps that can also be used on mobile devices for different types of disasters, natural or induced by man.

EMS is active for the following types of events: floods, earthquakes, forest fires, volcanic activities, typhoons, landslides, or emergencies related to anthropogenic events (explosions, collapses, demonstrations, etc.).

Figure 1, relating to fire damage in Greece in August 2021, presents, in addition to the map and the damage levels, other fundamental cartographic elements such as projections, scale, legend, statistics, etc.

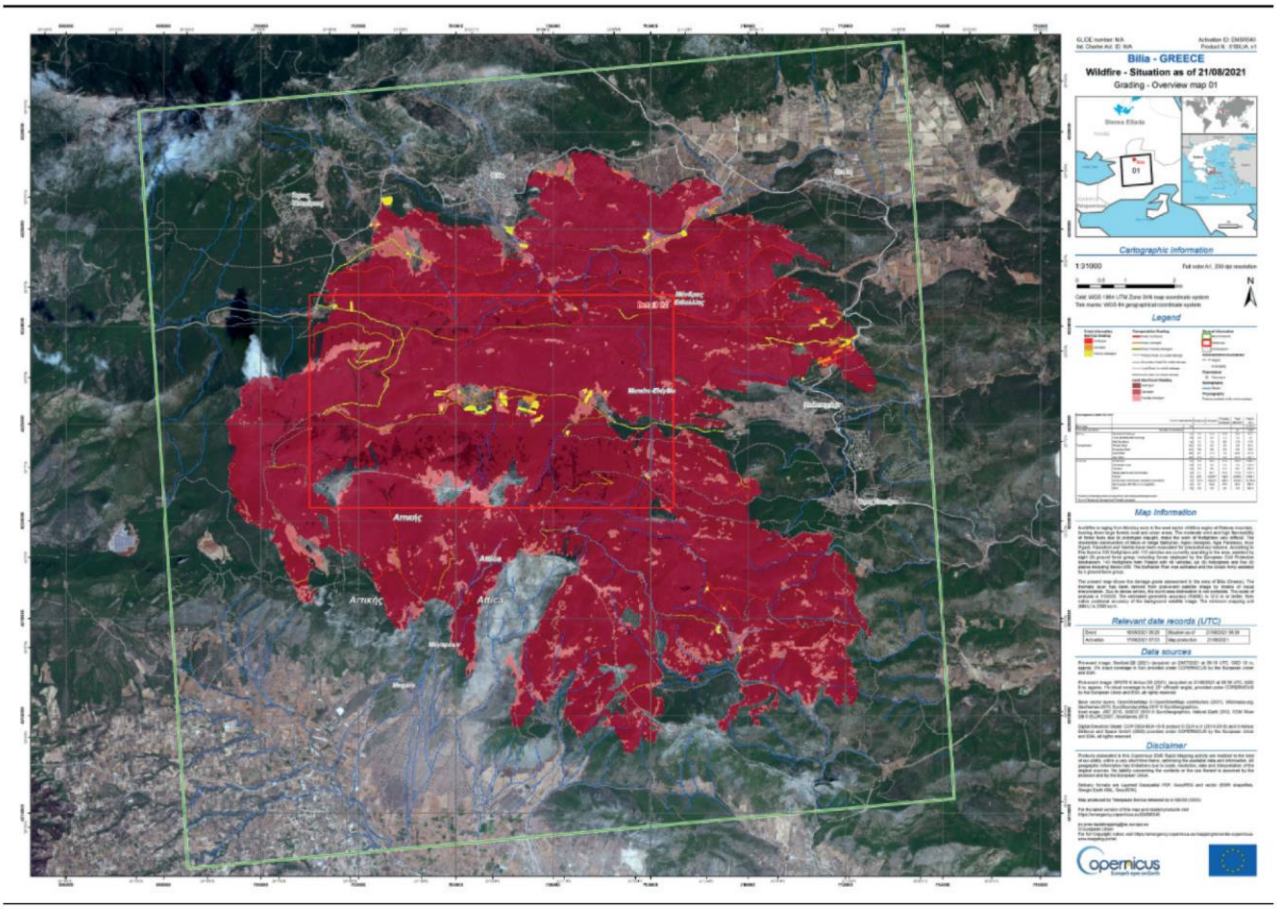


Figure 1

In general, it can be said that the Copernicus Rapid Mapping service, provided by e-Geos and its team of companies, contributes to the objectives of environmental sustainability, to the safety of citizens and supports the objectives of the "Sendai Framework" for disaster risk reduction aimed at: reducing the loss of human life, reducing the number of people who may be affected by negative impacts, reducing economic losses and damage to infrastructures.

In addition, EMS rapid mapping helps to provide an objective and synoptic view of the consequences of disasters, useful for planning an adequate reconstruction or the correct distribution of aid.

Client: European Union Satellite Centre, NATO European Reference Mapping Service

This project aims to provide a background of geographical context and representation of third country(ies) areas to support operational geodatabase. Cartography includes hydrography, topography, land cover/use, infrastructures, and population-relevant activities, through specific extraction of features from satellite imagery by skilled photointerpretation. The production of Reference Mapping follows specific extraction criteria and specific legend, mainly derived from the MGCP (Multinational Geospatial Co-production Program) standard one.

The Service mainly supports the monitoring of border areas and the improvement of decision-making and response capabilities of the authorities in charge of the control and monitoring of the European borders.

Role of e-GEOS: Leader of the International Team in charge of Project and Technical Management, point of contact to the Customer, and coordinator of the team of production sites. The main tasks are: Very High-Resolution optical satellite imagery collection and processing; mosaicking; feature extraction; internal Quality Control; intermediate and final product packaging; intermediate and Final Check & Delivery for around 34,000 skm

Defense Cartography MGCP (Multinational Geospatial Coproduction Program)

MGCP is a project aimed at realizing and maintaining updated worldwide land portions concerning land cover and uses for defense and intelligence purposes. The main tasks include vector data extraction from Very High Resolution satellite imagery (from 0,5 to 2,5 m) for a larger element definition in scale than the requested reference final mapping scale of 1:50.000/1:100.000. The dataset includes more than 200 feature classes, compliant with DFDD (Digital Feature Data Dictionary) standard. In addition, the hydrology sub-dataset includes hydrological network (polygonal/linear rivers, canals, ditches, lakes, reservoirs, natural pools, and connected point/line/area infrastructures) and related attributes. Full topological and geometric coherence is also ensured through a specific validation SW application. Ad hoc internal procedures have been developed and adopted for the associated complex geodatabase management and for the metadata production, to be compliant with ISO 9001. E-GEOS has produced and is maintaining updated around 1,450,000 kmq from 2008 to 2022.

Client: EU- DG JRC Copernicus Land Hot Spot Monitoring

The European Commission services, through the DG JRC Joint Research Centre requests thematic maps to provide detailed land information on specific areas of interest for the European Union, often outside the EU territory, with a focus on the African continent. The service wants to answer ad hoc territorial needs and focus particularly on the domain of the sustainable management of natural resources. For such areas of interest, including protected areas or "hot spots" for biodiversity maintenance and land degradation monitoring, land cover and land cover change products are provided in detail.

The product portfolio is articulated to cover a wide range of possible heterogeneous Land Cover / Land Cover Change mapping over the African continent based on the Classification System LCCS (dichotomous/modular), conceived by FAO/UNEP. The Variable Minimum Mapping Unit (MMU) is ranging from < 0.5ha to 25ha (see Figure 2).

Generally, the activities are organized in 2 lots: Lot 1 deals with the operations of the global land component: hot spot mapping including land cover mapping and land cover change mapping, while Lot 2 deals with independent validation and accuracy assessment

Role of e-GEOS

Consortium coordinator, project management, technical management, LC and LCC mapping production, final quality control management, geometrical correction and radiometric correction specialist, a specialist in photointerpretation and in IT support (https://land.copernicus.eu/global/hsm).

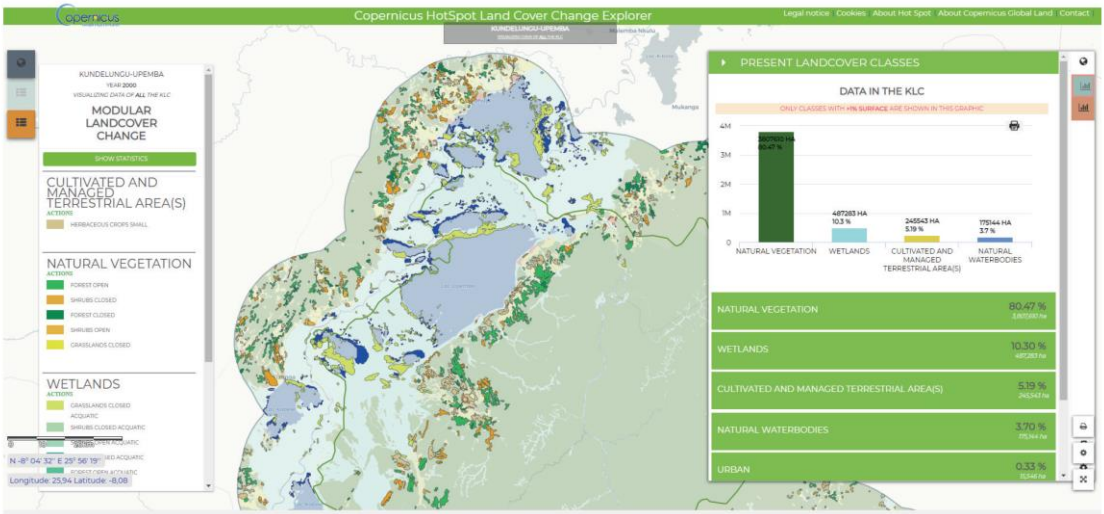


Figure 2

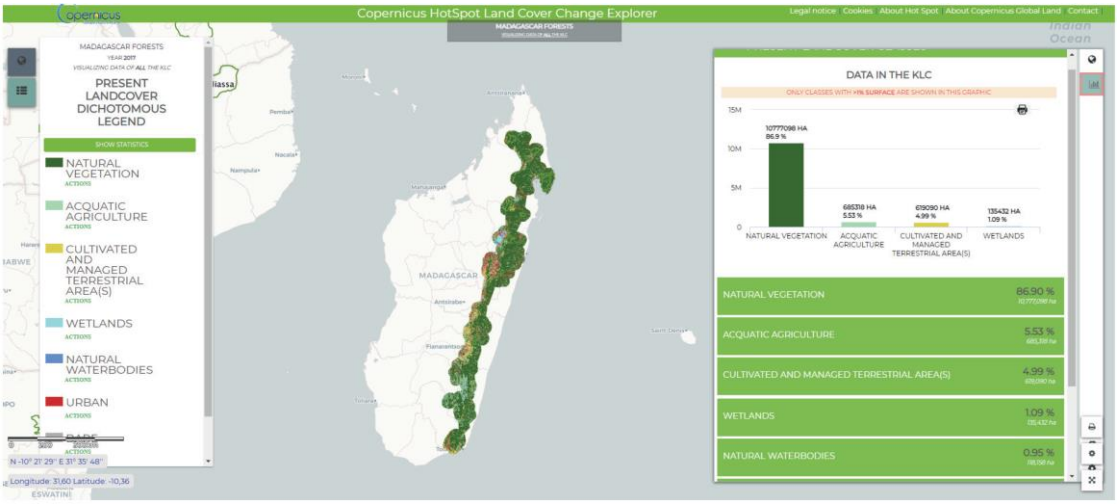


Figure 3

Client: AGEA (Italian Agency for the Agricultural subsidies) The Land Parcel Identification System LPIS for the Common Agricultural Policy in EU

The Land Parcel Identification System (LPIS) is a mandatory reference database which must include each single agricultural parcel used as a basis for the direct payments of subsidies to the farmers, in relation to the Common Agricultural Policy (CAP). Basically, the Common Agricultural Policy finances, through the European DG AGRI, direct payments to 8 million farmers in Europe facing the possible production/ market instabilities or environmental challenges. To ensure that payments are regular, the CAP relies on the Integrated Administration and Control System (IACS), a set of comprehensive administrative and checks on subsidy applications (sample-based or wall-to-wall), which is managed by the 27 Member States. The LPIS is a key cartographic component of the IACS, being an IT system based on ortho imagery (aerial or satellite data at very high resolution 0,2-0,5m pixel) which detects and delineates all agricultural parcels and their macro-uses (arable, permanent, grassland, pasture, forest, artificial) up to distinguishing 70- 80 different agronomic classes. The scope is both to clearly locate all eligible agricultural land parcels and to calculate their maximum eligible area/funding in advance.

e-GEOS started in 2007, within a consortium working for AGEA (the Italian Agency for the CAP distribution) to build the Italian LPIS system, using multispectral airborne ortho-photos 0,2 m with an updating cycle of three years to cover the entire Italy. From the technical point of view e-GEOS is implementing new operational Artificial Intelligence systems for a complete semi-automatic LPIS updating but at a larger scale, always using the airborne data at 0,2m and ad hoc machine learning solutions (figure 4).

Figure 4

Geo-graphics and Active Cartographic Education

Foreword

The production, collection, organisation and dissemination of images have their own intrinsic public dimension and consubstantial social value. Educating to the language of geo-graphics through a correct teaching of geography, at school and in universities, which enhances the advances of geographical research in areas such as geography education, children geography and geography's didactics, is therefore fundamental to put the young citizens of the future in the condition to read critically and understand autonomously, "through the spatially enunciated grammar of graphism, the relationship between culture and its concrete expression".

This is nothing new, as when John Dewey (1916, 1927, 1958), philosopher and theoretician of education, stated that the role of geography consists in the connection between natural facts and social events and in the study of their outcomes, for which reason the geographical description of the Earth insofar as inhabited by man is the expression of an educational reality, makes people aware of contemporary reality and contributes to cultural growth. In this sense, when the author considers geography as an instrument to reach peace and international cooperation through education, to live in a community, and understand diversity in the world and the right ways to relate to it, he touches on all the subjects that today we reorder around the concepts of citizenship, inter-culture, and sustainability.

The need to deconstruct representations and thus recognize them as the product of a social construction aimed at structuring power relations is a fundamental educational objective to be pursued through an accurate use and a non-trivial approach to cartography. On the one hand, it is necessary to accompany students in overcoming the claimed objectivity of representations and therefore their presumed neutrality, exercising a healthy critical approach to the reading and production of cartography, without however prejudicially denying the validity and usefulness of maps; a real risk only if one expects to trivialize much more articulated and complex reflections. On the other hand, the careful study and use of cartography in a perspective of geographical education to citizenship, allows us to question the representations in order to deconstruct and therefore modify the power relations that cartography itself can significantly contribute to stigmatize and reproduce, in particular, if these representations have the function of legitimizing forms of discrimination and/or violation of fundamental rights, such as the right to freedom and self-determination, for example. These principles are now accepted by the international scientific community, as demonstrated, for example, by the following documents:

- 2000: *International Declaration on Geographical Education for Cultural Diversity*
- 2007: *Lucerne Declaration on Geography Education for Sustainable Development*
- 2013: *Rome Declaration on Geographical Education*
- 2016: *International Charter on Geographical Education*[24].

Awareness of the importance of this form of knowledge, thanks also to the involvement of a number of geographers and geography experts in the teaching of geography, can be found in the Ministry of Education's documents defining the contents and learning objectives for Italian schools, in which, in theory, the acquisition of these skills is recognised as having a strategic value also because of their application in an interdisciplinary dimension and the ability of geography to reconnect different forms of disciplinary knowledge on a spatial level: "reading and interpreting geographic and thematic maps, photographs, diagrams, and graphs, assessing directions and dimensions, using coordinates, drawing hand sketches, working with computers" (Ministry of Education, 2021).

In an international panorama that is certainly not comforting, unfortunately, the Italian situation as regards the establishment of a widespread geographical culture is, without any rhetoric, dramatic.

Paradoxically, the school reforms introduced at the very beginning of the 2000s, demonstrating the lack of foresight/short-sightedness of the ruling class, have made the supply of geography teaching in the timetables of the various levels of the Italian school system even more inadequate, thus inhibiting the Italian school's ability to meet the growing demand for geographical knowledge.

[24] https://www.igu-cge.org/2016-charter/; https://www.aiig.it/carta-internazionalesulleducazione-geografica/.

In fact, throughout the twentieth century, a wealth of knowledge and skills was squandered and depleted, a heritage that Italian geographical culture and schools were already capable of expressing at the end of the nineteenth century, as lucidly documented by the Scottish geographer John Scott Keltie, who in 1884, appointed *Inspector of Geographical Education* by the *Royal Geographical Society*, edited a report on the state of geography teaching in several European countries:

"What has been said of France applies equally to Italy. The progress of education in that country in recent years has been of the most radical and hopeful character. All the best features and best methods of Germany have been imported, and maps of German origin, with Italian nomenclature, have been largely introduced. […] Under the guidance of Professor Dalla Vedova, Professor Cavaliere Guido Cora of Turin, Professor Malfatti of Florence, and other geographers, the Italians are themselves producing a series of school wall maps and atlases, some of which will bear comparison with the best products of Germany. Not only so, but in the matter of relief-maps Italian publishers are perhaps the most enterprising in Europe" (Keltie, 1886, *Geographical Education: Report to the Council of the Royal Geographical Society*, London, Supplementary papers, vol. I, part. 4, p. 503)

What to do? Public Geography as Civic Engagement

There is an intolerable imbalance between the process of legitimisation that geography has undergone on a scientific and educational level, the inadequate recognition in the political-institutional sphere and the insufficient supply of teaching and training in geography in Italy's schools and universities. This has given rise to the progressive impoverishment of the process of geographic literacy that Italian society experienced between the end of the 19th and the beginning of the 20th century, thanks also to private subjects particularly active in the production of extremely refined and accurate cartographic products, such as the Touring Club Italiano and the Istituto Geografico De Agostini.

The absence of such a widespread culture of geography can unfortunately no longer be remedied by technological progress, which over the years has greatly facilitated the possibility of accessing the production of cartography in an autonomous and individual manner. On the contrary, the ubiquitous condition of geographic illiteracy significantly weakens social value and severely limits the use of geo-technologies in a truly active and participatory manner.

If one takes this perspective as a discriminating element, one can clearly see the extent of the chasm that has been created between culture and civil society, and thus have the opportunity to refine one's reflections, tools, and arguments around these, not only in relation to the chain of production and reproduction of knowledge and scientific knowledge, but also in response to the satisfaction of an educational need, which is, in the immediate term, a social responsibility that one should not be able to shirk (especially if one operates within the public institutions of the school and university system, but not only), but, in the medium and long term, a pre-condition for guaranteeing adequate space and legitimacy to the very existence of places (not only physical) intended for the production and reproduction of knowledge and scientific knowledge.

The reactivation of a widespread process of geographic literacy is, in fact, the most efficient and effective driving force behind the interventions envisaged by the implementation of the National Plan for Recovery and Resilience in the school and education sectors, set out and declined by the School Re-Generation Plan (https://www.istruzione.it/ri-generazione-scuola/index.html), in line with the Sustainable Development Goals set by the United Nations 2030 Agency:

1. Regeneration of knowledge (knowledge, contents, activities, and lived knowledge): provides training actions targeting pupils, teachers, and families. The activities will be workshop-based, experiential, and interactive. They will take place not only inside the school building but also in symbolic places for learning knowledge, in open spaces in contact with nature, and in digital environments.
2. Regeneration of behaviour (food citizenship, waste, soft mobility): this involves setting up a series of training activities and issuing guidelines to stimulate and encourage the school community to adopt virtuous behaviour aimed at changing habits and lifestyles.
3. Infrastructure regeneration (physical and digital infrastructure): this aims to provide a clear direction for the construction of new sustainable schools with large green spaces and remodeled learning environments. It provides for the gradual energy upgrading of schools, the modification of outdoor spaces into green spaces, and the removal of asbestos.

4. Regeneration of opportunities (new courses of study): aims to set up new courses for secondary schools, such as Environmental High Schools and Technical High Schools with a Sustainable Development focus. It promotes the establishment of new ITS courses aimed at offering new job opportunities in sectors such as: bio-agriculture, precision and regenerative agriculture, circular economy, sustainable finance, green chemistry, bioeconomy, zero emission design, sustainable mobility, design and processing of new materials.

In keeping with its tradition of institutional collaboration, AIIG - Associazione Italiana Insegnanti di Geografia (Italian Association of Geography Teachers) immediately embraced these objectives and formalised its proposals for teaching and training workshops by responding to the Ministry of Education's call for the establishment of a Green Community, a network made up of "representatives of public administrations, cultural, scientific and research institutions, non-profit and for-profit organizations, including those of international importance, with the task of supporting the Administration and schools in the implementation of initiatives in the following fields ecological transition, civic, environmental and food education, sustainable development, health, and correct lifestyles, also linked to the different environmental contexts of the educational institutions" (https://www.istruzione.it/ri-generazione-scuola/partecipa.html). Indeed, if we want to nurture the hope that the start of this transitional phase will produce structural changes aimed at improving the quality of life of future generations, also through a process of correct and adequate geographical literacy, we cannot disregard a systematic action of civil commitment, in institutions and in society, without which it remains impossible even to imagine the full educational potential of geography and cartography.

LabGeoNet. The Network of Italian Geo-cartographic Laboratories

The project, the census, and establishment of the network

The experience gained in recent years within the community of Italian academic geographers and cartographers has shown how and to what extent research and teaching of cartography in national universities are increasingly linked to the presence of laboratory facilities, which support these activities at every level of education (bachelor's and master's degrees, doctorates, etc.). The wide-ranging discussion resulting from numerous scientific comparisons has highlighted the laboratories' function as 'training devices'. They are structures that combine teaching activities with those of internships, integrate knowledge with skills, promote the improvement of methodologies dedicated to Cultural Heritage, develop Digital Humanities, and produce research in theoretical and applied geography and cartography. The laboratories also articulate and support funding applications at local, national, and international scales. In order to join the existing and active laboratories, in 2018 the Italian Centre for Historical-Geographical Studies and the Association of Italian Geographers, with the support of the Coordination of Italian Geographical Associations (SoGeI)[25] shared a first census of the cartography laboratories scattered throughout the country. The survey had three main objectives:

- To produce a census of Italy's scientific geo-cartographic laboratories;
- To formally establish a network among them (LabGeoNet);
- To reflect on innovations and disseminate good practices.

Many structures, expressly called "laboratories" or with a different denomination, which support the research and teaching activities of geography teachers, have voluntarily responded to the questionnaire administered through an articulated online form. The data collected made it possible to create several useful working and communication tools, including the *Portale della rete dei laboratori geografici scientifici italiani* - Portal of the network of Italian scientific geographic laboratories (www.labgeonet.it), where each member structure has its own page.

The survey led to the first quantitative and qualitative analysis of the current situation, ranging from mere numerical data such as the list of teachers, technical staff, and young people in training (with and without contracts) who worked or permanently attended those facilities, the equipment (hardware and software) available. Information was also collected on the main research carried out, on scientific projects, whether funded or not, on the most popular topics, and on the theoretical and practical applications of the studies themselves. Lastly, all information collected has been published on the websites. The discussion of the network projects took place on the occasion of the seminars of historical-cartographic studies *Dalla mappa al GIS (From maps to GIS)*, held in Roma Tre University starting from March 2018, entitled *Laboratori in rete: ricerca, didattica, progettualità (Networked laboratories: research, teaching, projects)*. The data shows that the Italian academic geographic laboratories are quite well distributed across the national territory, albeit with a prevalent concentration in the centre and north. The structures surveyed present a wide variety of scientific and educational offerings, as well as the technologies they use and the skills they offer to universities and society (Table 1).

The latter data on the one hand show how geography dialogues with many other disciplines, and on the other, reflect the traditions of the individual structures, the cultural and economic contexts in which they operate and their relations with local authorities, for example, supporting academic courses in Physical, Human and Economic Geography, with workshops and exercises involving the use of cartography. An important element that helps to understand the orientation of the laboratories between pure and applied research is, in fact, the collaborations and networks within which they operate. Locally, there are partnerships with other universities, laboratories and centres for digital humanities, access to national and international funding (PRIN, PON, ERC), relationships with bodies (municipalities, ministries, archives, libraries, superintendencies, parks), private companies, agencies and institutions interested in cartography.

[25] SoGeI brings together the most important Italian associations and scientific societies in the field of geography and cartography: the Italian Geographical Society (SGI) and the Society for Geographical Studies (SSG), the Italian Association of Cartography (AIC), the Association of Italian Geographers (AGeI), the Italian Association of Geography Teachers (AIIG); the Italian Centre for Historical-Geographical Studies (CISGE).

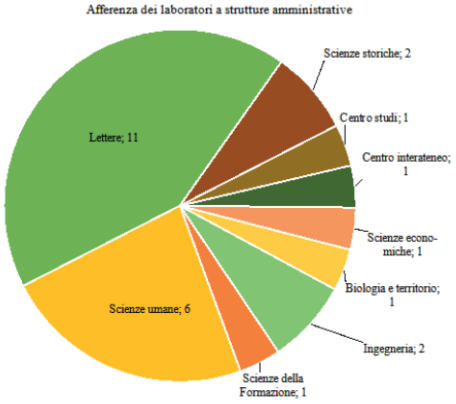


Table 1 - Administrative facilities of the LabGeoNet laboratories

All these elements determine the areas of research, which appear wide and varied. To simplify, we can reduce them to three macro-sectors (humanities 54%, technology 24% and economics 22%), but it is clear that almost all the laboratories use GIS and webGIS. The most structured laboratories are strongly devoted to spatial analysis and the development of strategies and tools dedicated to the management of spatial, economic and cultural assets. Where they can count on a good number of teachers, they tend to be involved in several levels of education (from undergraduate to doctoral degrees), and facilities also offer basic and advanced vocational courses (from those leading to certifications, such as ECDL-GIS, to second-degree master's degrees). The production of cartography appears to be a fundamental activity for Italian academic and scientific laboratories. This must be understood in a broad sense: known examples range from the production of thematic maps dedicated to and aimed at analyzing and returning the results of scholarly research (essays, collective volumes, exhibitions, etc.), to scientific and popular publications (articles for magazines, manuals, historical and thematic atlases), in static and dynamic form (3D GIS modeling, webGIS), to experimentation with interactive forms of reconstruction and visualization of geographical phenomena (flow analysis, historical GIS, storytelling, mental maps, etc.).

This shows the mature potential of the laboratories as structures for the production of maps for researchers and scholars, as well as for policymakers, private institutions, and civil society.

The establishment of LabGeoNet and the "COVID-19 Atlas. Geographies of infection in Italy"

The "Rete dei laboratori geografici scientifici italiani" (LabGeoNet - *Network of Italian Scientific Geographical Laboratories*) is represented by an executive committee periodically renewed[26]. In the light of the conceptual renewal of cartographic interpretation, the recovery of topological space, the logic of landscape, and the political and social objectives of cartography, the network has set itself the goal of representing all the Italian workshop realities, from those more oriented towards geomatics to those that refer to the theories coming from critical cartography, from the structures specialized in the history of cartography and in the use of geo-historical sources to those addressed to the elaboration of local development plans, participatory planning, social geography, just to mention a few examples. Over the years, the network has expanded, and there are now around forty member laboratories with wide national coverage, including also non-academic and non-public structures.

The strong determination of the AGeI presidency, and the drive imposed on the academic world by the spread of the SARS-CoV-2 pandemic, which saw Italy among the first countries in the world to be hit by the contagion, in particular, Lombardy, defined as the "Italian epidemic epicentre" led to the realization of the first joint scientific project: the *Atlante COVID-19. Geografie del contagio in Italia*. Understandably, the theme

[26] Andrea Riggio as National Coordinator; Carla Masetti for International Relations and SoGeI; Annalisa D'Ascenzo as Scientific Coordinator; Teresa Amodio, Luisa Carbone, Alessandra Ghisalberti, Giancarlo Macchi Jánica, Cristiano Pesaresi, Silvia Piovan, Paola Zamperlin for the Scientific Committee.

was, and still is, highly topical and has been at the centre of scientific debate in geography as well, as evidenced by numerous recent publications and special issues of Italian journals in the subject area. The Atlas was born as a national extension of the research undertaken by researchers at the University of Bergamo's Centre for Territorial Studies – DiathesisLab, aimed at investigating why the spread of the contagion took on the devastating scale found in the Bergamo area, particularly in the so-called "first phase", i.e., February-June 2020.

Andrea Riggio and Emanuela Casti coordinated a large group of 22 units from as many laboratories – and 96 researchers – who discussed the theoretical assumption that contemporary living is based on mobility and urbanity, in order to verify the territorial importance assumed by the phenomenon and how transmission occurred locally, through reticularity and/or proximity, producing a reflective mapping that explains the territorial peculiarities. The reasoning revolves around the lengthy discussion carried out by the laboratories and researchers, which has shown how the emergence of outbreaks, the spread of contagion, and the virulence of the disease in certain regions are to be sought in the holistic socio-territorial aspects that determine their diversity and their multi-scalar functioning.

Each local research unit focused on its own territory, considering its structural characteristics, associating it with data on contagion and health organizations provided by the State administration and bodies (e.g. the Ministry of Health, the Higher Institute of Health, the National Institute of Statistics, the Regions, Regional Agencies for Environmental Protection, Municipalities, etc.), but also collecting information from newspapers, social networks, interviews, personal experience and knowledge of the phenomena. The data and information processing has led to a broad national analysis, which shows a differentiated situation between regions and also between municipalities within the same region. In particular, the centralizing role of all phenomena, including virus circulation, emerged in strongly systemic realities such as metropolitan cities.

Conclusions

Reflective mapping on coronavirus infection was carried out by LabGeoNet laboratories using GIS and spatial data analysis. The *Atlante COVID-19. Geografie del contagio in Italia*, edited by A. Riggio and E. Casti and published in 2022 by the Italian Association of Geographers – Agei[27], has an initial part dedicated to the synthesis of regional cases and to a reflection on the epistemological need to change the lens to look at a complex phenomenon such as COVID-19. This is followed by regionally structured studies, each analysis consisting of a predetermined number of explanatory composite tables and accompanying analysis texts. Of these, the first section is devoted to themes common to all, with shared approaches and references, flanked by others focused on local relevant phenomena highlighted by the researchers, such as population distribution, age composition, settlement distribution, organization of regional health systems, location of hospitals and assisted living facilities, mobility flows and patterns, labor systems, pollution, land morphology, and climate.

The tables correlate the regional and socio-economic aspects, highlighting the lifestyles that had such an impact on the timing and methods of the spread of the contagion in the first phase, with some reflections also projected onto the second phase, always taking into account the trends in transmission and trying to identify local weaknesses or, on the contrary, the operations that proved effective in containing the virus. This brief presentation clearly shows the enormous amount of work carried out by the group of participants in the network of Italian scientific laboratories. The researchers have produced an articulate territorial and social analysis, equipped with a very rich graphic apparatus (topographical maps, anamorphic maps, graphs, indexes, etc.) in close synergy with the accompanying texts. Below are some illustrative tables from the Atlas.

[27] https://www.ageiweb.it/eventi-e-info-per-newsletter/pubblicazioni/atlante-covid-19/

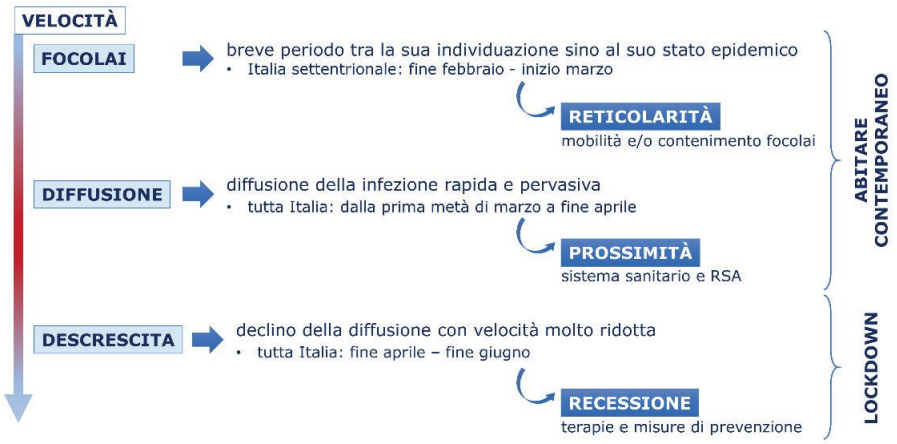


Figure 1 - The phases of virus propagation with different speeds in relation to social and territorial factors

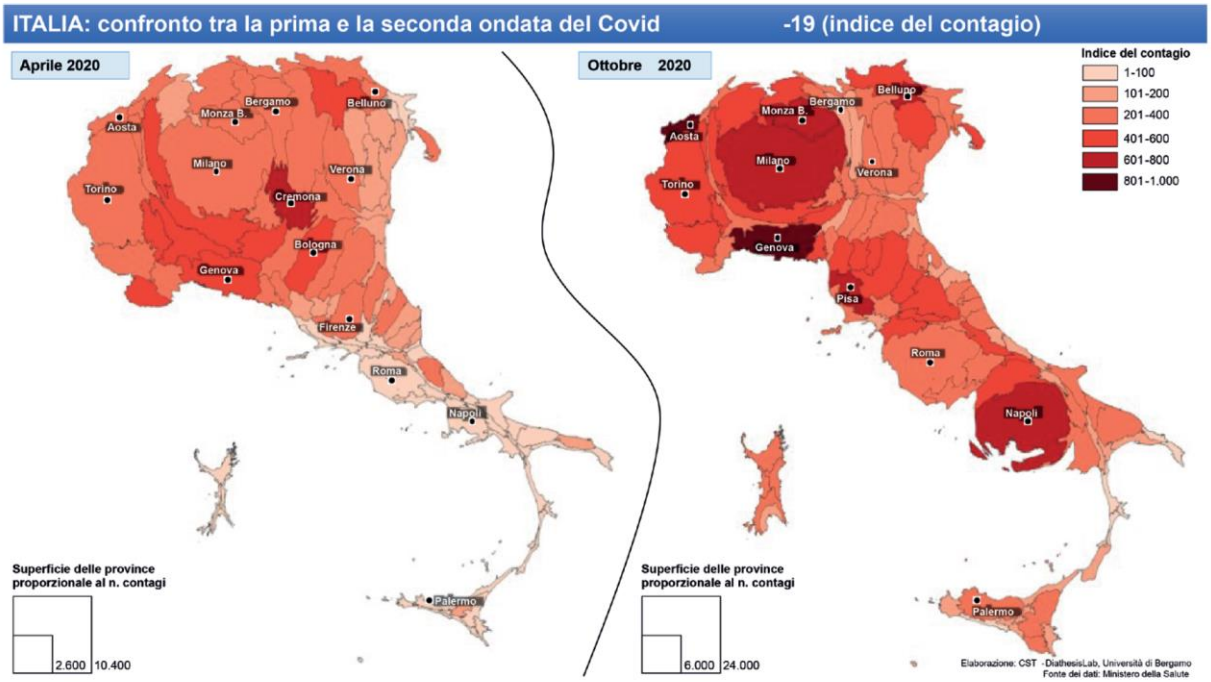


Figure 2 - Italy's anisotropic shape in the first phase of the pandemic and the trend towards epidemiological alignment in the second phase

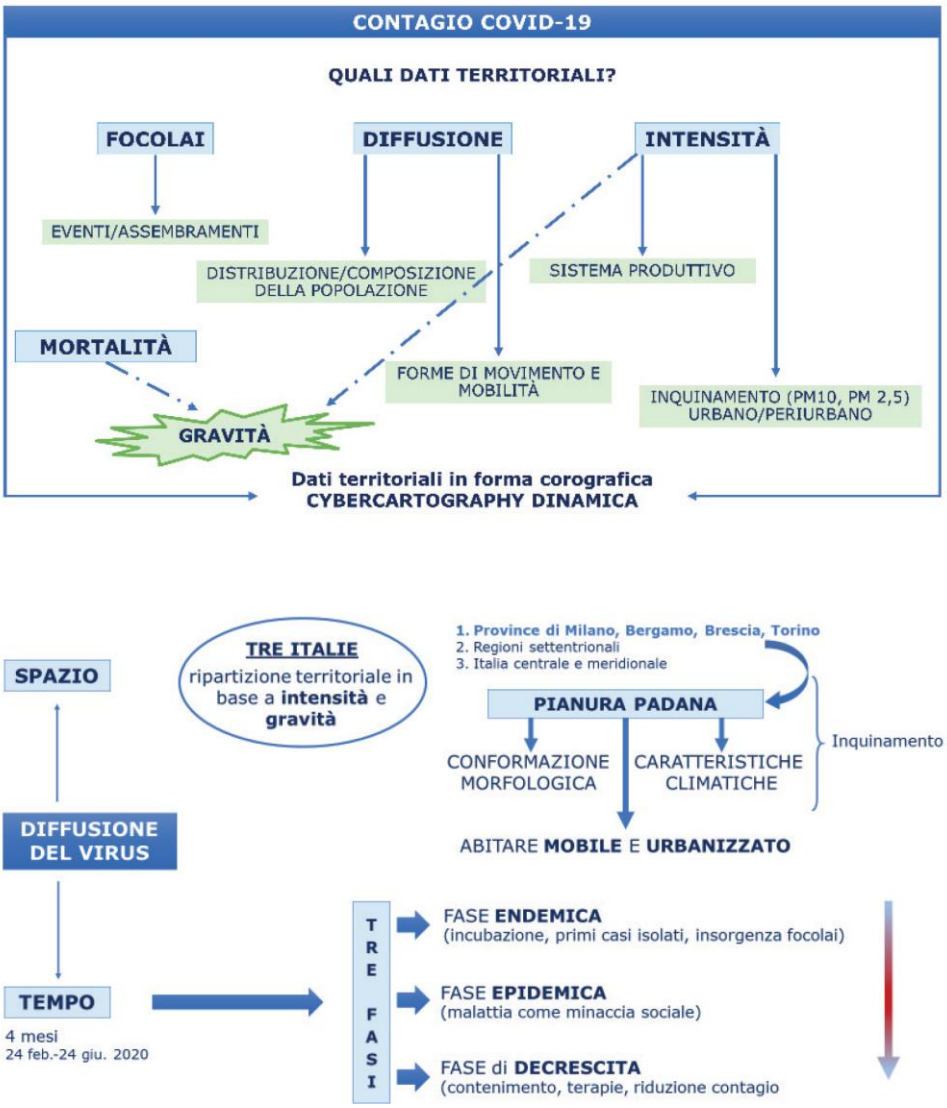


Figure 3 - Spatial data used for the analysis of COVID-19 infection and the three 'Italies' in the spatio-temporal spread of the epidemic

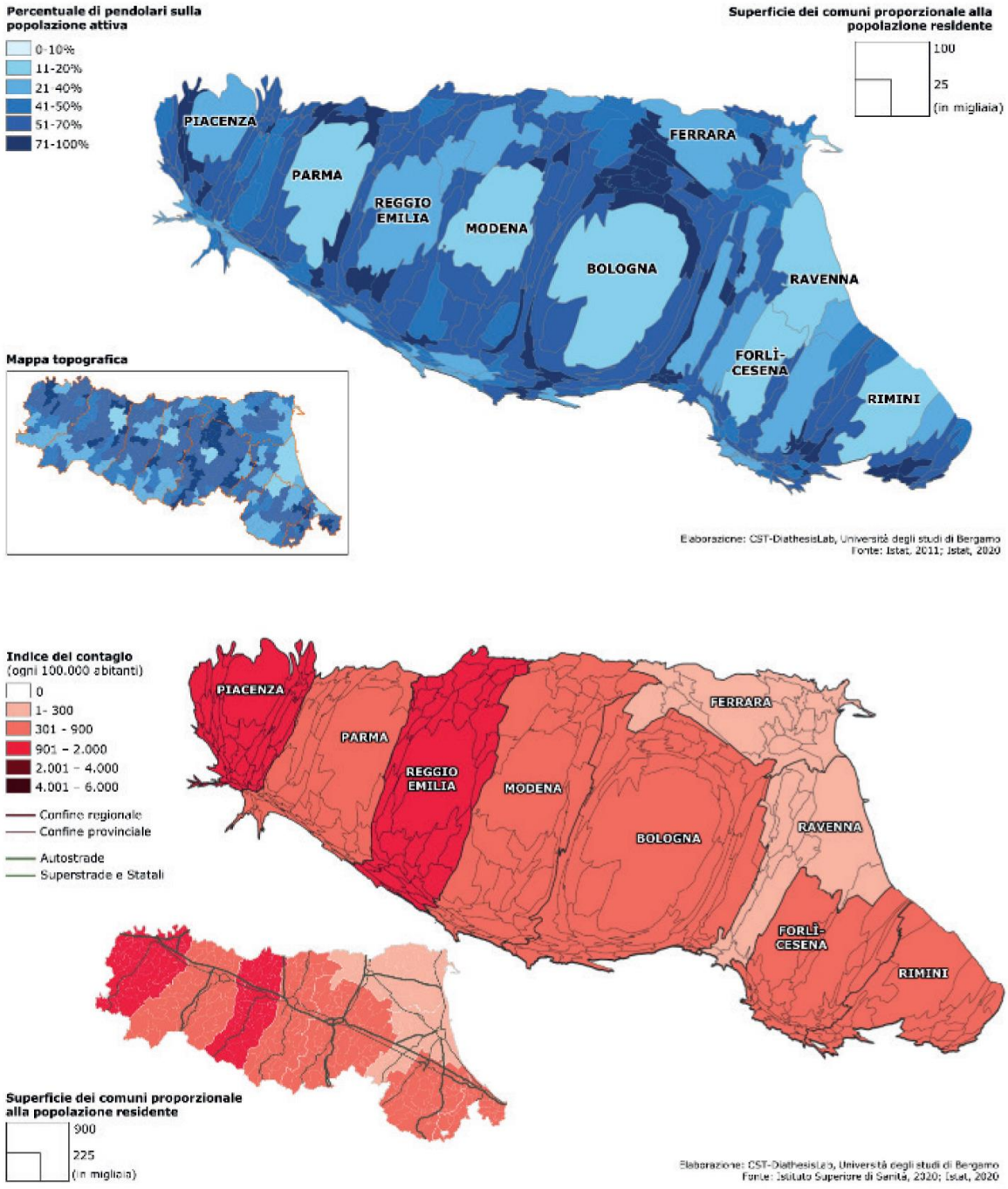


Figure 4 - Evolution of the COVID-19 infection in Emilia-Romagna in relation to the resident population and the flow of incoming commuters for work in the provincial capitals

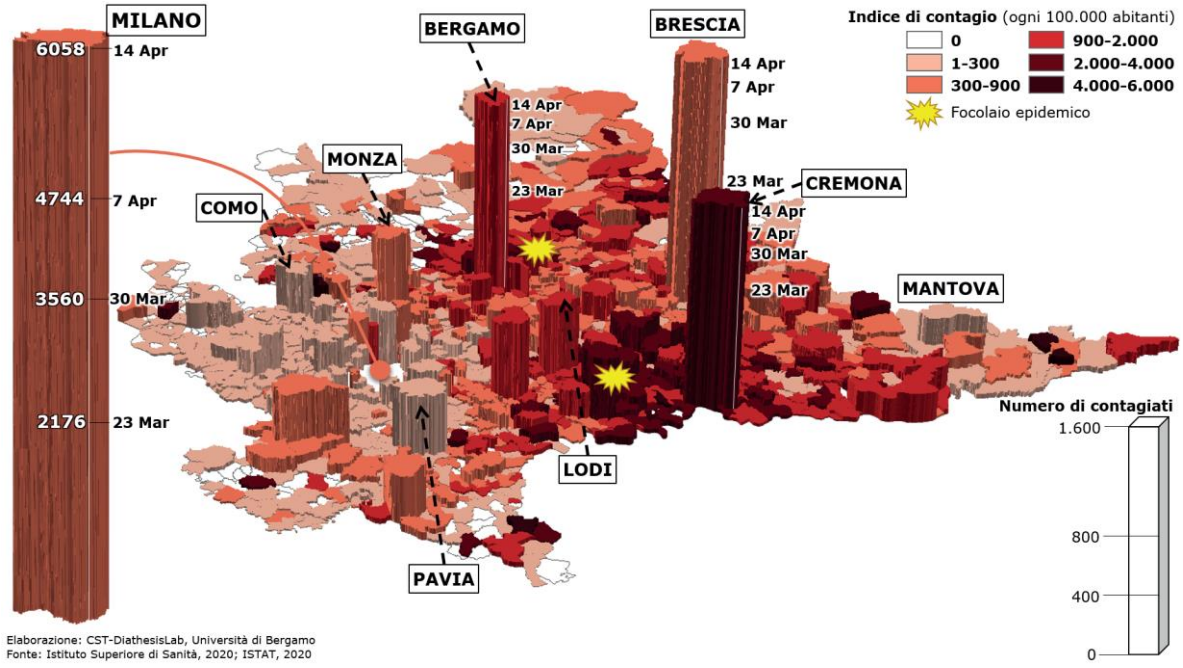


Figure 5 - Municipal distribution of infection in Lombardy from 24 February to 14 April 2020 Figure 6 - Over-mortality by tourist areas in Valle d'Aosta in the lockdown period (XI-XVIII weeks). Source: ISTAT data processing, 2020

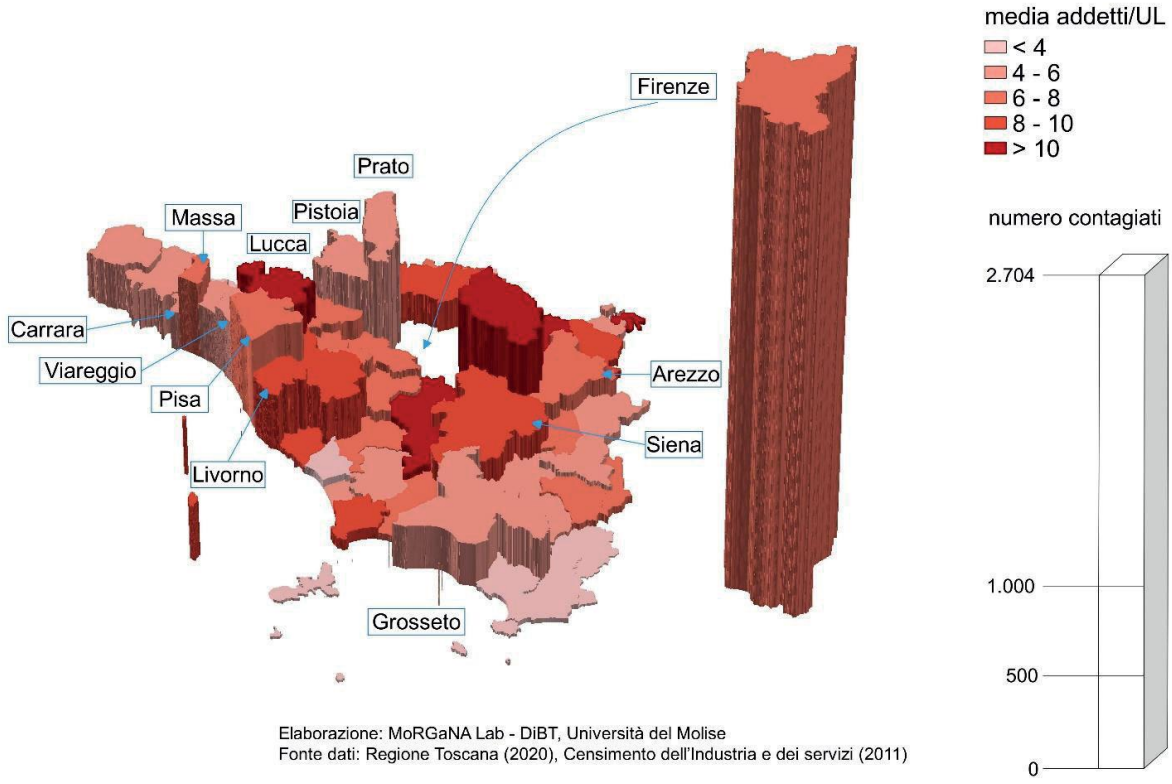


Figure 6 - The contagion in the local labor systems of Tuscany

Hazard Cartography. University Centre for the Prediction and Prevention of Major Hazards (C.U.G.R.I.-DICIV_UNISA) of the University of Salerno

Introduction

The Interuniversity Consortium, called University Centre for the Prediction and Prevention of Major Hazards between the University of Salerno and the "Federico II University of Naples", located in the Campus Universitario di Fisciano (Salerno), is a public research body with its own legal personality recognised by Ministerial Decree of 14 June 1994 (*Gazzetta Ufficiale* – Official Bulletin - no. 242 of 15 October 1994). The C.U.G.RI. has the statutory purpose of providing organizational, technical, and financial support to consortium members and institutions (public bodies and public administrations) in the field of forecasting and prevention of major hazards, in particular in the relevant sectors of earth science and engineering, with the general aim of planning strategies, measures, and operational models for the transfer of scientific knowledge for hazard mitigation, originally in the field of soil protection, but subsequently also in the field of protection of natural, environmental and landscape resources and, recently, also in the field of health protection. In order to cope with the need to prepare such hazard assessment, planning, and management tools, deriving from the ever more pressing demands in terms of soil and water protection and, more generally, in the environmental sector, the C.U.G.RI. has always invested a great deal of energy into setting up databases of environmental, territorial and landscape parameters and characteristics. All this is with a view to increasingly becoming a technical-scientific and institutional reference point for the local authorities that deal with these issues on a daily basis, also in the light of the complexity of Community, national, and regional environmental legislation, linked to the transposition of numerous European directives. The databases, in any case, although of fundamental importance, would make little sense if they were not seen as a tool for the development of models, procedures, and prototypes capable of increasing the Centre's know-how and the possibility of transferring it to collaborative relationships with local authorities and the economic system.

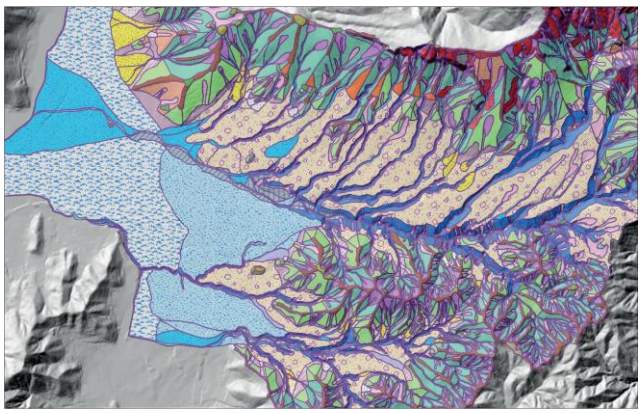
The Geomorphological Information System GmIS_UNISA®-CUGRI-DICIV

Among the other research activities with repercussions of an institutional nature, is the creation of the CUGRI-UNISA Geomorphological Information System, internationally recognized (Fig. 1) as GmIS_UNISA® – CUGRI. This has constituted one of the references for the revision and computerization of the National Geomorphological Cartography – CARG Project – within the Joint Commission constituted by ISPRA, AIGeo, and the National Council of Geologists and which, through the specific Programme Agreement with ISPR, could represent the scientific-institutional reference for updating planning at a national level in the field of geological hazards (seismic and volcanic hazards), hydrogeological hazards (landslides, floods, and coastal erosion), fire hazards (Fig. 3) and desertification, resource management (water, soil, air), radioactive hazards (radon and other radionuclides), and infrastructural and health hazards. Currently, the conceptual, logical, and physical model of the GmIS_UNISA-CUGRI is being adapted to the Content Specifications of the Ministerial Decree dated 10 November 2011 and its annexes, as well as to the Specifications of the INSPIRE Directive and ISO19100, with the translation of the traditional layer-based structure into an object-oriented structure. In this revision phase, the C.U.G.RI. has implemented and translated in object-oriented terms the hierarchical and multiscale Databases of the Informative Layers and Themes developed within the research activities of the Department of Civil Engineering of the University of Salerno in the hydro-geomorphological field at a national level: orographic barriers (Fig. 2), Land Units, eco-regions, Inventory of Earthquake Phenomena in Italy, Seismic Macrozonation, Hydro-geomorphological Units, Radon-prone Areas, and also being extended to the national level are the assessments and mapping related to the Base Flow Index, already developed at a regional level, and the cartographic specifications for the application of hydro-morphological indices (Fig. 4), for the updating of Water Management and Protection Plans.

The Major Hazards Object Information System

The whole of the C.U.G.RI.-DICIV_UNISA's cognitive heritage, together with the Models of Predictive Assessment of Hazards and Resources, constitute the Information Services Heritage that can be made

available to the institutional subjects to support their Sustainable Development Strategies. The C.U.G.RI. can therefore constitute an integrated platform with other platforms oriented to the management of landscape, territorial and environmental programming, planning and design, thus sharing the data, information and structures of multi-level and multi-topic implementations of the S.I.G.RI. (Major Hazards Information System), reworked in an environment compatible with the Ministerial Decree of 10 November 2021 and the relative Content Specifications approved by the State-Regions conference, which is mandatory for public administrations and bodies. To this end, the C.U.G.RI. has integrated the Hyper-BIM Platform into the SIGRI, including also the GIM (Geological Infrastructure 4D Model) and the ECOIM (Ecological Informative Model), consisting of real-time support of the requirements of the ecological transition, and based on the engineering of the ecoregional approach implemented by ISTAT. The cartographic production of the C.U.G.RI. is always referred to as the thematic restitution of numerical models related to a single study or research activity. These models, pertaining to the institutional activities described, have always been integrated into a univocal management system in order to allow their reusability, integration over time, and updating. An information system has been set up in which, within the limits of the specific characteristics of scale and detail of the data, there is a congruence of the same, regardless of the specific work activity. In other words, regardless of the nature of the specific studies underway (hydraulic hazard management rather than geological models or those aimed at ecological characterization), the same basic geometric references have been reused, normally referring to the reference cartographic bases at a regional scale (Technical maps at a nominal scale of 1:5000 either as a topographical base or organized in topographical DBs within the limits of the specific agreements with the bodies owning the data, i.e., Regions and Provinces). A significant example may be the hydrographic network which, in geometric terms, is realized in various sources and materialization and which is used taking as a reference the CTRN data, sometimes simplified for use at a less detailed scale rather than updated for studies at a larger scale. The thematic data returned in the form of cartographic elaborations is always understood as the product of model elaborations made starting from common basic data. The thematicization rules have been defined from time to time based on sector-specific regulations, where codified, or by introducing procedures for transforming basic numerical data into thematic data.



FOCAL LEVEL			1:100,000 GENERALIZATION	1:25,000 GENERALIZATION
Symbol	DESCRIPTION	UNITS	SYSTEM	UNIT+SYSTEM
	Crest or very sharp mountain ridge	MNT - Mountain Unit	SMT- Mountain System	MNT-SMT
	Mountain ridge	MNT - Mountain Unit	SMT- Mountain System	MNT-SMT
	Triangular facet	MNT - Mountain Unit	HSP – Hillslope System	MNT-HSP
	Canyon or gorge	VLL - Valley Unit	HSP – Hillslope System	VLL-HSP
	Debris flow deposition zone	MNT - Mountain Unit	HSP – Hillslope System	MNT-HSP
	Debris flow triggering scar	MNT - Mountain Unit	HSP – Hillslope System	MNT-HSP
	Debris flow channel scar	MNT - Mountain Unit	HSP – Hillslope System	MNT-HSP
	Accumulation glacis	PMT – Piedmont Unit	HSP – Hillslope System	PMT-HSP
	Isolated hill	MNT - Mountain Unit	SMT- Mountain System	MNT-SMT
	Denudation terrace	MNT - Mountain Unit	SMT- Mountain System	MNT-SMT
	Selective erosion scarp	MNT - Mountain Unit	HSP – Hillslope System	MNT-HSP
	Saddle	MNT - Mountain Unit	SMT- Mountain System	MNT-SMT
	Colluvial debris talus	PMT – Piedmont Unit	HSP – Hillslope System	PMT-HSP
	Concave small valley	VLL - Valley Unit	HSP – Hillslope System	VLL-HSP
	"V-shaped" small valley	VLL - Valley Unit	HSP – Hillslope System	VLL-HSP
	Hanging concave small valley	MNT - Mountain Unit	HSP – Hillslope System	MNT-HSP
	Colluvial valley	MNT - Mountain Unit	HSP – Hillslope System	MNT-HSP
	Fluvio-denudational slope	VLL - Valley Unit	HSP – Hillslope System	VLL-HSP
	Structural slope	VLL - Valley Unit	HSP – Hillslope System	VLL-HSP
	Degradation scarp	MNT - Mountain Unit	HSP – Hillslope System	MNT-HSP
	First order basin	MNT - Mountain Unit	HSP – Hillslope System	MNT-HSP
	Plain	PLN - Plain	PLN - Plain	PLN

Figure 1 - Geomorphological model map for landslide hazard and risk assessment– Fisciano University Campus Landscape (SA) - Attribute table of the focal level geomorphological objects and generalization to, 1:25,000 and 1:100,000 scales (modified from Dramis et al., 2011)

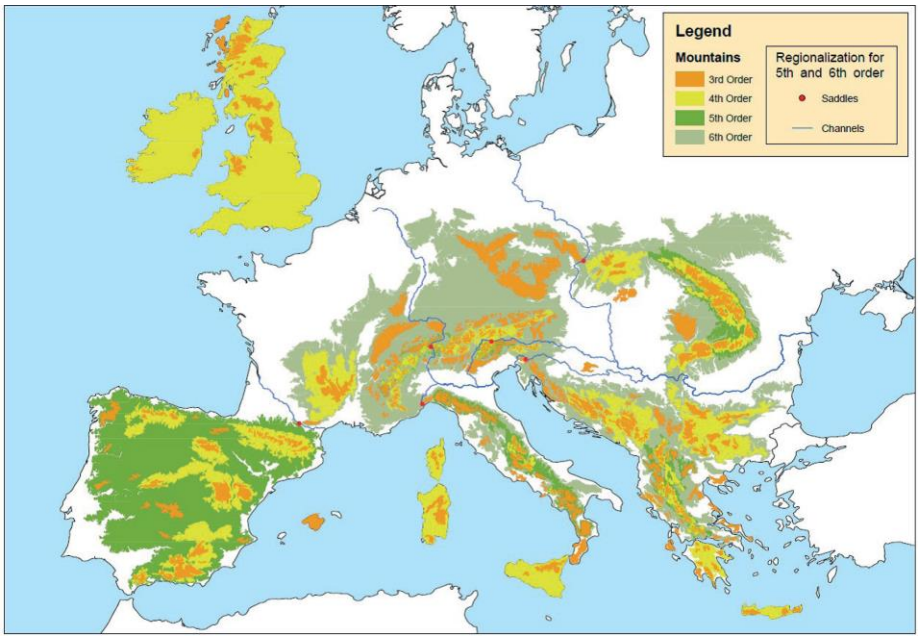


Figure 2 - Hierarchical orographic entities of Europe for frontal rainfall systems

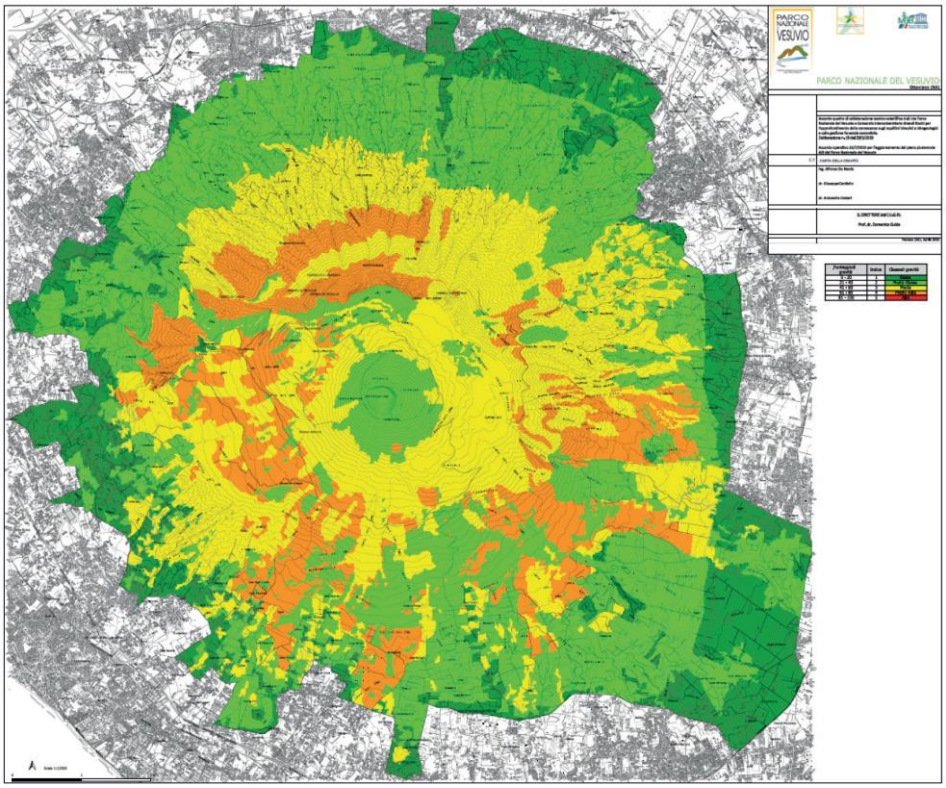


Figura 3 - Fire hazard management plan - Vesuvius National Park

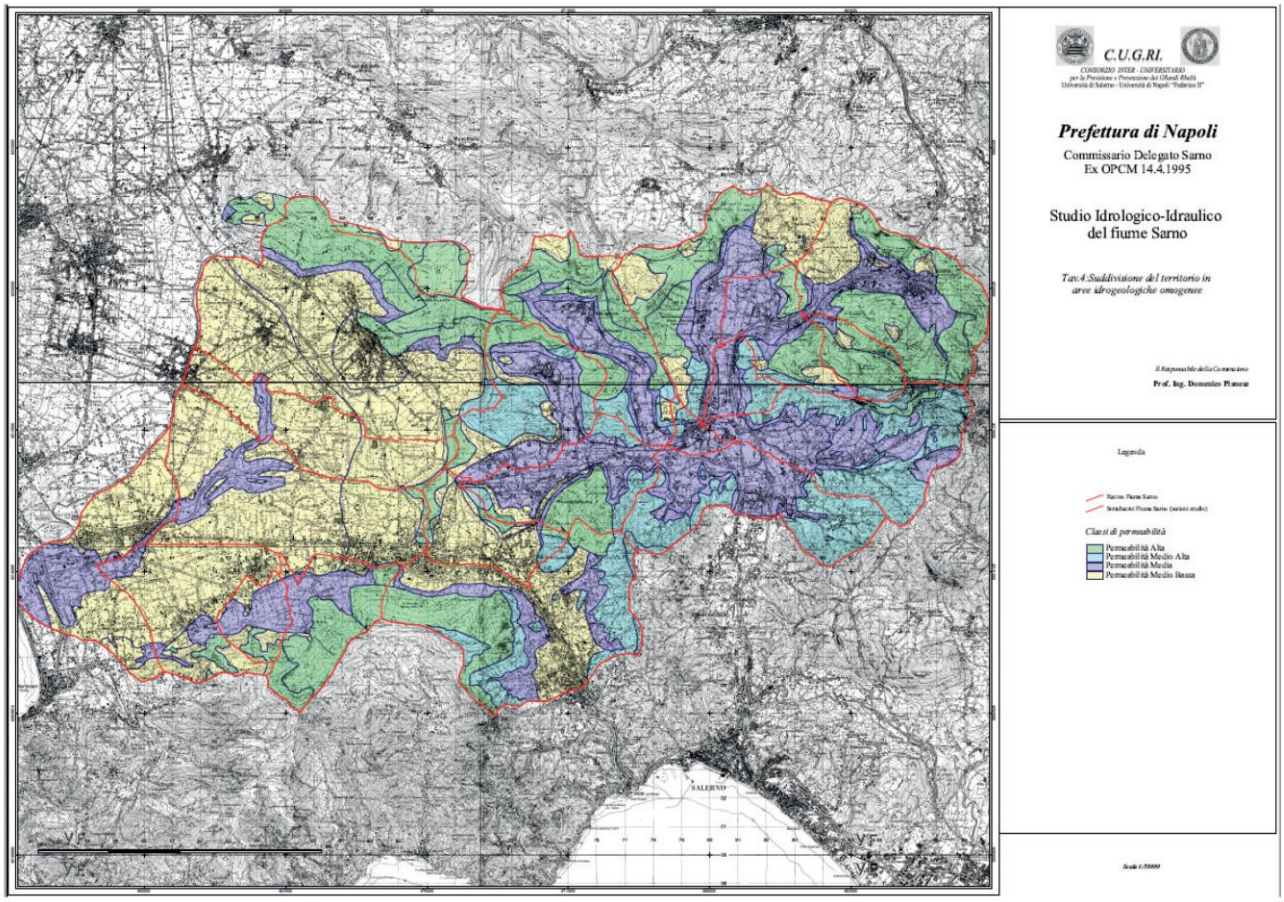


Figura 4 - Hydrological-hydraulic study Sarno River - Homogeneous hydrogeological areas (Permeability Classes)

Part Four.
The 30th International Cartographic Conference – ICC 2021

The 30th International Cartographic Conference in brief

Overview

The Italian Association of Cartography (AIC) and AIM Group International lodged da bid to host the Thirtieth International Cartographic Conference in 2021 in Firenze/Florence, Italy.

The conference was initially supposed to be held in July 2021, but the outbreak of the covid 19 pandemic forced the organizers in agreement with the ICA Executive Committee to postpone the conference to 14-19 December of the same year, in the hope that the situation improves globally to make international travel possible and reduce the measures globally adopted to contain the pandemic.

Despite the absolute novelty of the situation and the organizational problems it caused, the response of the international community of cartographers was truly surprising, showing participation at a high emotional and qualitative level.

Local Organizing Committee

The Local Organizing Committee (LOC) for ICC 2021 was led by Giuseppe Scanu, the President of the AIC as Chair and Conference Director; Paola Zamperlin and Andrea Cantile served as the Scientific Program Chairs; Margherita Azzari served as Chair of the Local Arrangements Committee; Elena Dai Prà as Chair of the International Cartographic Exhibition, Riccardo Morri as Chair of the Barbara Petchenik Children's World Map Drawing Exhibition, Paola Zamperlin, Francesca Manzani, and Gilberto Fumarola also played a leading role in organizing and managing ICC 2021.

The members of the LOC included:

Giuseppe Scanu, University of Sassari (President)
Margherita Azzari, University of Florence
Teresa Amodio, University of Salerno
Serafino Angelini, GeoSoul Italia
Milena Bertacchini, University of Modena
Camillo Berti, University of Florence
Angelo Besana, University of Torino
Giuseppe Borruso, University of Trieste
Andrea Cantile, Italian Geographic Military Institute (IGM) and University of Florence
Elena Dai Prà, University of Trento
Giuseppe Evangelista, Centre of Aeronautical Geotopographic Informations (CIGA)
Andrea Favretto, University of Trieste
Flavio Ferrante, Revenue Agency
Massimiliano Grava, University of Pisa
Aldo Ianniello, Tuscany Region
Giovanni Mauro, University of Campania "Luigi Vanvitelli"
Manuela Milli, Italian Hydrographic Institute (IIM)
Marco Pantaloni, Italian National Institute for Environmental Protection and Research (ISPRA)
Silvia Elena Piovan, University of Padua
Cinzia Podda, University of Sassari
Maria Giovanna Riitano, University of Salerno
Ilaria Tabarrani, Tuscany Region
Domenico Tacchia, Italian National Institute for Environmental Protection and Research (ISPRA)
Elena Torretta Italian Geographic Military Institute (IGM)
Paola Zamperlin, University of Pisa

Conference Management Company

AIM Group International, a professional conference management company, under the direction of Francesca Manzani, supported the AIC in organizing and managing the ICC 2021.

Assisting the LOC for the online conference the Center SIAF (Sistema Informatico dell'Ateneo Fiorentino) of the University of Florence (https://www.siaf.unifi.it/), involved in the organization after deciding to hold the ICC 2021 in hybrid mode (in presence and virtual).

Sponsors and supporters

The global uncertainty caused by the Covid-19 pandemic and the containment measures, mainly regarding social distance, updated from week to week on the basis of the trend of infections, did not allow for the technical exhibition to be set up, a factor that heavily affected the amount of sponsorship.

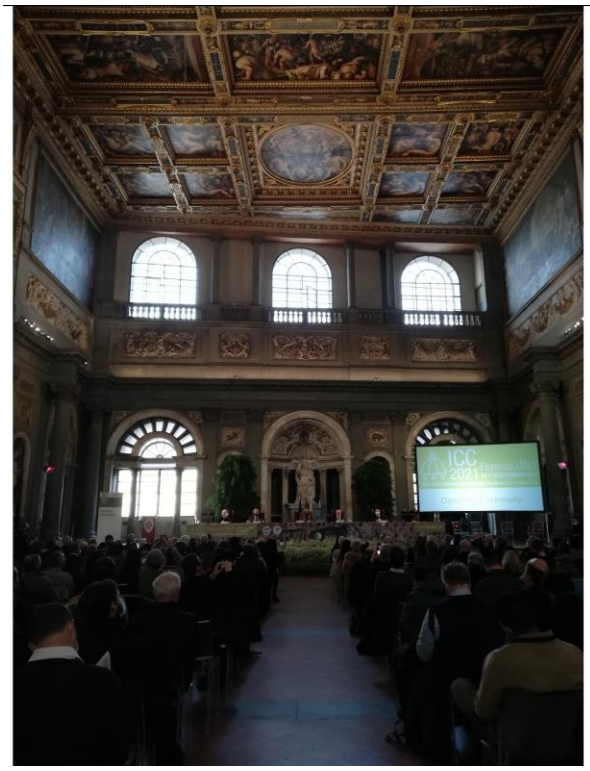
ICC 2021 received sponsorships from Regione Toscana (19.500 euro), Fondazione Cassa di Risparmio di Firenze (7.500 euro), Intesa Innovation Center (5.000 euro), Regione Autonoma della Sardegna Almaviva (5.000 euro), Esri Italia (5.000 euro), Esri (4.000 euro), Insiel Regione Friuli Venezia Giulia (3.500 euro).

Many other Institutions supported the ICC 2021: University of Firenze, Municipality of Firenze, Metropolitan City of Firenze, Italian Geographic Military Institute, Italian Hydrographic Institute, ISPRA, Agenzia delle Entrate, Italian Geographical Society, Italian Society for Geographical Studies, Italian Association of Teachers of Geography (AIIG), Italiana Association of Geographers (AGEI), Italian Center for Historical-Geographic Studies (CISGE), ASITA Federation, GFoss Italia, Scuola di Musica di Fiesole, Galileo Museum, Uffizi Gallery, ASD Firenze Orienteering.

Venue

The Conference was held in various venues located in the historic center of Firenze:

Opening Ceremony
The Salone dei Cinquecento in Palazzo Vecchio
Piazza della Signoria

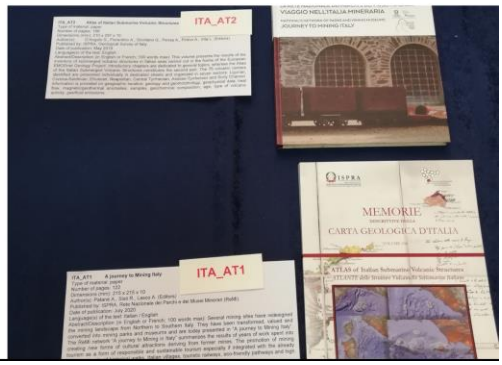



OPENING
CEREMONY

Conference Venue
The School of Humanities, University of Florence
Plesso Via Laura

International Cartographic Exhibition Venue
The Italian Geographic Military Institute
Via Cesare Battisti


AUSTRIA
AUT_AT2
AUT_AT3
CZECH REPUBLIC
SDGs IN ACTION
THE ART OF WINE FROM THE EARTH
ATLAS NÉRET


ITA_AT2
VIAGGIO NELL'ITALIA MINERARIA
JOURNEY TO MINING ITALY
ISPRA
MEMORIE
CARTA GEOLOGICA D'ITALIA
ITA_AT1
A journey to Mining Italy


INTERNATIONAL
CARTOGRAPHIC
EXHIBITION
ICA
ACI
ICC
2021
30th INTERNATIONAL
CARTOGRAPHIC EXHIBITION
START


INTERNATIONAL
CARTOGRAPHIC
EXHIBITION

Children's Map Exhibition
Ex-Circolo in Palazzo Medici Riccardi
Via De' Ginori

Closing Ceremony
The Sala Pegaso in Palazzo Guadagni Strozzi Sacrati
Piazza Duomo

Program Overview

Pre-conference workshops (Visualization of Dynamic Phenomenons and Processes on Web Maps; Mapping the Ottoman Realm: Travelers, Cartographers and Archaeologists; Map Design for Atlases; Geospatial approaches to combating Covid-19; Workshop on Map Generalisation and Multiple Representation; Sharing cartographic Knowledge; Immersive Cartography / Cartography for Immersive Environments; Disaster risk reduction (DRR) progress for cartography in Big Data era; Geospatial Semantics) were held in hybrid mode on December 13th.

The day after, the ICA Executive Committee was invited to a press release at the Uffizi Museum on the occasion of the re-opening of the famous Terrace of the Map Room.

The ICC 2021 officially began with an opening ceremony at the Salone dei Cinquecento in Palazzo Vecchio officiated by Timothy Trainor, ICA President. After a number of welcomes from the Italian public and cultural Institutions and mapping Agencies, special remarks were delivered by Abri Kampfer, Director of International Hydrographic Organisation, Gregory Scott, Inter-Regional Advisor, UN-GGIM at United Nations, and the International Science Council; International Cartographic Association Awards were given; closing remarks were delivered by Giuseppe Scanu, President of the Italian Cartographic Association and Margherita Azzari, President of the School of the Humanities, University of Florence. A very emotional program of classical music (Mozart, Quartet n.19 in C major K.465) by the Enigma Quartet, from the prestigious Scuola di Musica di Fiesole closed the ceremony.

In total 80 parallel technical sessions were held in hybrid form on December 15-18.

Two keynote speakers were invited by the LOC: Greg Scott, Cartography in an Age of Digital Transformation (December 15), and Menno-Jan Kraak, Open Map Knowledge - ICA's contribution to the SDGs (December 17).

Four hybrid panel sessions also enriched the program: 1) Urban Data Analytics platform based on Earth Observation and Artificial Intelligence: Latitudo 40, Geospatial Data and Business Innovation, panelists Mauro Manente (Latitudo 40) and Luigi Ruggerone (Intesa Sanpaolo Innovation Center); 2) Geospatial Data, Dashboards, Analytics and Scientific Communication – Lessons Learned from the COVID-19 Pandemic, organized by Paola Zamperlin (University of Pisa) and Aileen Buckley (Esri, Redlands), moderated by Aileen Buckley, discussant: Tim Trainor, ICA President and panelists: Este Geraghty, Esri Chief Medical Officer, Frank Dong, Johns Hopkins University, Jim Herries, Esri, Redlands - ArcGIS Living Atlas, Gianni Campanile, Project Manager - Esri Italia; 3) National Mapping, National Geospatial and National Statistical Agencies Day of Collaboration and Information Sharing; 4) Spatial information at the heart of the Country's recovery, the renewed role of the Italian Regions.

Only 33 posters were included in the virtual poster session. The impossibility of being able to participate in presence has discouraged many authors.

The Orienteering competition took place December 18th (Saturday morning) at Parco delle Cascine, a monumental and historical park in the city of Florence, led by Pierluigi Cantini (ASD Firenze Orienteering).

The Gala Dinner took place on 17th of December evening at the beautiful location of Palazzo Borghese, with a suggestive aperitivo in the Sala Specchi (the Mirror Room), the ancient bedroom of Paolina Bonaparte.

The organization of technical and social tours has been drastically affected by the pandemic. Only small group visits were possible, according to the rules for Covid-19 prevention and with EU Digital Covid Certification required, to the following sites: Italian Geographic Military Institute, Historical Museum of Italian Cartography; Museum Galileo - Institute and Museum of the History of Science, guided tour of the collections of scientific instruments from Medici period to XX century; Exhibition Natura Collecta, Natura Exhibita, Salone Donatello, San Lorenzo Church; Dante's Cosmography at Pitti Palace.

Attendance

The final number of participants is divided as follows:

In presence	
- *regular fee*	227
- *student and from developing countries*	105
Online	
- *regular fee*	230
- *student and from developing countries*	79
Total attendance	**641**

Country	IN PERSON	ONLINE	Total	Country	IN PERSON	ONLINE	Total
AUSTRALIA	1	2	3	LUXEMBOURG		1	1
AUSTRIA	12	12	24	MAKEDONIJA		1	1
BELGIUM	1	4	5	MEXICO		1	1
BRAZIL		23	23	NEW ZEALAND		1	1
BULGARIA	4	1	5	NIGERIA		1	1
CANADA	2	9	11	NORWAY	3	3	6
CHILE	4	1	5	POLAND	15	3	18
CHINA	1	19	20	ROMANIA	6		6
CROATIA	5	3	8	RUSSIA	7	7	14
CZECH REPUBLIC	34	4	38	SERBIA		1	1
DENMARK		1	1	SINGAPORE	1		1

Country	IN PERSON	ONLINE	Total	Country	IN PERSON	ONLINE	Total
EGYPT		1	1	SLOVAK REPUBLIC	3	1	4
ESTONIA	2		2	SLOVENIA	6	1	7
FINLAND	3	6	9	SOUTH AFRICA	2	9	11
FRANCE	12	12	24	SOUTH KOREA	1	1	2
GERMANY	27	27	54	SPAIN	7	9	16
GREECE	1	7	8	SWEDEN	2	1	3
HONDURAS	2		2	SWITZERLAND	11	17	28
HONG KONG		18	18	TAIWAN		2	2
HUNGARY	11	10	21	THE NETHERLANDS	6	1	7
ICELAND	1		1	TURKEY	1	2	3
INDIA		4	4	UKRAINE		1	1
ISRAEL	1	1	2	UNITED ARAB EMIRATES	5		5
ITALY	76	48	124	UNITED KINGDOM	8	2	10
JAPAN	1	11	12	UNITED STATES	1		1
LATVIA	3		3	USA	29	29	58
LITHUANIA	1	1	2	UZBEKISTAN		1	1
				Totale complessivo	**309**	**321**	**641**

Scientific Program and Technical Paper and Poster Sessions

Scientific Program Committee included:

Paola Zamperlin, University of Pisa
Andrea Cantile, Italian Geographic Military Institute and University of Firenze
Manuela Milli, Italian Hydrographic Institute

Caterina Balletti, Universtity IUAV of Venice
Pierfrancesco Bellini, University of Florence
Stefania Bertazzon, University of Calgary
Annibale Biggeri, University of Florence
Piero Boccardo, Politecnico di Torino
Enrico Borgogno Mondino, DISAFA – Università degli Studi di Torino
Gherardo Chirici, University of Florence
Virgilio Cima, Center for Information, Geographical and Statistical Systems (CISIS)
Branka Cuca, Politecnico di Milano
Paolo Dabove, Politecnico di Torino
Annalisa D'Ascenzo, Roma Tre University
Massimo De Marchi, University of Padova
Sergio Farruggia, Stati Generali dell'Innovazione
Marco Folin, University of Genoa
Stefano Gandolfi, University of Bologna
Anna Guarducci, University of Siena
Francesco Guerra, Universtity IUAV of Venice
Robert Laurini, Knowledge Systems Institute, USA e Università di Lione, Francia
Andrea Maria Lingua, Politecnico di Torino
Evangelos Livieratos, Aristotle University, Thessaloniki

Fabio Lucchesi, University of Florence
Giorgio Mangani, University of Bologna
Carla Masetti, Roma Tre University
Riccardo Mazzanti, University of Pisa
Riccardo Morri, Sapienza Università di Roma
Beniamino Murgante, University of Basilicata
Maurizio Napolitano, Fondazione Bruno Kessler
Paolo Nesi, University of Florence
Cosimo Palagiano, Accademia Nazionale dei Lincei
Gianni Pantaleo, University of Florence
Michela Paolucci, University of Florence
Cristiano Pesaresi, Sapienza Università di Roma
Marco Pierozzi, Italian Navy Hydrographic Office
Andrea Riggio, University of Cassino and Southern Lazio
Massimo Rossi, Fondazione Benetton
Massimo Rumor, University of Padua
Marco Scaioni, Politecnico di Milano
Monica Sebillo, University of Salerno
Silvia Siniscalchi, University of Salerno
Claudio Smiraglia, University of Milanf
Luca Tavasci, University of Bologna
Davide Travaglini, University of Florence
Umberto Trivelloni, Interregional Center for Information, Geographical and Statistical Systems (CISIS)
Grazia Tucci, University of Florence
Francesco Vallerani, Universtity IUAV of Venice

Timothy Trainor, ICA President
Andrés Arístegui, ICA Vice-President
Temenoujka Bandrova, ICA Vice-President
Otakar Čerba, Commission on Maps and the Internet
Serena Coetzee, Commission on SDI and Standards
Arzu Çöltekin, Commission on Visual Analytics
Philippe De Maeyer, ICA Vice-President
Imre Josef Demhardt, Commission on the History of Cartography
Igor Drecki, ICA newsletter – University of Auckland
Ron Furness, Commission on Marine Cartography
Georg Gartner, ICA Past President
Mátyás Gede, Commission on Cartographic Heritage into the Digital
Amy Griffin, Commission on Cognitive Issues in Geographic Information Visualization
Haosheng Huang, Commission on Location Based Services
Bin Jiang, Commission on Geospatial Analysis and Modeling
Liu Jiping, Commission on Cartography in Early Warning and Crisis Management
Peter Jordan, Commission on Toponymy (ICA-IGU joint commission)
Alexander Kent, Commission on Topographic Mapping
Menno-Jan Kraak, ICA Past President
Jonathan Li, Commission on Sensor-driven Mapping
Liqiu Meng, ICA Vice-President
Terje Midtbø, ICA Vice-President
Ian Muehlenhaus, Commission on Map Design

Andrea Naß, Commission on Planetary Cartography
Taien Ng-Chan, Commission on Art and Cartography
Dušan Petrovič, Commission on Mountain Cartography
Silvana Philippi Camboim, Commission on Open Source Geospatial Technologies
Carla Cristina Reinaldo Gimenes de Sena, Commission on Cartography and Children
Waldirene Ribeiro, Commission on Maps and Graphics for Blind and Partially Sighted People
Anthony C. Robinson, Commission on Visual Analytics
Robert Roth, Commission on User Experience
Peter Schmitz, Commission on Map Production and Geoinformation Management
Thomas Schulz, ICA Secretary-General and Treasurer
René Sieber, Commission on Atlases
M. Pilar Sònchez-Ortiz Rodriguez, ICA Vice-President
Guillaume Touya, Commission on Generalisation and Multiple Representation
Lynn Usery, Commission on Map Projections
Dalia Varanka, Commission on Geospatial Semantics
Vít Voženílek, ICA Vice-President
Yoshiki Wakabayashi, Commission on Ubiquitous Mapping
Tao Wang, Commission on Education and Training
Xiaobai Angela Yao, Commission on Geospatial Analysis and Modeling

Conference Themes

The Conference themes were decided after a long reflection involving the LOC and the members of the EC of ICA and the representatives of the commissions. It was decided to reduce the number of themes and update their wording. In the final version, they included:

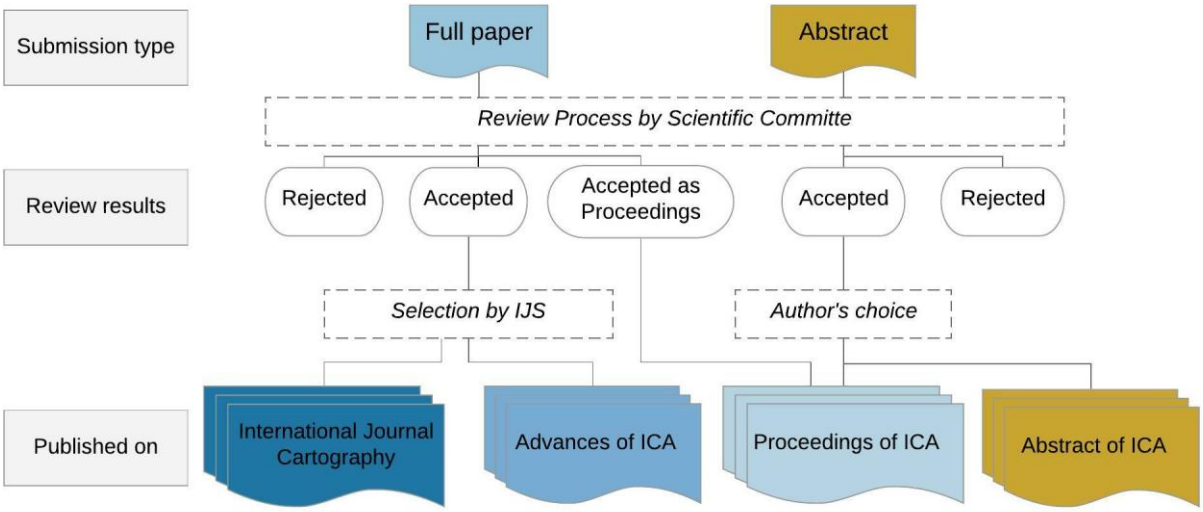
T01. Art in Cartography
T02. Atlases
T03. Cartographic Heritage into the Digital Domain
T04. Cartography and Children
T05. Cartography for Early Warning and Crisis Management
T06. Cognition in Geovisualization
T07. Education and Continuous Learning in Cartography
T08. Generalization and Multiple Representation
T09. Artificial Intelligence in Mapping
T10. Social Sensing and Visual Analytics
T11. History of Cartography
T12. Location Based Services and Ubiquitous Mapping
T13. Map Design
T14. Map Production and Geoinformation Management
T15. Maps and Accessibility
T16. Participatory Mapping
T17. Marine Cartography
T18. Mountain Cartography
T19. Open Geospatial Data and Technologies
T20. Planetary Cartography
T21. Spatial Data Infrastructure and Standards
T22. Sensor-Driven Mapping
T23. Toponymy in Cartography

T24. Cartography and Public Health
T25. Cartography and Sustainable Development
T26. Perspectives in a New Cartographic Research Agenda
T27. Transformation of National Mapping Agencies
T28. Cartography in Digital Humanities
T29. Mapping Urban Environments
T30. Theoretical Cartography
T31. Cartography for Leisure
T32. Military Mapping
T33. Augmented and Virtual Realities in Cartography
T34. Use, User, and Usability
T35. Map Projections
T36. Cartography, Privacy, and Ethics

International Scientific Program Committee, Submissions and Review

The entire Scientific Committee was included in the review panel, to which some names of close trusted collaborators were added.

The procedure for submission, evaluation, selection, and publication of contributions strictly followed the guidelines provided by the ICA. The figure below summarizes the phases of the entire process.



According to the ICA guidelines, two types of submission could be accepted: abstract and full paper, compliant with the template available online (full papers have a length of 8 pages, abstracts have a length of 1-2 pages).

The review was carried out in a single-blind fashion. Each contribution was sent to two reviewers, one Italian and one international.

The review form was based on the following criteria: scientific originality, potential interest in the community, proper documentation of prior work, clarity of presentation, technical correctness, and correct use of language.

After the deadline, there were 563. After the first review phase, 485 were submitted for the second phase.

Conference publications and Journal

The publications of ICC 2021 have been published in the ICA proceedings series at Copernicus, in three different formats:

Full papers:

- Advances in Cartography and GIScience of the International Cartographic Association, Volume 3, 2021 | 30th International Cartographic Conference (ICC 2021), 14–18 December 2021, Florence, Italy, Editor(s): P. Zamperlin, A. Cantile, and M. Milli (https://ica-adv.copernicus.org/articles/3/index.html). 14 papers
- Proceedings of the International Cartographic Association, Volume 4, 2021, 30th International Cartographic Conference (ICC 2021), 14–18 December 2021, Florence, Italy, P. Zamperlin, A. Cantile, and M. Milli (https://ica-proc.copernicus.org/articles/4/index.html). 117 papers

Extended abstract:

- Abstracts of the International Cartographic Association, Volume 3, 2021 | 30th International Cartographic Conference (ICC 2021), 14–18 December 2021, Florence, Italy, Editor(s): P. Zamperlin, A. Cantile, and M. Milli (https://ica-abs.copernicus.org/articles/3/index.html). 324 abstract

A selection of the best papers was further reviewed and published in the International Journal of Cartography:

- International Journal of Cartography, Volume 7, Issue 3 (2021). Special Issue: International Cartographic Conference 2021, Florence, Italy. Part 1. (https://www.tandfonline.com/toc/tica20/7/3?nav=tocList). 5 papers
- International Journal of Cartography, Volume 8, Issue 1 (2022). International Cartographic Conference 2021, Florence, Italy. Part 2 (https://www.tandfonline.com/toc/tica20/8/1?nav=tocList). 11 papers

International Cartographic Exhibition

The International Cartographic Exhibition (ICE) in Florence has been organized as a part of the 30th International Cartographic Conference (ICC). All exhibits were physically displayed at the Italian Geographic Military Institute – via Cesare Battisti 10, Florence, Italy – from 13th to 17th December 2021, but also virtually at www.geografia-applicata.it.

As in its previous editions, the Exhibition was structured according to seven categories: Maps on Panels (MP), Charts on Panels (CP), Atlases (AT), Digital Products (DP), Digital Services (DS), Educational Cartographic Products (EP), Other Cartographic Products (OC).

In addition, this year the Local Organizing Committee (LOC) decided to welcome additional cartographic materials in an Out-of-Competition section (Additional Products), with the aim of granting visibility to as many cartographic products as possible, even if exceeding the set number of entries officially being accepted from each ICA member, without compromising the fairness of the contest.

As in its previous editions, the Exhibition was able to attract great interest among professional cartographers, professors, experts, and researchers, and it fostered widespread participation in the world of cartography. Notwithstanding the numberless logistic criticalities stemming from the temporal coincidence of the Exhibition with a new peak of the COVID-19 pandemic still occurring in many countries, the event was able to convey a total amount of 410 products, coming from 26 different countries all over the world. Overall, the 32 participants (National Members and Affiliate Members) were able to propose the following materials:

- 240 maps on panels
- 31 charts
- 42 digital products
- 16 digital services

- 33 atlases
- 22 educational products
- 26 other cartographic products.

A total amount of 180 panels were employed to display the 271 hang-up cartographic products, with a total linear extent of 180 metres. 92 out of the 271 products exceeded the maximum width extent communicated through the guidelines, and 2 of them exceeded the maximum height extent. A total amount of 81 printed products were exhibited on tables and shelves for a total linear extent of 20 meters. 6 workstations were prepared to show 58 cartographic digital products and services.

Unfortunately, travel bans, quarantine periods, and other Visa delays, all related to the ongoing pandemic, prevented the products of 10 participants from being exhibited in due time for the formal inauguration, and the products of 7 out of them to be physically exhibited. 3 out of the latter managed to realize a partial exhibition (Sweden, Canada, Israel), while 4 out of them were not able to send a substitute nor able to send their products in time for the event and had to completely withdraw, formally or de facto (Catalonia, China, USGS, South Africa).

With the purpose of offering the possibility of viewing the Exhibition also to those who will participate in the conference remotely, the Exhibition was accompanied, for the first time, by a parallel online virtual Exhibition. All this was possible thanks to the cooperation between the GeCo - University of Trento and the LabGeo - University of Florence, which took care, respectively, of the systematic acquisition and collection of all the cartographic products and of the design and implementation of the dedicated website where the virtual Exhibition was hosted. Through this method, a "general public vote" was allowed together with the traditional vote from the Jury to animate the cartographic competition.

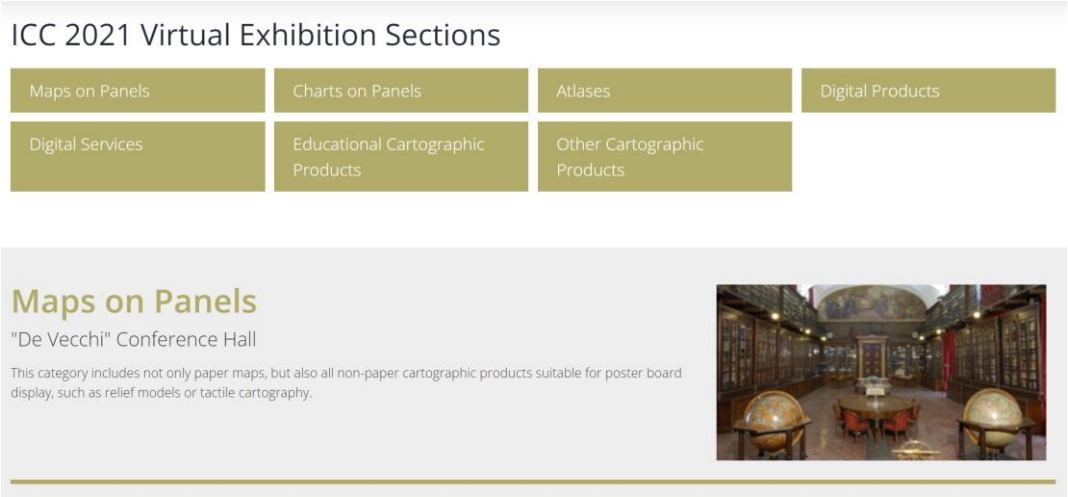
The proposed items ranged from political maps to physical maps representing every corner of the Earth, and even the surface of other celestial bodies; from the strictest technical standard specimens of official cartography to the most evocative reinterpretations of classical cartography; from the finest depictions of natural environments and geological and lithological substrates to the most vivid and crowded urban and metropolitan networks. Geomorphology, Economics, Politics, Boundaries, Cities, Forests, Nature, Sustainability, History, Archaeology, Vulcanology, Urbanistics, Glaciology, Animals, Transports, and all the other infinite elements that can be geographically set and analyzed were at the core of the visual investigations that the participants offered to the visitors through the valuable outputs of their limitless effort.

The abundant cartographic production presented by the 32 participants to this year's Exhibition was visited and appreciated by a large number of ICC participants, who purposefully joined the event despite the obstacles related to logistics and the global health emergency. This once again testifies to the role of cartography as an instrument that is always able to harness the efforts and the keenness of many professionals and scholars, catalyzing them toward the common purpose to improve, disseminate and celebrate the art and science of map production.

An international jury selected 18 awards in six categories, reaching from Maps on Panels, Charts on Panels, Atlases, Digital Products, and Educational Products, to Other Products. In addition, a popular vote was conducted online, which resulted in 8 additional awards for six categories. All map awards were presented by the jury at the Closing Ceremony on 18 December in the beautiful Sala Pegaso in Palazzo Guadagni Strozzi Sacrati (https://icaci.org/presidents-blog-ica-map-awards-at-30th-icc/).

The complete catalog has been published and it is free for download from: https://www.openstarts.units.it/collections/328a29fc-2b21-43f7-95e1-95eddfd13270

The virtual Exhibition is accessible through http://www.geografia-applicata.it/en/icc-2021-virtual-exhibition/



Barbara Pechenik Children's Map Competition

The Barbara Petchenik Competition is a biennial map drawing competition for children created with the aim to promote the creative representation of the world in graphic form by children.

The theme for the Barbara Petchenik Children's Map Competition for the ICC 2021 in Florence is "A map of my future world".

The Italian Association of Geography Teachers, and his president Riccardo Morri, supported the ICA Commission on Cartography and Children in managing the international competition, which drew 178 submissions from 32 countries and 5 continents. Drawings are available at the following temporary webpage: https://vanderkrogt.net/petchenik/index.php

For the first time, a virtual trip to the exhibition was developed, thanks to Alessandro Rissone: http://www.observo360.com/icadrawingexhibition/

Barbara Petchenik Competition 2021

Under 6 years:

1st award: *My Favorite Planet,* Ivayla Lazarova (5), 37 votes, Lesnovo (Bulgaria)

2nd award: *We are one family,* Elzė Marija Jakubėnaitė (4), 36 votes, Jonava (Lithuania)

3rd award: *Où vont le glaciers? (Where do the glaciers go?),* Lyyti Kalakoski (5), 32 votes, Tampere (Finland)

6 to 8 years:

1st award: *Friendly World,* Alfonsina Valdez Galli (7), 71 votes, Resistencia (Argentina)

2nd award: *Countries in the World overcoming COVID-19 Together,* Yang Se-Ha (7), 35 votes, Gimpo (Republic of Korea)

3rd award: *The Most Important Game of Chess,* Pavol Rybár (8), 26 votes, Rajec (Slovakia)

9 to 12 years:

1st award: *Stop the Pandemic: We love to travel, we love maps,* Matvei Pilko (10), 32 votes, (Israel)

2nd award: *The planet of the future,* Magda Oswald (12), 25 votes, Osijek (Croatia)

3rd award: *My future is in your hands: You choose,* Barnaby Blampied (11), 14 votes, Warkworth (New Zealand)

13 to 15 years:

1st award: *Holographic map of my future world,* Angela Waiman (15), 30 votes, West Jakarta (Indonesia)

2nd award: *The Fragile World,* Elmira Sabanchieva (13), 23 votes, Nalchik (Russian Federation)

3rd award: *In the same water,* Daniela N. Villacrés Ribadeneira (14), 22 votes, Quito (Ecuador)

Creativity award: *Virtual Reality*, Pijus Jokubaitis (15) (Lithuania)

Public award: *Friendly World,* Alfonsina Valdez Galli (7) (Argentina)