

Geospatial Data Processing to Support Seismic Emergency Management



WebGIS Services to Support Locational Choices of Shelters

Presented by: Group 1

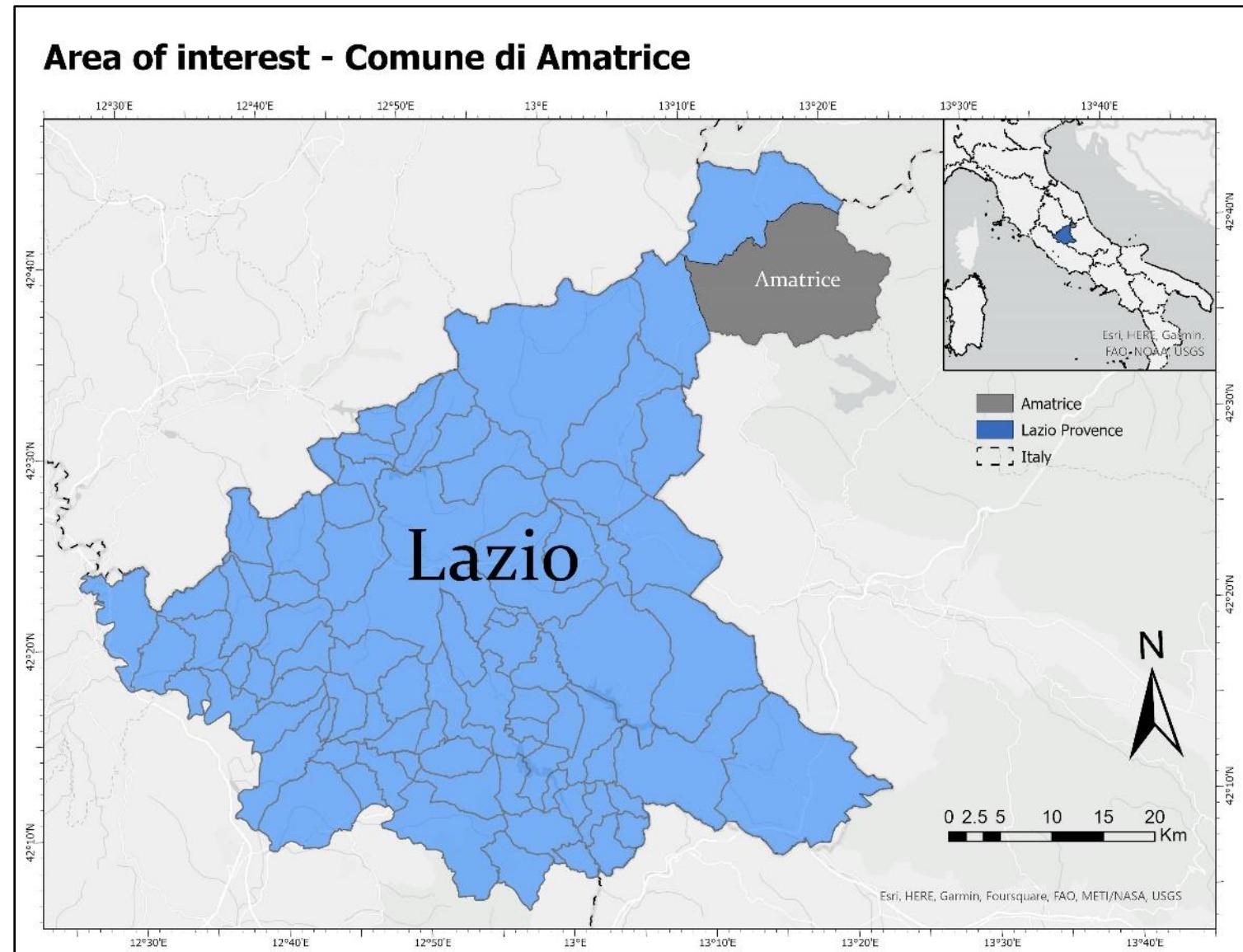
Supervised by: Professor Daniela Carrion, Professor Maria Pia Boni and Professor Scira Menoni

Introduction

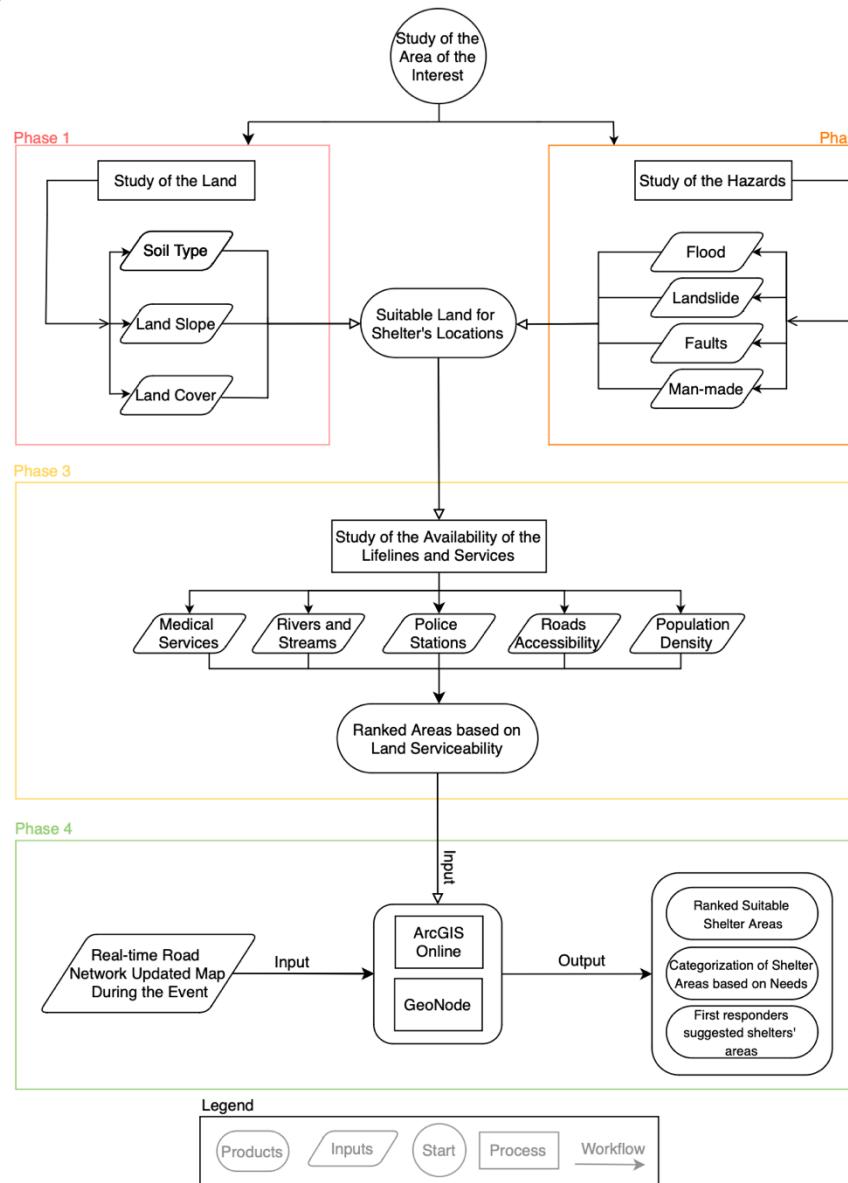
Emergency plan for shelter locations in Amatrice, Italy

Using Geospatial data to identify suitable shelter locations during and after the event

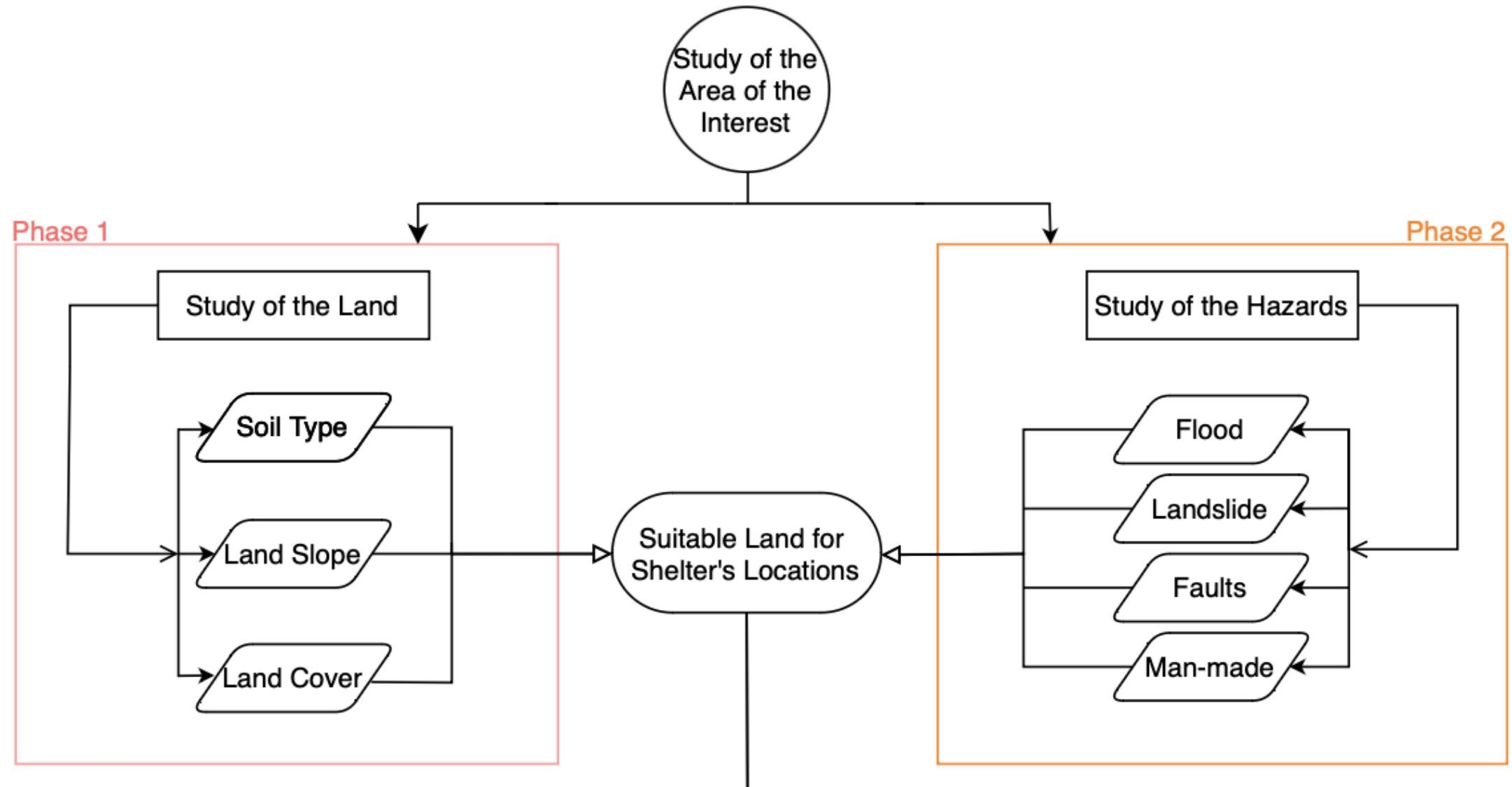
WebGIS platform to visualize and access the computed data. Factors like accessibility and facilities considerations will be analyzed to choose suitable shelter locations



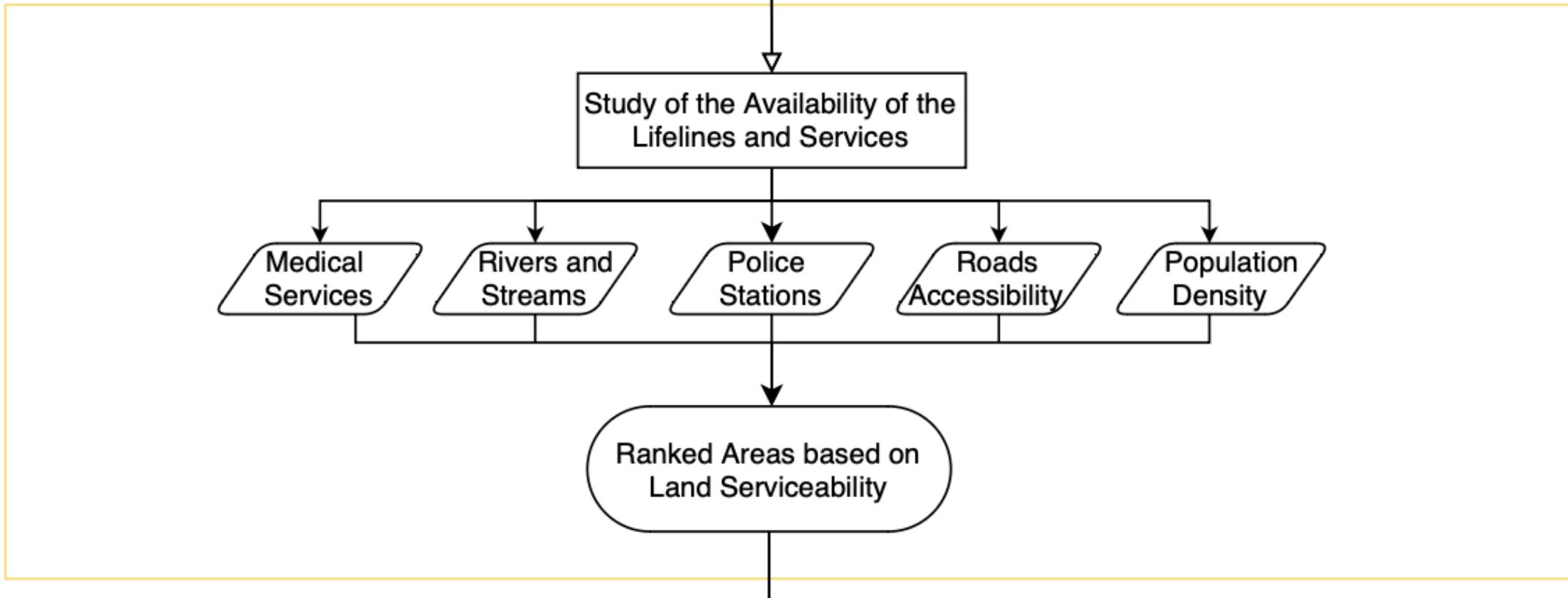
Framework



Framework

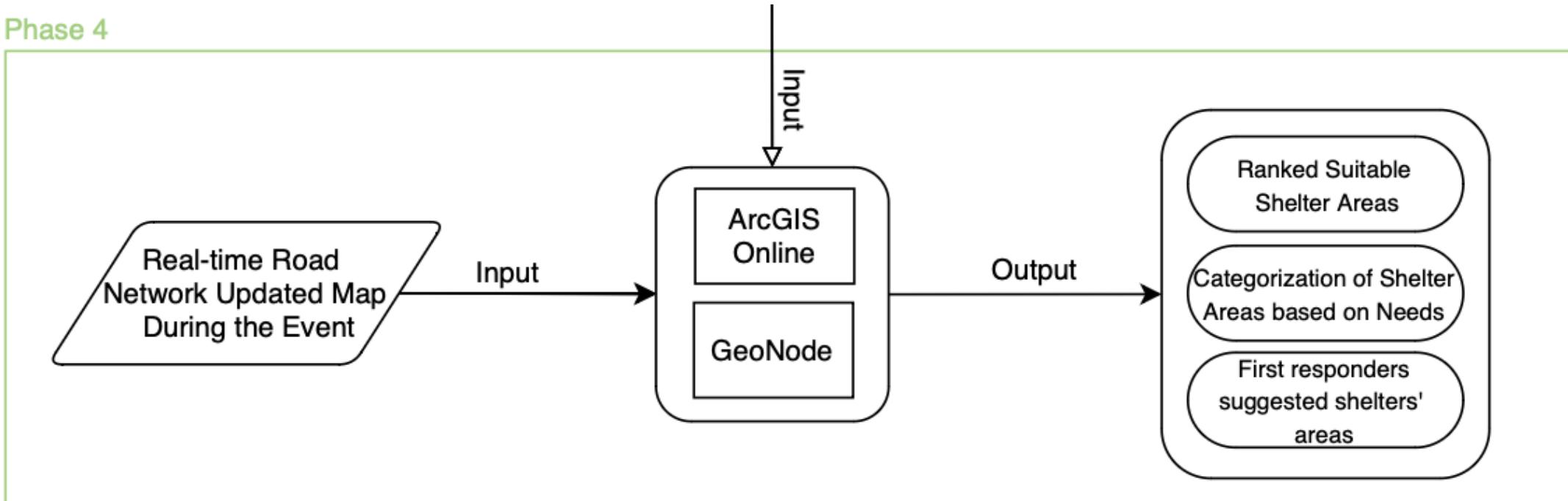


Phase 3



Framework

Phase 4





Weights Assignment

Phase	Layers	Classification	Interpretation	Suitability Weights	Main Weight
	Slope	$\theta \leq 2^\circ \text{ & } \theta > 10^\circ$ $2^\circ < \theta \leq 4^\circ$ $4^\circ < \theta \leq 10^\circ$	Unsuitable Neutral Suitable	0 2 5	7

Phase 1

Flood Hazard	Susceptible areas	Unsuitable	0	-
	Un-susceptible areas	Suitable	1	

Phase 2

Population Density	No. of People <20 21< No. of People < 50 No. of People > 51	Less suitable Neutral Suitable	1 1,23 1,35	
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Phase 3

Estimated Number of Evacuees

Inhabitants



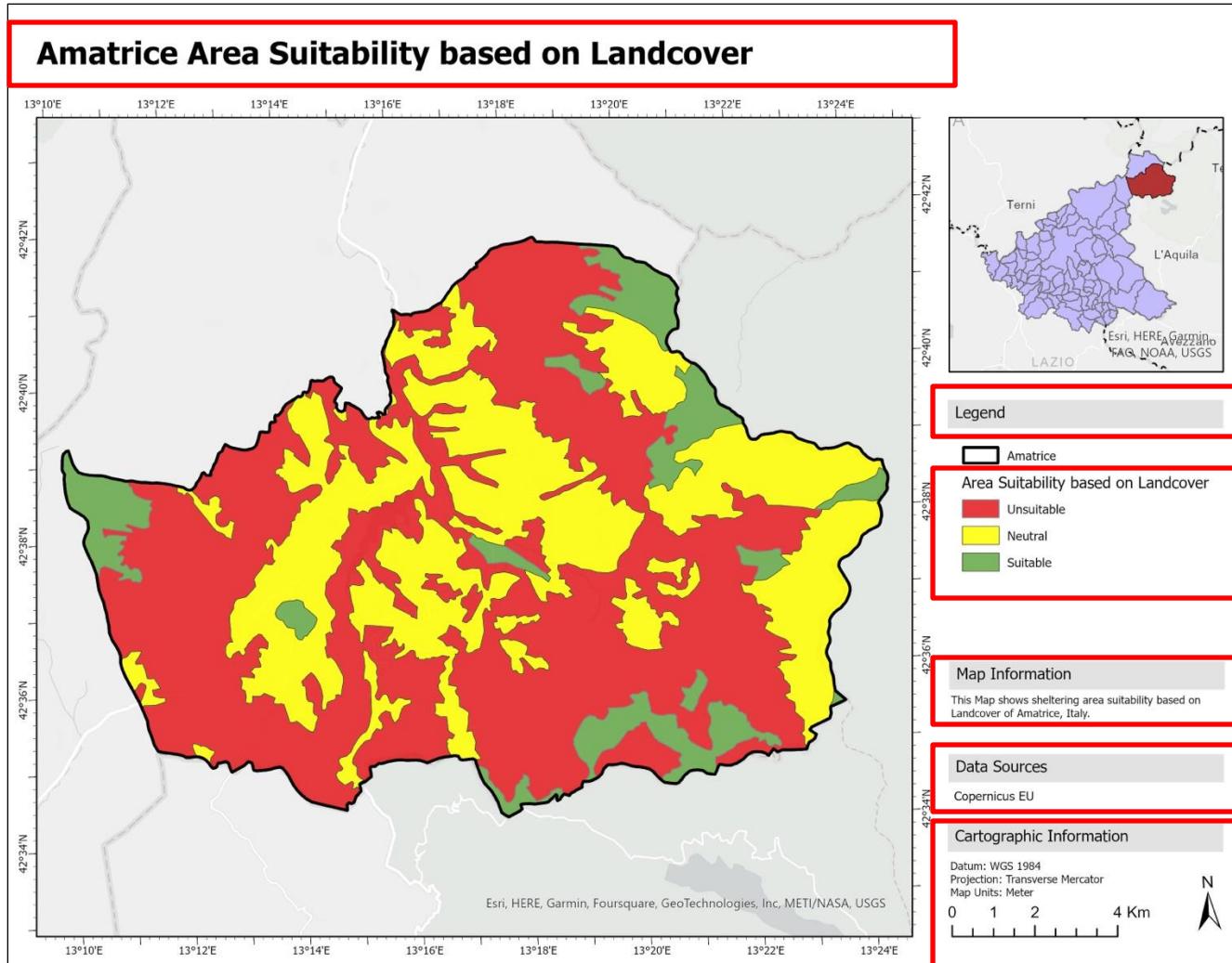
SAR Team



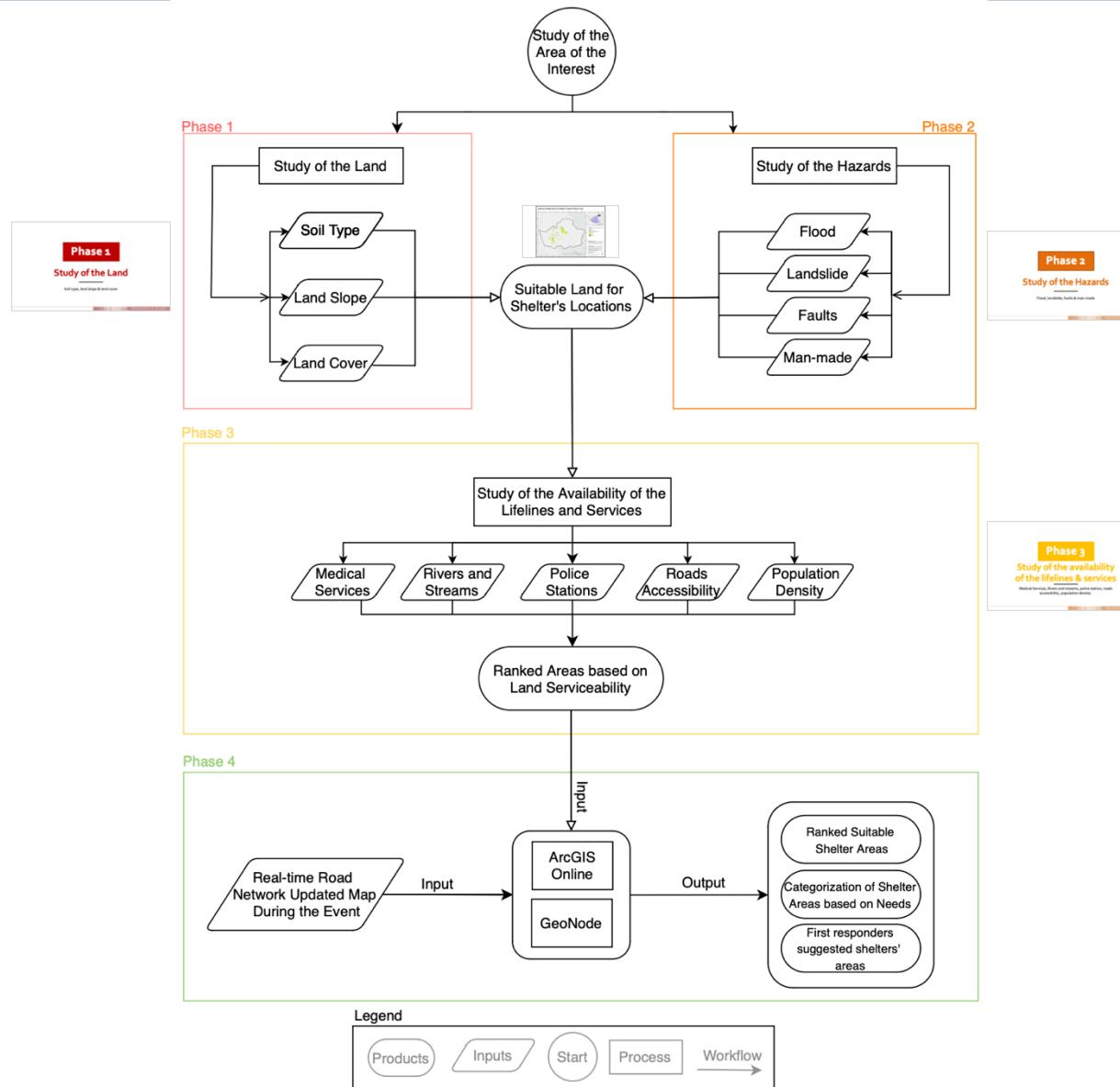
$$\text{Estimated Number of Evacuees} = 2689 + 200(\text{SAR}) = 2889$$



Map Template



Workflow



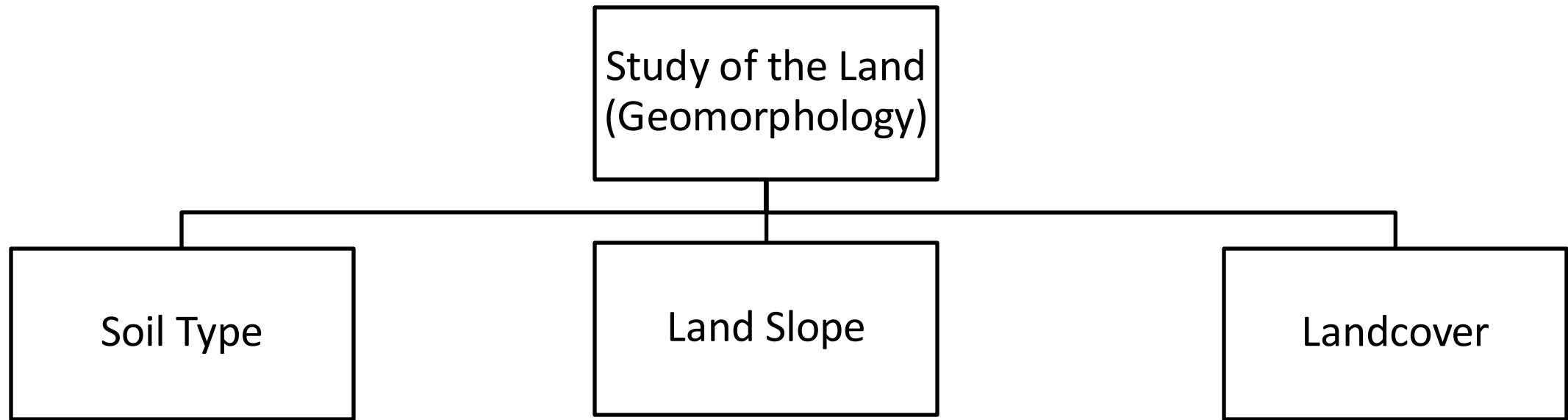
Phase 1

Study of the Land

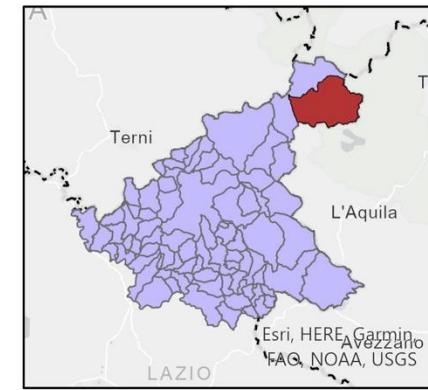
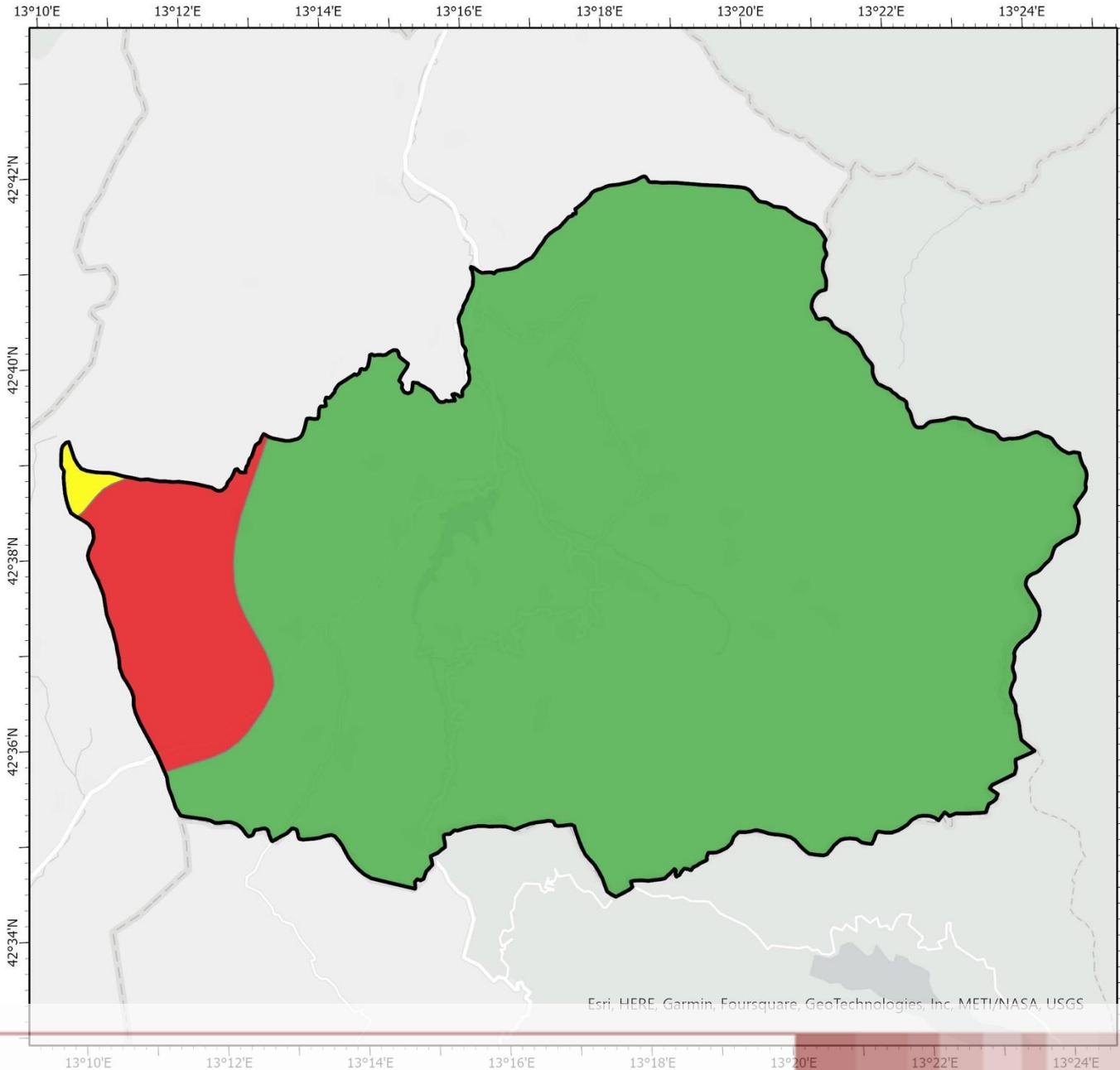
Soil type, land slope & land cover



Study of the land (Phase 1)



Amatrice Area Suitability based on Soil Type



Legend

- Amatrice
- Area Suitability based on Soil Type
 - Unsuitable
 - Neutral
 - Suitable

Map Information

This Map shows sheltering area suitability based on Soil Type of Amatrice, Italy.

Data Sources

BGR's IHME1500

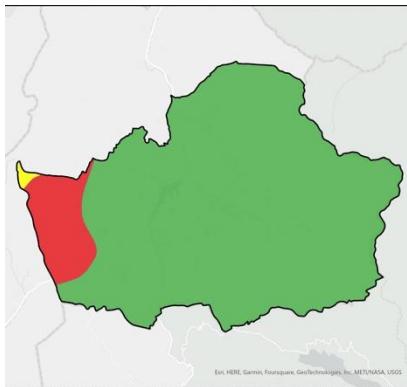
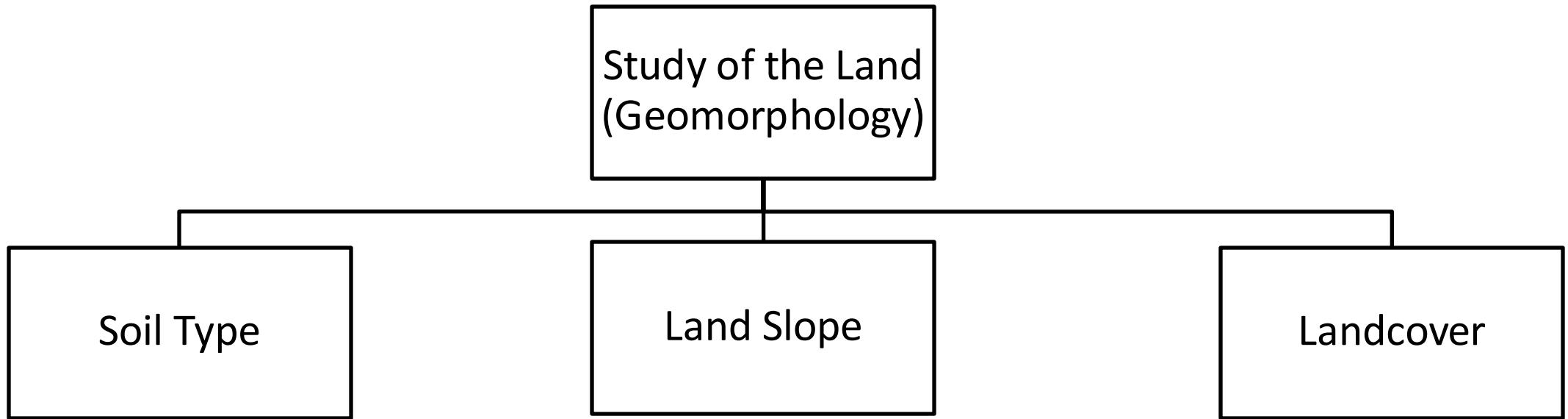
Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter

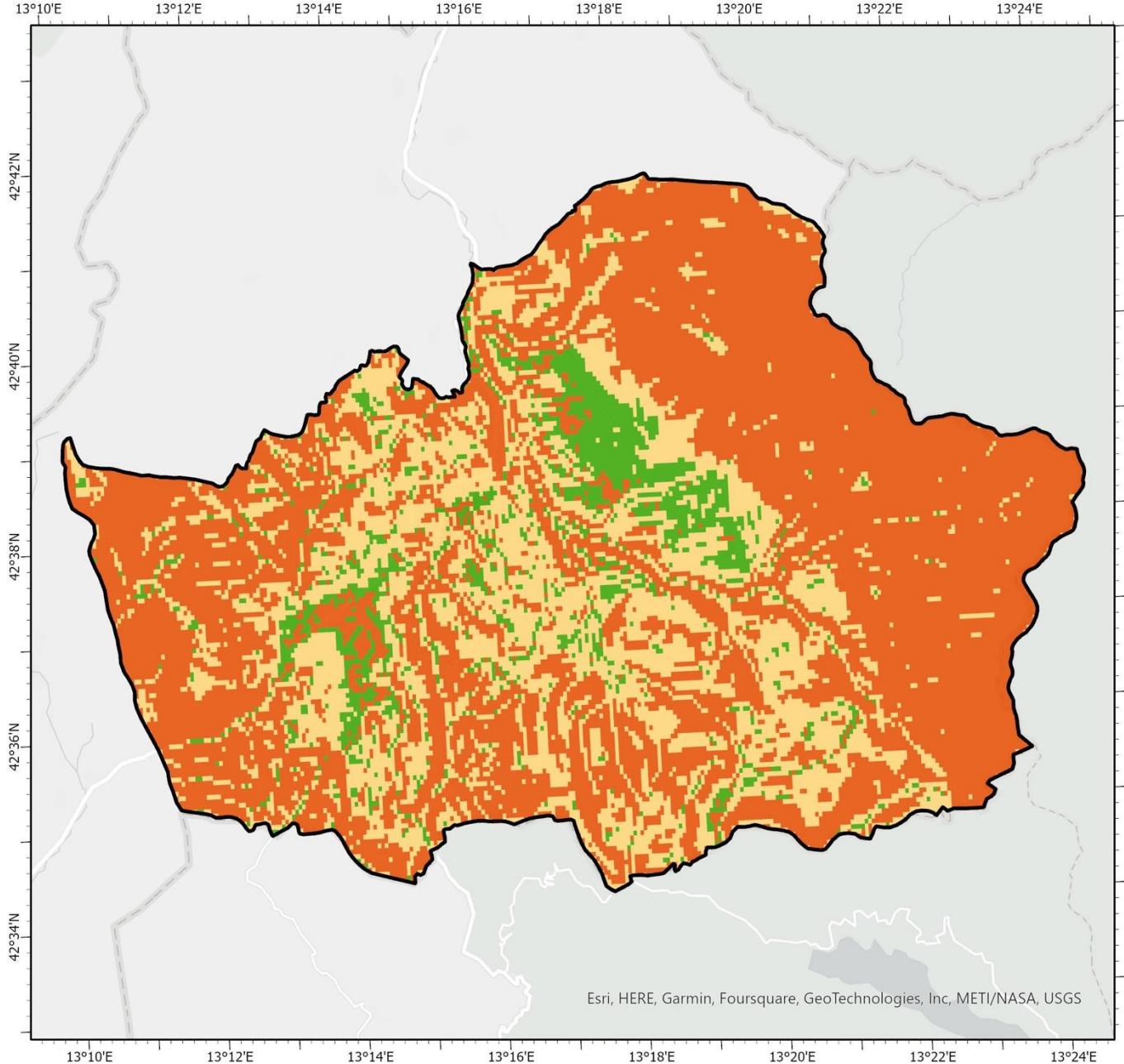
0 1 2 4 Km



Study of the land (Phase 1)



Amatrice Area Suitability based on Slope



Legend

- Amatrice
- Area Suitability based on Slope
 - Unsuitable
 - Neutral
 - Suitable

Map Information

This Map shows sheltering area suitability based on slope of Amatrice, Italy.

Data Sources

Regional Geoportal Lazio

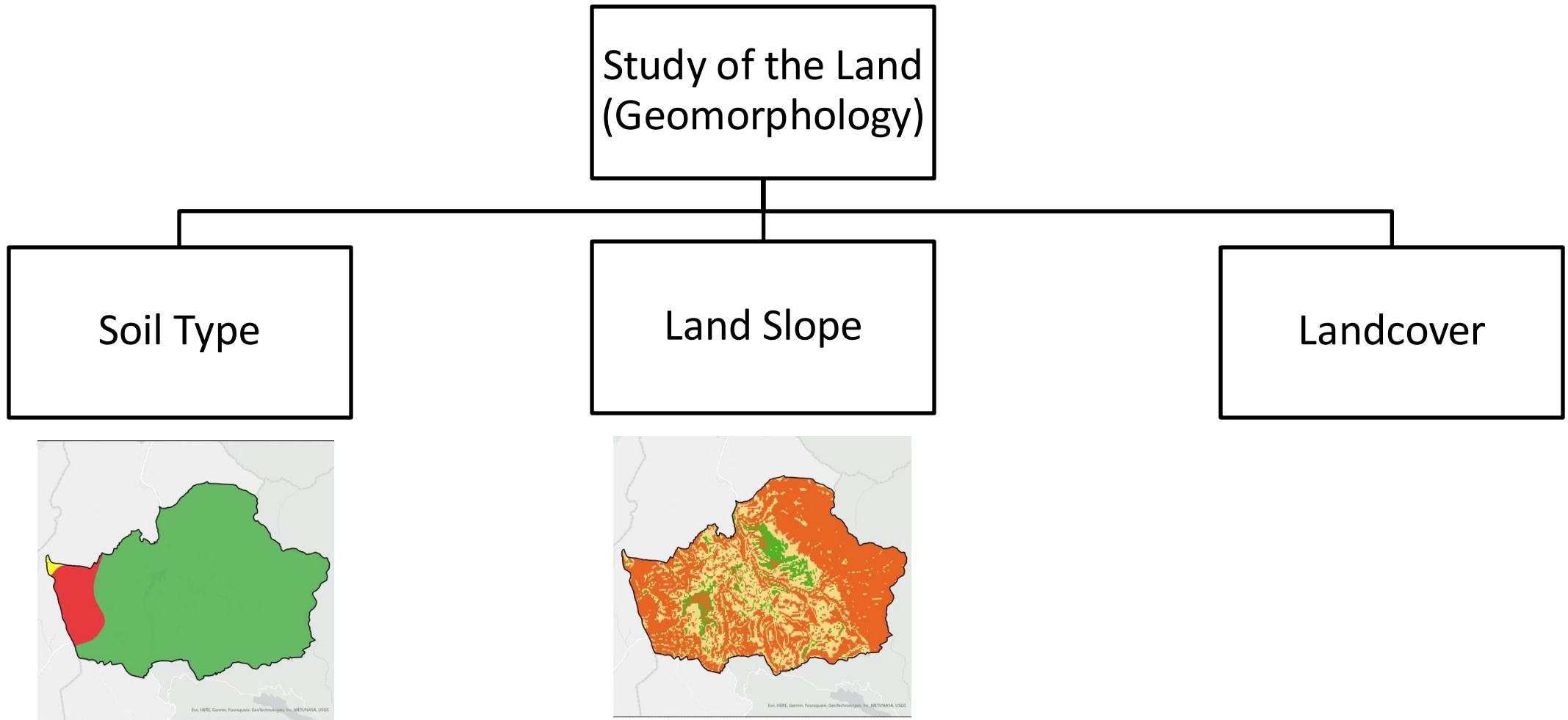
Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter

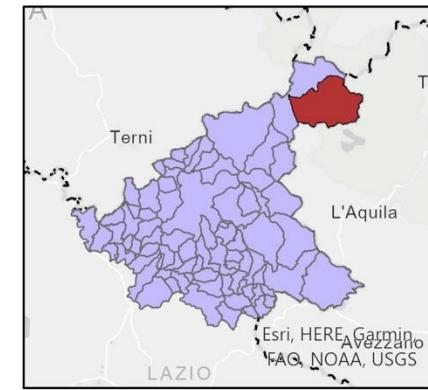
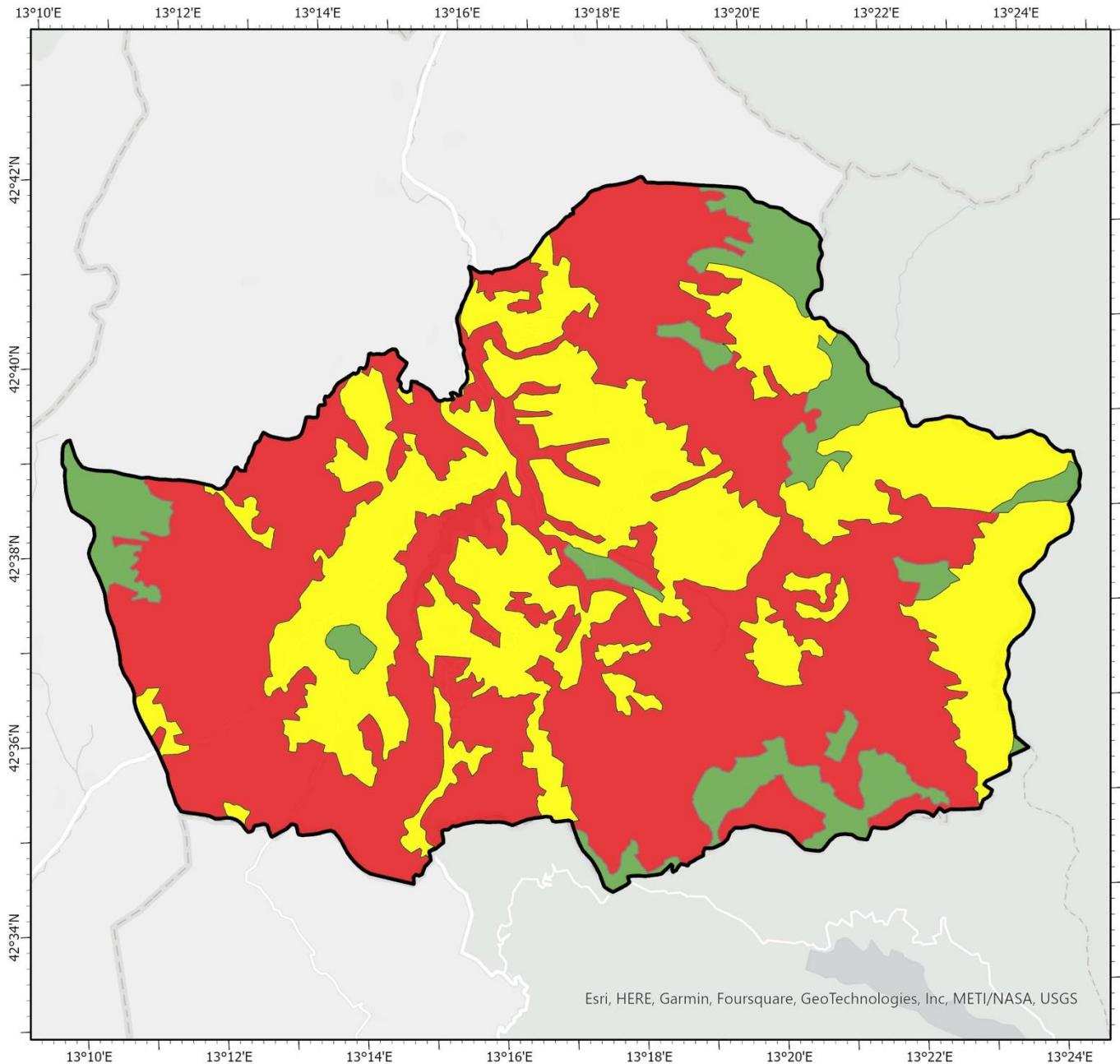
0 1 2 4 Km



Study of the land (Phase 1)



Amatrice Area Suitability based on Landcover



Legend

- Amatrice
- Area Suitability based on Landcover
 - Unsuitable (Red)
 - Neutral (Yellow)
 - Suitable (Green)

Map Information

This Map shows sheltering area suitability based on Landcover of Amatrice, Italy.

Data Sources

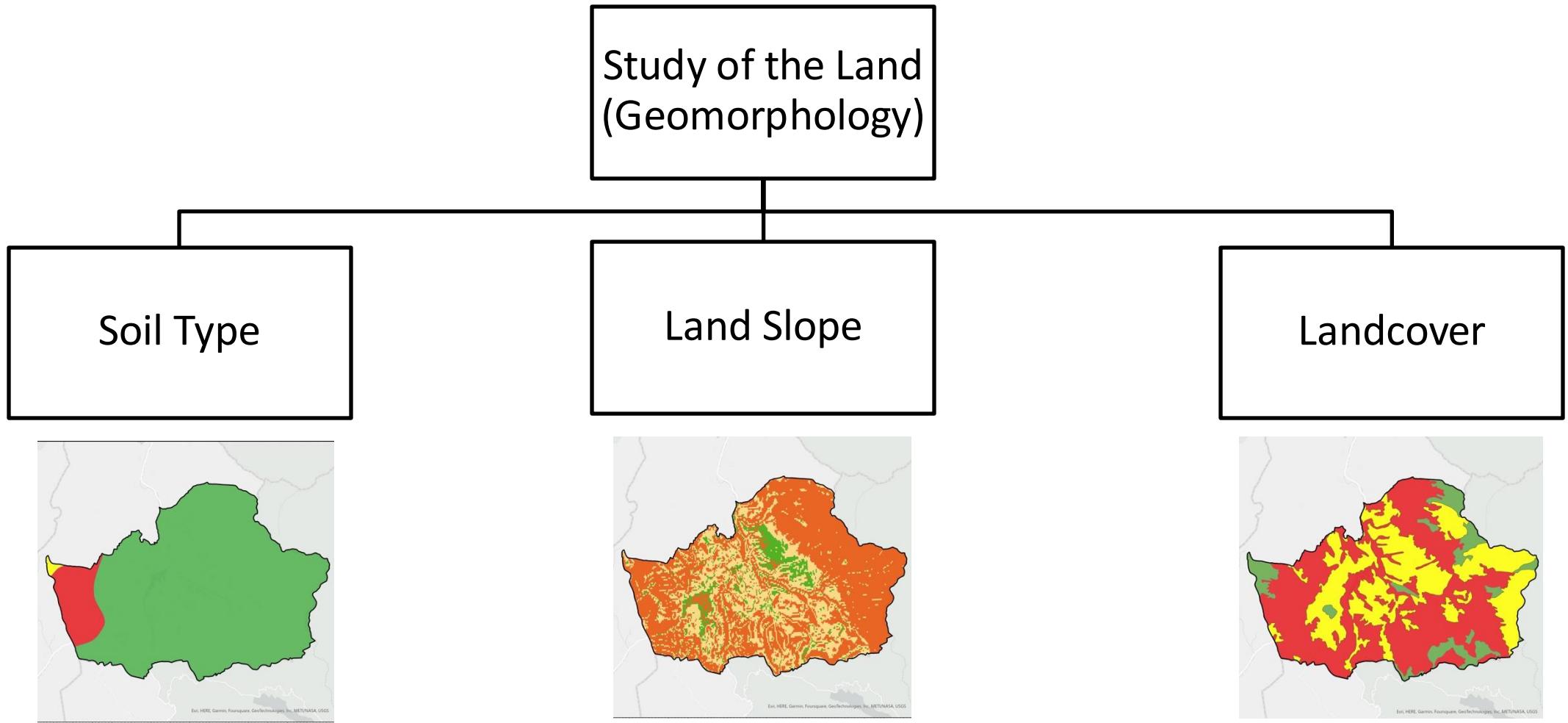
Copernicus EU

Cartographic Information

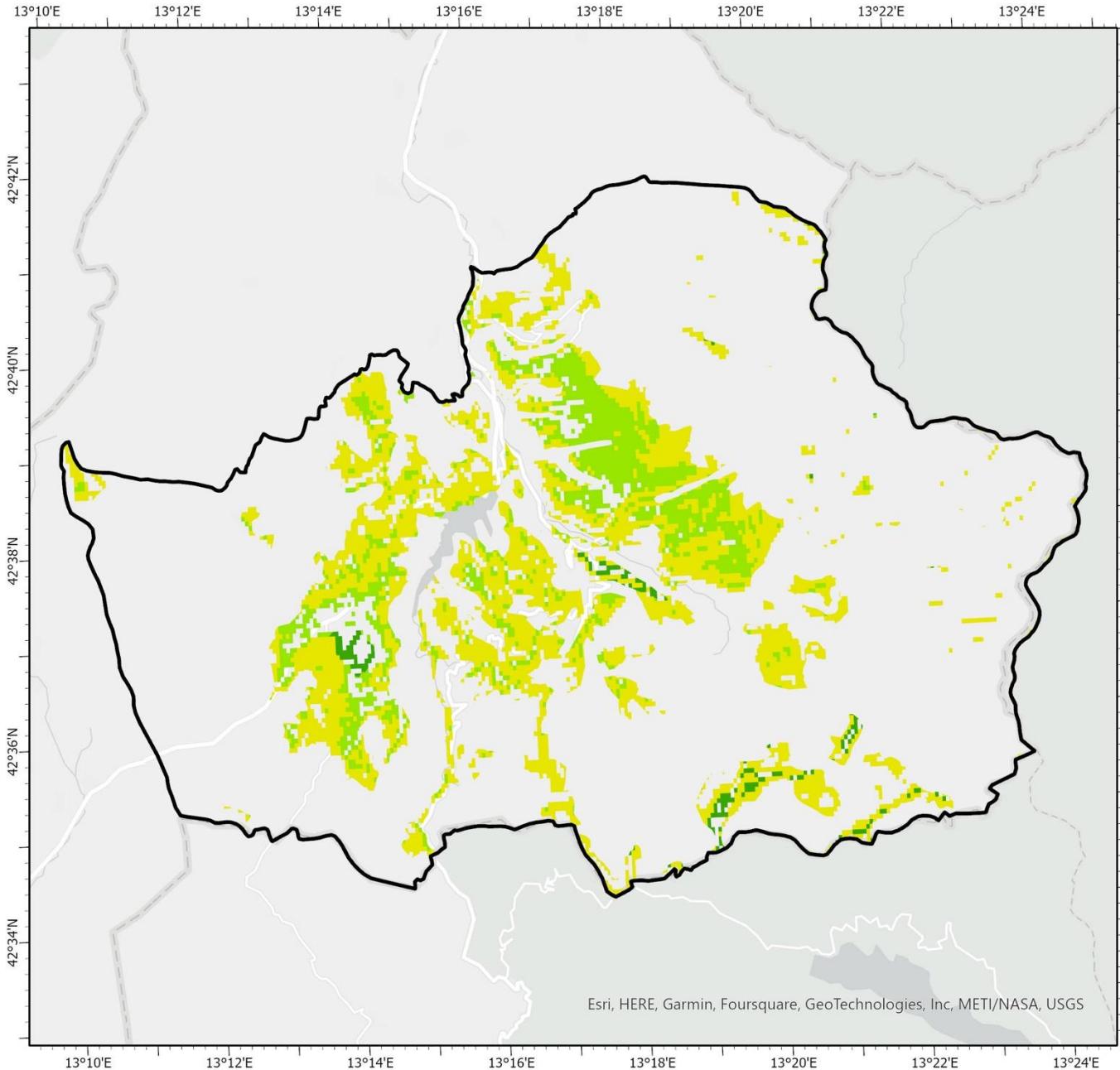
Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter



Study of the land (Phase 1)



Amatrice Sheltering Area Suitability (Study of the land)



Legend

- Amatrice (Black outline)
- Area Suitability
 - Suitable (Yellow)
 - High Suitability (Light Green)
 - Very High Suitability (Dark Green)

Map Information

This Map shows sheltering area suitability for phase 1 "Study of the land" of Amatrice, Italy. Layers used to produce this map: Soil Type, Land Slope, and Landcover.

Data Sources

Copernicus EU, BGR's IHME1500, Regional Geoportal Lazio

Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter

0 1 2 4 Km



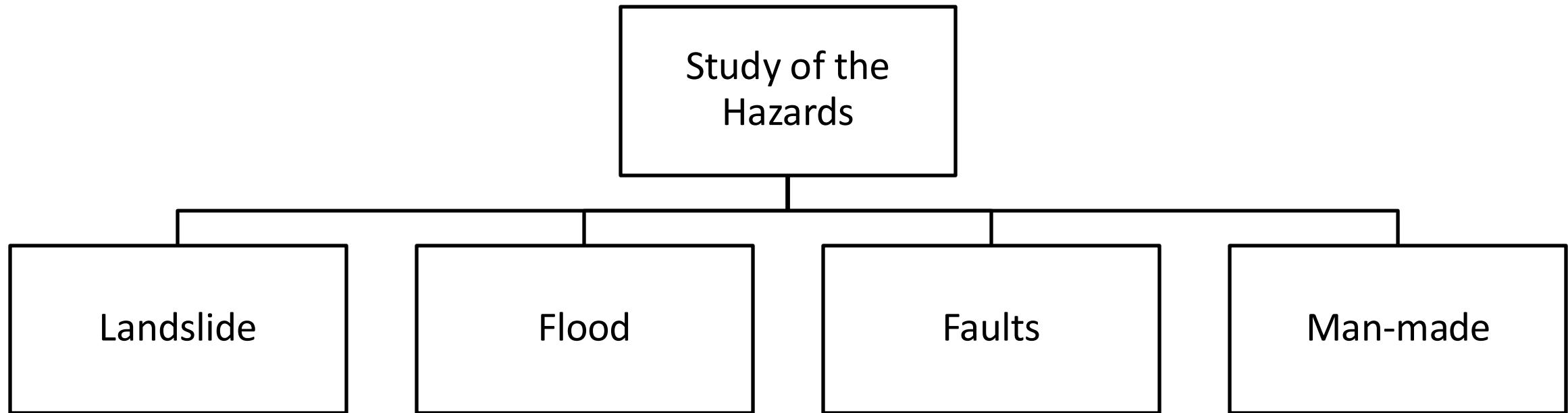
Phase 2

Study of the Hazards

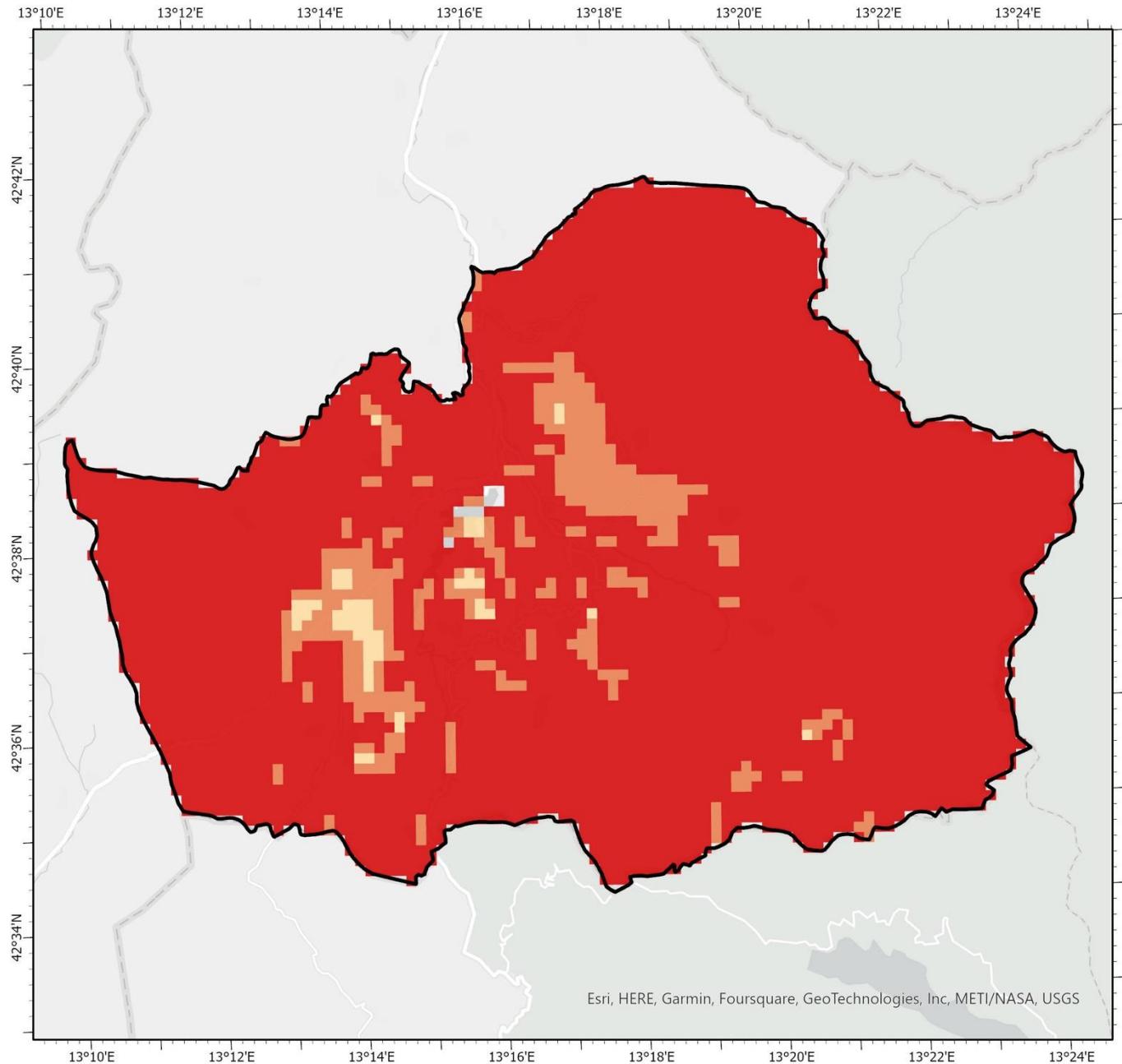
Flood, landslide, faults & man-made



Study of the Hazards (Phase 2)



Amatrice Landslide Hazard Map



Legend

	Amatrice
Landslide Hazard Level	
	Hazardous
	Low Hazard
	Very Low Hazard

Map Information

This Map shows landslide hazard classification for Amatrice, Italy.

Data Sources

European Commission JRC

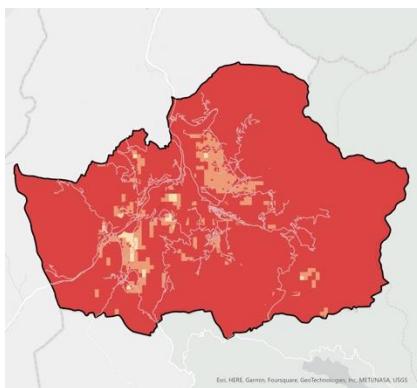
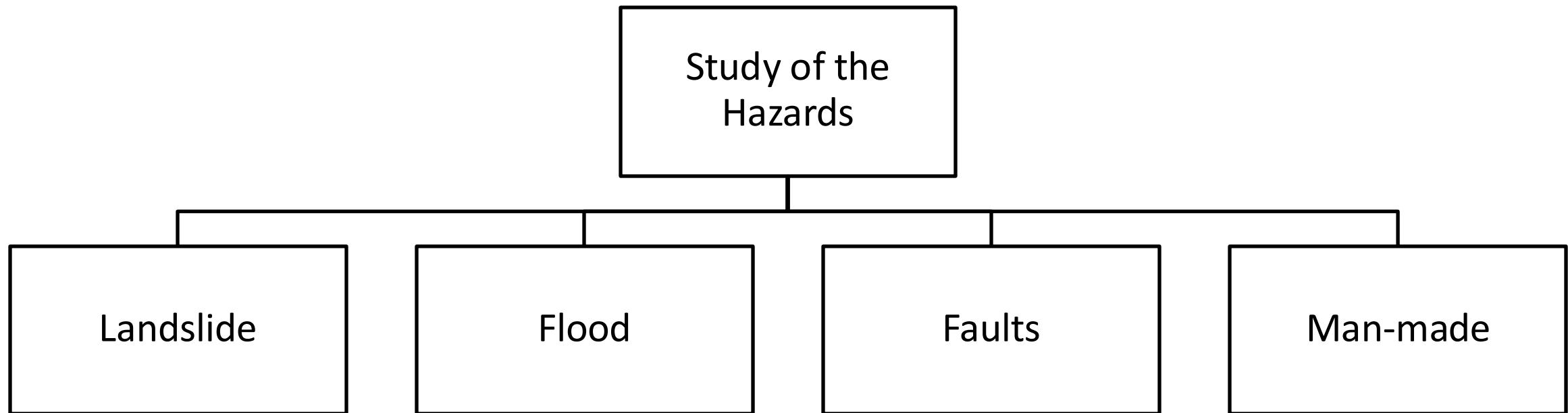
Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter

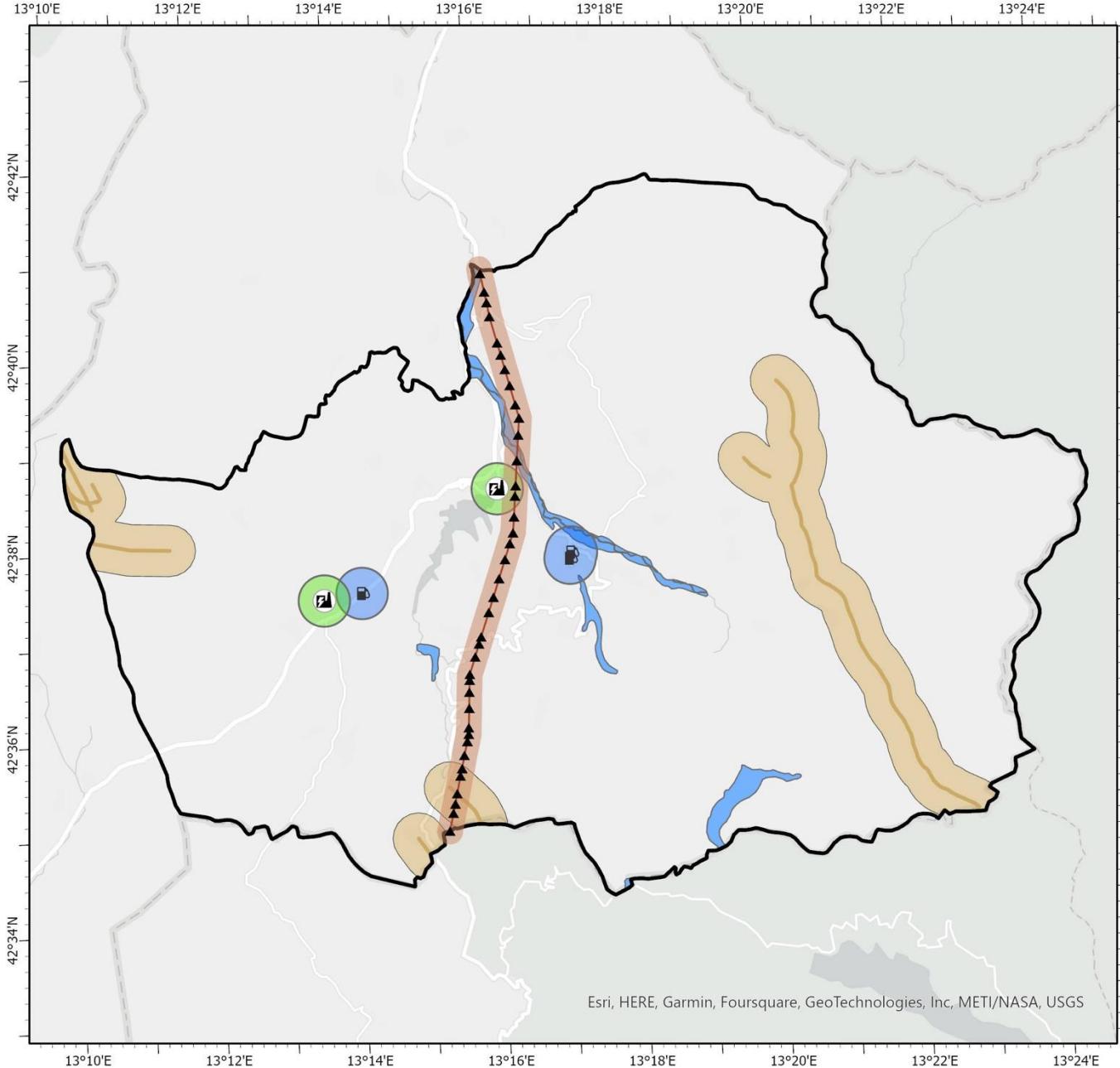
0 1 2 4 Km



Study of the Hazards (Phase 2)



Amatrice Hazard Map



Legend

■	Amatrice	■	Flood Hazard
■	Power Plants	■	Buffer (500m)
■	Fuel Stations	■	Buffer (500m)
▲	Power Towers	■	Buffer (250m)
—	Faults	■	Buffer (500m)
—	Power Line	—	

Map Information

This Map shows hazards and manmade hazards considered for Amatrice, Italy.
Layers presented: Faults, Flood Hazard, Power Plants, Fuel Stations, and Power Towers

Data Sources

Regional Geoportal Lazio, OpenStreetMap

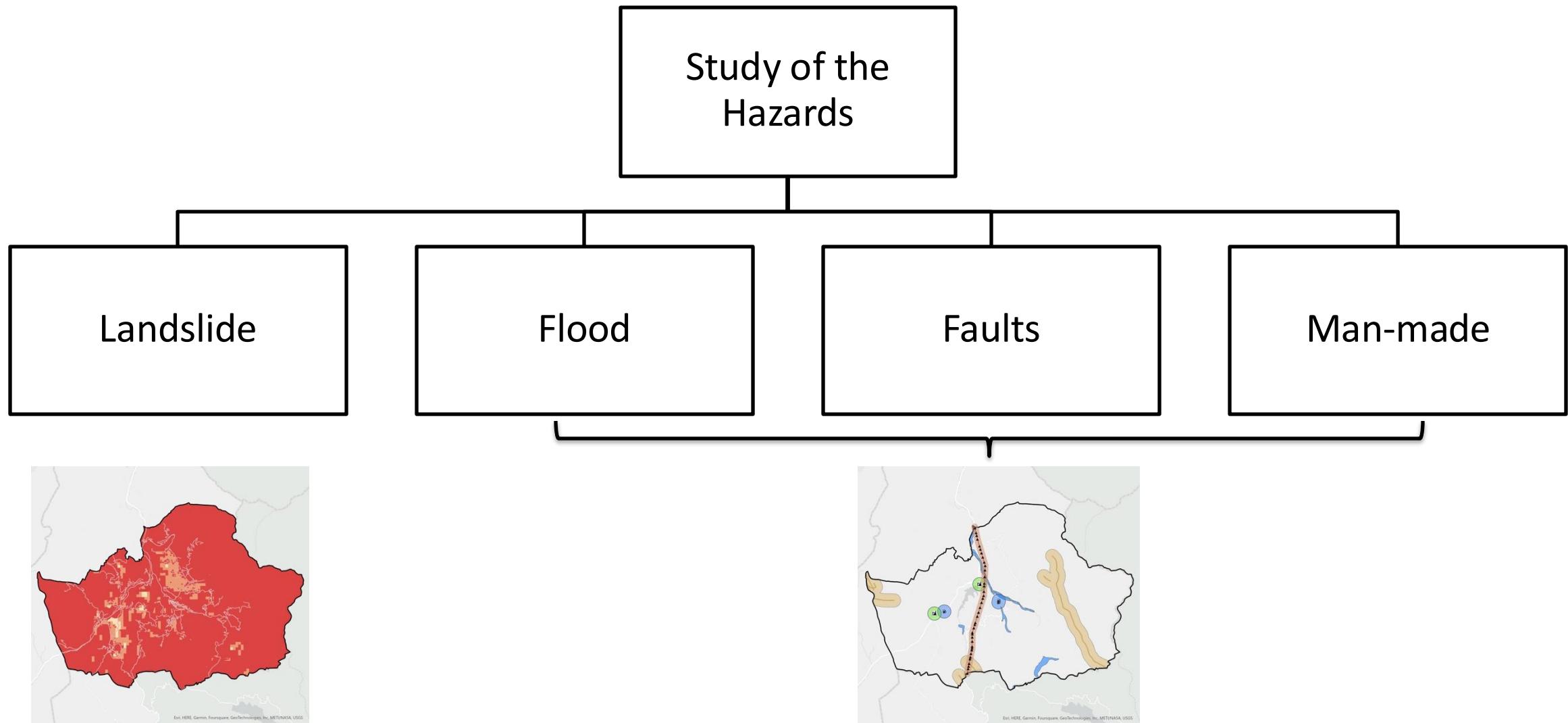
Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter

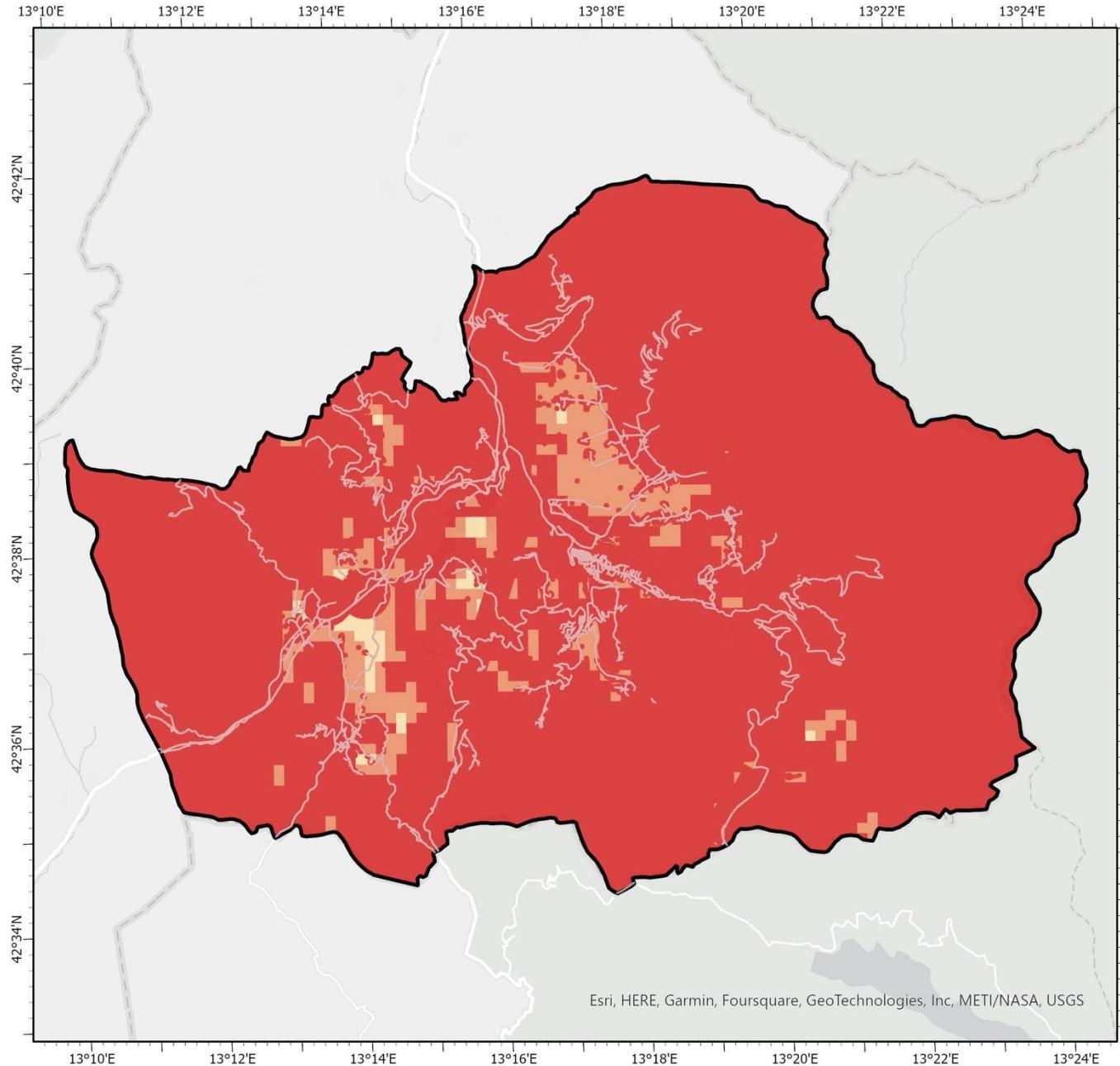
0 1 2 4 Km



Study of the Hazards (Phase 2)



Amatrice Hazard Level Map "phase 2"



Legend

- Amatrice
- Road Network
- Hazard Level
 - Hazardous
 - Low Hazard
 - Very Low Hazard

Map Information

This Map shows hazard classification for Amatrice, Italy. It is produced considering:

- Natural Hazards: Landslide Hazard, Flood Hazard
- Manmade Hazard: Fuel Station, Power Plant, and Power Towers

Data Sources

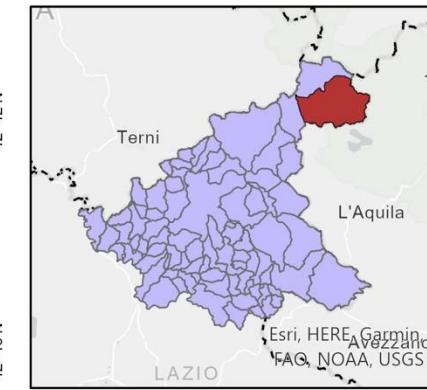
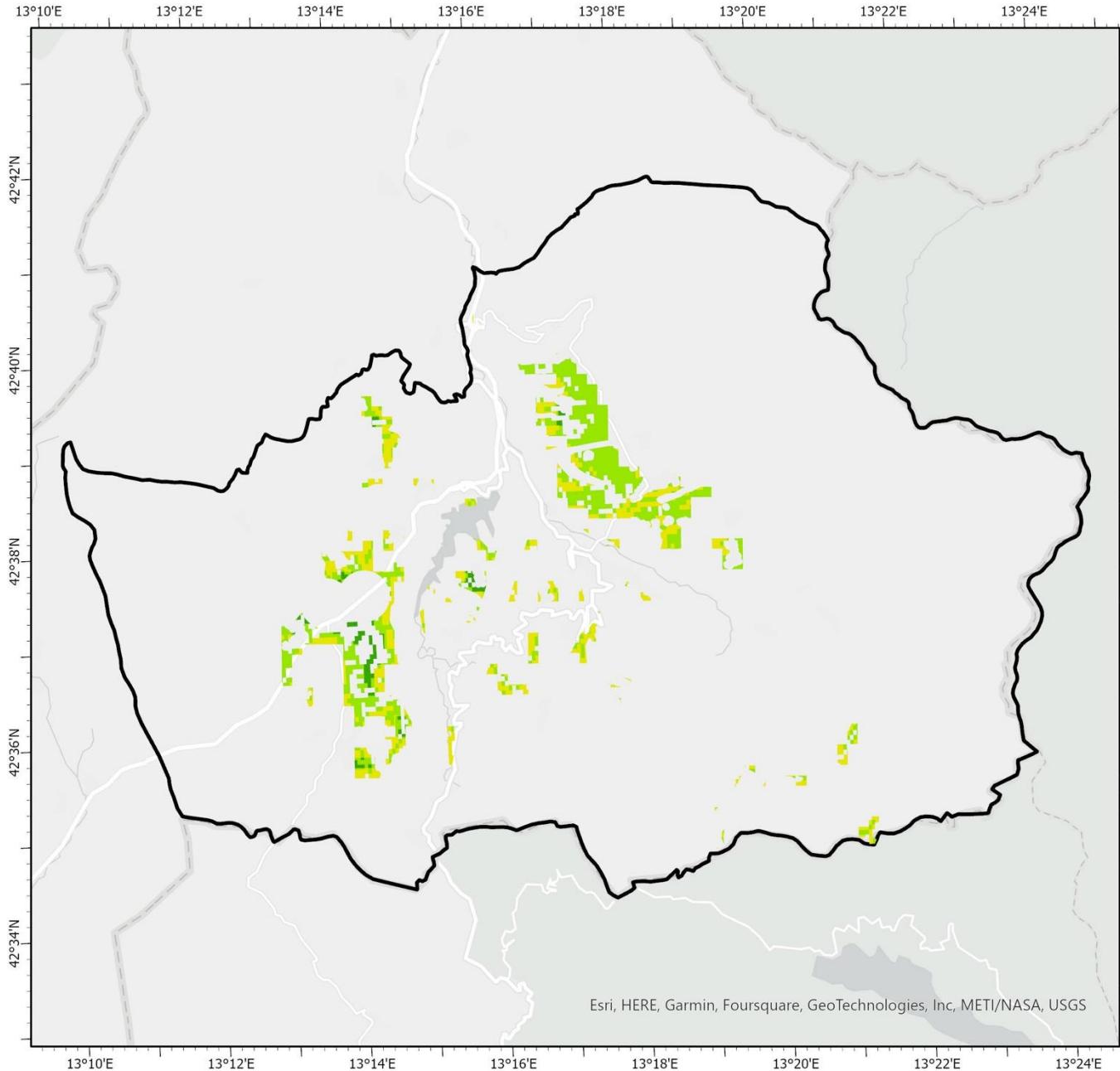
European Commission JRC, Regional Geoportal Lazio, OpenStreetMap

Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter



Amatrice Suitable Area for Shelter's location (Phase 1 &2)



Legend

- Amatrice
- Sheltering Suitability Area
 - Neutral
 - High
 - Very High

Map Information

This Map shows suitable area for shelter's location for Amatrice, Italy. It is a product of Phase 1 and Phase 2.

Data Sources

European Commission JRC, Regional Geoportal Lazio, BGR's IHME1500, Copernicus EU, OpenStreetMap

Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter



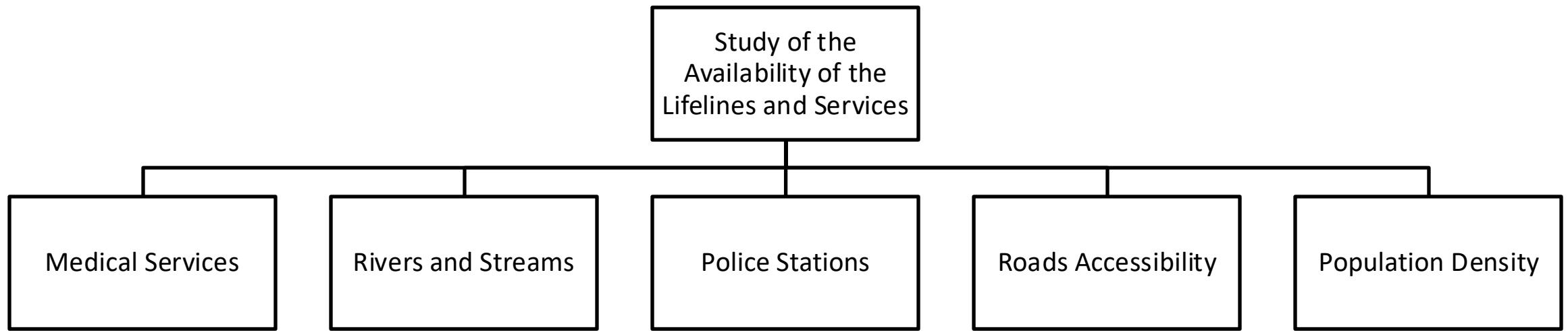
Phase 3

Study of the availability of the lifelines & services

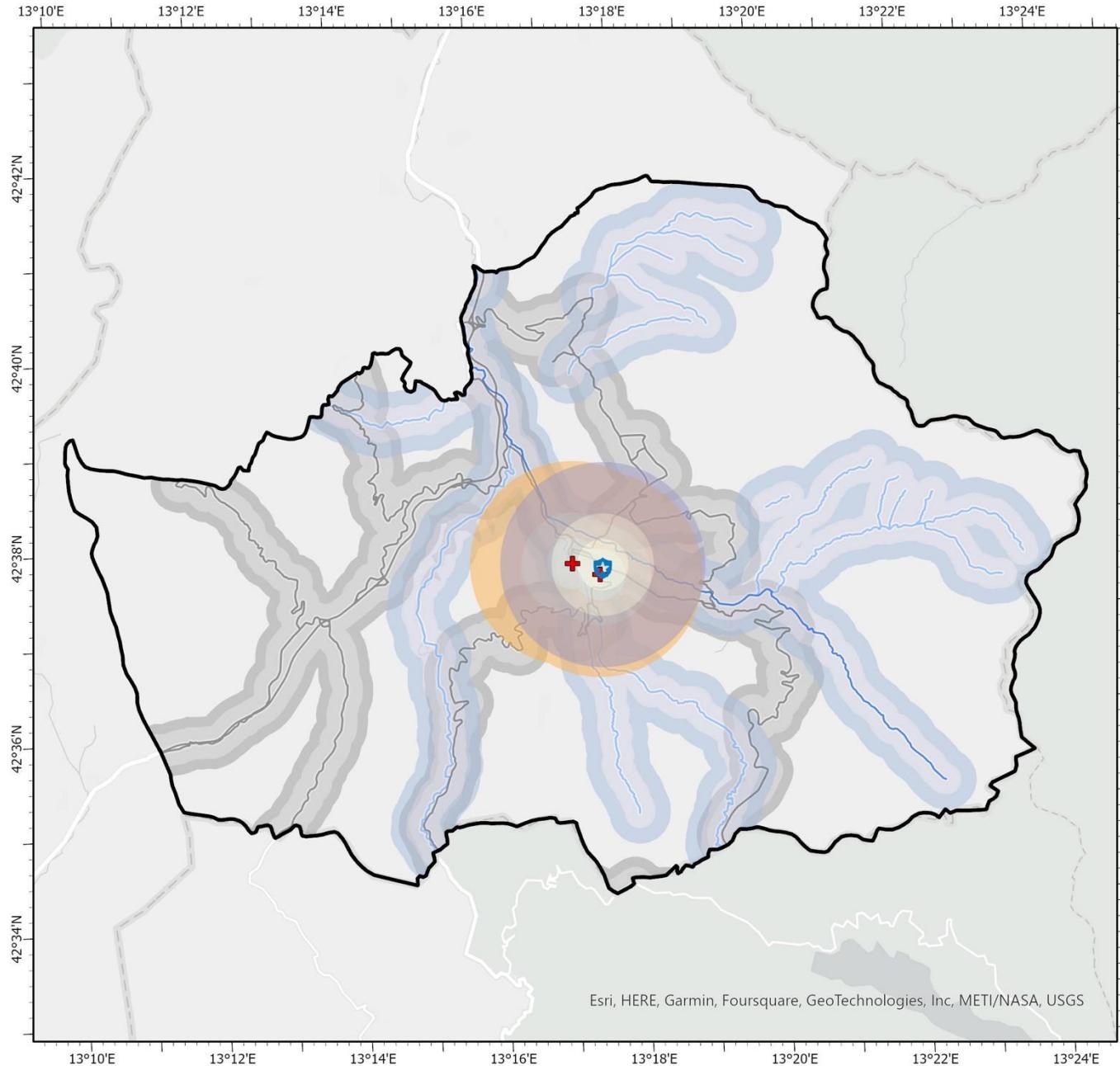
Medical Services, Rivers and streams, police station, roads accessibility, population density.



Study of the availability of the lifelines & services



Amatrice Lifelines and Services Map



Legend

	Amatrice	Police Buffer	Road Buffer
	Police Station	500 m	50 m
	Medical Services	1000 m	300 m
	Road Network	2000 m	500 m
	River	Medical Buffer	Water Buffer
	Main Streams	500 m	50 m
		1000 m	300 m
		2000 m	600 m

Map Information

This Map shows the lifelines and services used to rank the areas based on serviceability (Phase 3) for Amatrice, Italy. Layers used: Medical Services, Police Stations, River, Streams, and Road Network.

Data Sources

OpenStreetMap

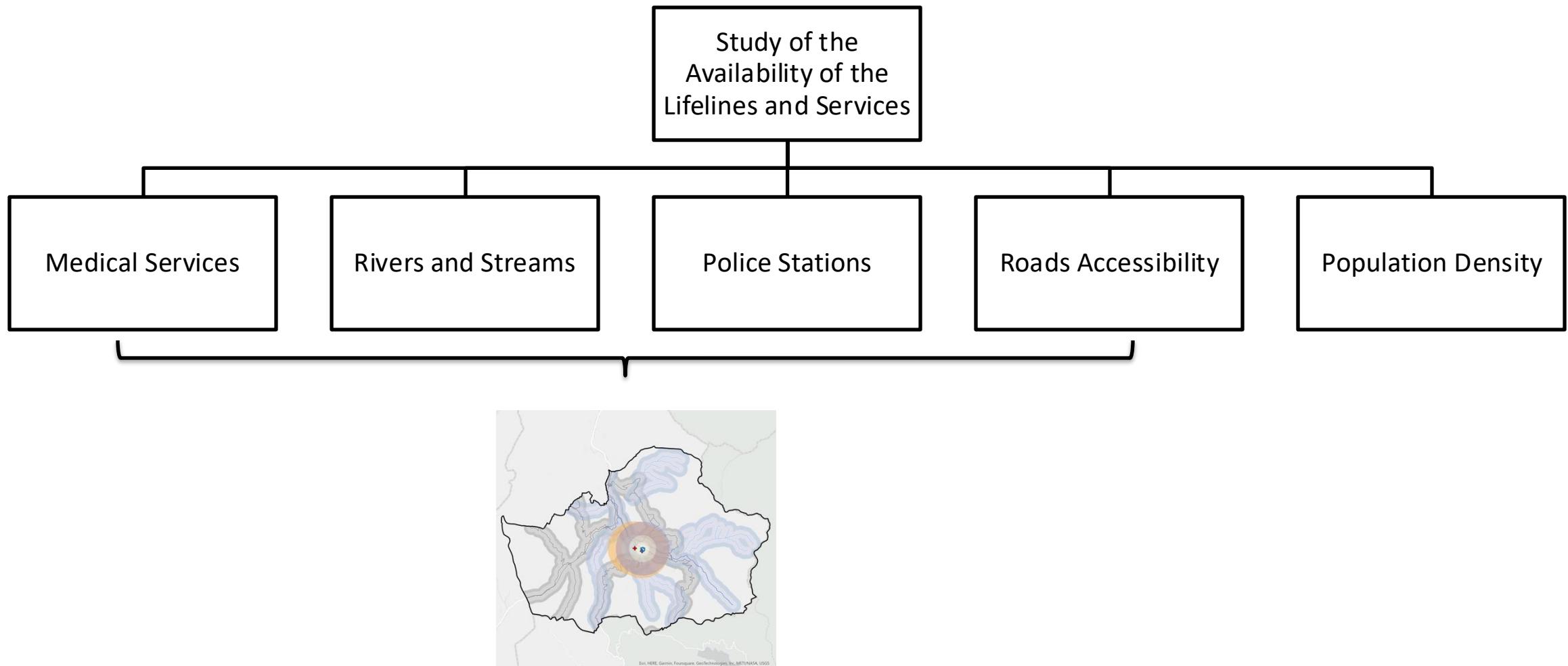
Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter

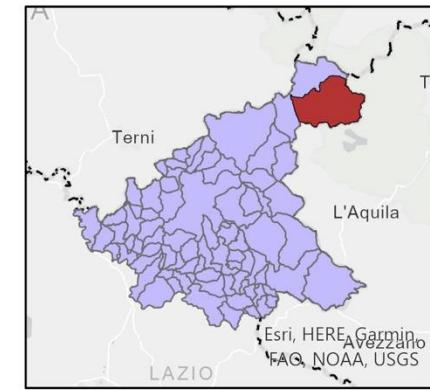
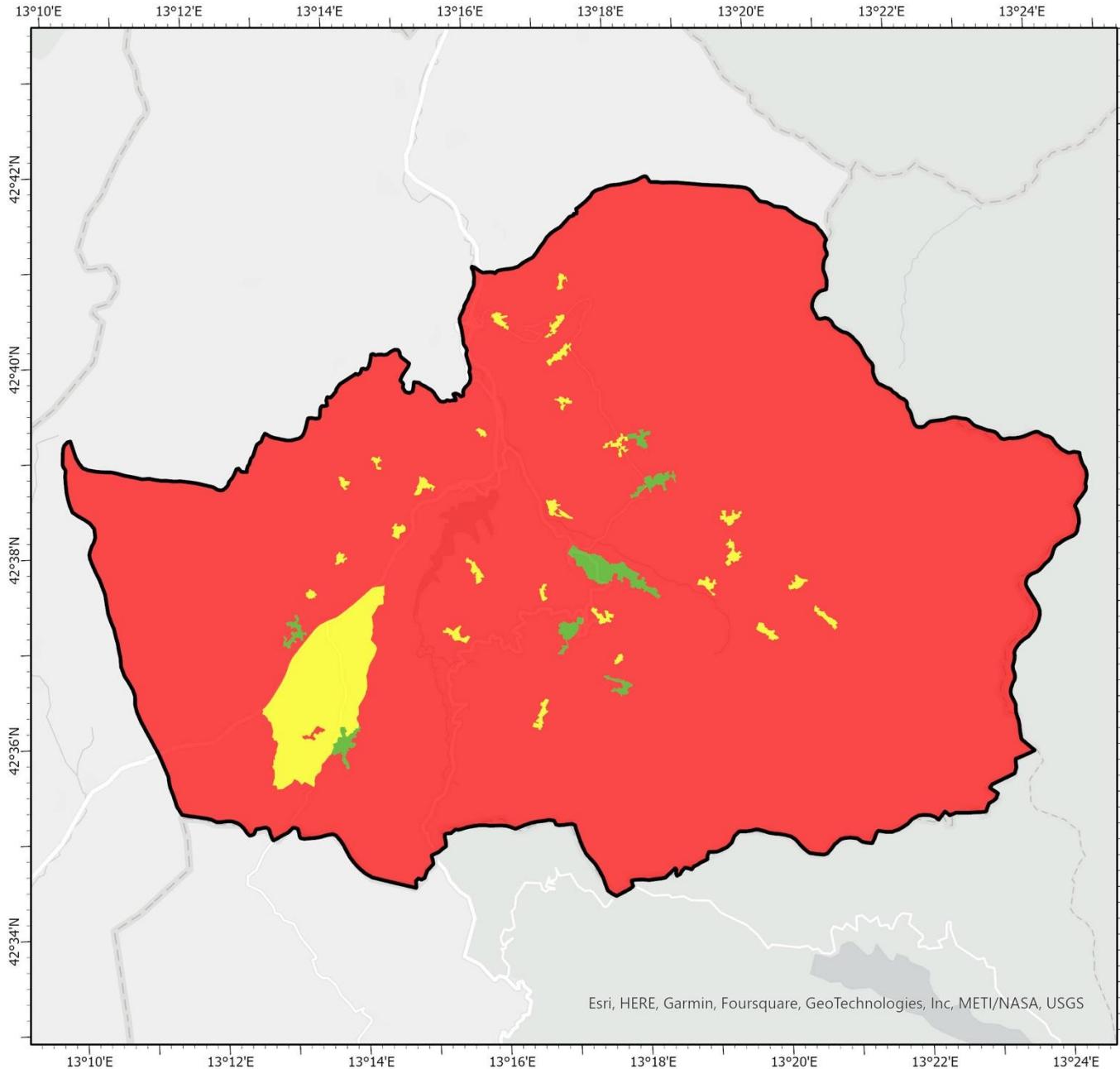
0 1 2 4 Km



Study of the availability of the lifelines & services



Amatrice Area Suitability Map based on Population Density



Legend

- Amatrice
- Population Density Area Suitability
 - Less Suitable (Red)
 - Neutral (Yellow)
 - Suitable (Green)

Map Information

This Map shows the Population density area suitability which is used to rank the areas based on serviceability (Phase 3) for Amatrice, Italy.

Data Sources

Regional Geoportal Lazio

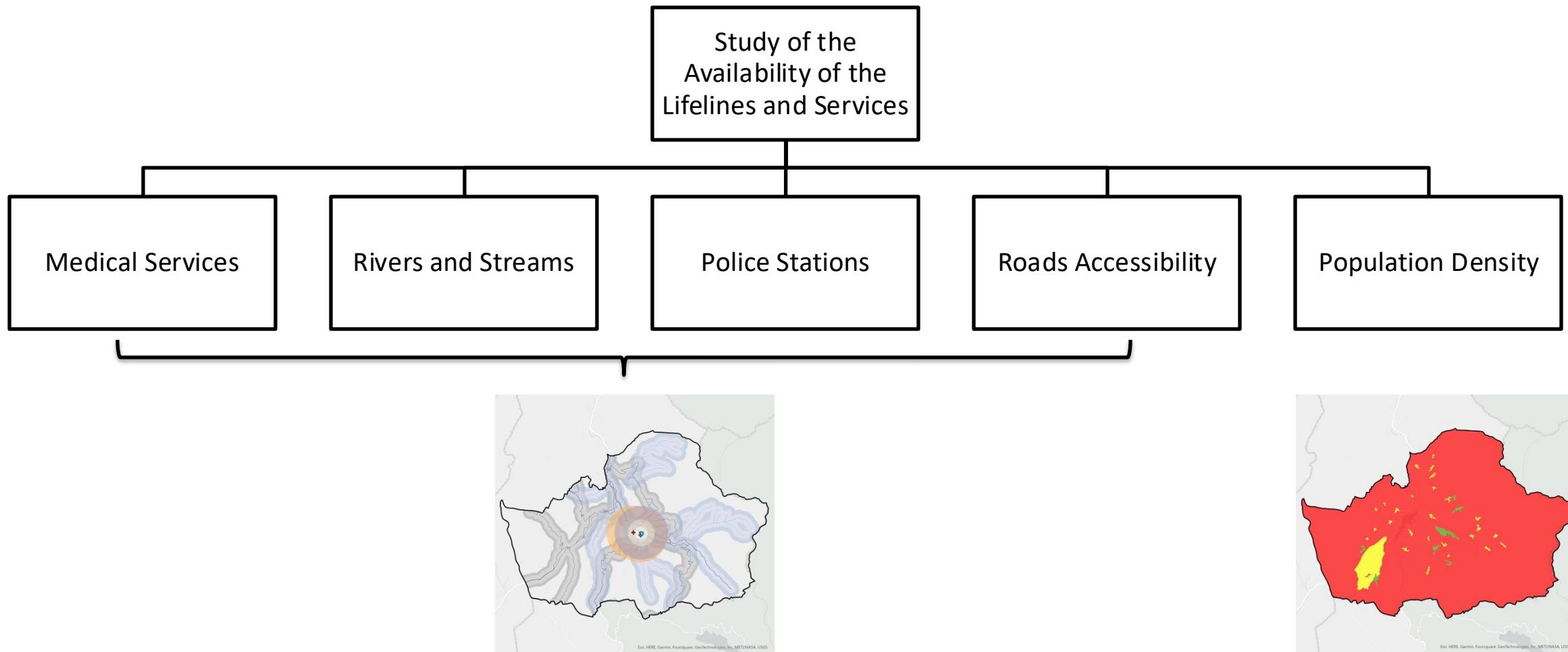
Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter

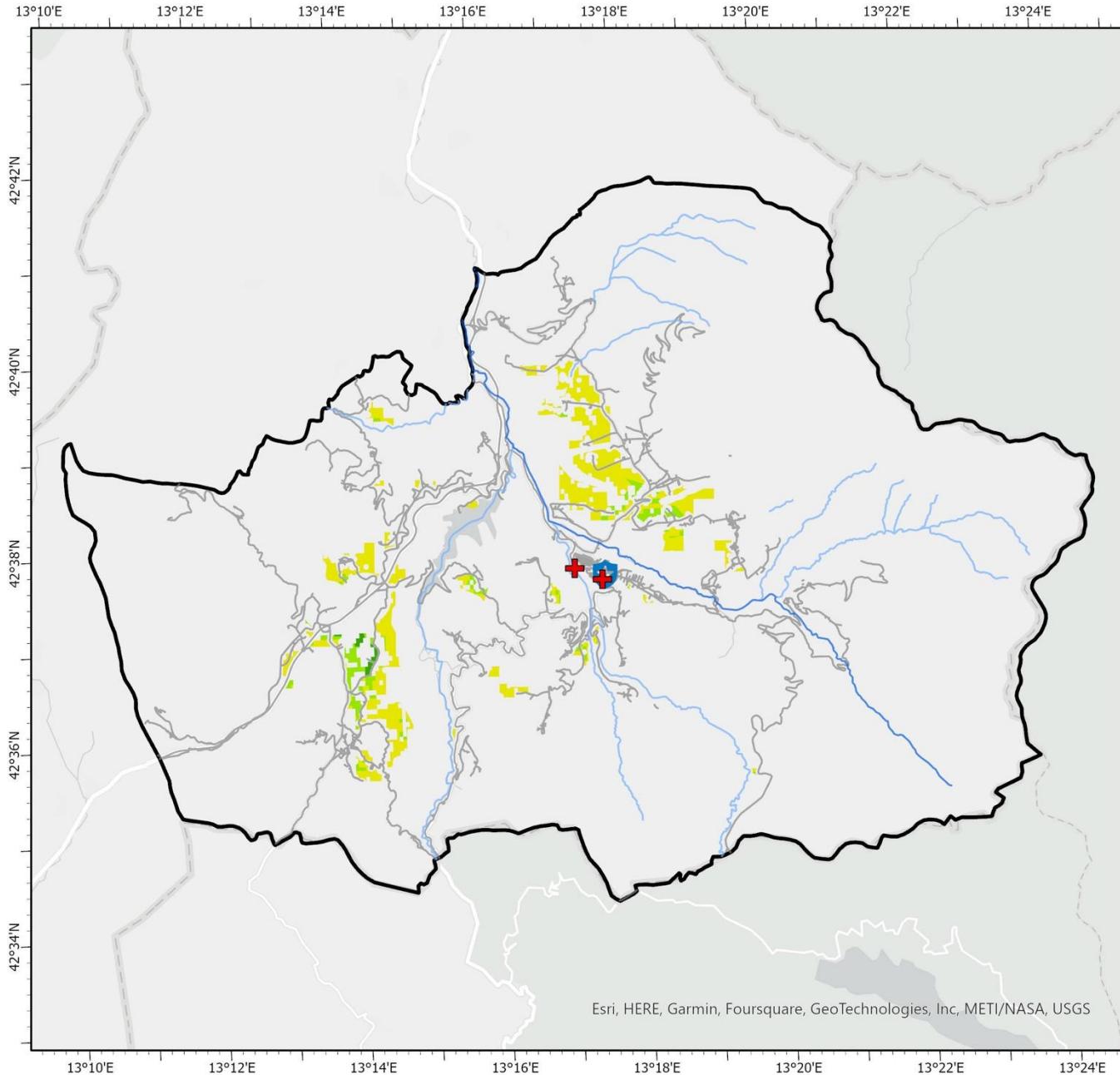
0 1 2 4 Km



Study of the availability of the lifelines & services



Amatrice Area Suitability after Applying Serviceability Factors



Legend

Amatrice	Area Suitability
Road Network	Road Network
Police Station	Suitable
Medical Services	High Suitability
River	Very High Suitability
Main Streams	

Map Information

This Map shows Suitable Sheltering Areas after applying serviceability factors for Amatrice, Italy. Layers used to produce the map: Soil Type, Slope, Landcover, Landslide Hazard, Flood Hazard, Faults, Fuel Stations, Power Plants, Power Towers, Police Station, Medical Services, Roads, River, Streams, and Population Density.

Data Sources

Copernicus EU, BGR's IHME1500, Regional Geoportal Lazio, European Commission JRC, OpenStreetMap

Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter

0 1 2 4 Km



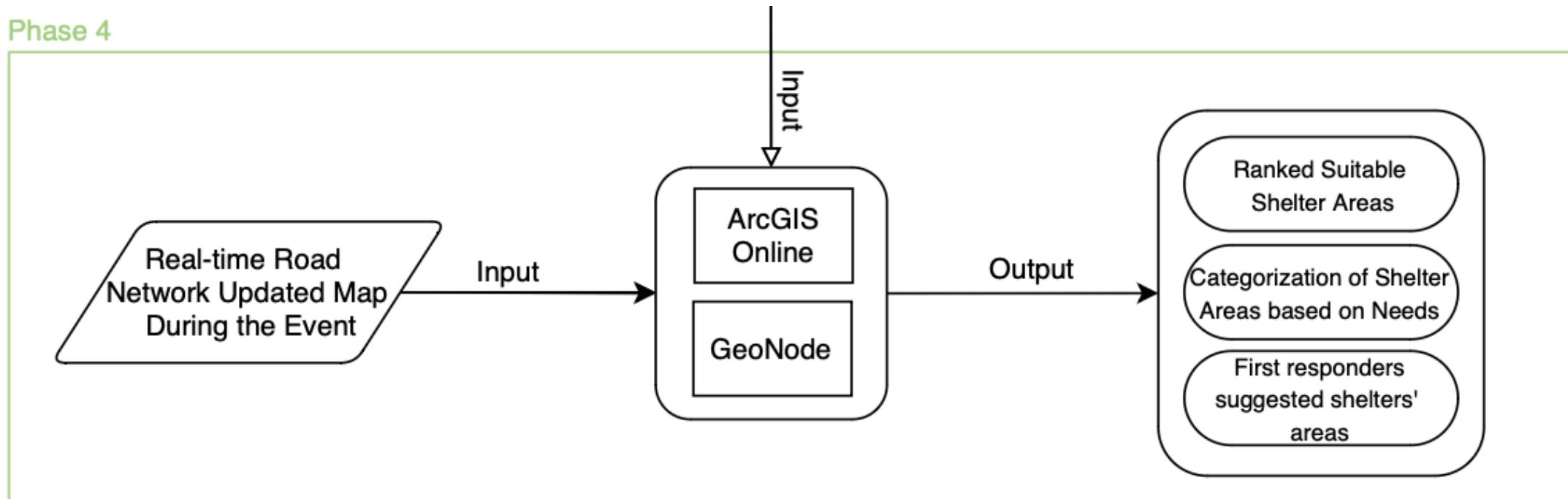
Phase 4

Suitable shelter areas

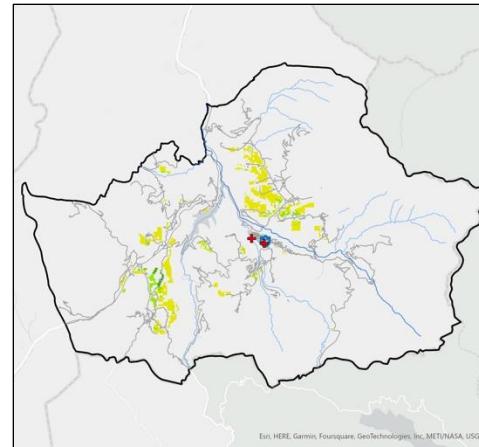
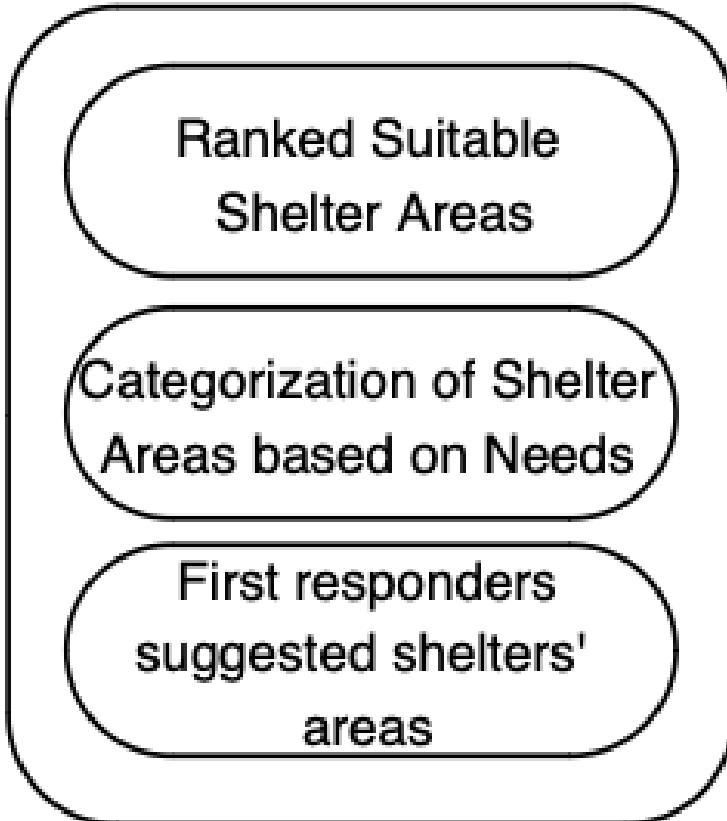
Ranked, based on needs & first responders suggested areas

Workflow: Phase 4

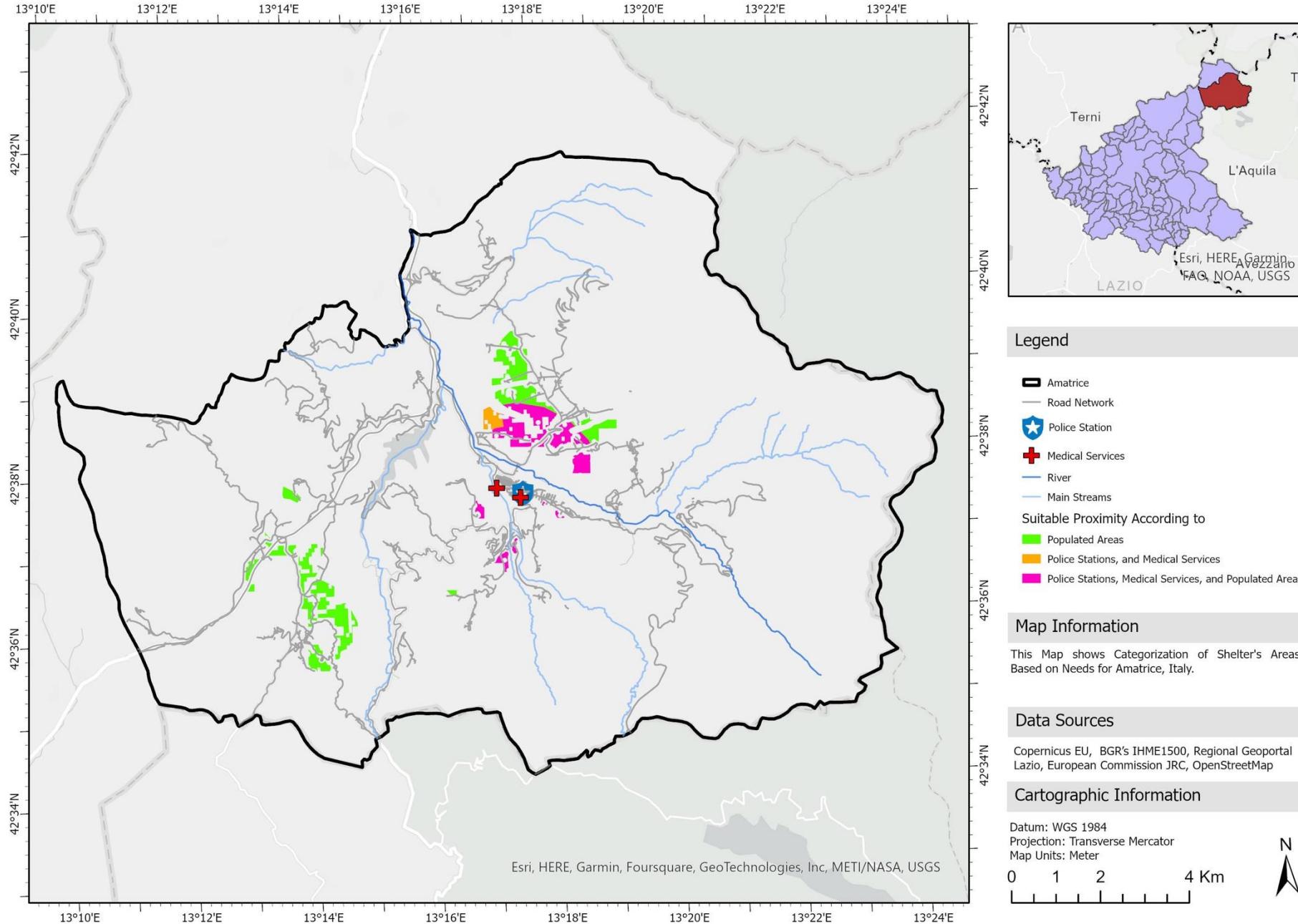
Phase 4



Workflow: Phase 4



Amatrice Categorization of Shelter's Areas Based on Needs

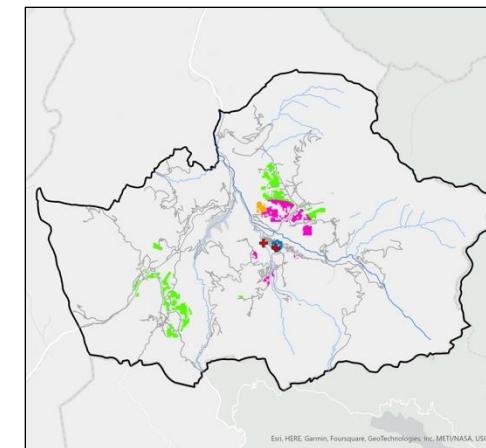
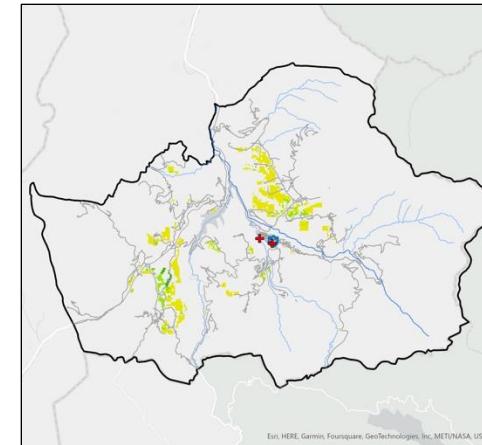


Workflow: Phase 4

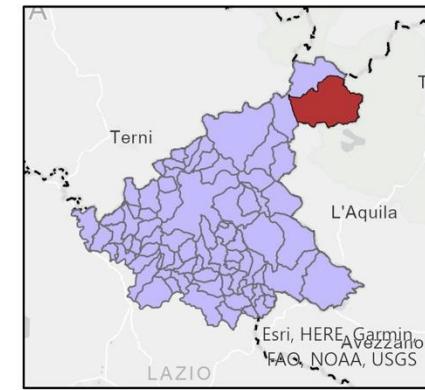
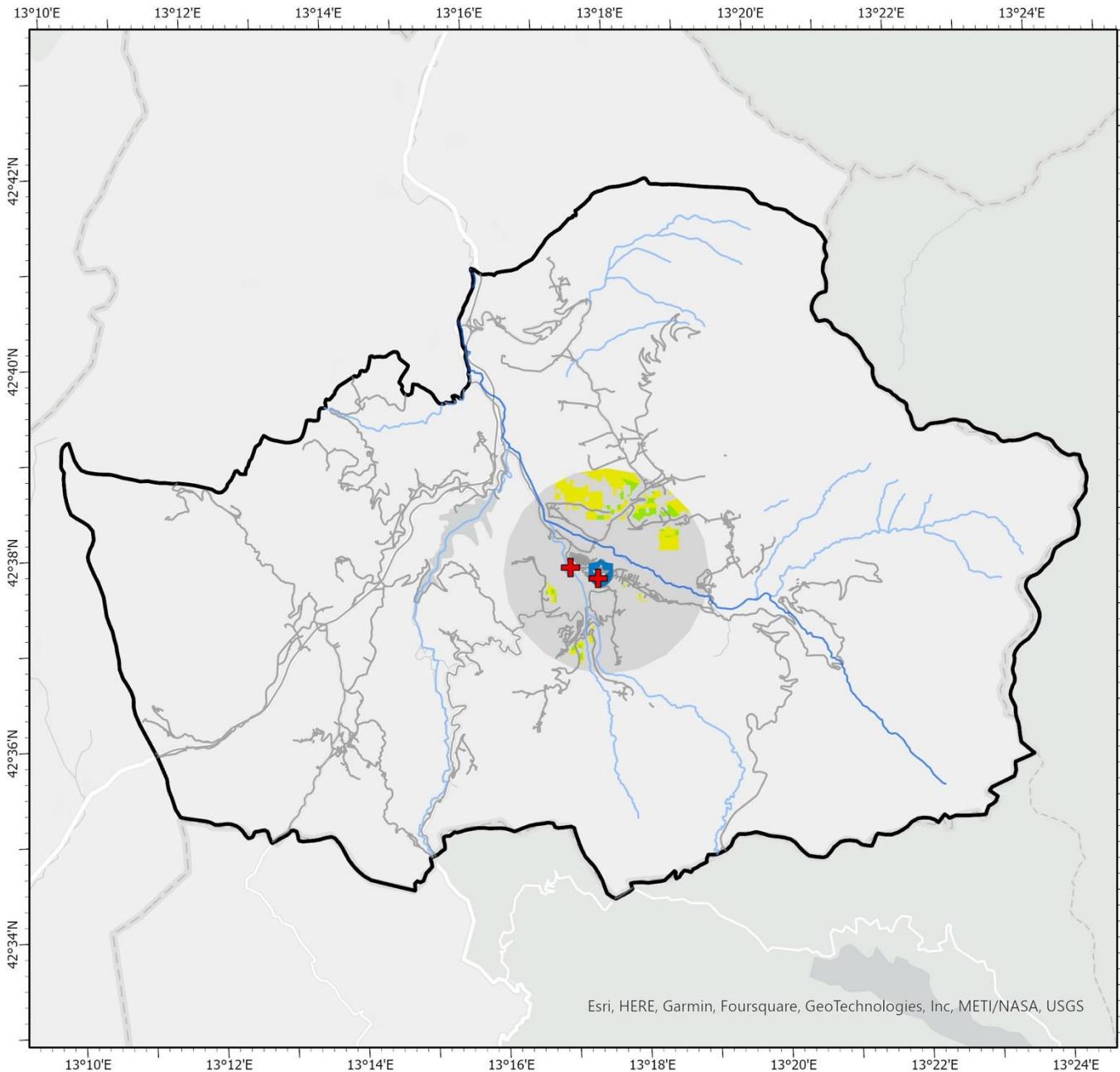
Ranked Suitable
Shelter Areas

Categorization of Shelter
Areas based on Needs

First responders
suggested shelters'
areas



Amatrice Suggested Shelter's Areas for First Responders and Civil Protection



Legend

	Area Suitability
■ Amatrice	High Suitability
— Road Network	Suitable
■ Police Station	Very High Suitability
■ Medical Services	
— River	
— Main Streams	
■ Buffer (2000m)	

Map Information

This Map shows suggested shelter's areas for first responders and civil protection for Amatrice, Italy.

Data Sources

Copernicus EU, BGR's IHME1500, Regional Geoportal
Lazio, European Commission JRC, OpenStreetMap

Cartographic Information

Datum: WGS 1984
Projection: Transverse Mercator
Map Units: Meter

0 1 2 4 Km

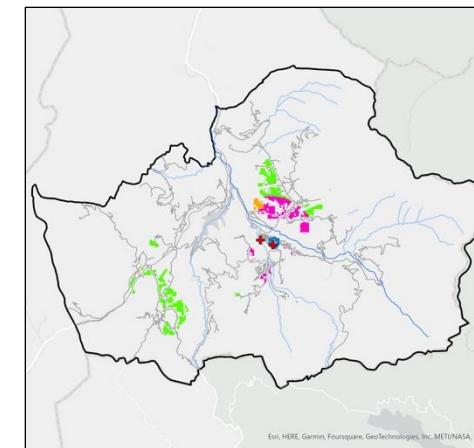
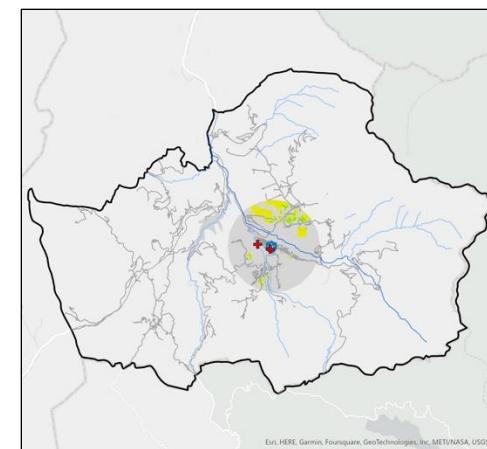
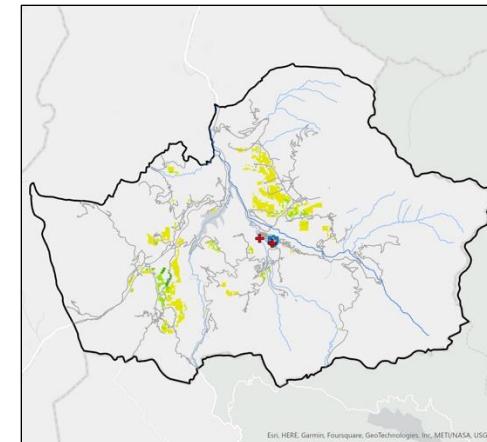


Workflow: Phase 4

Ranked Suitable
Shelter Areas

Categorization of Shelter
Areas based on Needs

First responders
suggested shelters'
areas





Why?

To publish the final maps online, on a WebGIS platform using ArcGIS Online and GeoNode.



Added value

- Dynamic exploration of spatial data: interactive tools.
- Real-Time Access: up-to-date information by incorporating real-time data.



Suitable shelter areas

Earthquake Emergency shelter areas in Amatrice

X

Use forward and back arrows to navigate slides, and display the legend from the bottom left corner.

The app includes:

Slide 1: Suitable shelter locations

Slide 2: Categorization based on needs

Slide 3: First responders suggested shelters location

You can measure the areas, locate coordinates, and calculate distances for each map/slides.

Select features to display its information and classification.

Explore

Activate Windows
Go to Settings to activate Windows.



ArcGIS Online: Dashboard

Suitability

Suitability Level	Percentage
Suitable	83.99%
High suitability	14.36%
Very High suitability	1.65%

Area (m²)

Area Range	Value
0m ²	0
4,685,288m ²	4,685,288

Emergency Access Routes of Amatrice

Search

Polizia Stradale Amatrice

Centro di emergenza sanitaria "campo sportivo A. Sbardella"

Ospedale Grifoni

Farmacia Mauro Di Mauro Dott. Massimiliano

The center

Police stations

Medical services

Suitable shelter locations

- High suitability (Yellow)
- Suitable (Light Yellow)
- Very High suitability (Green)

Buffer_2000 m

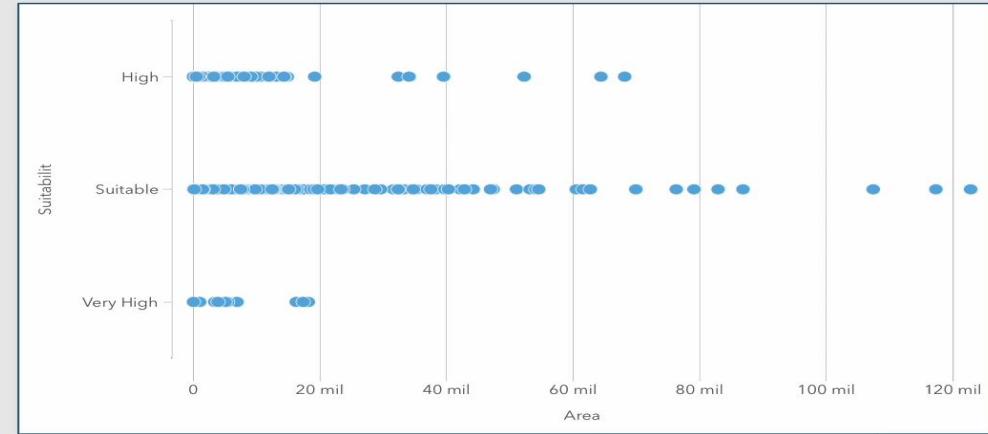
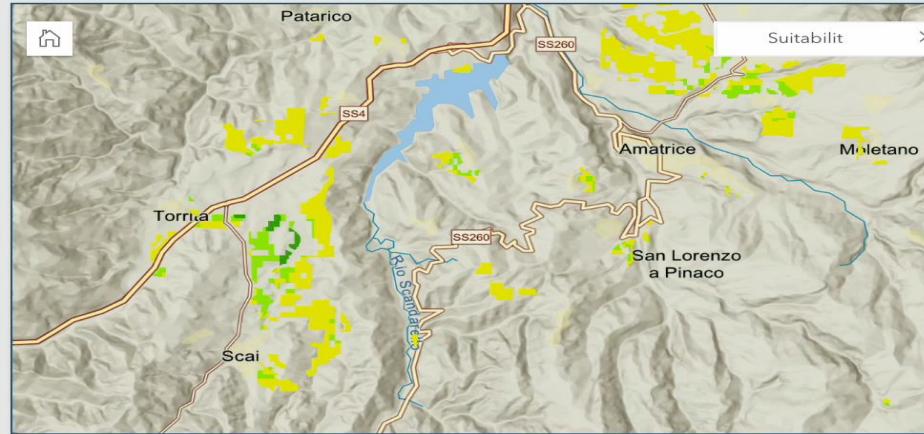
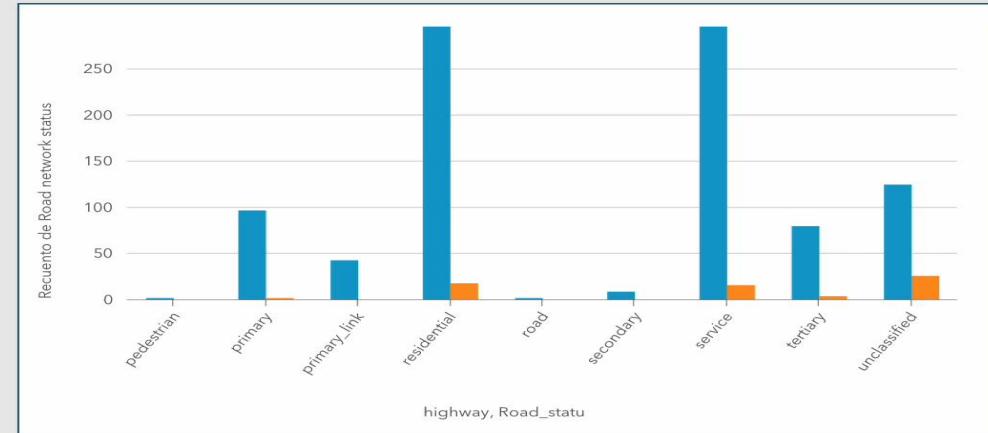
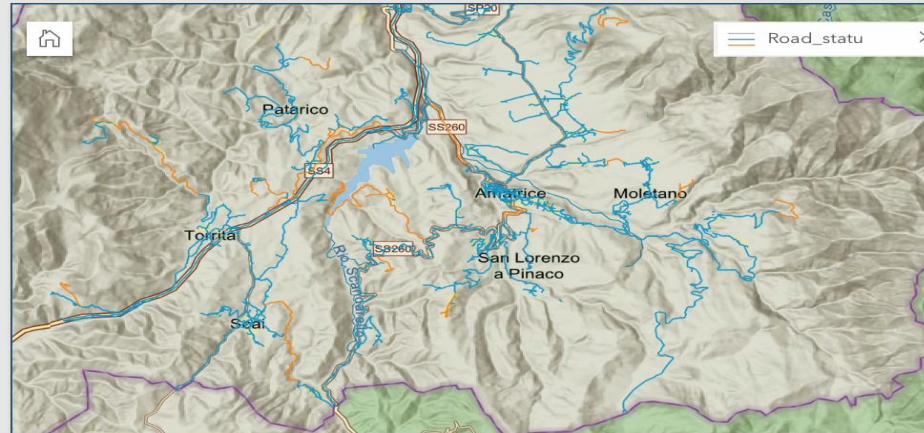
Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, ... Powered by Esri

Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS Powered by Esri

POLITECNICO DI MILANO



ArcGIS Online: Insight



	Suitable	C	High Suitability	E	Very High Su...	G
1	Suitable	<Sin datos>	High Suitability	<Sin datos>	Very High Suitability	<Sin datos>
2	Area	Population	Area	Population	Area	Population
3	5203.13	1156	4.52	1	16242.65	3609
4	2267.08	503	3039.72	675	17346.22	3854
5	232.72	51	7479.74	1662	5006.33	1112
6	825.94	183	2098.98	466	973.67	216
7	4874.66	1083	494.18	109	6876.71	1528
8	44201.38	9822	6669.23	1482	18141.68	4031
9	42131.84	9362	3416.69	759	3363.19	747
10	16425.03	3650	6925.69	1539	5385.52	1196



GeoNode Application

File Machine View Input Devices Help

Welcome! - example.com - Mozilla Firefox

* Welcome! - example.com +

http://geonode

Data Maps About user1

Search

Amatrice Shelter

Committed to finding suitable shelter for Amatrice.

Discover Amatrice

VIGILI DEL FUOCO

Search for Data.

Search

Advanced Search

Discover the available datasets.

Privacy & Cookies Policy

110% ... ☰ ⌂ ⌃

14:22

Right Ctrl

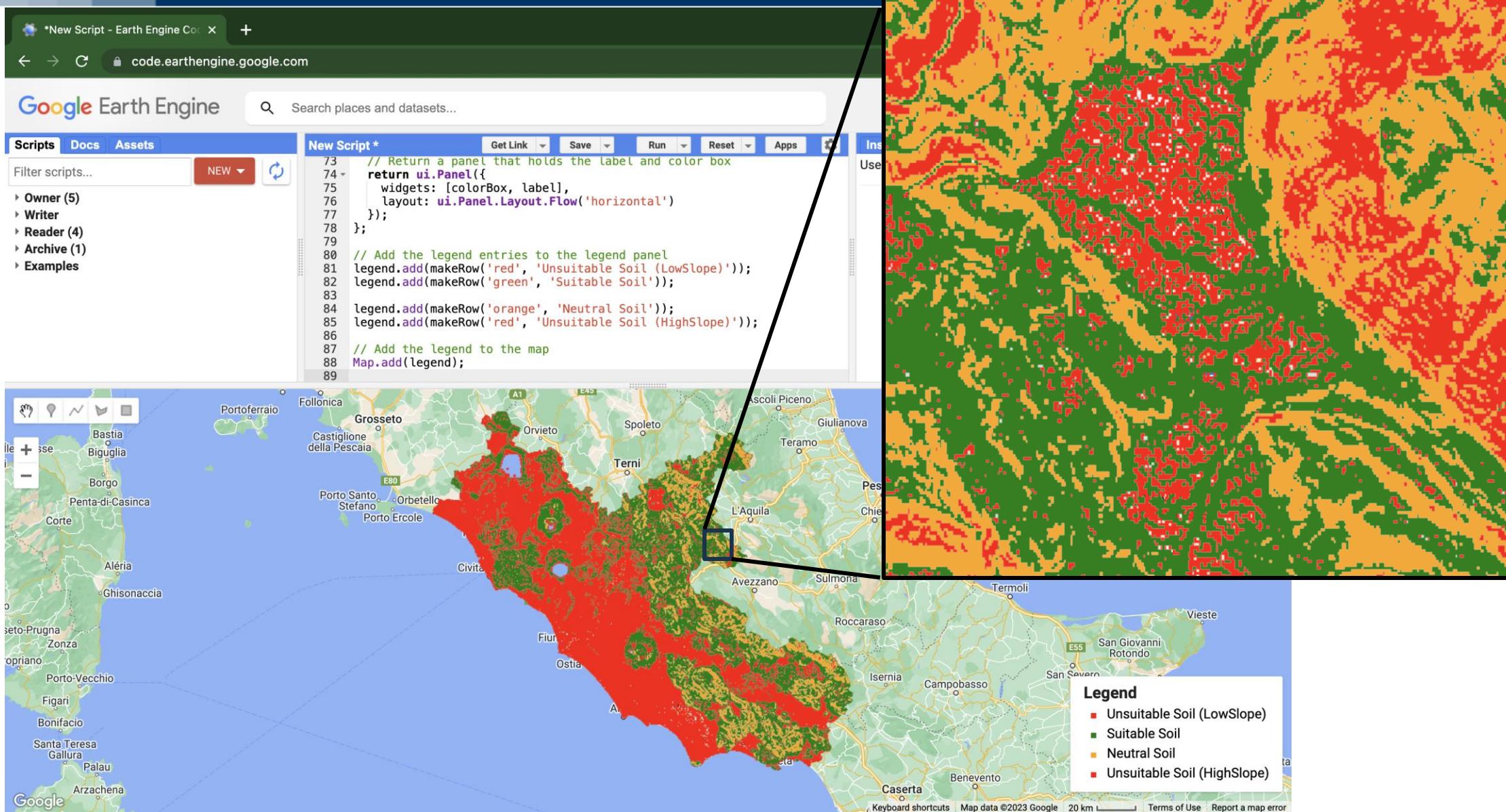
This screenshot shows the GeoNode application running in a Mozilla Firefox browser. The main header includes a logo, a search bar, and navigation links for Data, Maps, and About. A user profile for 'user1' is visible on the right. The main content area features a large banner image of a firefighter in a field of rubble. Overlaid on the banner are the text 'Amatrice Shelter' and 'Committed to finding suitable shelter for Amatrice.', along with a 'Discover Amatrice' button. Below the banner is a dark panel with a search bar containing a magnifying glass icon and the word 'Search'. A link to 'Advanced Search' is also present. At the bottom, there's a call to action 'Discover the available datasets.' and a 'Privacy & Cookies Policy' link. The browser's address bar shows 'Welcome! - example.com' and the URL 'http://geonode'. The system tray at the bottom right shows the date and time as '14:22' and includes icons for battery, signal, and network status.

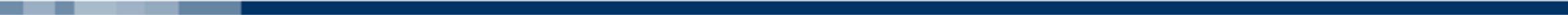
Traditional Workflow Problems Vs.

Google Earth Engine

- Scalability
 - Computational Cost
 - Updatability
 - Licensing and Integration
- Scalable
 - Computations on Clouds
 - Can be Connected to the Satellites
 - Free (to some extent)

Suggestions for Future Works





Thank you!

