TERRITORI APERTI

Risk planning and assessment at the regional and urban scale

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UNIVERSITÀ DEGLI STUDI DELL'AQUILA

COMUNE DELL'AQUILA

PARTNER

CNR-ISTI

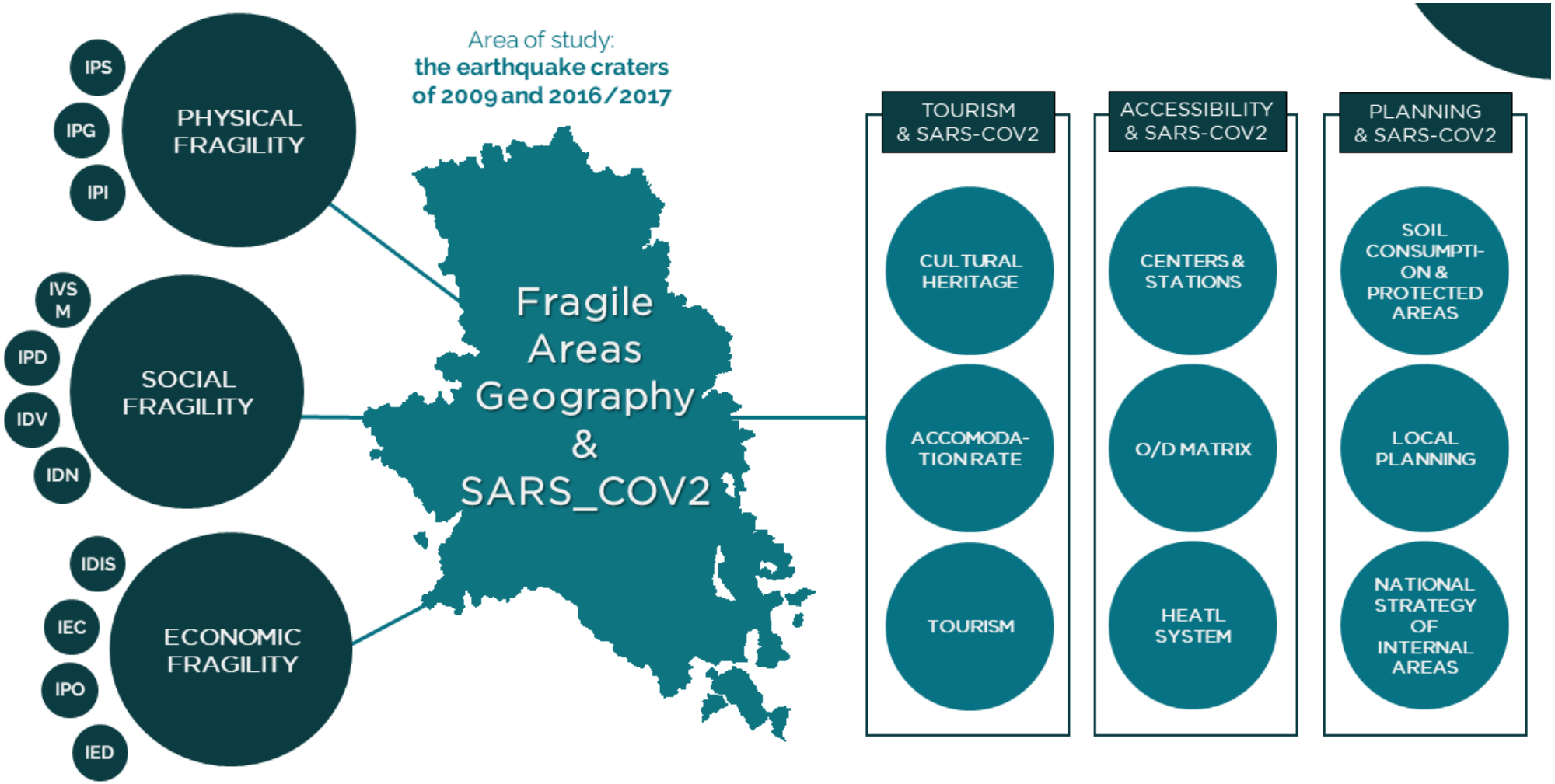
USRA Ufficio Speciale per la Ricostruzione dell'Aquila

UNIVERSITA' DEGLI STUDI D'ANNUNZIO

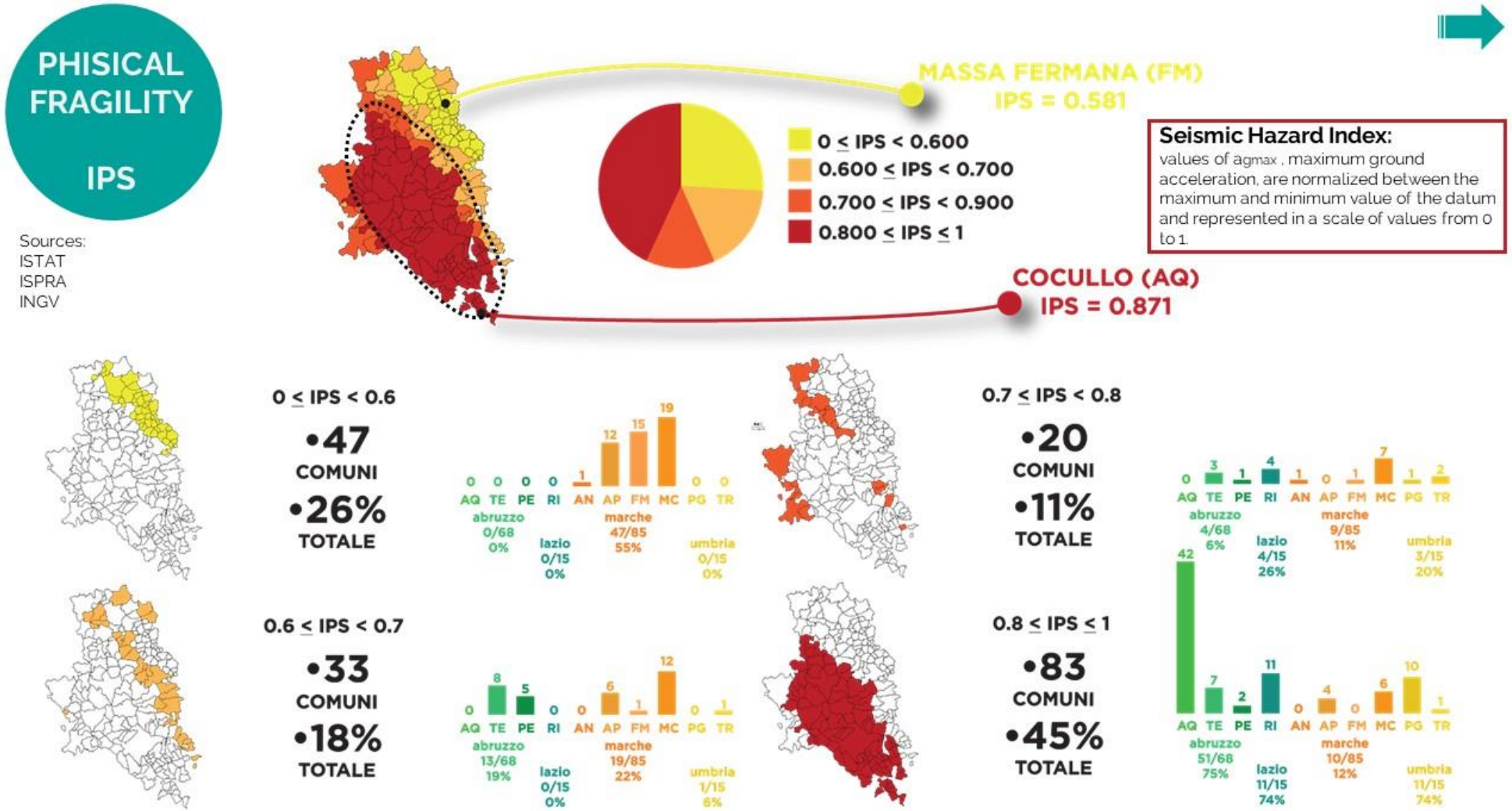
CGIL CISL UIL

Regional scale

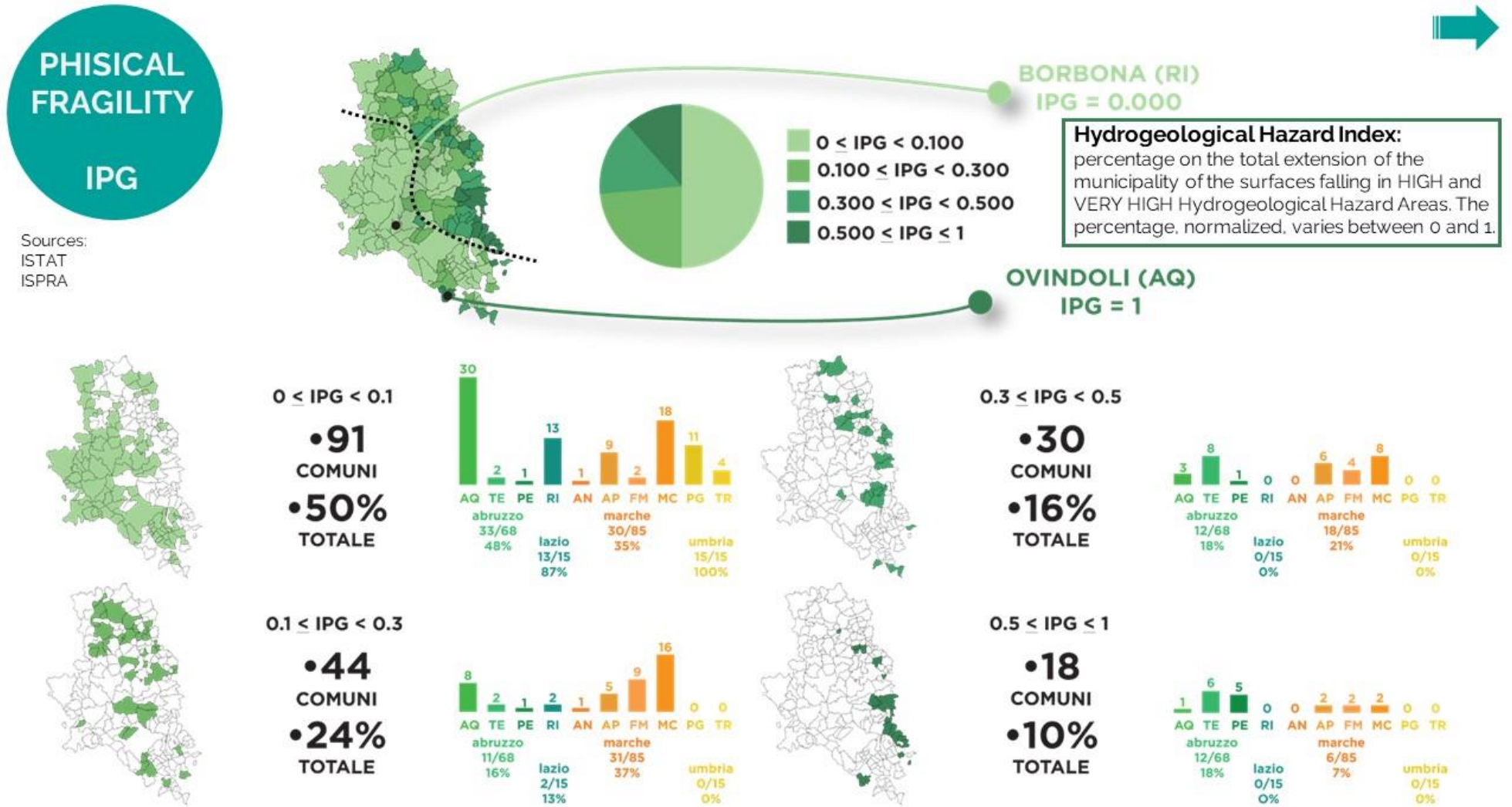
SARS-COV2 In Fragile Areas



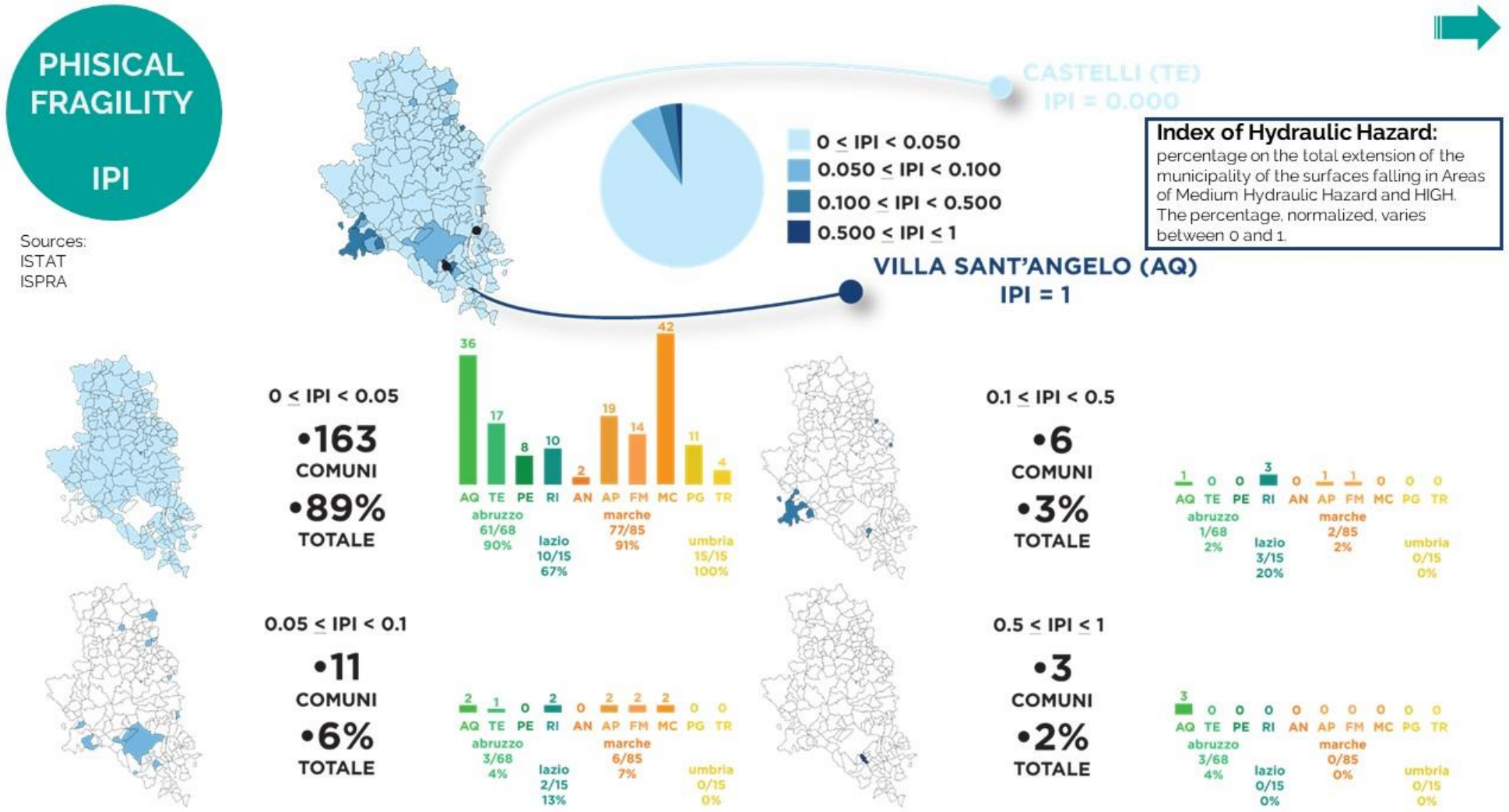
Physical Fragility – Seismic Hazard Index



Physical Fragility – Hydrogeological Hazard Index



Physical Fragility – Index of Hydraulic Hazard

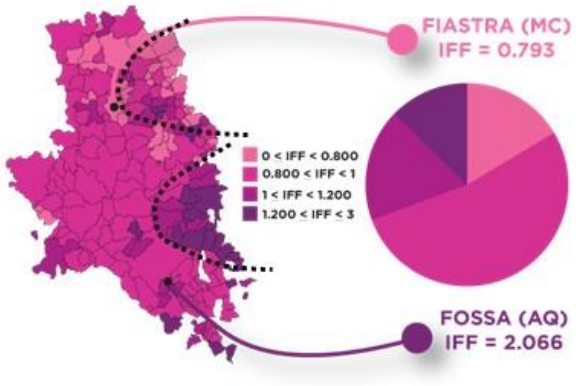


Physical Fragility Index

PHISICAL FRAGILITY

IFF

Sources:
ISTAT
ISPRA
INGV

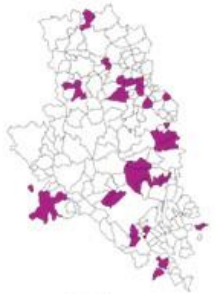


IFF

The Physical Fragility Index (**IFF**) is the combination of the previously described Indices (IPS, IPG, IPI).
The score attributed to the Index of Physical Fragility varies between 0 and 3, where 3 is the maximum value that overall indicates a greater fragility, at the physical level, of the territory. From the graphic representation it is clear that compared to all the municipalities of the Crater there is a clear difference between the physical fragility in the Abruzzo area, especially in Teramo, which has much higher values of IFF, mainly due to the combination of a very high Seismic Hazard (IPS) and Hydrogeological Hazard (IPG).

0 ≤ IFF < 0.8

•33
COMUNI
•18%
TOTALE



1 ≤ IFF < 1.2

•28
COMUNI
•15%
TOTALE

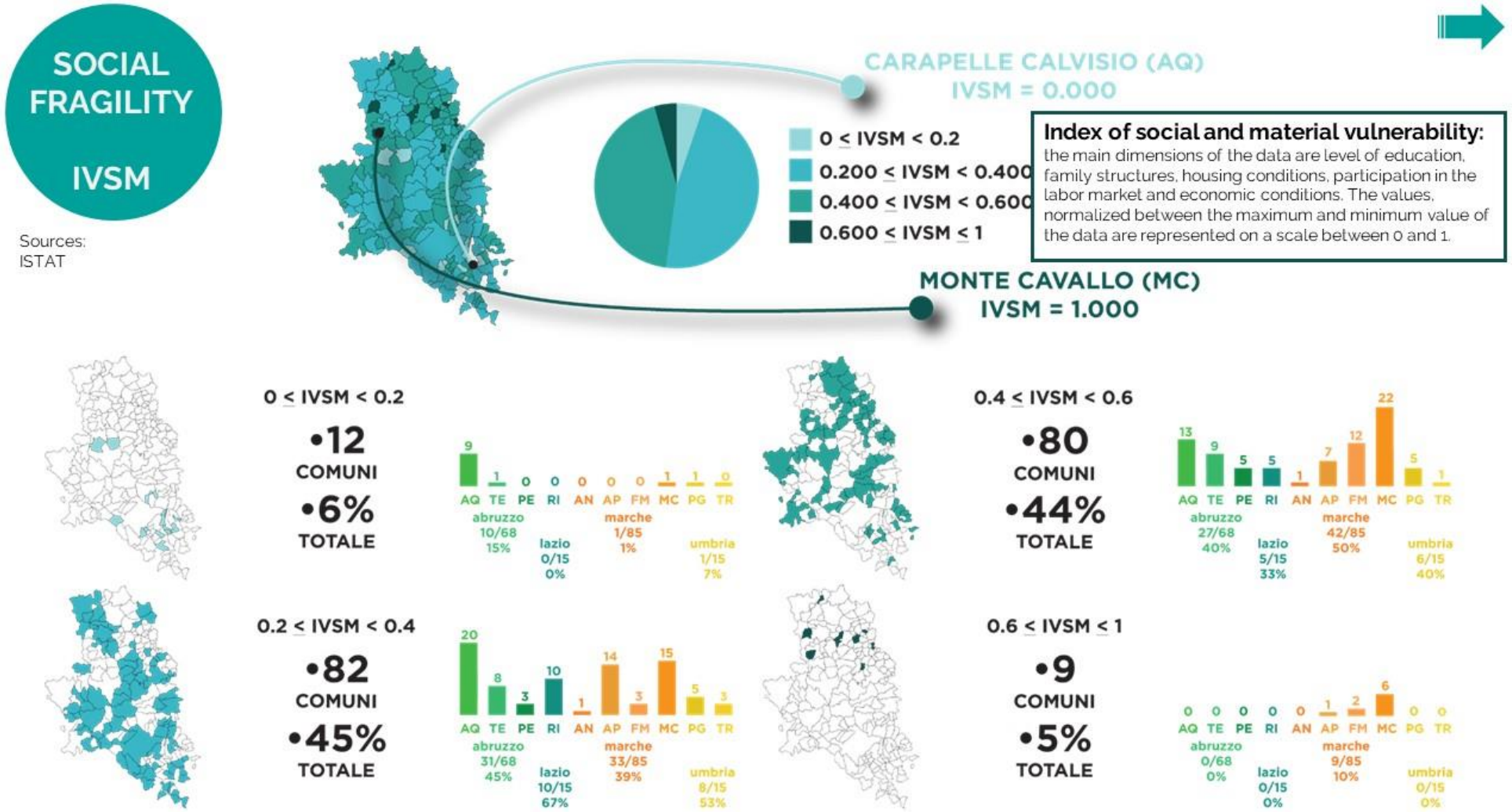
0.8 ≤ IFF < 1

•98
COMUNI
•54%
TOTALE

1.2 ≤ IFF ≤ 3

•24
COMUNI
•13%
TOTALE

Social Fragility – Social & Material Vulnerability Index

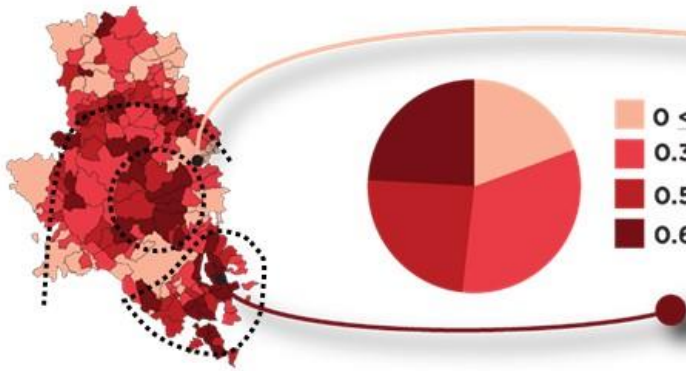


Social Fragility – Population Dynamics Index

SOCIAL FRAGILITY

IPD

Sources:
ISTAT



FOLIGNANO (AP)
IDP = 0.000

0 ≤ IDP < 0.300
0.300 ≤ IDP < 0.500
0.500 ≤ IDP < 0.600
0.600 ≤ IDP ≤ 1

Population dynamics index: median of the percentage change in population every 10 years from 1951 to 2051. Values, normalized between the maximum and minimum value of the percentage, are represented on a scale between 0 and 1.

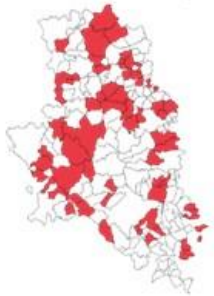
VILLA SANTA LUCIA DEGLI ABRUZZI (AQ) IDP = 1.000

0 ≤ IDP < 0.3

•36 COMUNI
•20% TOTALE

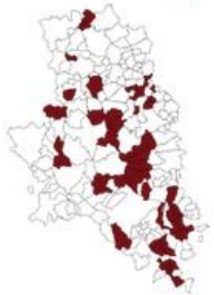
0.5 ≤ IDP < 0.6

•40 COMUNI
•22% TOTALE



0.3 ≤ IDP < 0.5

•62 COMUNI
•34% TOTALE



0.6 ≤ IDP ≤ 1

•45 COMUNI
•24% TOTALE

Social Fragility – Old Age Index

SOCIAL FRAGILITY

IDV

Sources:
ISTAT

0 ≤ IDV < 0.100
0.100 ≤ IDV < 0.200
0.200 ≤ IDV < 0.300
0.300 ≤ IDV ≤ 1

PIZZOLI (AQ)
IDV = 0.039

VILLA SANTA LUCIA DEGLI ABRUZZI (AQ) IDV = 1

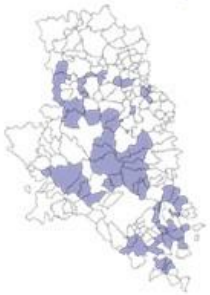
Old age index: ratio of the population aged 65 and over to the population aged 0-14, multiplied by 100. IDV values, normalized between the maximum and minimum value of the figure are represented on a scale between 0 and 1.

0 ≤ IDV < 0.1

•117
COMUNI
•64%
TOTALE

0.2 ≤ IDV < 0.3

•5
COMUNI
•3%
TOTALE



0.1 ≤ IDV < 0.2

•58
COMUNI
•32%
TOTALE

0.3 ≤ IDV ≤ 1

•3
COMUNI
•1%
TOTALE

Social Fragility – Birth Rate

SOCIAL FRAGILITY

IDN

Sources:
ISTAT

GAGLIANO ATERNO (AQ)
IDN = 0.000

0 ≤ IDN < 0.500
0.500 ≤ IDN < 0.700
0.700 ≤ IDN < 0.900
0.900 ≤ IDN ≤ 1

Birth rate: ratio between the number of live births and the average amount of the resident population, multiplied by 1000. Values were normalized between the maximum and minimum value and represented on a scale between 0 and 1.

USSITA (MC)
IDN = 1

0 ≤ IDN < 0.5

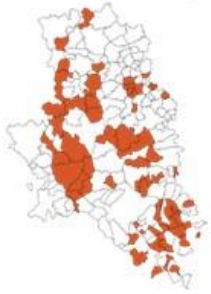
•7
COMUNI
•4%
TOTALE

0.7 ≤ IDN < 0.9

•93
COMUNI
•51%
TOTALE

0.5 ≤ IDN < 0.7

•16
COMUNI
•9%
TOTALE



0.9 ≤ IDN ≤ 1

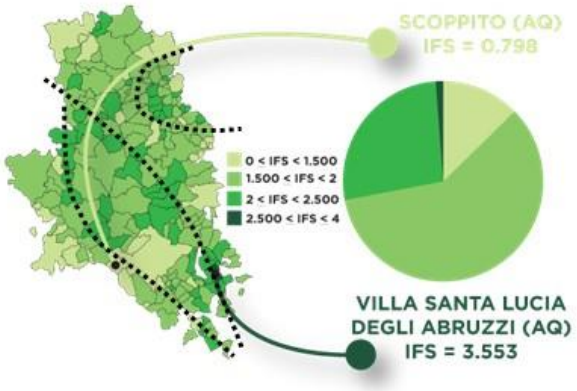
•67
COMUNI
•36%
TOTALE

Social Fragility Index

SOCIAL FRAGILITY

IFS

Sources:
ISTAT



IFS

The Index of Social Fragility (IFS) is the combination of the previously described Indices (IVSM, IDP, IDV, IDN). The score attributed to the Social Fragility Index varies between 0 and 4, where 4 is the maximum value that overall indicates greater fragility at the social level of the territory.
The graphic representation shows how in the 183 municipalities of the earthquake crater there is a homogeneous distribution of the various levels of fragility. Most municipalities have medium and medium-high values of IFS.

0 ≤ IFS < 1.5

•28
COMUNI
•15%
TOTALE

2 ≤ IFS < 2.5

•49
COMUNI
•27%
TOTALE

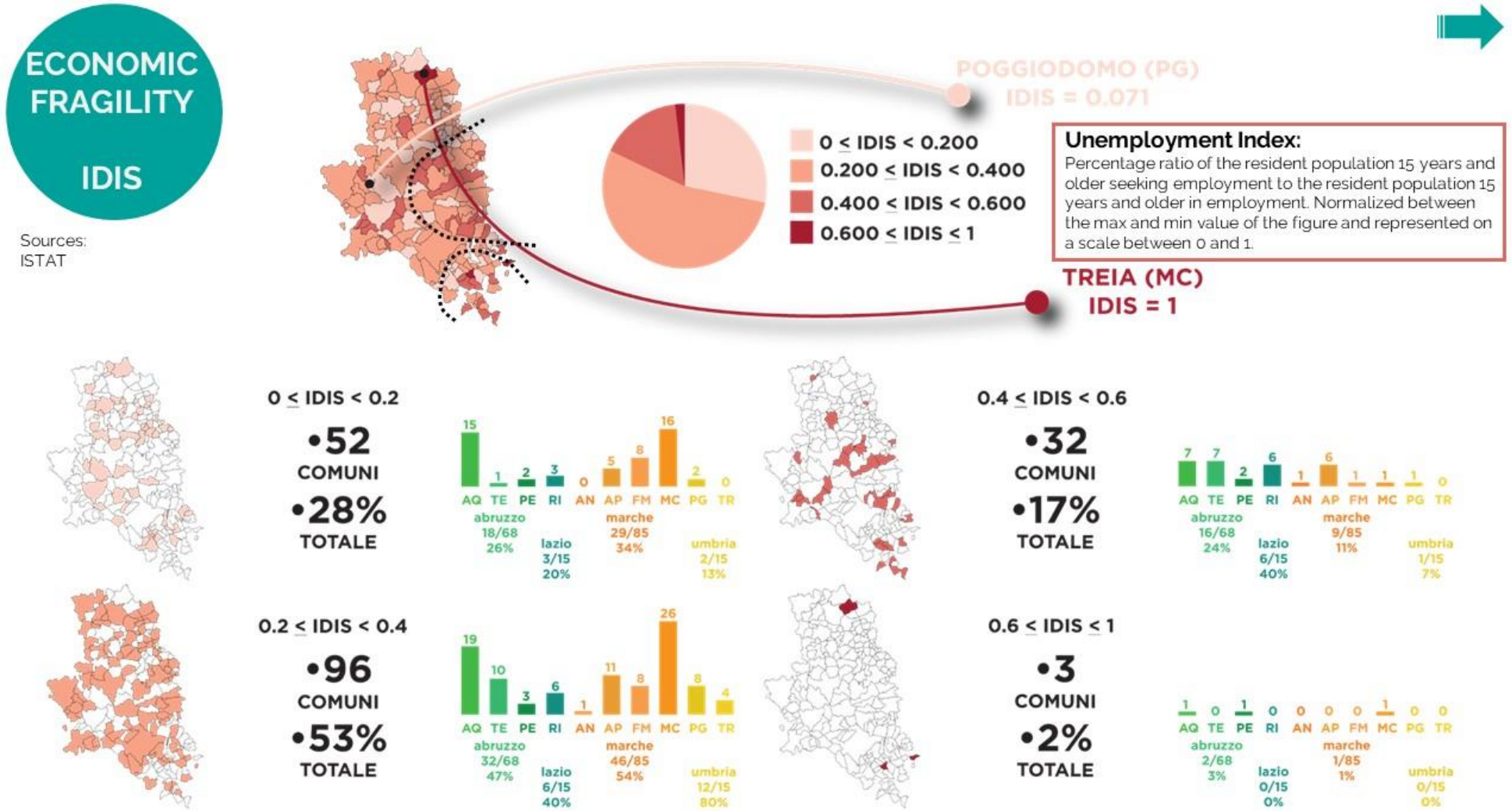
1.5 ≤ IFS < 2

•105
COMUNI
•83%
TOTALE

2.5 ≤ IFS ≤4

•1
COMUNI
•1%
TOTALE

Economic Fragility – Unemployment Index

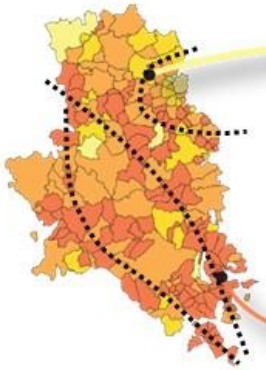


Economic Fragility – Index of Economic Inertia

ECONOMIC FRAGILITY

IEC

Sources:
ISTAT



COLMURANO (MC)
IEC = 0.281

0 ≤ IEC < 0.300
0.300 ≤ IEC < 0.500
0.500 ≤ IEC < 0.700
0.700 ≤ IEC ≤ 1

VILLA SANTA LUCIA DEGLI ABRUZZI (AQ) IEC = 1

Index of economic inertia: calculated from the average of the percentages of employees in agriculture, manufacturing, commerce and services over the total population. Obtained by normalizing between 0 and 1 the values obtained from the average.

0 ≤ IEC < 0.3
•7
COMUNI
•4%
TOTALE

0.5 ≤ IEC < 0.7
•60
COMUNI
•33%
TOTALE

0.3 ≤ IEC < 0.5
•23
COMUNI
•12%
TOTALE

0.7 ≤ IEC ≤ 1
•93
COMUNI
•51%
TOTALE

Economic Fragility – Poverty Index

ECONOMIC FRAGILITY

IPO

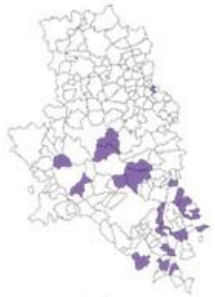
Sources:
ISTAT

0 ≤ IPO < 0.300
0.300 ≤ IPO < 0.500
0.500 ≤ IPO < 0.700
0.700 ≤ IPO ≤ 1

Poverty index: percentage of the total population with an income of less than € 10,000. The percentage was then normalized between the maximum and minimum value of the data and represented on a scale between 0 and 1.

0 ≤ IPO < 0.3

•84
COMUNI
•46%
TOTALE



0.5 ≤ IPO < 0.7

•21
COMUNI
•12%
TOTALE

0.3 ≤ IPO < 0.5

•70
COMUNI
•38%
TOTALE

0.7 ≤ IPO ≤ 1

•8
COMUNI
•4%
TOTALE

Economic Fragility – Digital Exclusion Index

ECONOMIC FRAGILITY

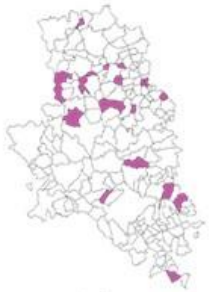
IED

Sources:
ISTAT

0 ≤ IED < 0.300
0.300 ≤ IED < 0.500
0.500 ≤ IED < 0.700
0.700 ≤ IED ≤ 1

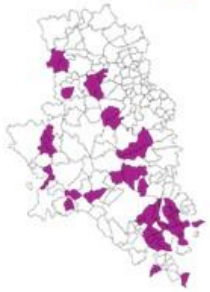
Digital Exclusion Index:
Percentage of population excluded from fixed and mobile broadband, also normalized between the maximum and minimum value of the figure and represented on a scale between 0 and 1.

0 ≤ IED < 0.3
•107 COMUNI
•58% TOTALE



0.5 ≤ IED < 0.7
•17 COMUNI
•9% TOTALE

0.3 ≤ IED < 0.5
•18 COMUNI
•10% TOTALE



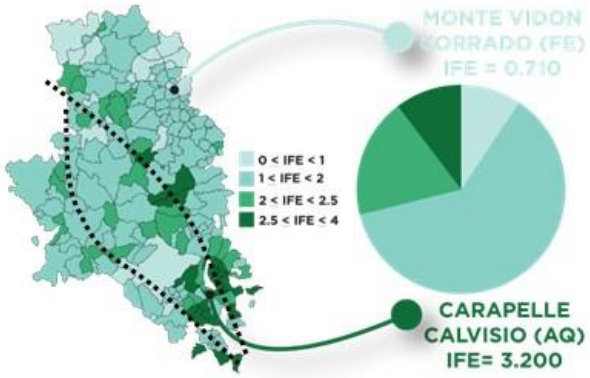
0.7 ≤ IED ≤ 1
•41 COMUNI
•23% TOTALE

Economic Fragility Index

ECONOMIC FRAGILITY

IFE

Sources:
ISTAT



IFE

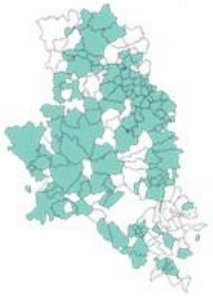
The Index of Economic Fragility (IFE) is the combination of the previously described Indices (IDIS, IEC, IPO, IE).
The score attributed to the Index of Economic Fragility varies between 0 and 4, where 4 is the maximum value that overall indicates a greater fragility, at the economic level, of the territory.
From the graphical representation it can be seen that in the 183 municipalities of the Crater there is greater economic fragility in the municipalities of Abruzzo, in particular in the Teramo area and in the area east of the province of L'Aquila.On the contrary, also comparing the percentages with respect to the number of municipalities involved, the Marche region has lower values than the IFE, confirming the positive trend also found in the previous elaborations of the 85 municipalities involved.

0 ≤ IFE < 1

•19
COMUNI
•10%
TOTALE

2 ≤ IFE < 2.5

•32
COMUNI
•18%
TOTALE

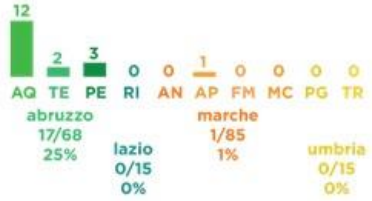


1 ≤ IFE < 2

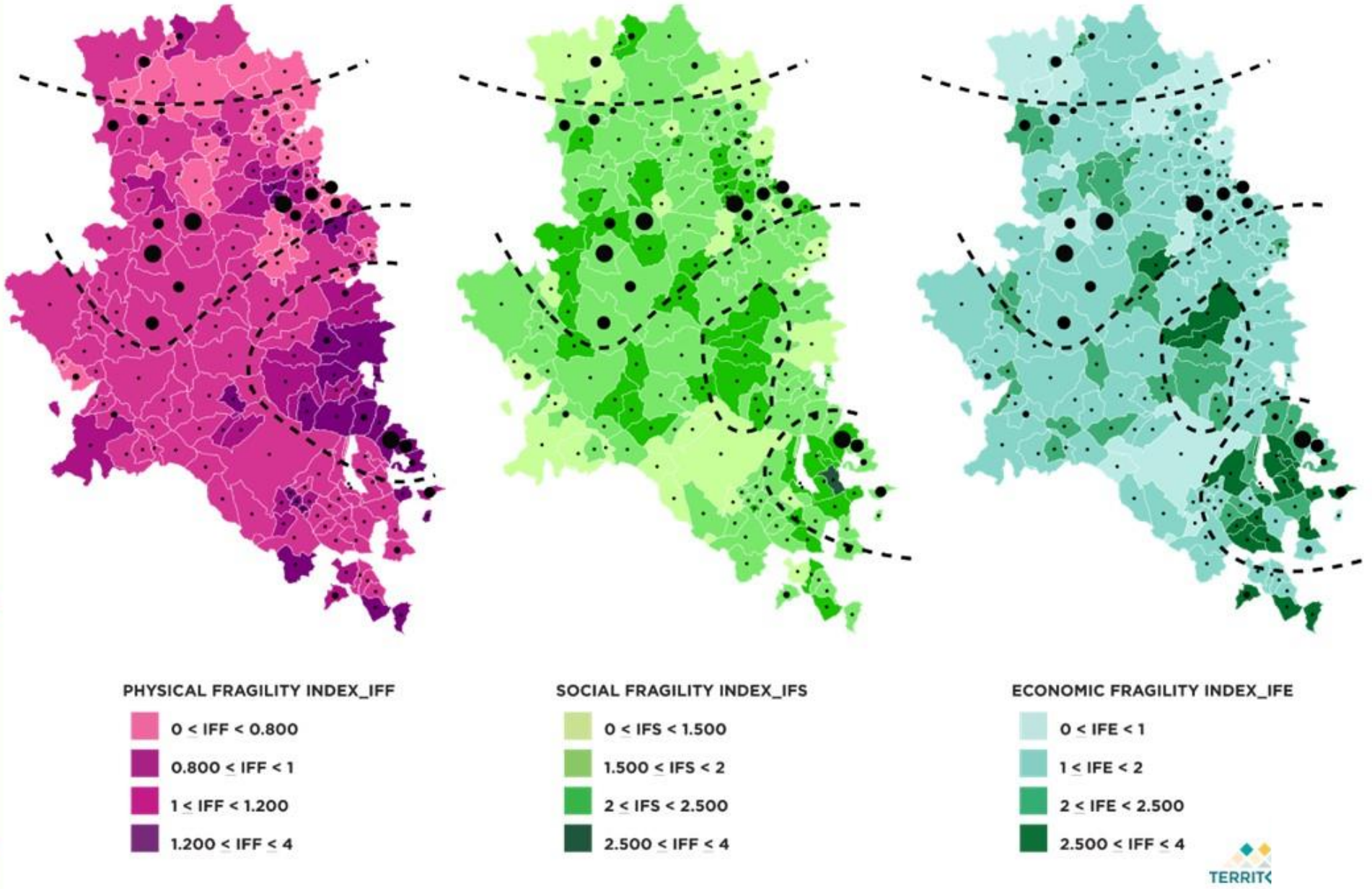
•114
COMUNI
•62%
TOTALE

2.5 ≤ IFE ≤ 4

•18
COMUNI
•10%
TOTALE



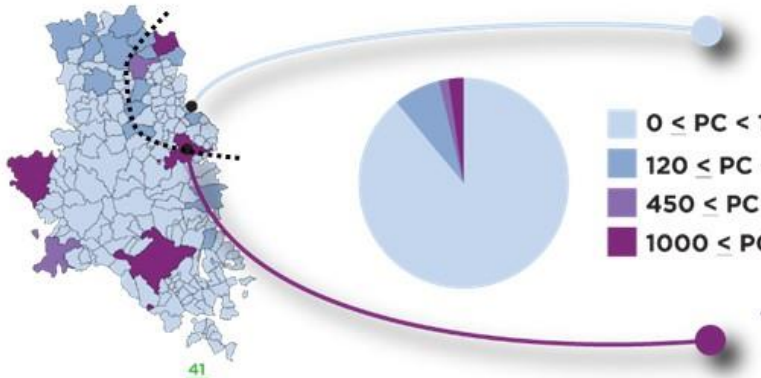
OVERLAY BETWEEN SARS_COV2 & FRAGILITY SYNTHETIC INDEXES



Tourism – Cultural Heritage

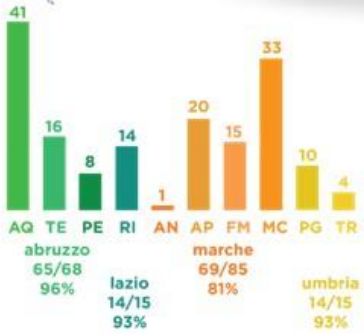
TOURISM

Sources:
ISTAT
Mibact



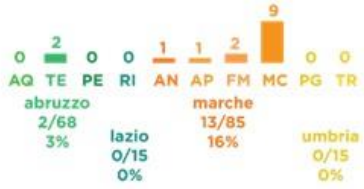
Cultural heritage: The indicator collects the number of assets catalogued by the Ministry of Cultural Heritage, including architectural and landscape, archaeological, anthropomorphic, photographic, musical, naturalistic, numismatic, scientific and technological, historical and artistic assets.

0 ≤ PC < 120
•162
COMUNI
•89%
TOTALE



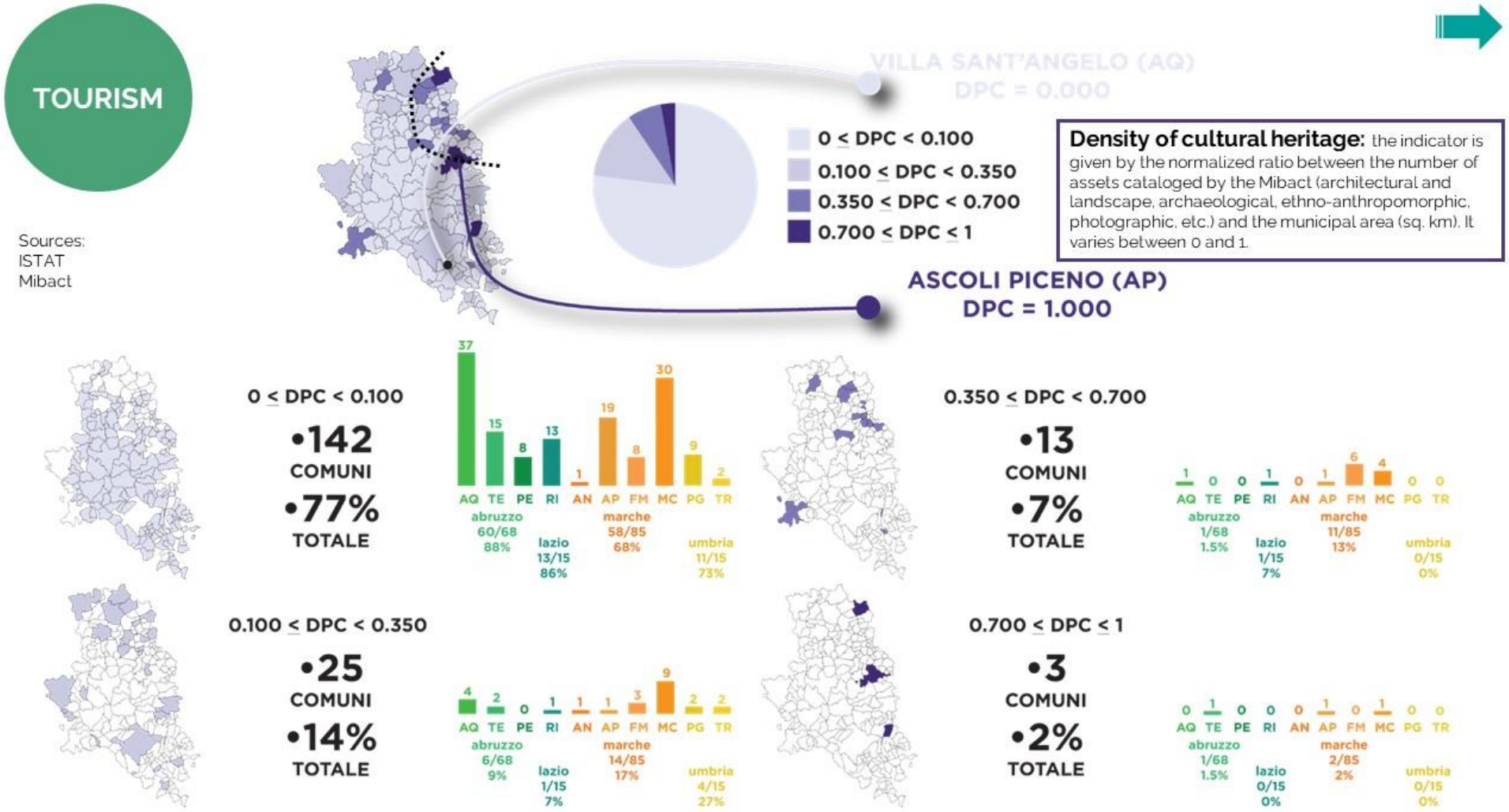
450 ≤ PC < 1000
•2
COMUNI
•1%
TOTALE

120 ≤ PC < 450
•15
COMUNI
•8%
TOTALE

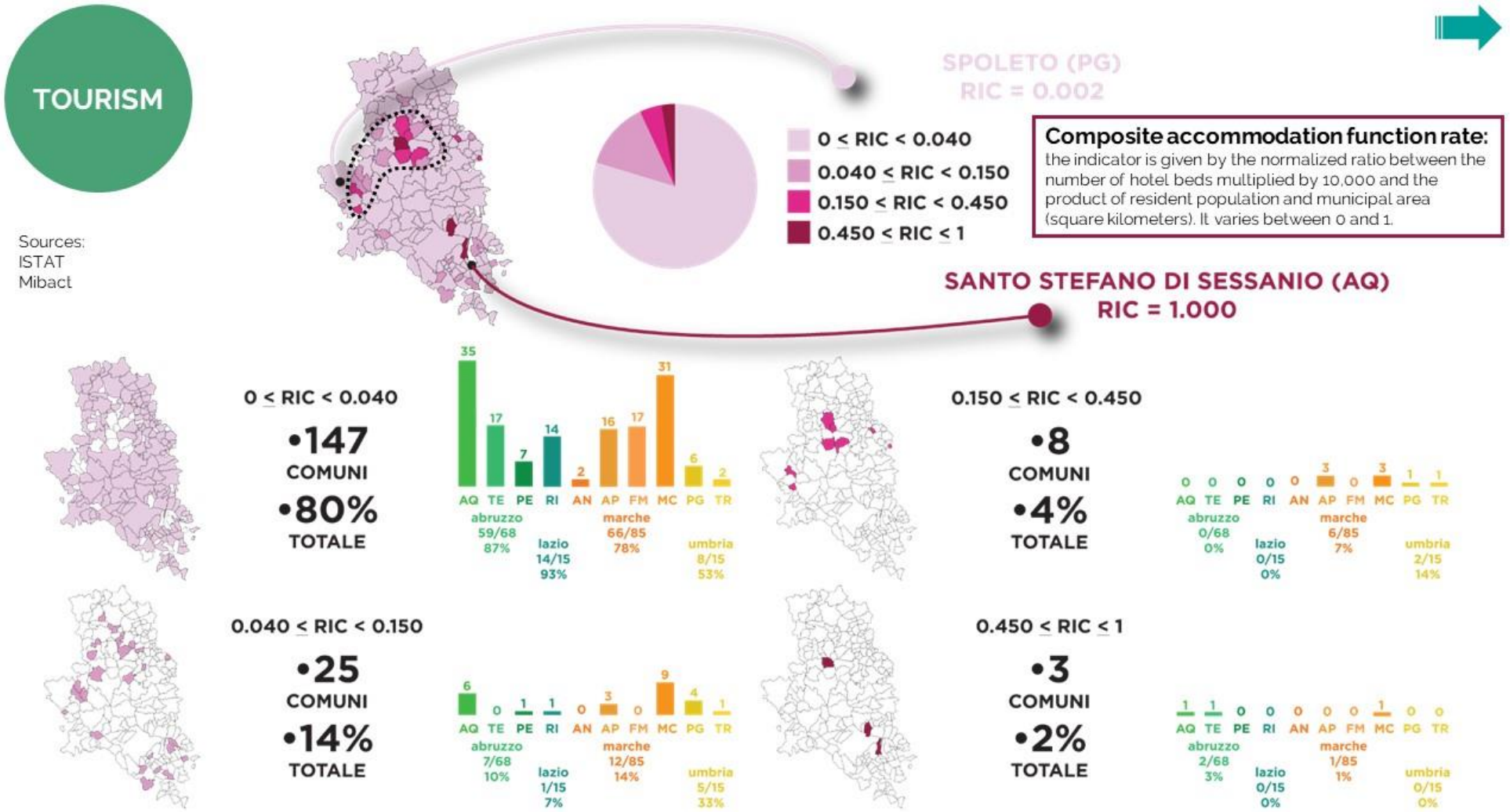


1000 ≤ PC ≤ 3404
•4
COMUNI
•2%
TOTALE

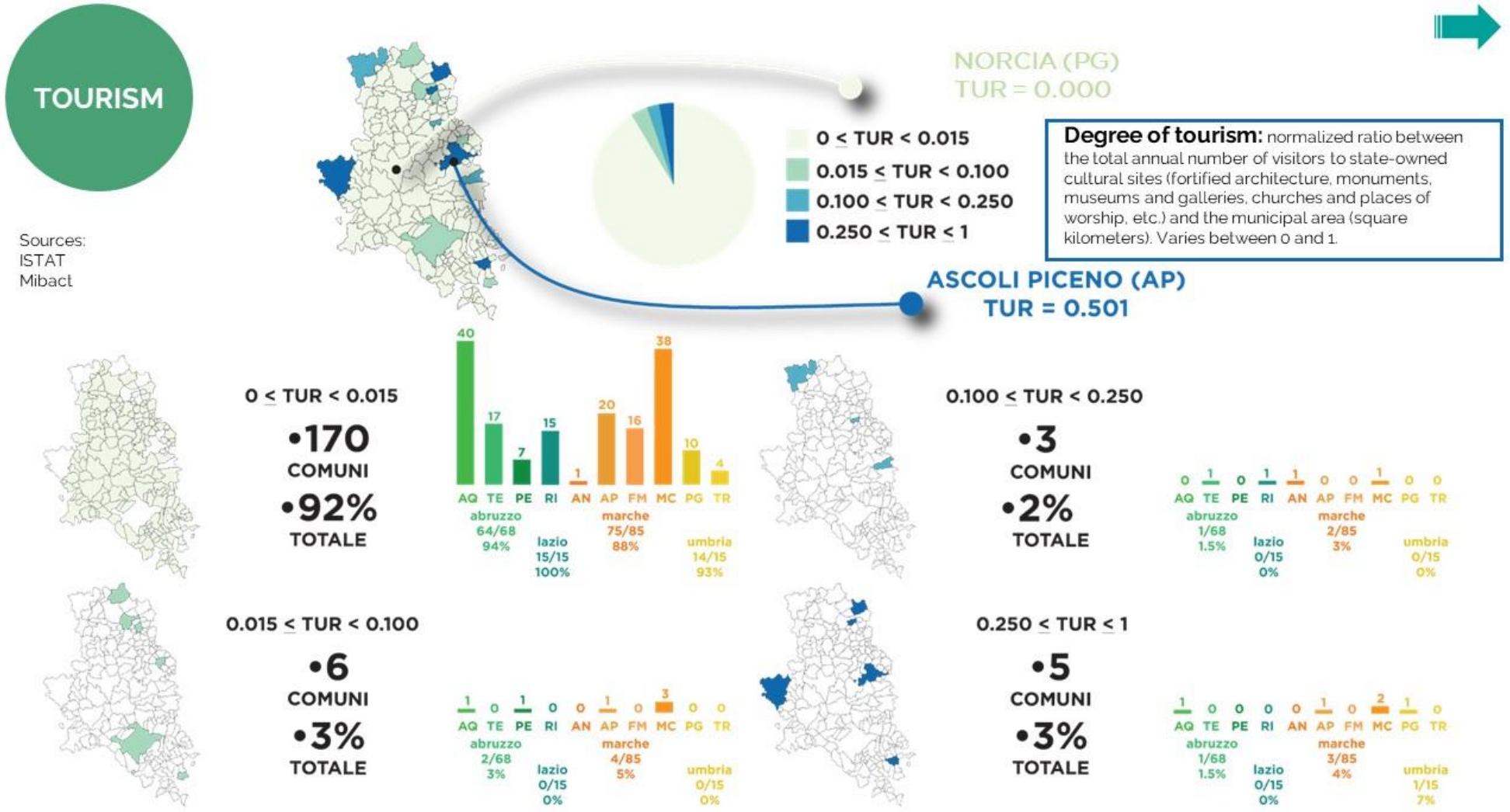
Tourism – Density of cultural heritage



Tourism – Composite Accommodation Function Rate

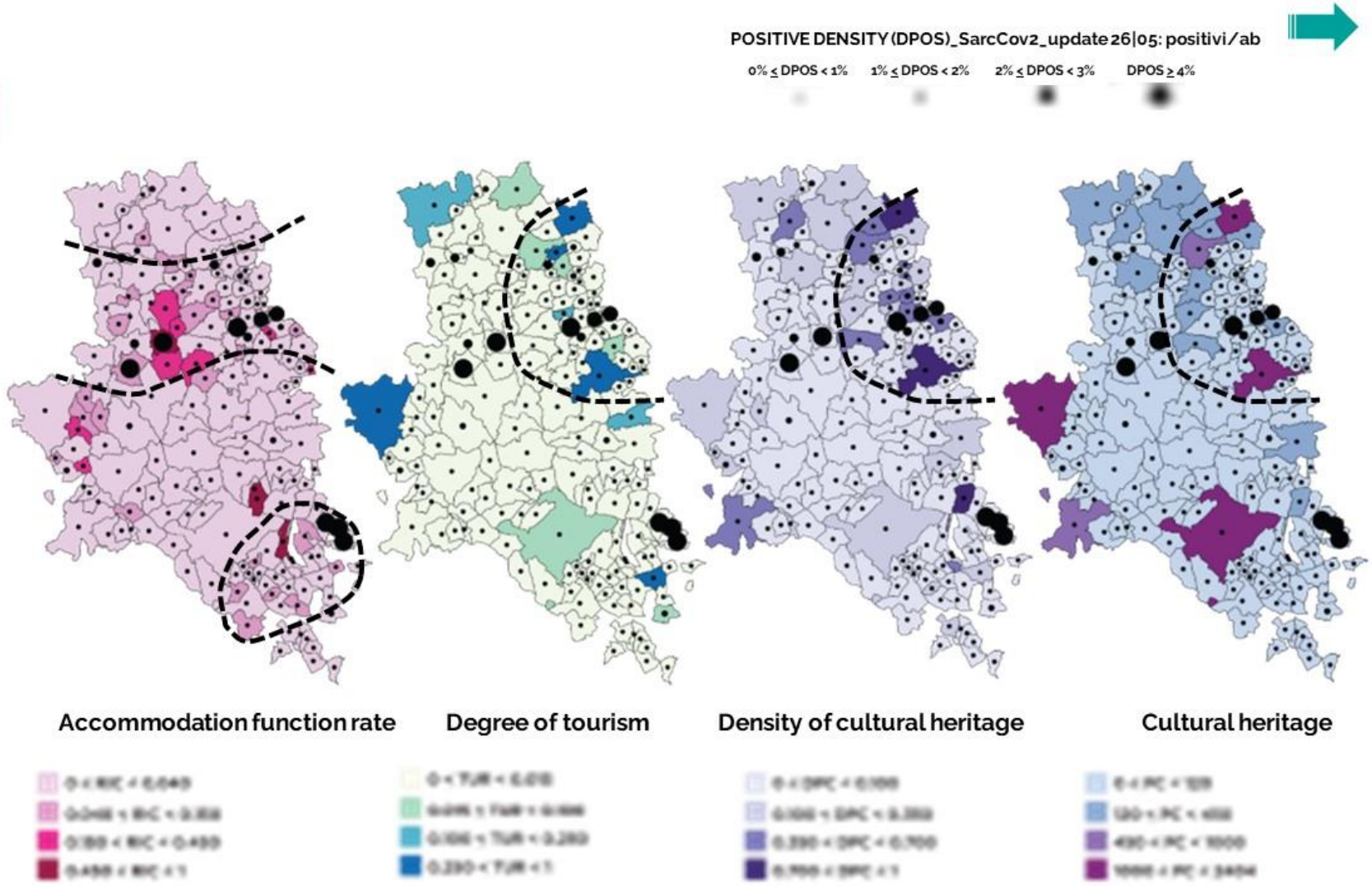


Tourism Index



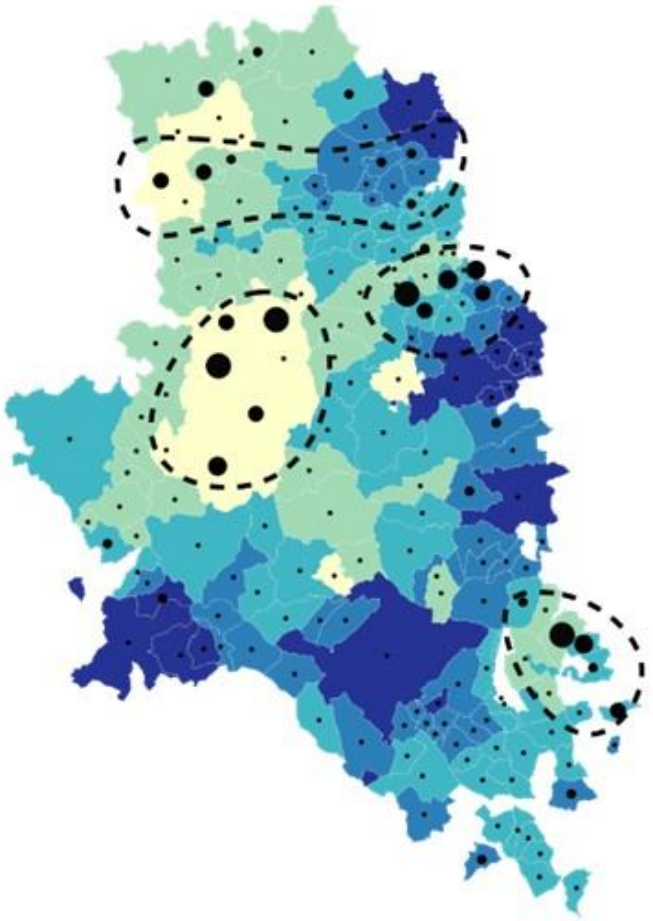
Tourism & Sars_Cov2

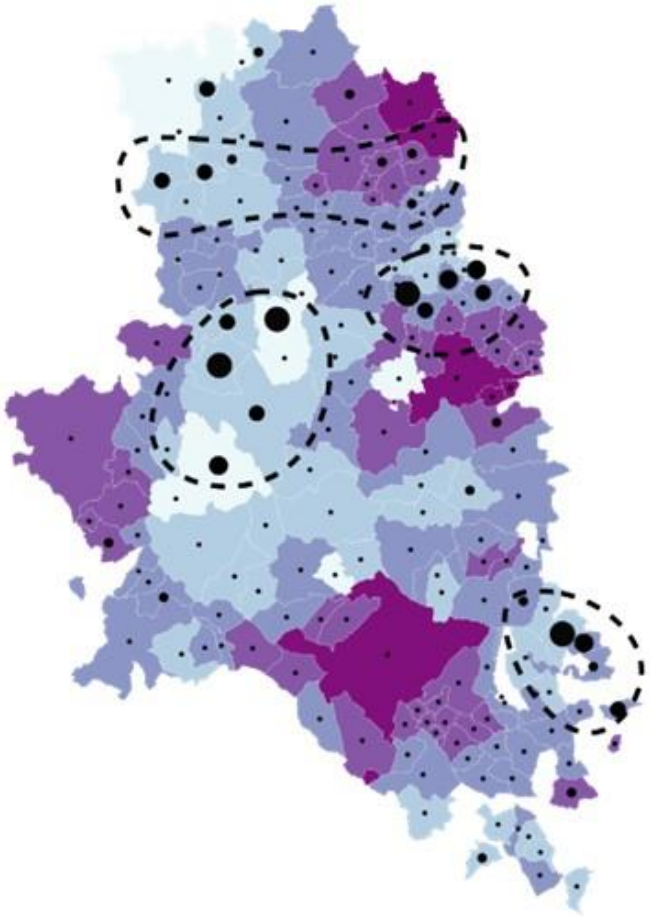
TOURISM & SARS-COV2



Sources:
ISTAT
ISPRA
INGV
Mibact
Ministero della Salute
ISS

OVERLAY BETWEEN SARS_COV2 & ACCESSIBILITY INDEXES





POSITIVE DENSITY_DPOS_SarsCov2 _updated to 08|26th: pos/inhab

- 0% < DPOS < 1%
- 1% < DPOS < 2%
- 2% < DPOS < 3%
- 3% < DPOS < 4%
- DPOS > 4%

DEFINITION OF THE PHENOMENON

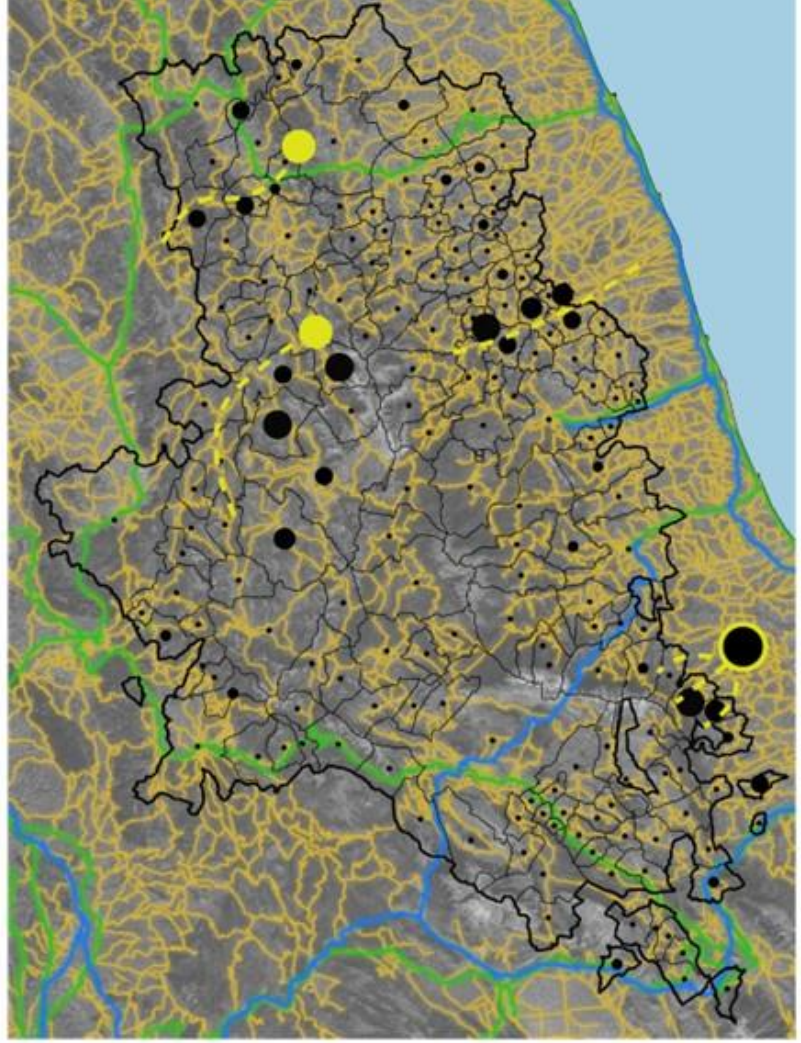
CENTERS ACCESSIBILITY INDEX

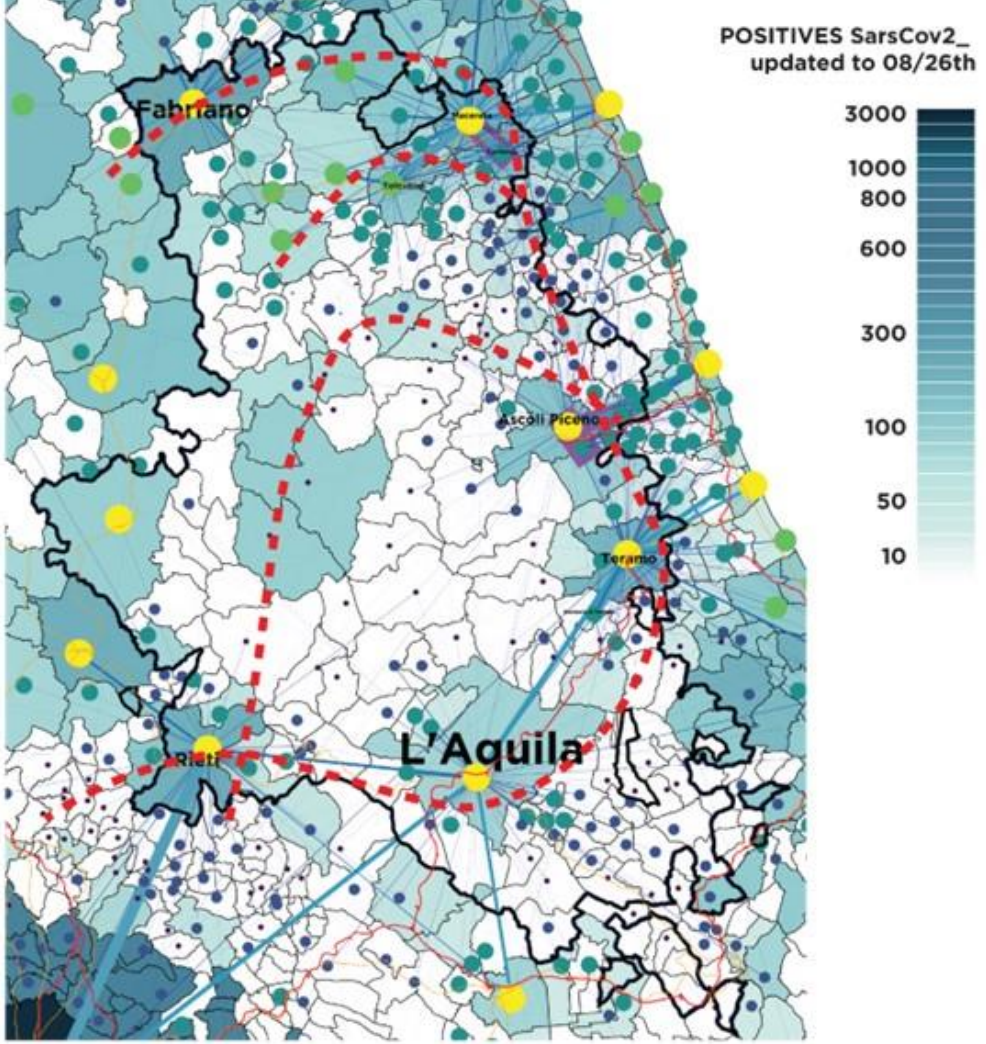
- 0
- 1
- 2
- 3
- 4

STATIONS ACCESSIBILITY INDEX

- 0
- 1
- 2
- 3
- 4

OVERLAY BETWEEN SARS_COV2 & O/D MATRIX





POSITIVE DENSITY_DPOS_SarsCov2_updated to 08|26th: pos/inhab

- 0% < DPOS < 1%
- 1% < DPOS < 2%
- 2% < DPOS < 3%
- 3% < DPOS < 4%
- DPOS > 4%

DEFINITION OF THE PHENOMENON

INFRASTRUCTURES

- RAILWAY
- HIGHWAY
- REGIONAL HIGHWAY
- COUNTY ROAD
- TANK
- TERMINAL

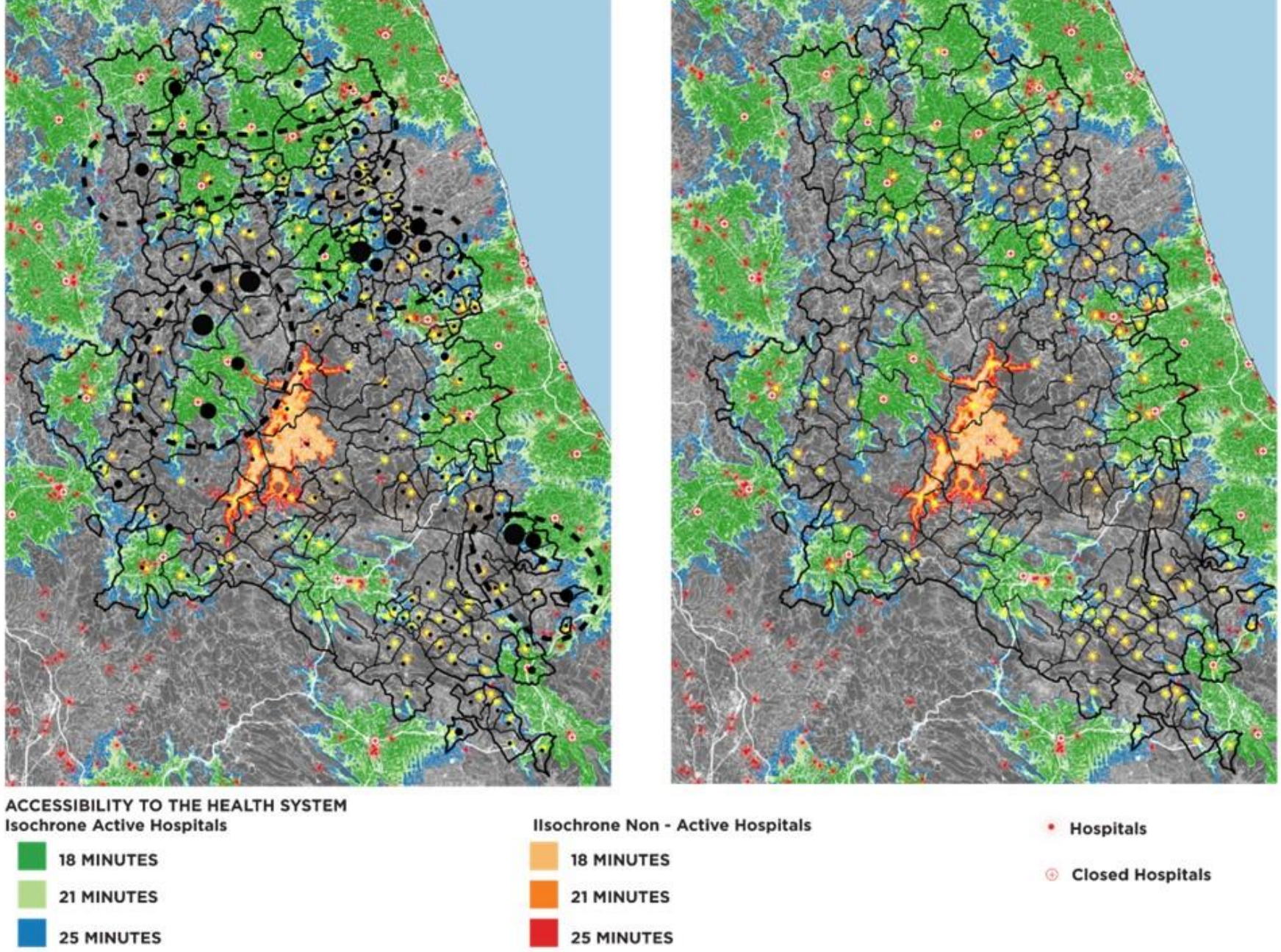
STUDY AND WORK FLOWS

- 1 - 65
- 65 - 256
- 256 - 555
- 555 - 1125
- 1125 - 2668

CLASSIFICATION OF THE MUNICIPALITY

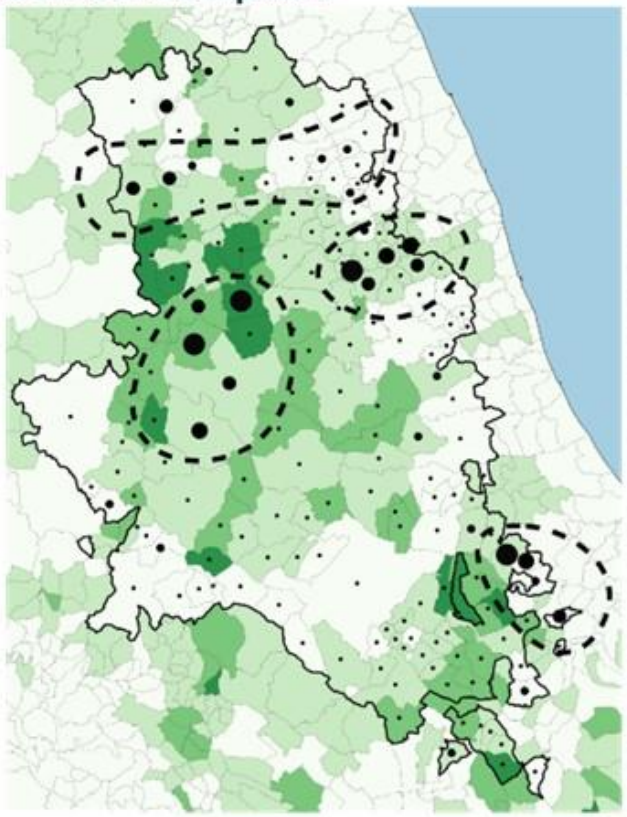
- A - POLO
- B - INTERMUNICIPAL POLE
- C - BELT
- D - INTERMEDIATE
- E - PERIPHERICAL

OVERLAY BETWEEN SARS_COV2 & HEALT SYSTEM



OVERLAY BETWEEN SARS_COV2 & PLANNING

SARS-COV2 & Soil Consumption



POSITIVE DENSITY_DPOS_SarsCov2 _updated to 08|26th: pos/inhab

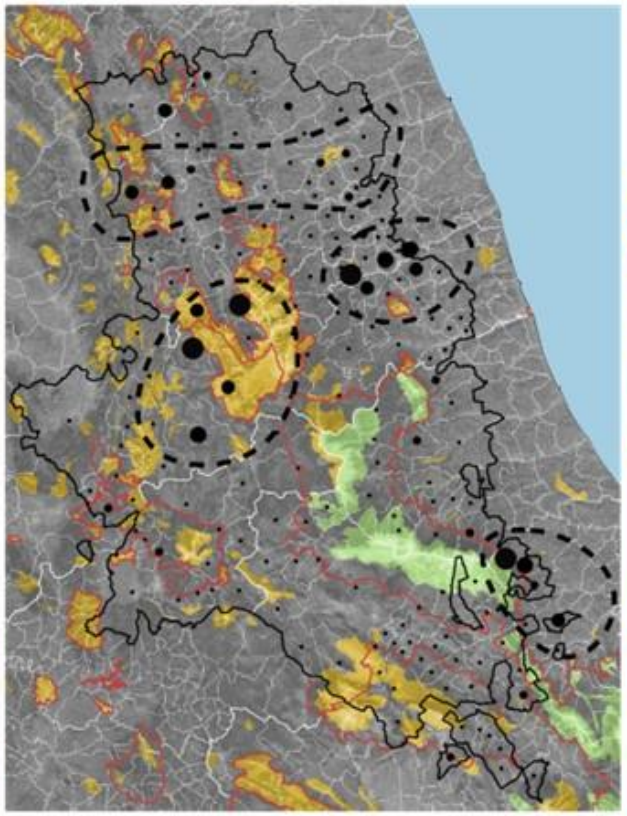
- 0% < DPOS < 1%
- 1% < DPOS < 2%
- 2% < DPOS < 3%
- 3% < DPOS < 4%
- DPOS > 4%

DEFINITION OF THE PHENOMENON

SOIL CONSUMPTION (m²/inhab)

- 0 - 675
- 675 - 1380
- 1380 - 2773
- 2773 - 6191
- 6191 - 17097

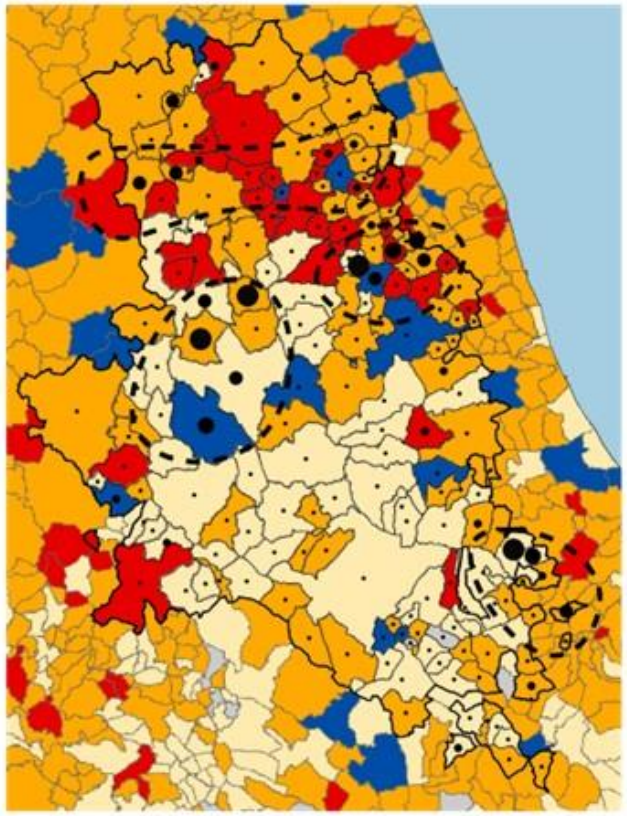
SARS-COV2 & Protected Areas



PROTECTED AREAS

- SITES OF COMMUNITY INTEREST (SIC)
- SPECIAL AREAS OF CONSERVATION (ZSC)

SARS-COV2 & Local planning



LOCAL PLANNING - Year of approvation

- NO PLANNING
- BEFORE 1955
- 1955 - 2010
- 2010 - 2014
- POST 2014

TERRI

Conclusions

The first results described, allow us to highlight some phenomena in terms of issues:

- A persistent **isolation** of the territories that present **a high fragility**, not only related to physical infrastructures but also to digital or telecommunications infrastructures, made even more evident with the analysis of the distribution of Sars-Cov-2.

- The **fragility of the system of relations** between the territories of the crater that in project terms will require a system of governance and alliances that will necessarily have to face the territorial rebalancing to ensure accessibility and therefore the use, for example tourism, developing the **integration** of fragile contexts with the strong ones.

- The **gap** that characterizes the system of **territorial and proximity services**, which leaves open important questions such as health.

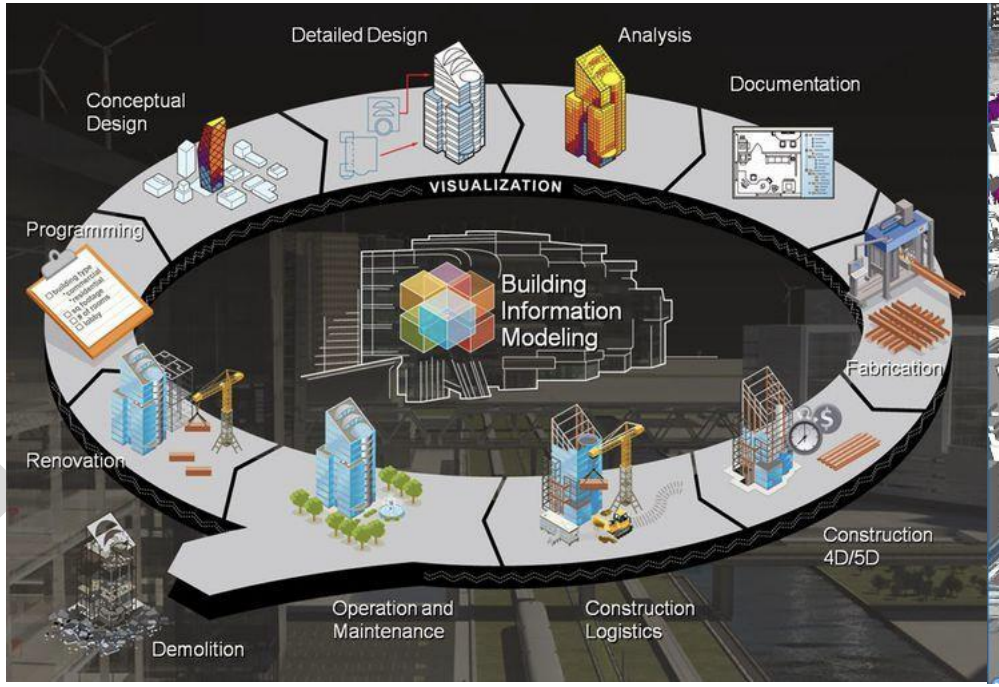
Urban scale

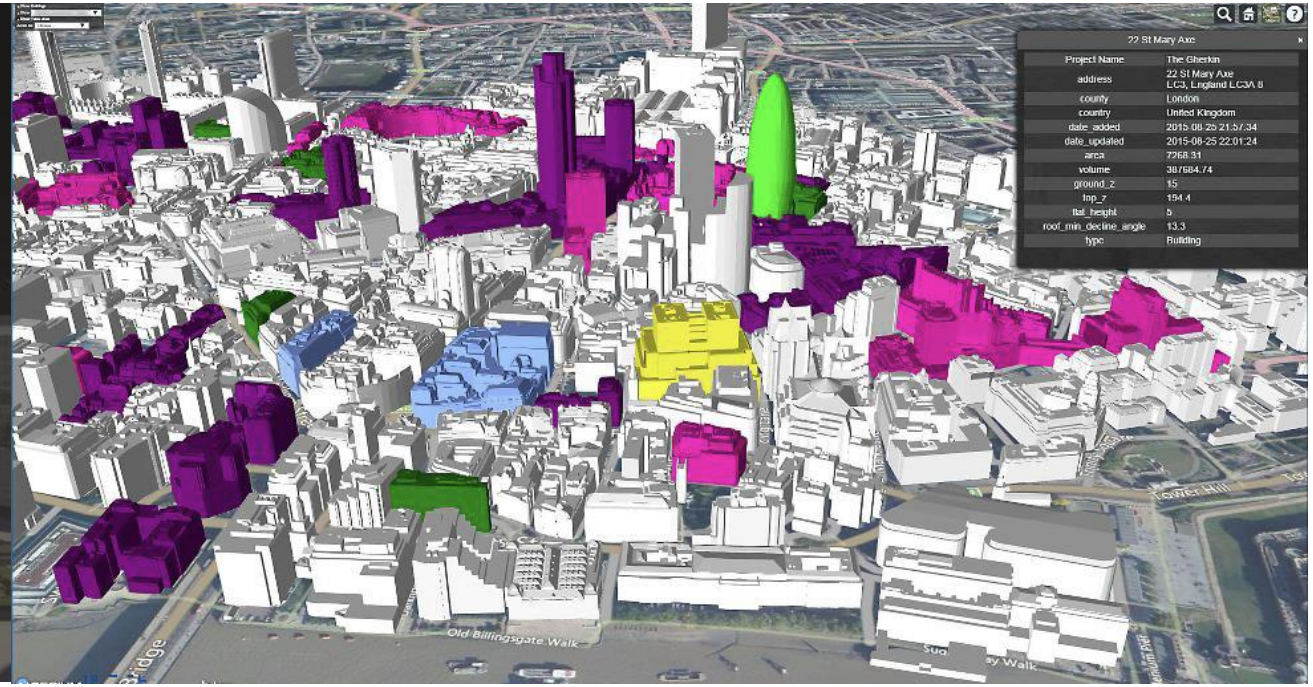
Building Information Modeling

ISO 19650:2019 defines BIM as: Use of a shared digital representation of a built asset to facilitate design, construction and operation processes to form a reliable basis for decisions.

City Information Modeling

Use of a shared 3D digital representation of a city asset to facilitate design, assessment and management processes and form a reliable basis for decision-making.





The information base of the CIM is the 3D GIS, in which the information concerns all 3D surfaces. The three-dimensional elements representing constructions (buildings, infrastructures, etc.) are connected to their BIM

CIM is first a knowledge tool of the city, but the research experience of the University of L'Aquila is directing CIM also to these 3 uses:

City Information Modeling

uses

City DESIGN

Urban Design, Cost Evaluation, Design Management, etc.

City design ASSESSMENT

Urban Performance Assessment, Urban Environmental Assessment, Urban Risk Assessment, etc.

City MANAGEMENT

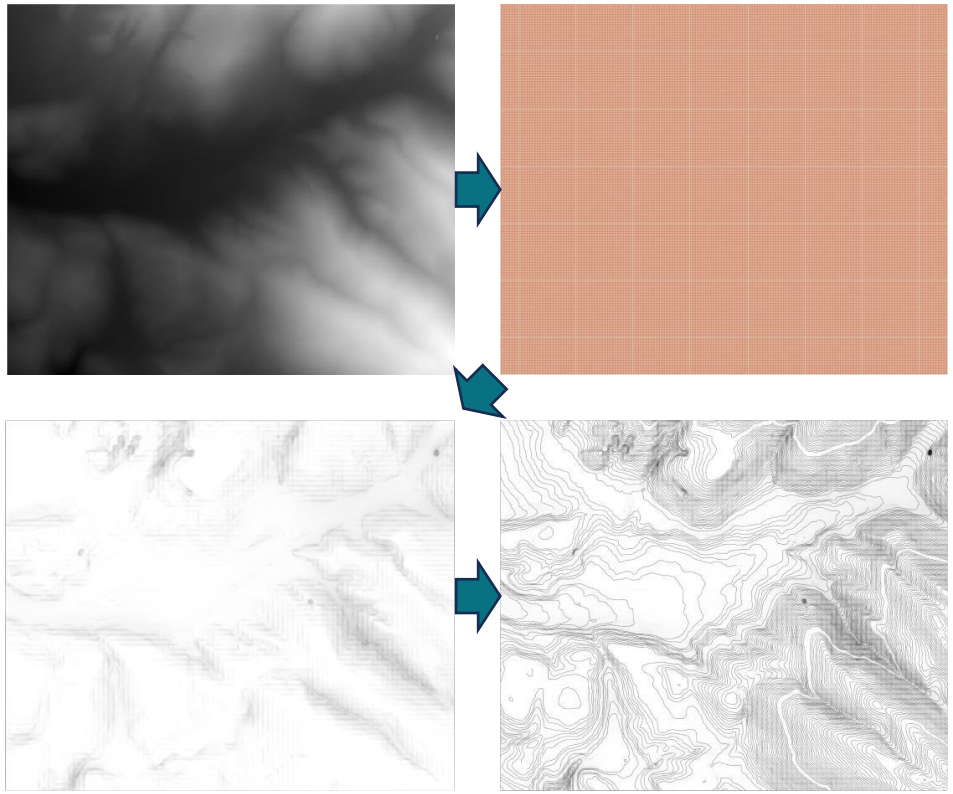
Evacuation planning and management, emergency management, safety, mobility, etc.

City Information Modeling

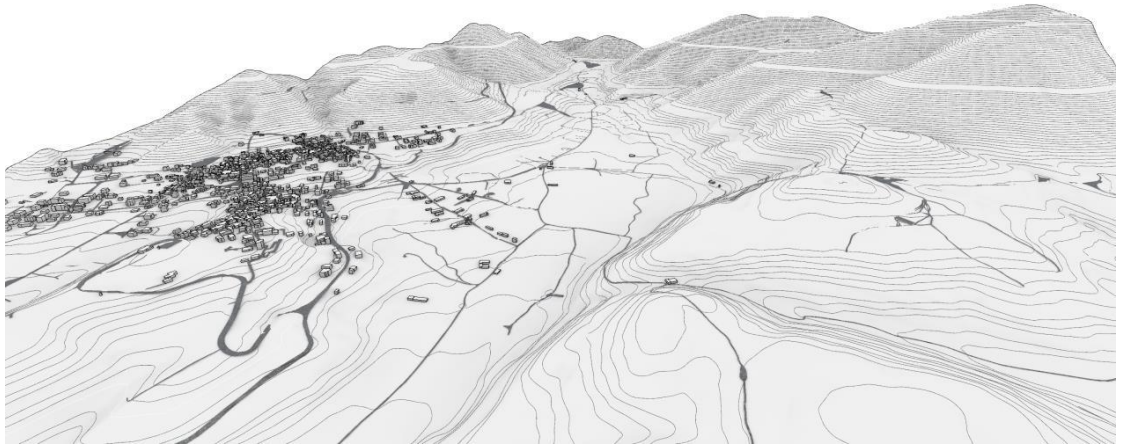
data sources

- **3D base MAP** (3d GIS at the City Scale)
- **BIM Model** (replaces the GIS volume of the constructions)
- **SCIENTIFIC ANALYSIS** (specific scientific research on the city)
- **SOCIO-ECONOMIC DATA** (e.g. linked to individual constructions)
- **SATELLITE DATA**
- **SENSORS -REAL TIME DATA**
- **URBAN DESIGN** and **URBAN PLANNING** (design data)

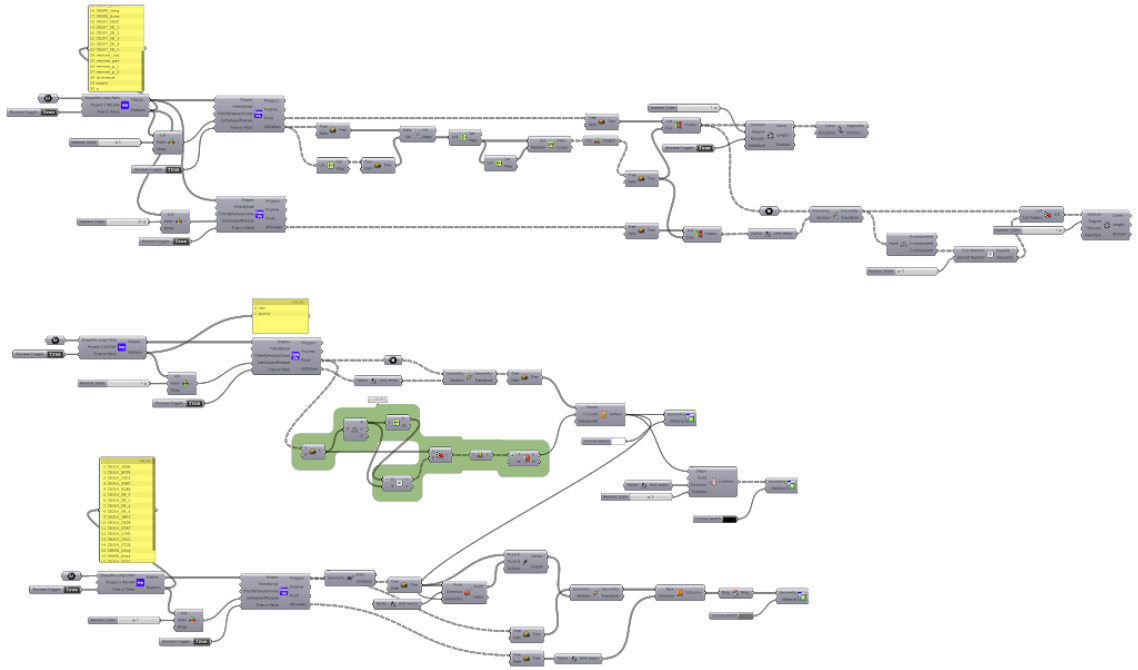
City Information Modeling



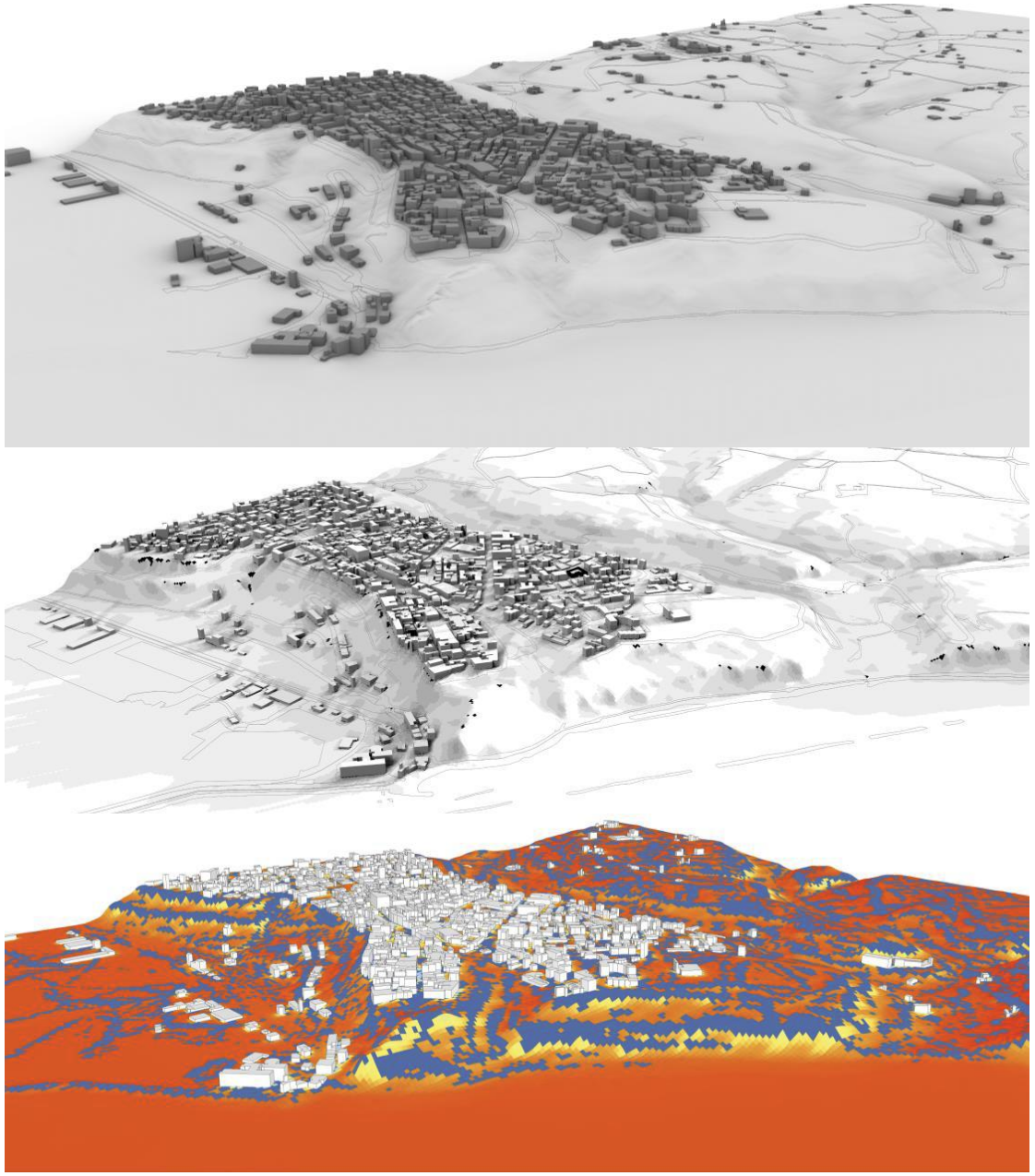
From Digital TerrainModel (DTM) to 3D model



City Information Modeling

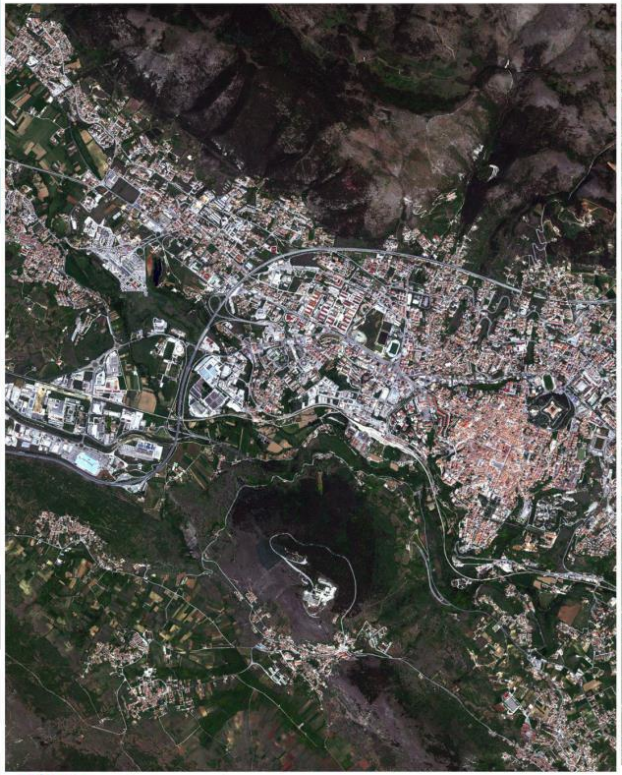


Visual scripting in Grasshopper towards automatic 3D modeling



City Information Modeling

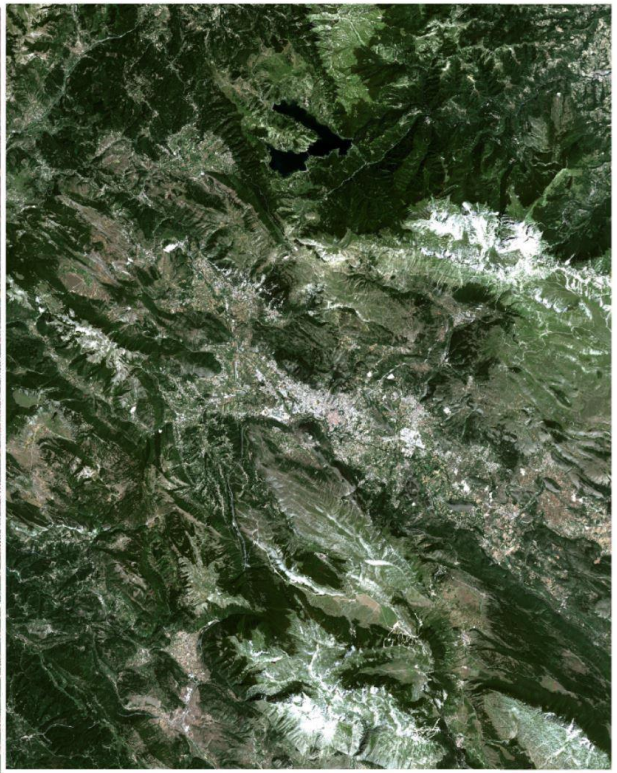
Worldview II



1. COASTAL Band (400-450 nm)
2. BLUE Band (450-510 nm)
3. GREEN Band (510-580 nm)
4. YELLOW Band (585-625 nm)
5. RED Band (630-690 nm)
6. RED-EDGE Band (705-745 nm)
7. NIR1 Band (770-895 nm)
8. NIR2 Band (860-1040 nm)

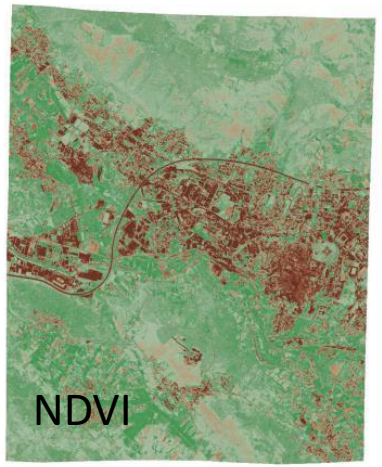
Dimensione Pixel:
- Pancromatico 0,46 metri
- Multispettrale 1,84 metri

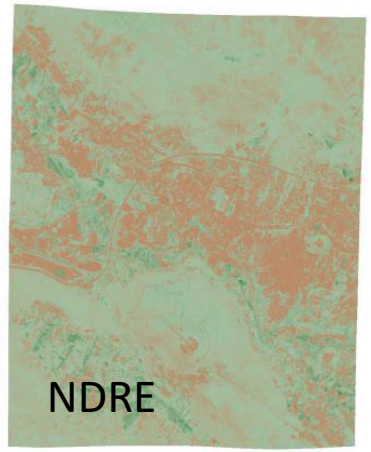
Landsat 8

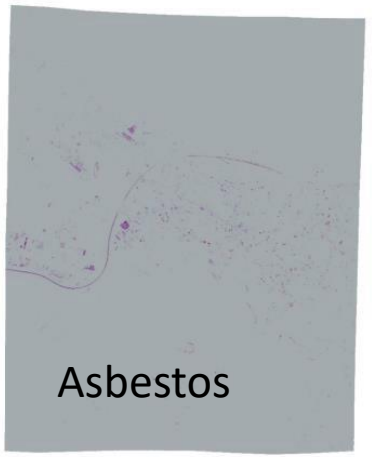


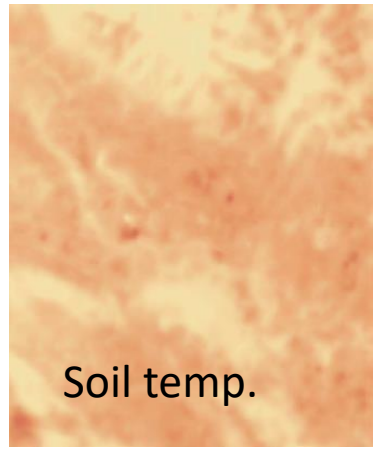
1. COASTAL AEROSOL Band (435-451 nm)
2. BLUE Band (452-512 nm)
3. GREEN Band (533-590 nm)
4. RED Band (636-673 nm)
5. NEAR INFRARED NIR (851-879 nm)
6. SWIR 1 (1566-1651 nm)
7. SWIR 2 (2107-2294 nm)
8. PANCHROMATIC (503-676 nm)
9. CIRRUS (1363-1384 nm)
10. THERMAL INFRARED (TIRS)1 (10600-11190 nm)
11. THERMAL INFRARED (TIRS)2 (11500-12510 nm)

Dimensione Pixel:
- Pancromatico 15 metri
- Multispettrale 30 metri
- Termico 100 metri

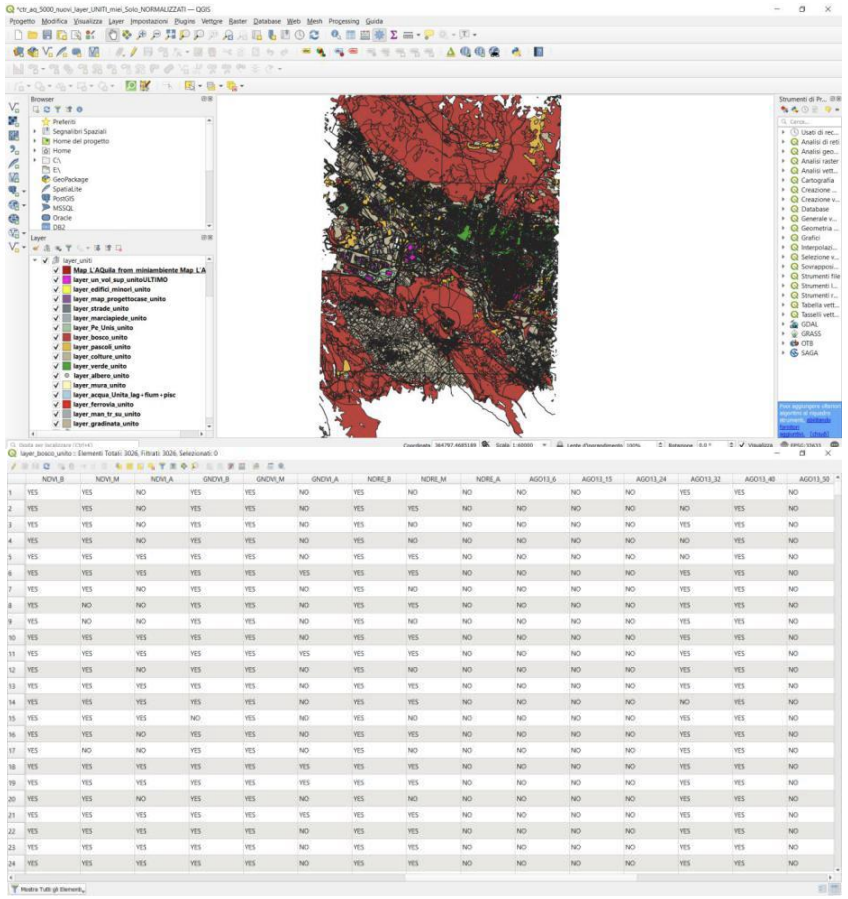




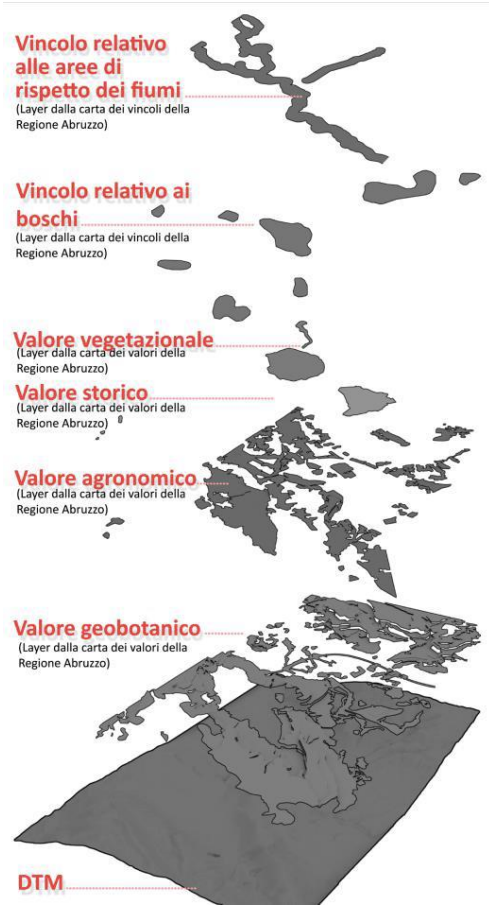


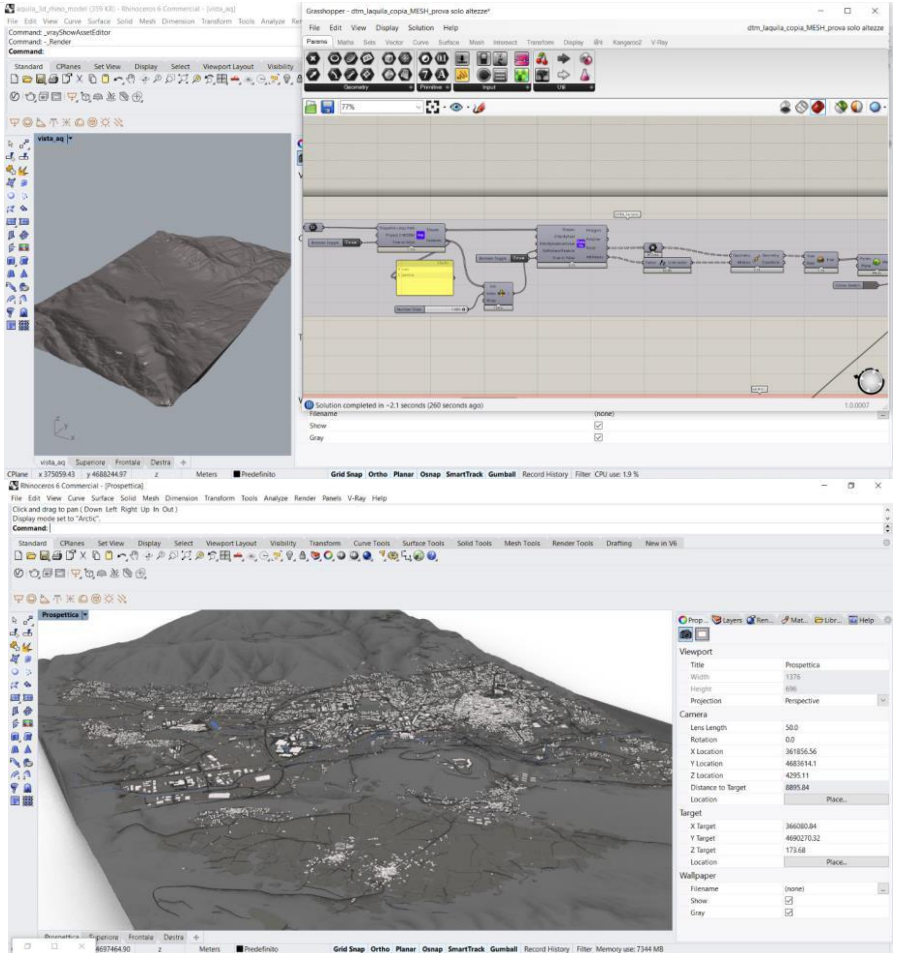


City Information Modeling



Geographic Information System





3DS + Database

City Information Modeling

Next Steps

- As seen in the slides, our research considered only a few uses of CIM and considered only a few data sources.
- In the next steps we will continue this experimentation in order to realize an integrated BIM/CIM environment.
- In another line of research we will also extend the concept of CIM to the Land, to constitute Land Information Modeling.

City Information Modeling & Land Information Modeling

Thank you for your attention! ☺