



Anthropogenic Pressure on Coastal zones

Copernicus for Coastal Zone Management



User
Uptake

Introduction of problem

Almost half of European
population lives on coastal
areas





User
Uptake

Introduction of problem

High impact on the natural
evolution of coastline



Natural erosion of coastline
become a problem



Impact on houses, economic
activities and infrastructures





User
Uptake

Monitoring the changes

In order to understand the threats on coastal areas is important to monitor the evolution of urbanization in those areas

Use case 1:

The Italian Imperviousness layer at 5/10 m spatial resolution for monitoring changes in sensible zones

Use case 2:

Coastal anthropogenic pressure indicator for urban planner and coastal manager



User
Uptake

USE CASE 1



User
Uptake

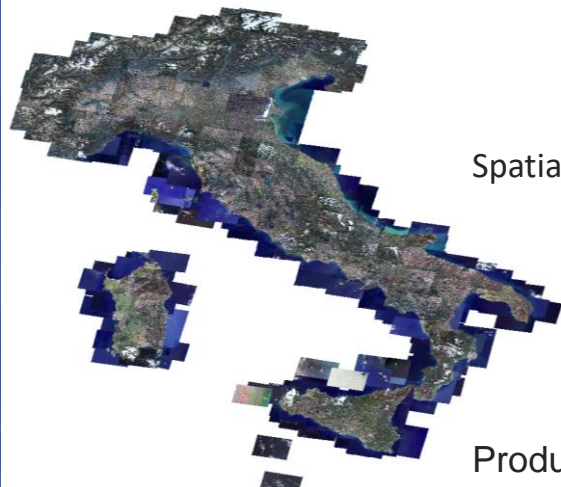
Italian downstream at 5/10 m

A very high resolution Imperviousness layer was product for Italy (2012, 2015)



ISPRA

Istituto Superiore per la Protezione
e la Ricerca Ambientale



Spatial resolution of 5 m for 2012 and 10 m for 2015 (Sentinel-2 data used)

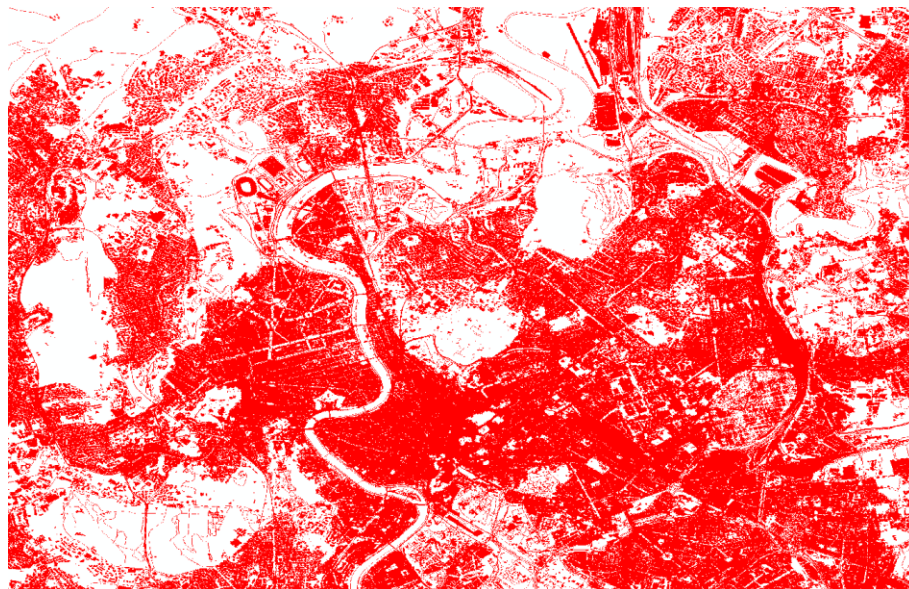
Product for Italian National Institute for Environmental Protection and Research



User
Uptake

The Italian 5 m resolution imperviousness layer

With respect to the European scale (20 m), the better spatial resolution data allowed the classification of minor sealed soil elements (including small road and railway network)

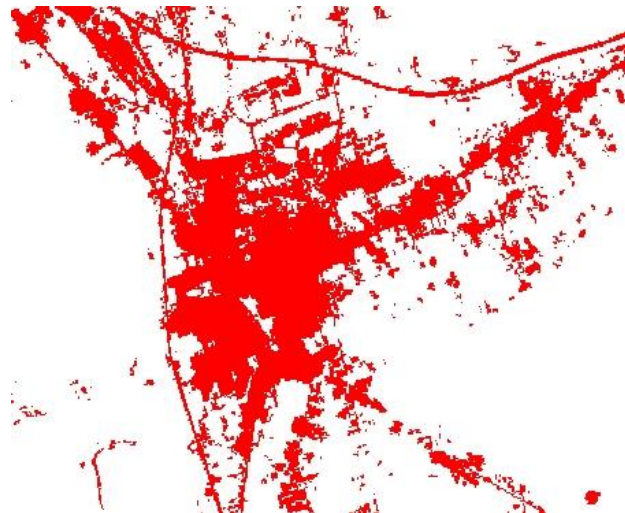


Rome

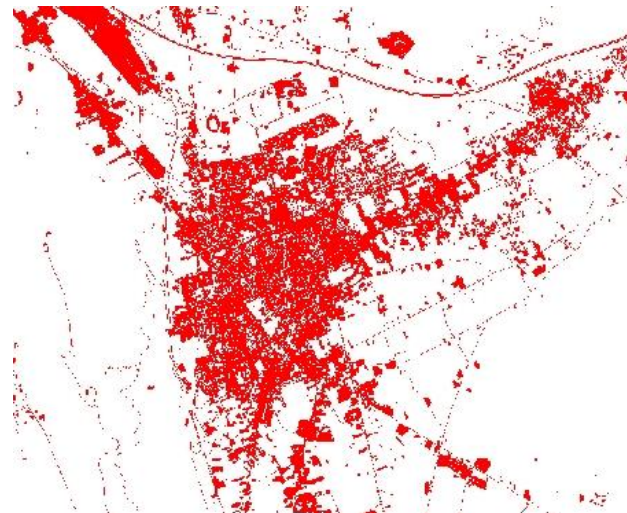


User
Uptake

Comparison HRL and 5 m layer



EEA imperviousness layer



5 m imperviousness layer

(the specifications are similar but not the same)

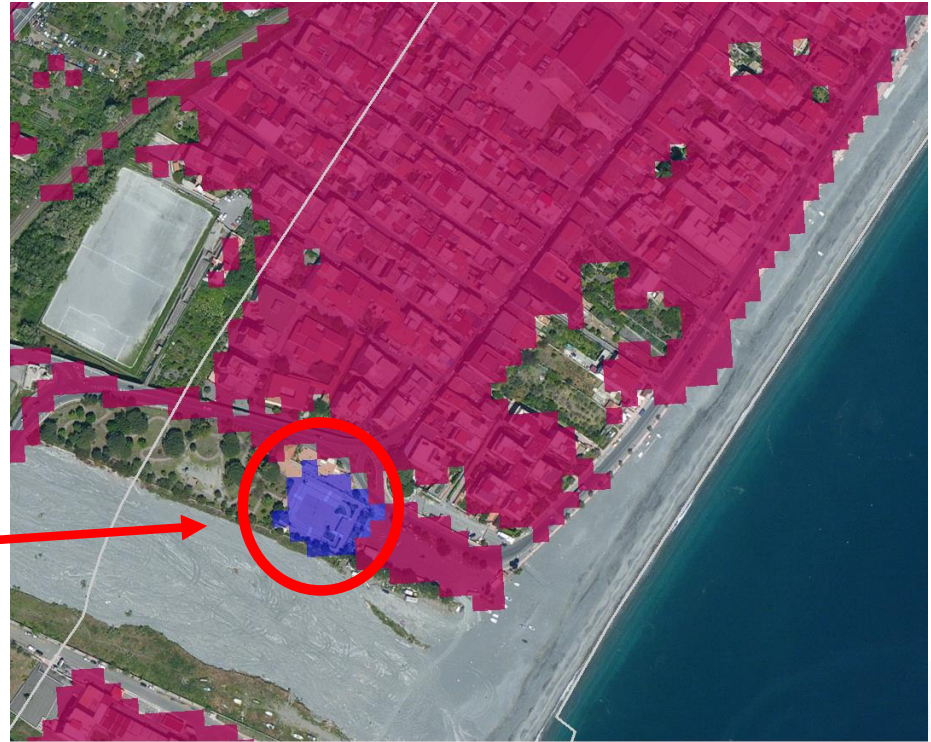


User
Uptake



Analysis of changes

The changes on sensible coastal areas (300 m from coastline in Italy)

New impervious areas in sensible zone



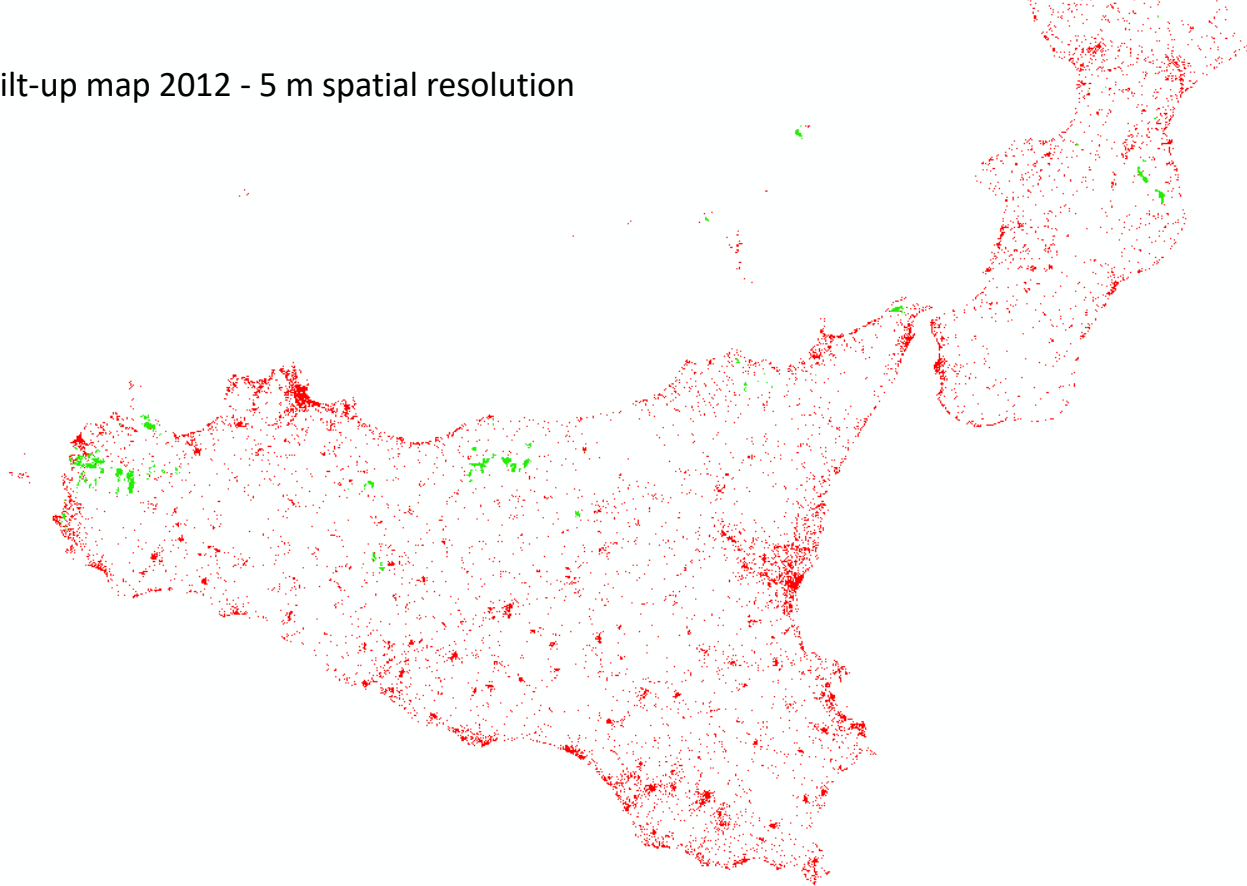
Built-up map 2012 - 5 m spatial resolution



-  Impervious areas
-  Cloud areas

- Basemap
-  Zoom




Built-up map 2012 - 5 m spatial resolution

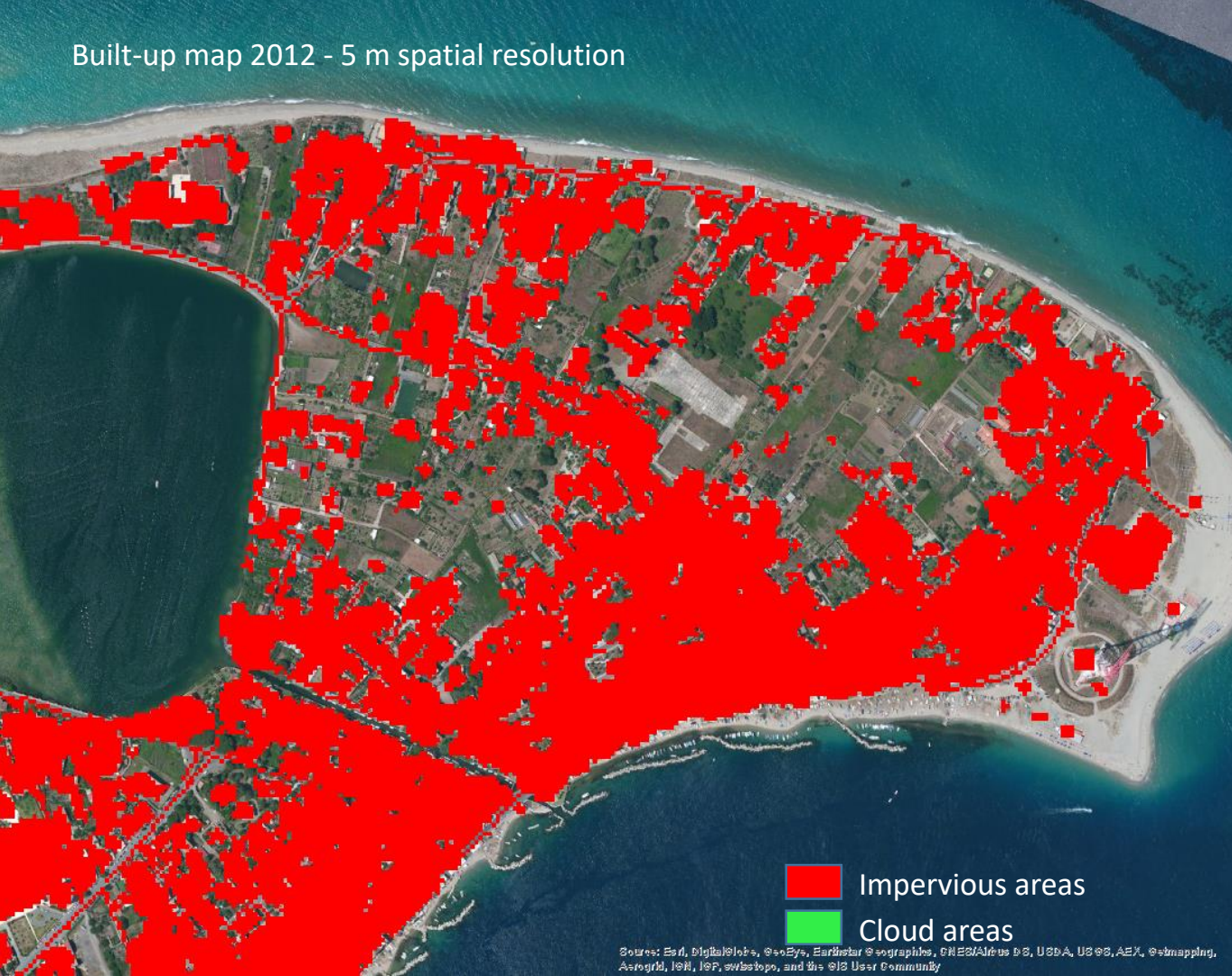


-  Impervious areas
-  Cloud areas

 Basemap

 Zoom

Built-up map 2012 - 5 m spatial resolution

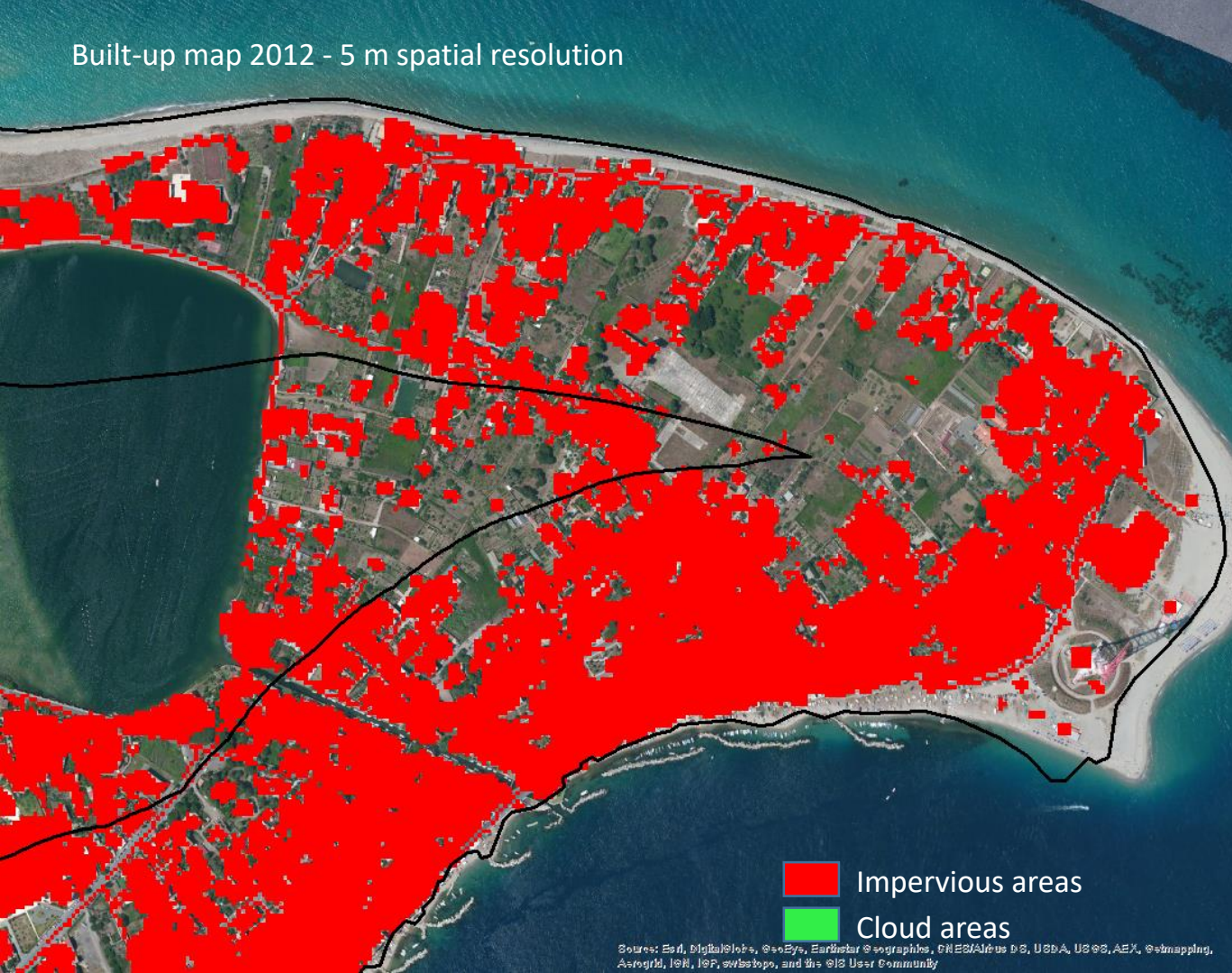


- ➡ Sicily map
- Coastal buffer (300 m)
- ➡ Resampled 10 m

■ Impervious areas
■ Cloud areas

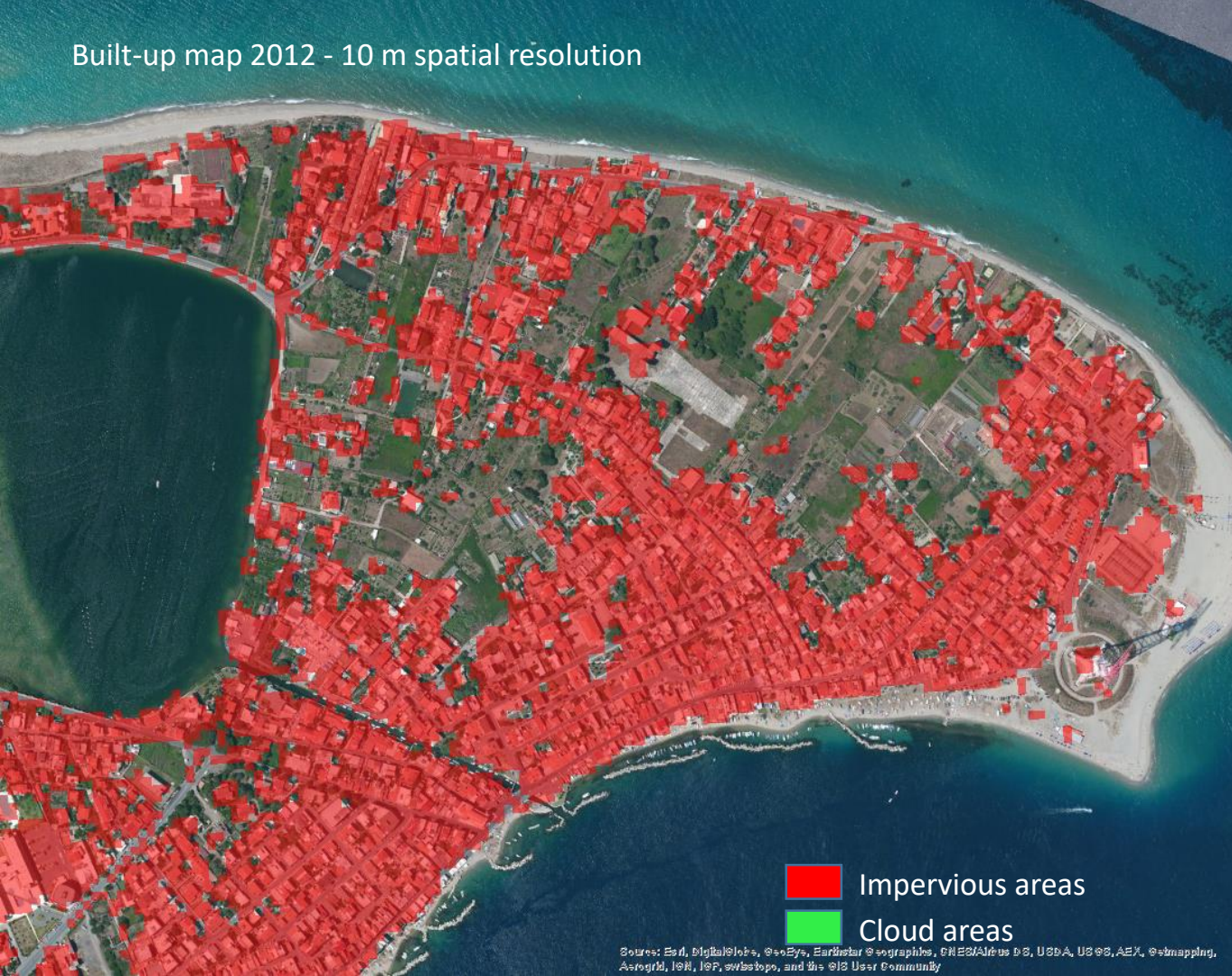
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroX, @swmapping, AerialGrid, IGN, ICF, swisstopo, and the @IS User Community

Built-up map 2012 - 5 m spatial resolution



- ➡ Sicily map
- ☑ Coastal buffer (300 m)
- ➡ Resampled 10 m

Built-up map 2012 - 10 m spatial resolution

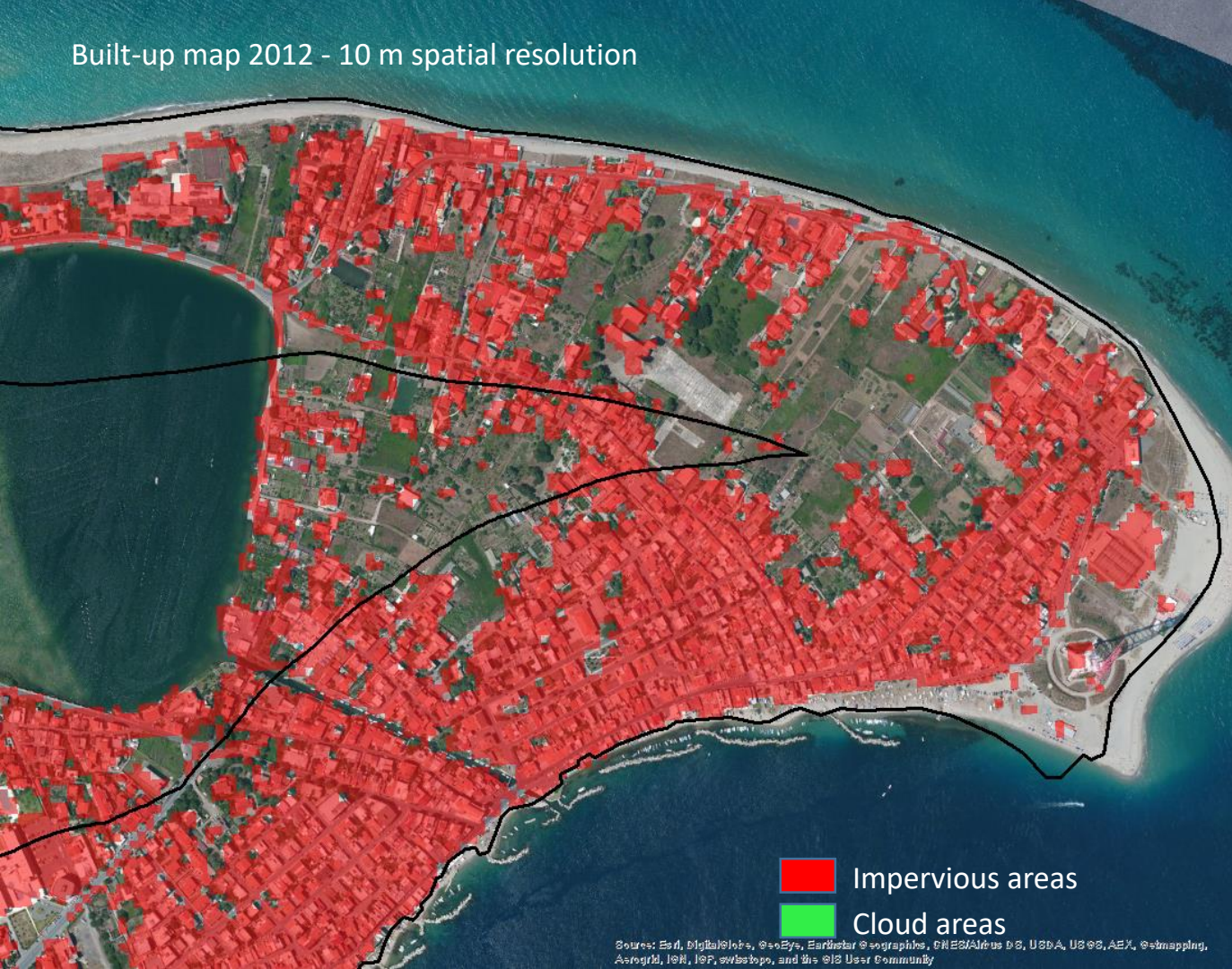


- ➡ Sicily map
- Coastal buffer (300 m)
- ➡ Built-up map 2015

■ Impervious areas
■ Cloud areas

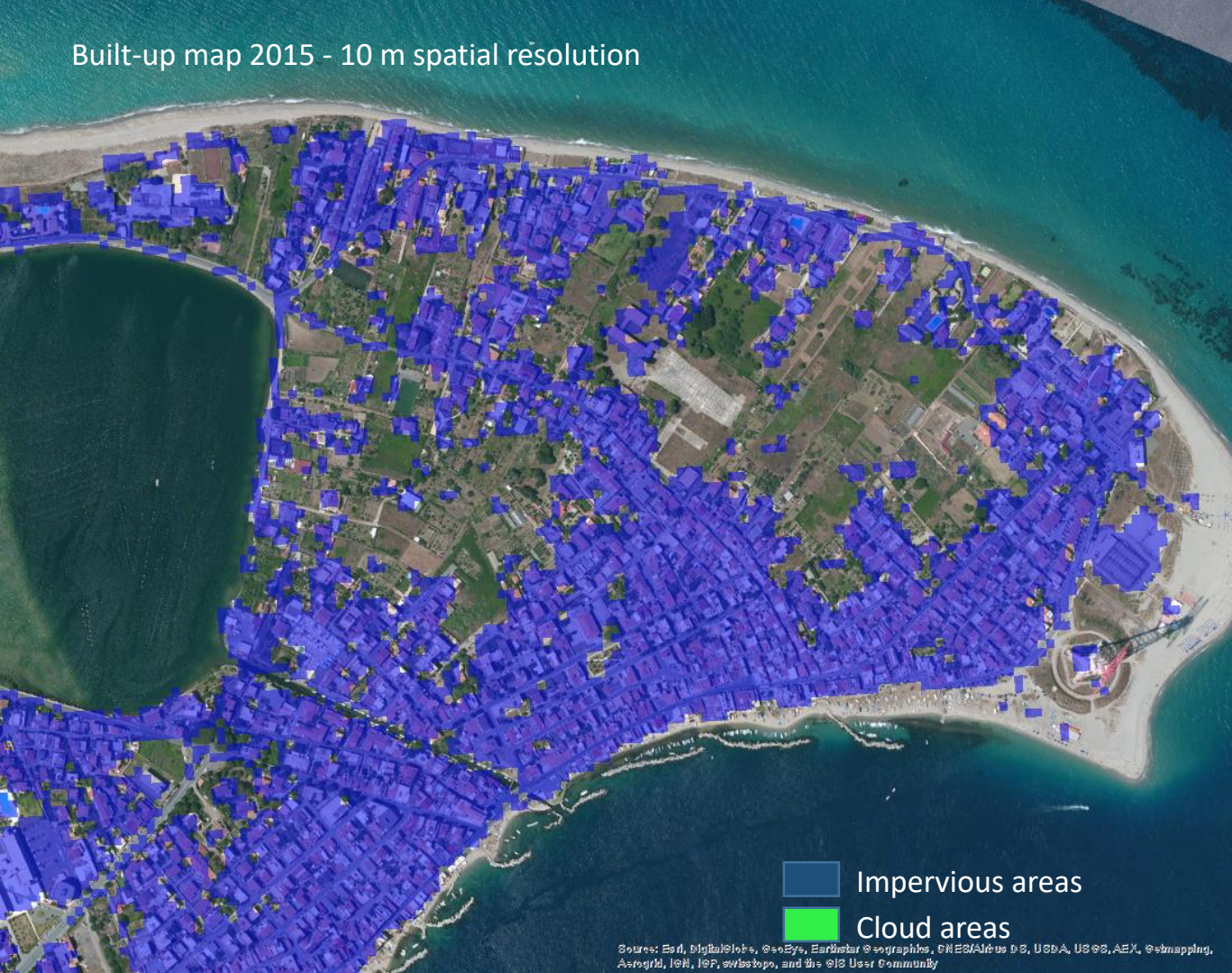
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroX, Swisstopo, and the GIS User Community

Built-up map 2012 - 10 m spatial resolution



- ➡ Sicily map
- Coastal buffer (300 m)
- ➡ Built-up map 2015

Built-up map 2015 - 10 m spatial resolution

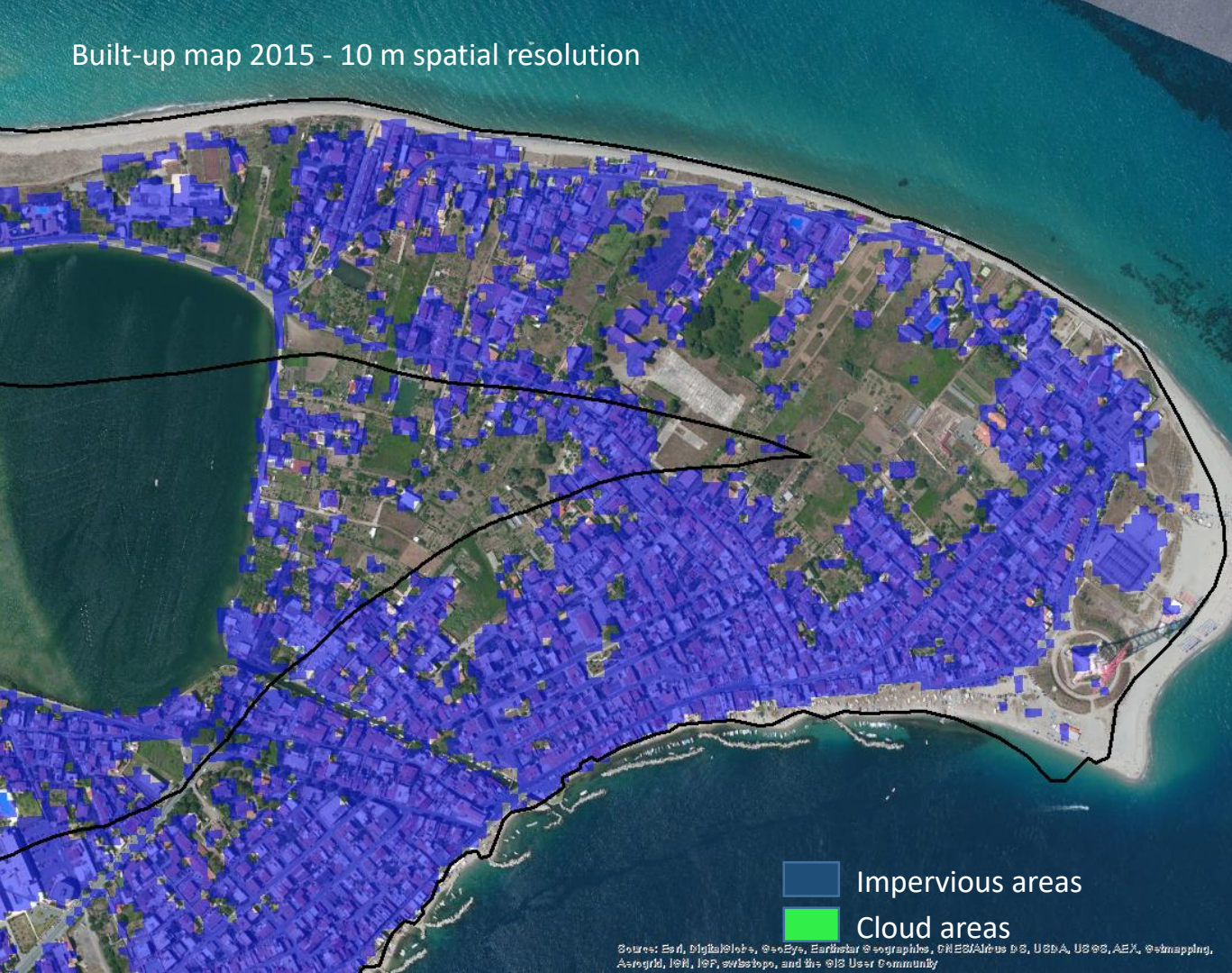


- ➡ Sicily map
- Coastal buffer (300 m)
- ➡ Built-up map 2012
- ➡ Change map

Impervious areas
Cloud areas

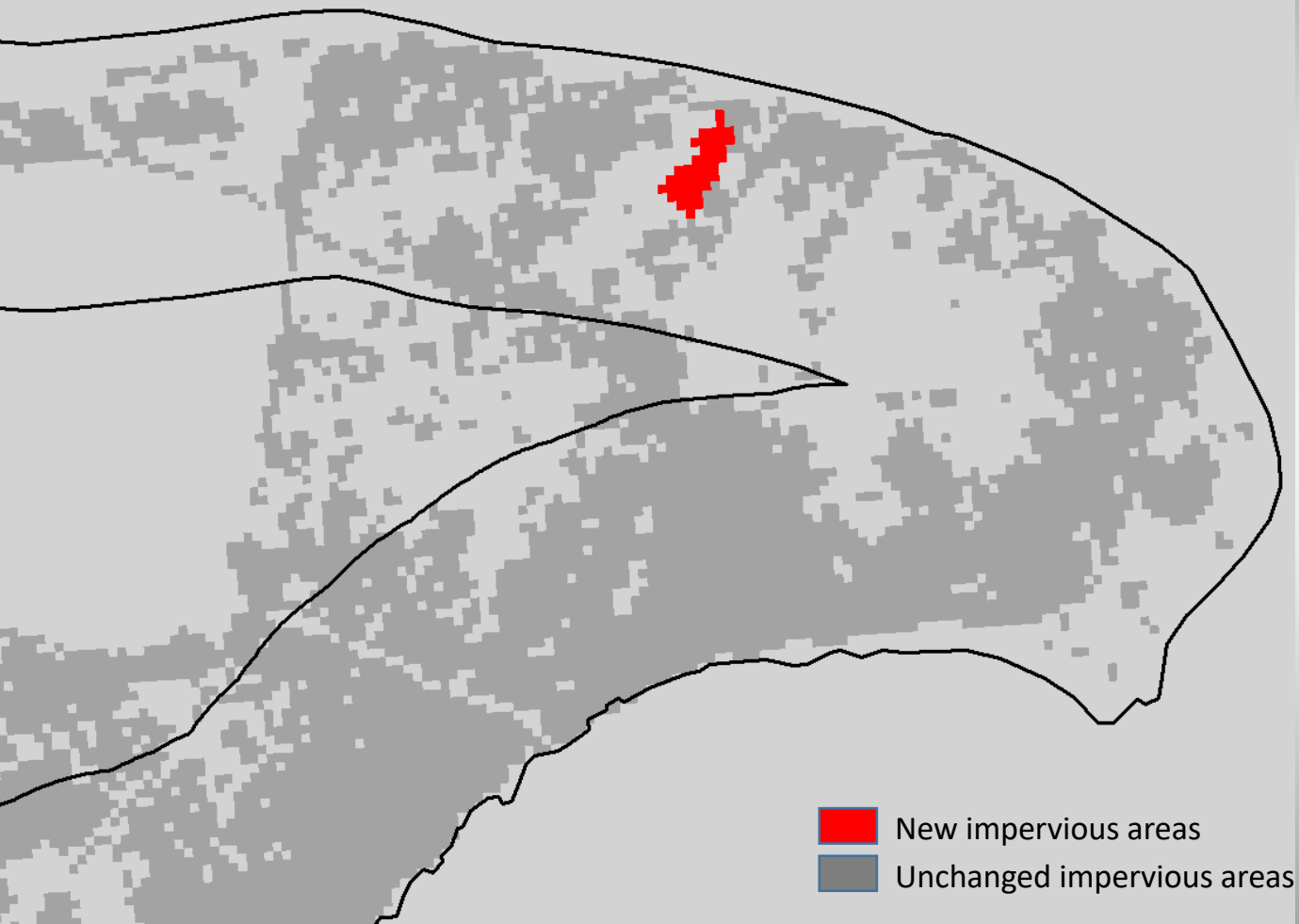
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGF, swisstopo, and the ©IS User Community

Built-up map 2015 - 10 m spatial resolution



- ➡ Sicily map
- Coastal buffer (300 m)
- ➡ Built-up map 2012
- ➡ Change map

Change map 2012-2015 - 10 m spatial resolution



- ➡ Sicily map
- ➡ Built-up map 2012
- ➡ Built-up map 2015
- ➡ Sentinel-2 image

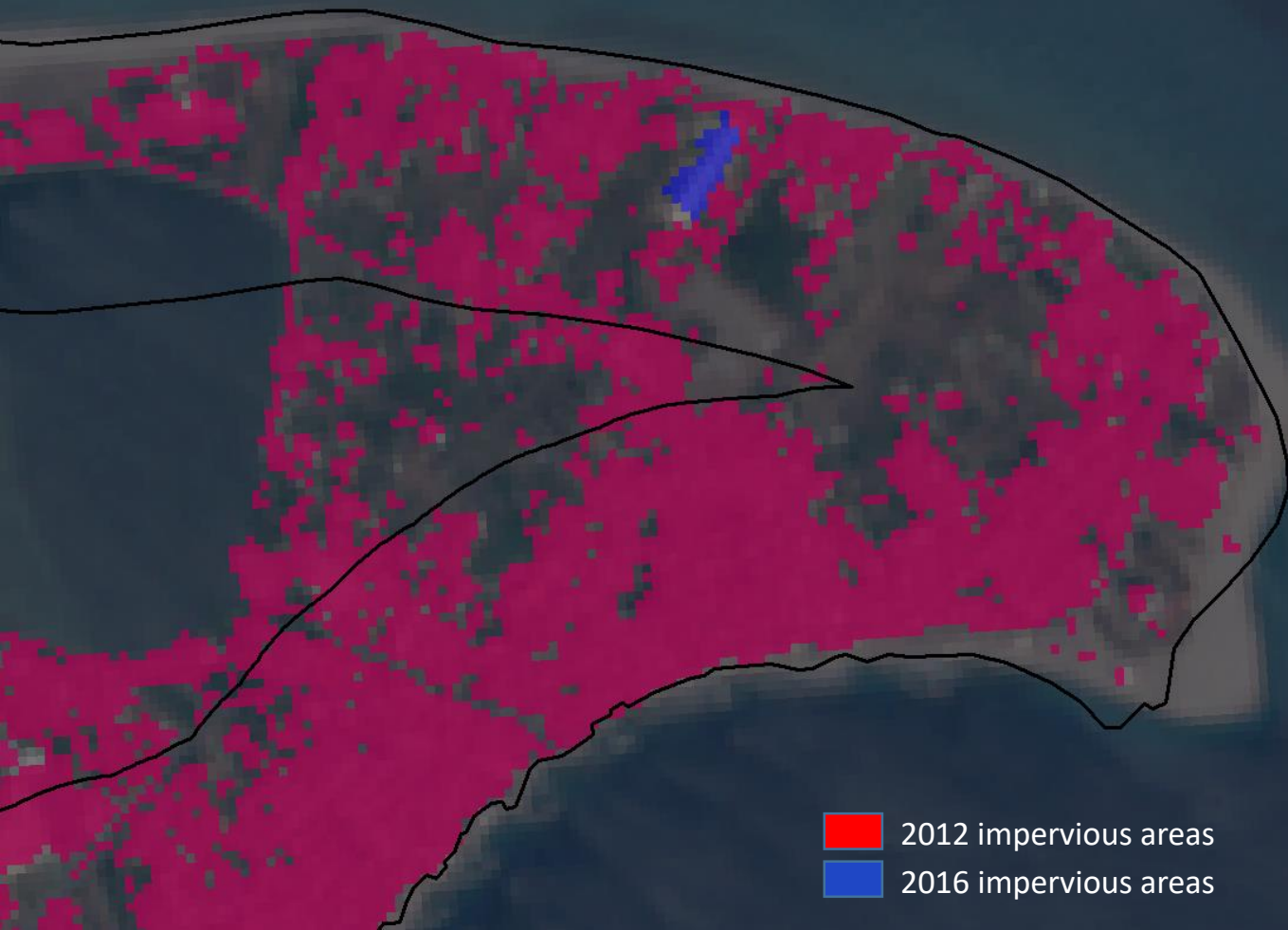
Sentinel 2 - 10 m spatial resolution










- ➡ Sicily map
- ➡ Built-up map 2012
- ➡ Built-up map 2015
- ➡ Sentinel 2 + maps
- ➡ Basemap + maps
- ➡ Change image

➡ Quit

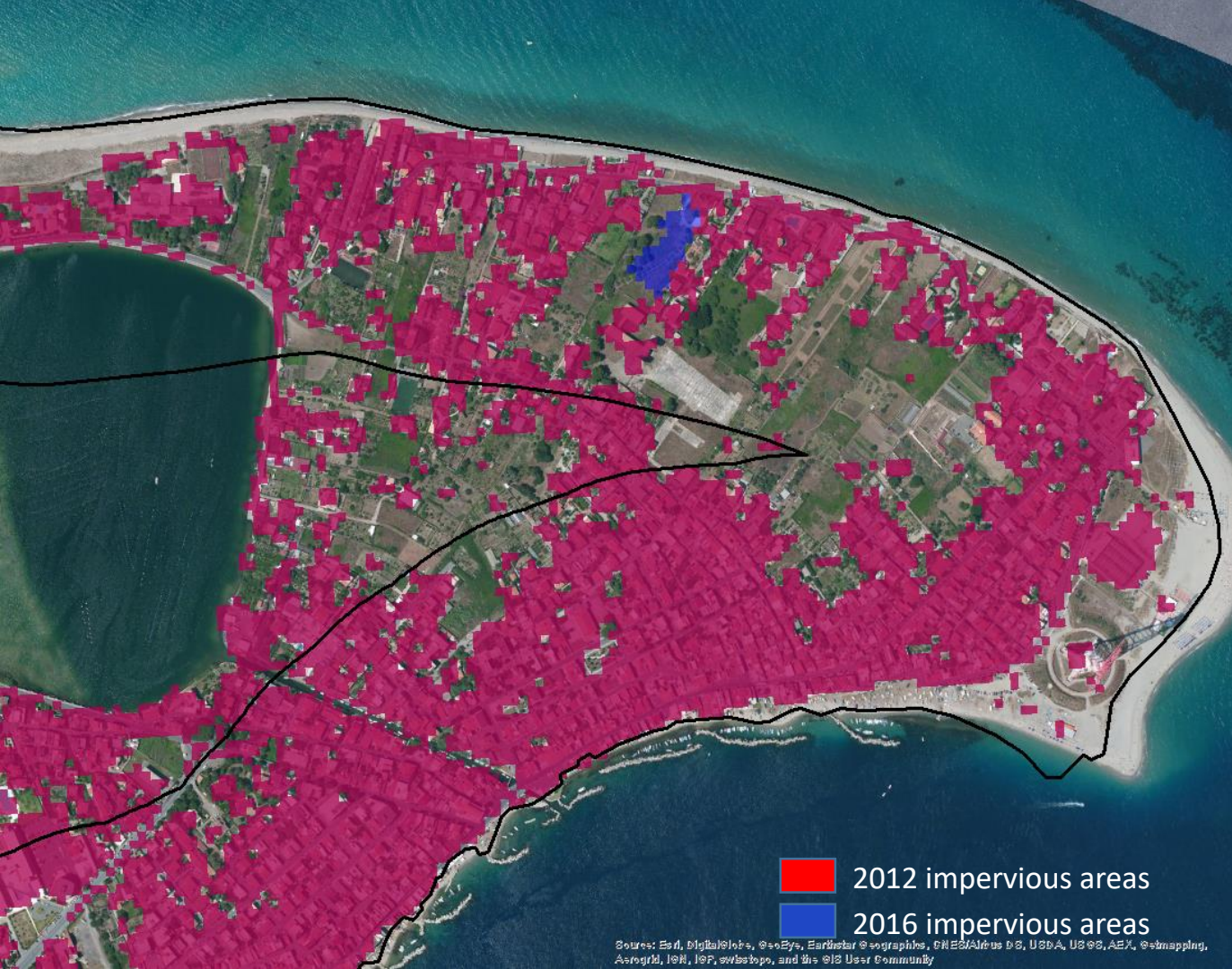
Sentinel 2 - 10 m spatial resolution





 2012 impervious areas
 2016 impervious areas

-  Sicily map
-  Built-up map 2012
-  Built-up map 2015
-  Sentinel 2
-  Basemap + maps
-  Change image

 Quit



 2012 impervious areas
 2016 impervious areas

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroX, @xmapping, AerialGrid, IGN, ICF, swisstopo, and the @IS User Community

- ➡ Sicily map
- ➡ Built-up map 2012
- ➡ Built-up map 2015
- ➡ Sentinel 2
- ➡ Sentinel 2 + maps
- ➡ Change image

➡ Quit



User
Uptake

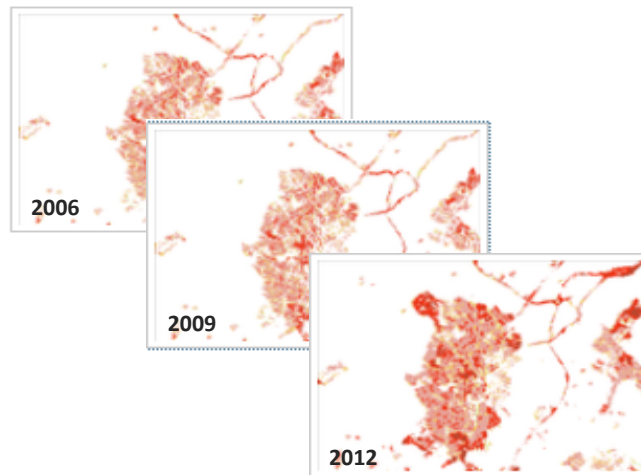
USE CASE 2



User
Uptake

Introduction of problem

Homogeneous time series of thirty part input data allow a consistent estimation of the human impact through the years for an independent evaluation of them





User
Uptake

Introduction of use case

Coastal anthropogenic pressure indicator

Aim of indicator

- To quantify the urbanization on coastal areas
- It provides a measurement of the impact of the urbanization on coastal areas
- It provides information useful for urban planner and coastal manager



Description

User
Uptake

Coastal anthropogenic pressure indicator

3 buffer areas are defined from coastline

300 m

1 km

10 km



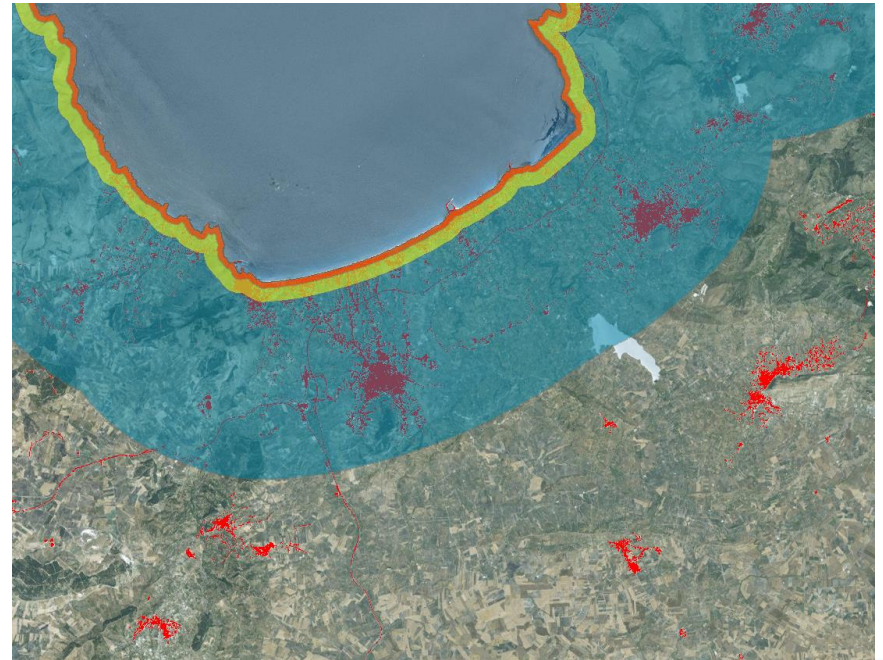


User
Uptake

Description

Coastal anthropogenic pressure indicator

To compute the amount of impervious areas in these buffer zones for the entire region and for the administrative units (provinces)





User
Uptake

Input Data

HLR Imperviousness Time series



HLR Imperviousness degree 2006

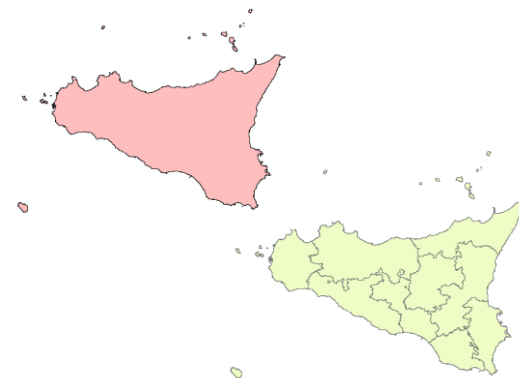


HLR Imperviousness degree 2009



HLR Imperviousness degree 2012

Shapefile of administrative units





User
Uptake

Tool used

Any “good” GIS Software





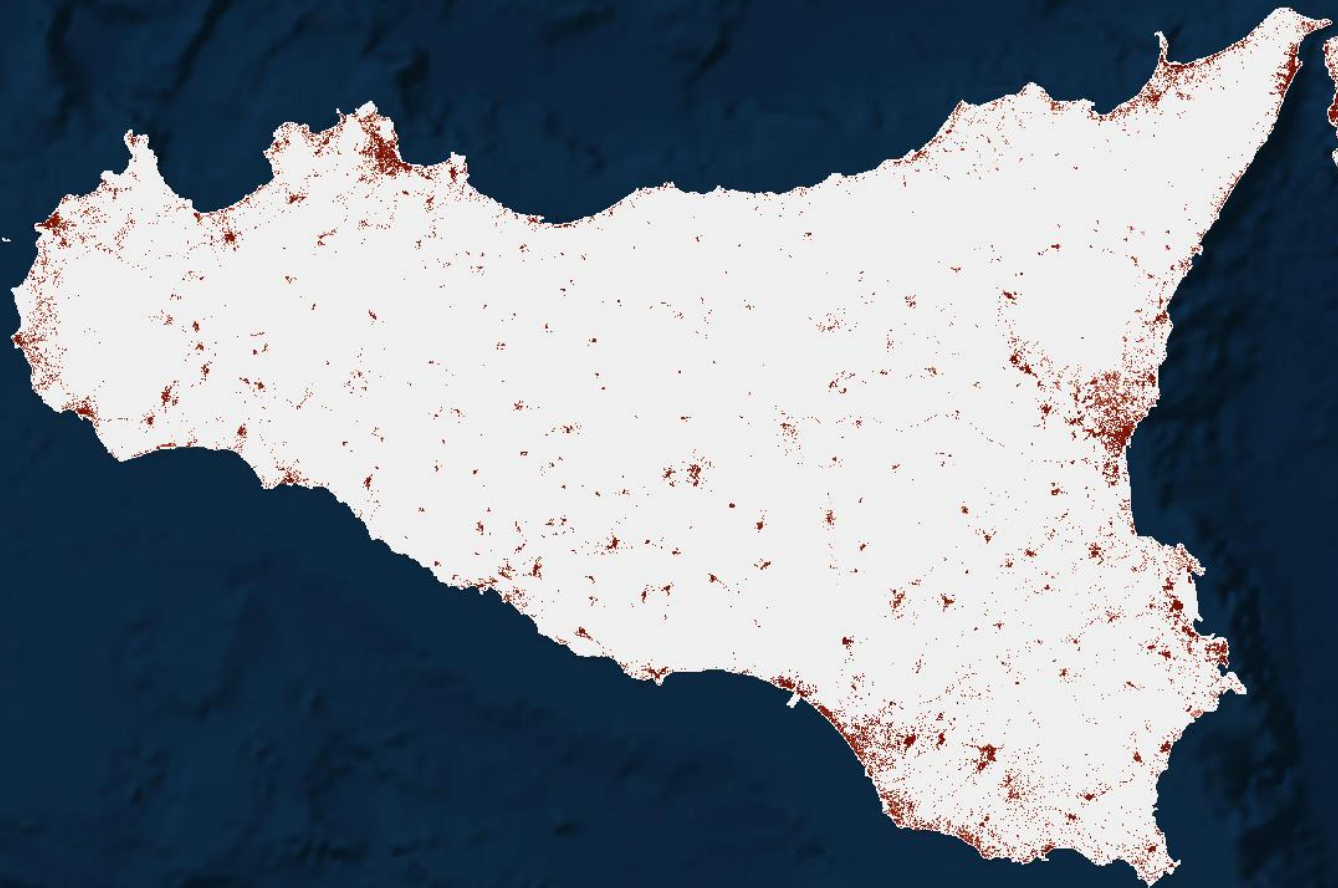
User
Uptake

Demonstration

- Interactive ppt

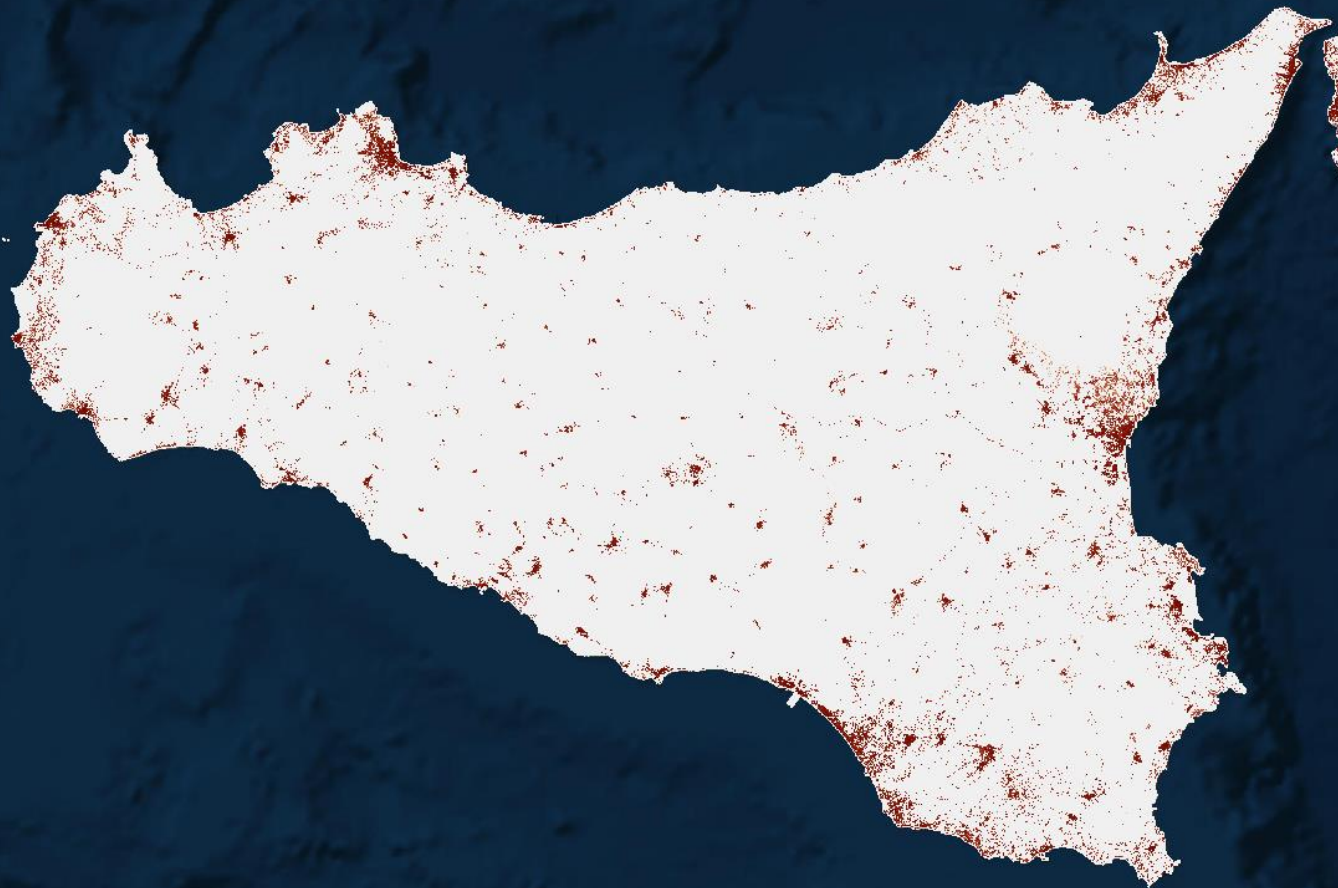


HRL Imperviousness 2006 - 20 m spatial resolution



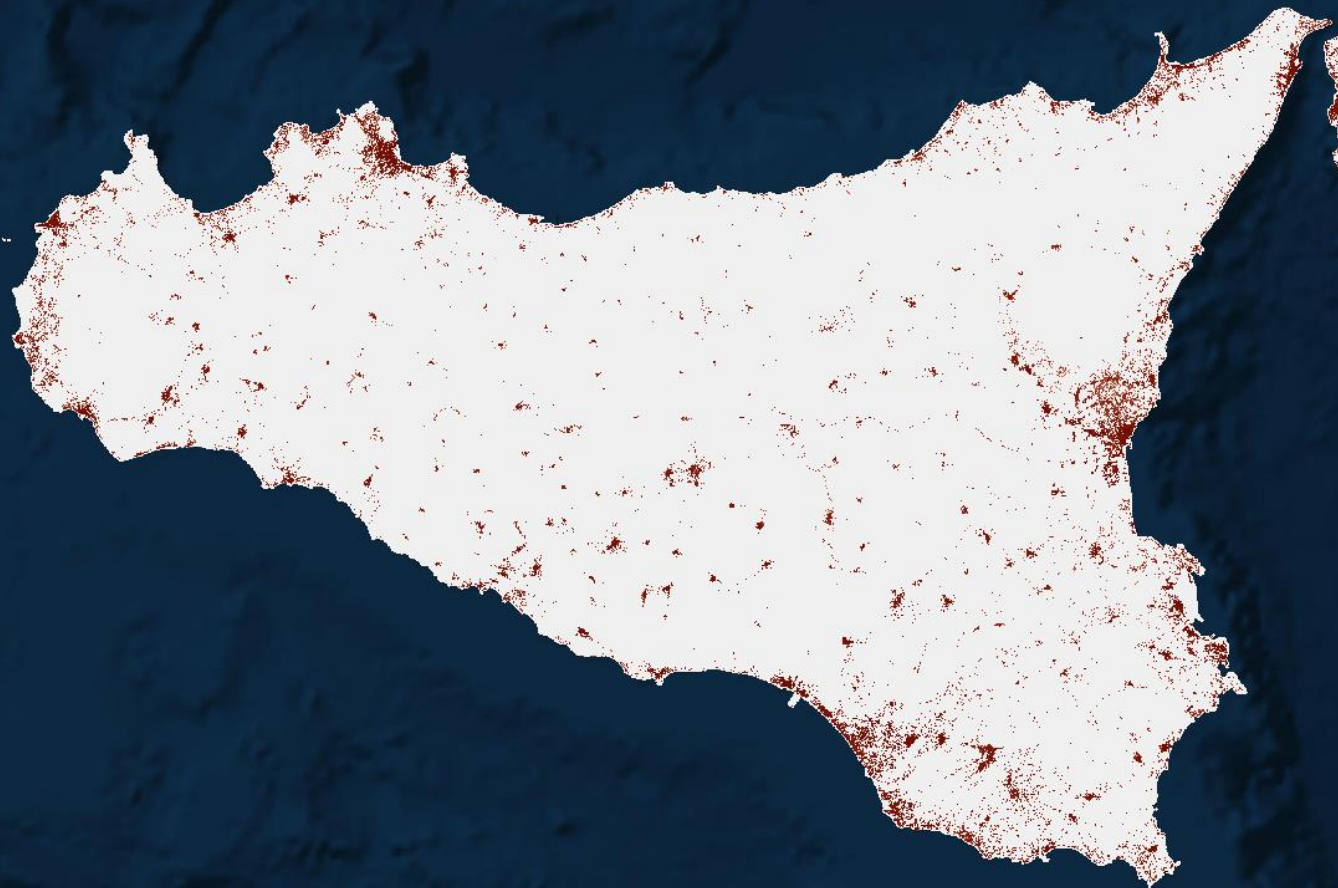
- ➡ HRL Imperv. 2009
- ➡ HRL Imperv. 2012
- ➡ Zoom
- ➡ Step 1 - Recode

HRL Imperviousness 2009 - 20 m spatial resolution

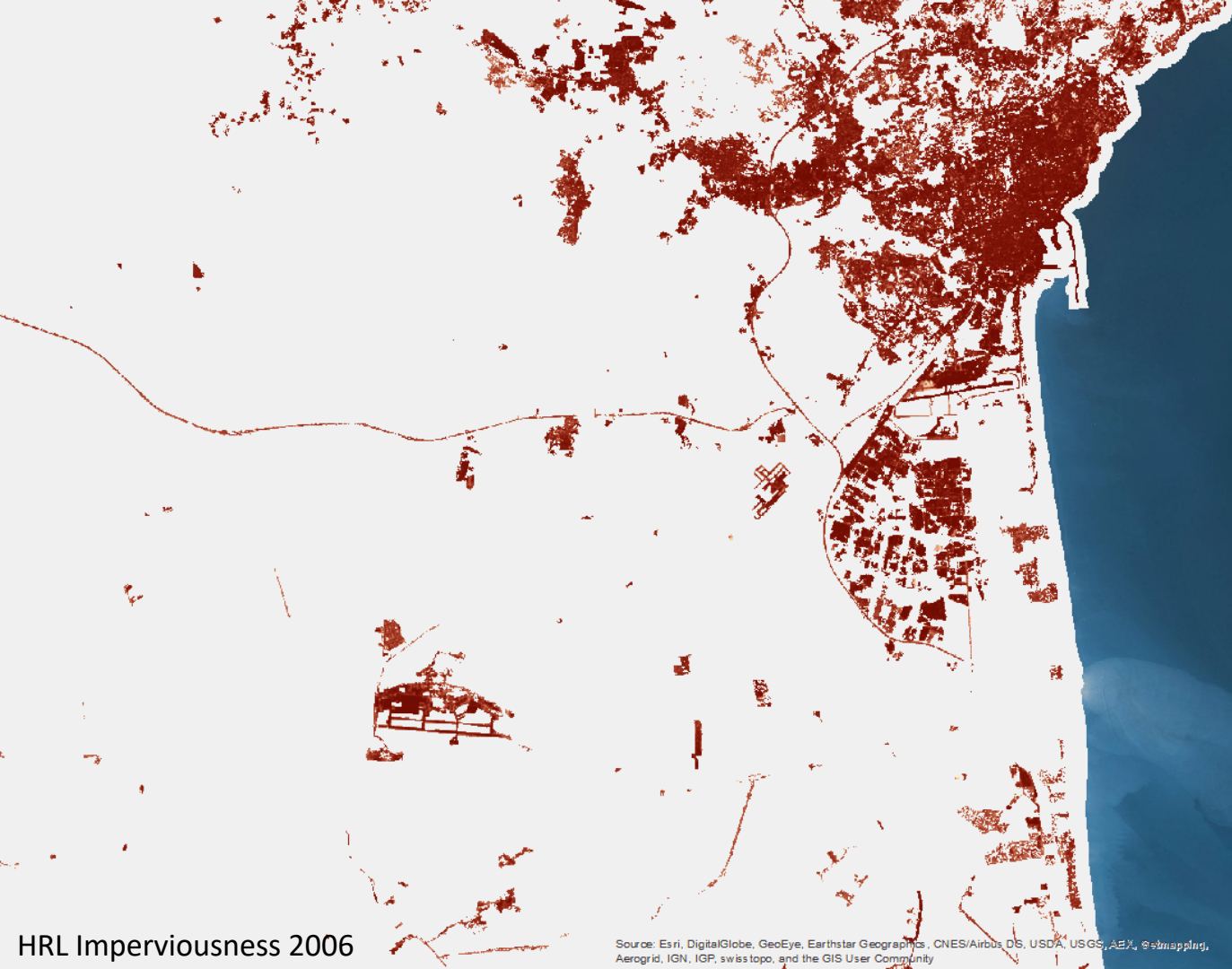


- ➡ HRL Imperv. 2006
- ➡ HRL Imperv. 2012
- ➡ Zoom
- ➡ Step 1 - Recode

HRL Imperviousness 2012 - 20 m spatial resolution



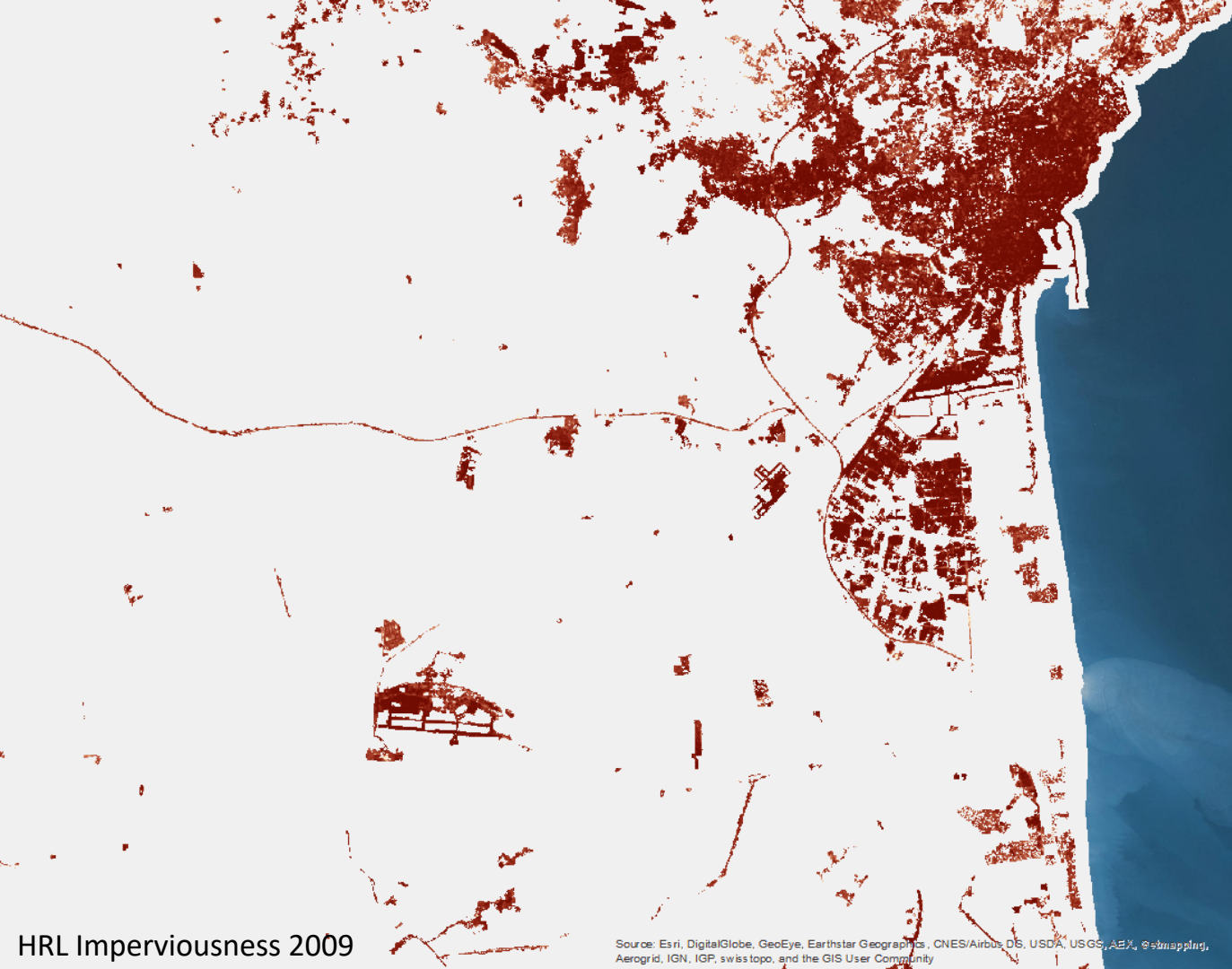
- ➡ HRL Imperv. 2006
- ➡ HRL Imperv. 2009
- ➡ Zoom
- ➡ Step 1 - Recode



- ➡ HRL Imperv. 2009
- ➡ HRL Imperv. 2012
- ➡ Sicilian Map 2006
- ➡ Step 1 - Recode

HRL Imperviousness 2006

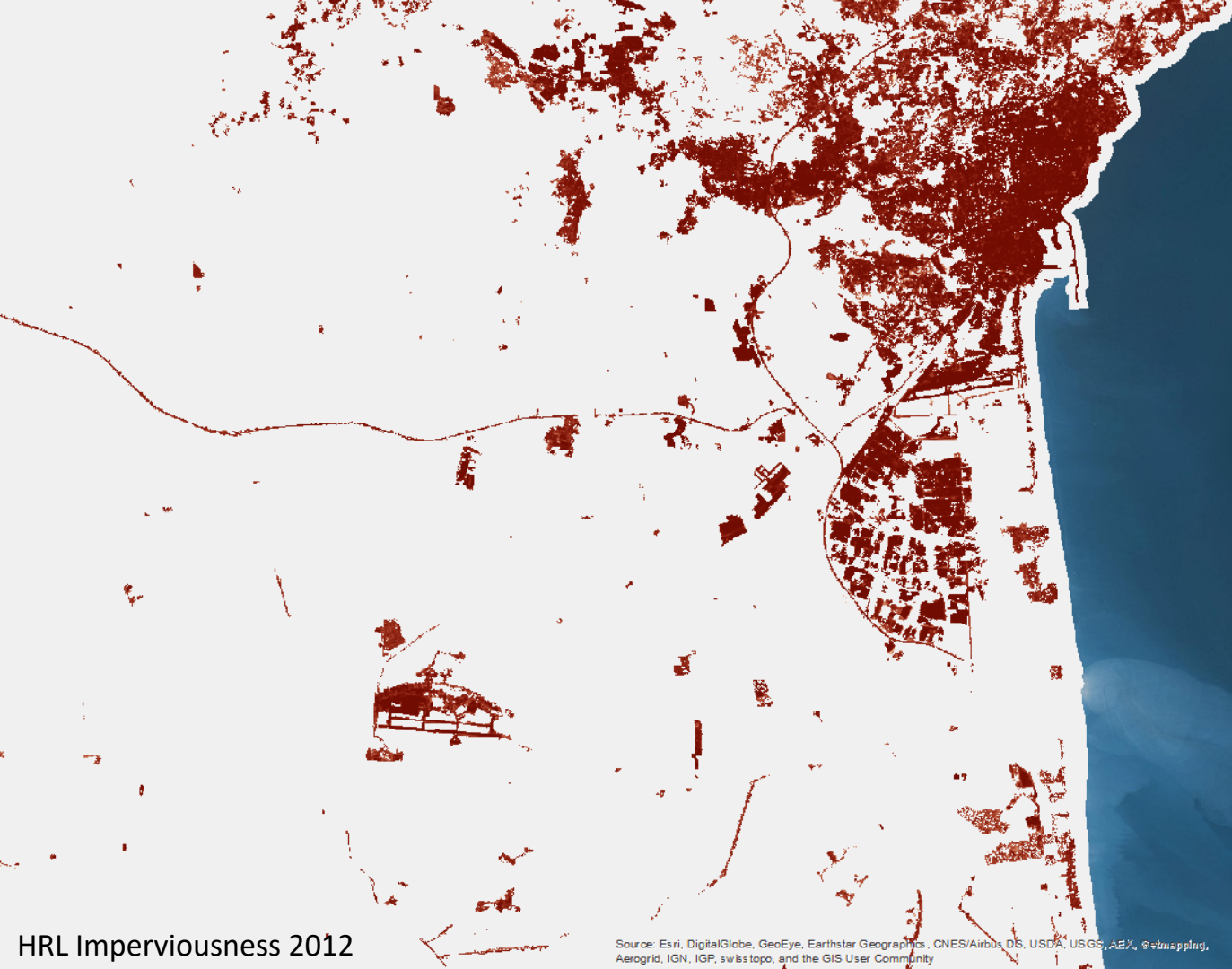
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community



- ➡ HRL Imperv. 2006
- ➡ HRL Imperv. 2012
- ➡ Sicilian Map 2006
- ➡ Step 1 - Recode

HRL Imperviousness 2009

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community



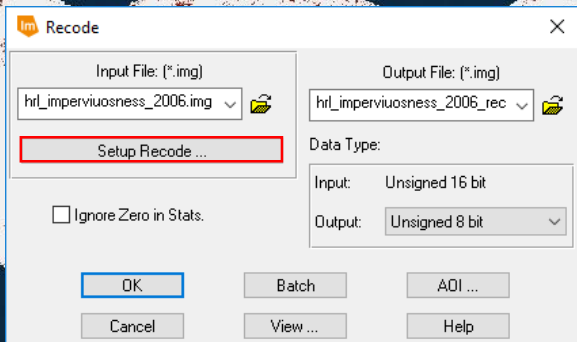
- ➡ HRL Imperv. 2006
- ➡ HRL Imperv. 2009
- ➡ Sicilian Map 2006
- ➡ Step 1 - Recode

HRL Imperviousness 2012

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

STEP 1 – Recode HRL Imperviousness to have Built-up map

- ➡ HRL Imperv. 2009
- ➡ HRL Imperv. 2012
- ➡ Zoom



HRL Imperviousness 2006 - 20 m spatial resolution

Recode

Input File: (*.img)
hrl_imperviousness_2006.img

Output File: (*.img)
hrl_imperviousness_2006_rec

Setup Recode ...

Ignore Zero in Stats.

Data Type:
Input: Unsigned 16 bit
Output: Unsigned 8 bit

OK Batch ADI ...
Cancel View ... Help

Thematic Recode

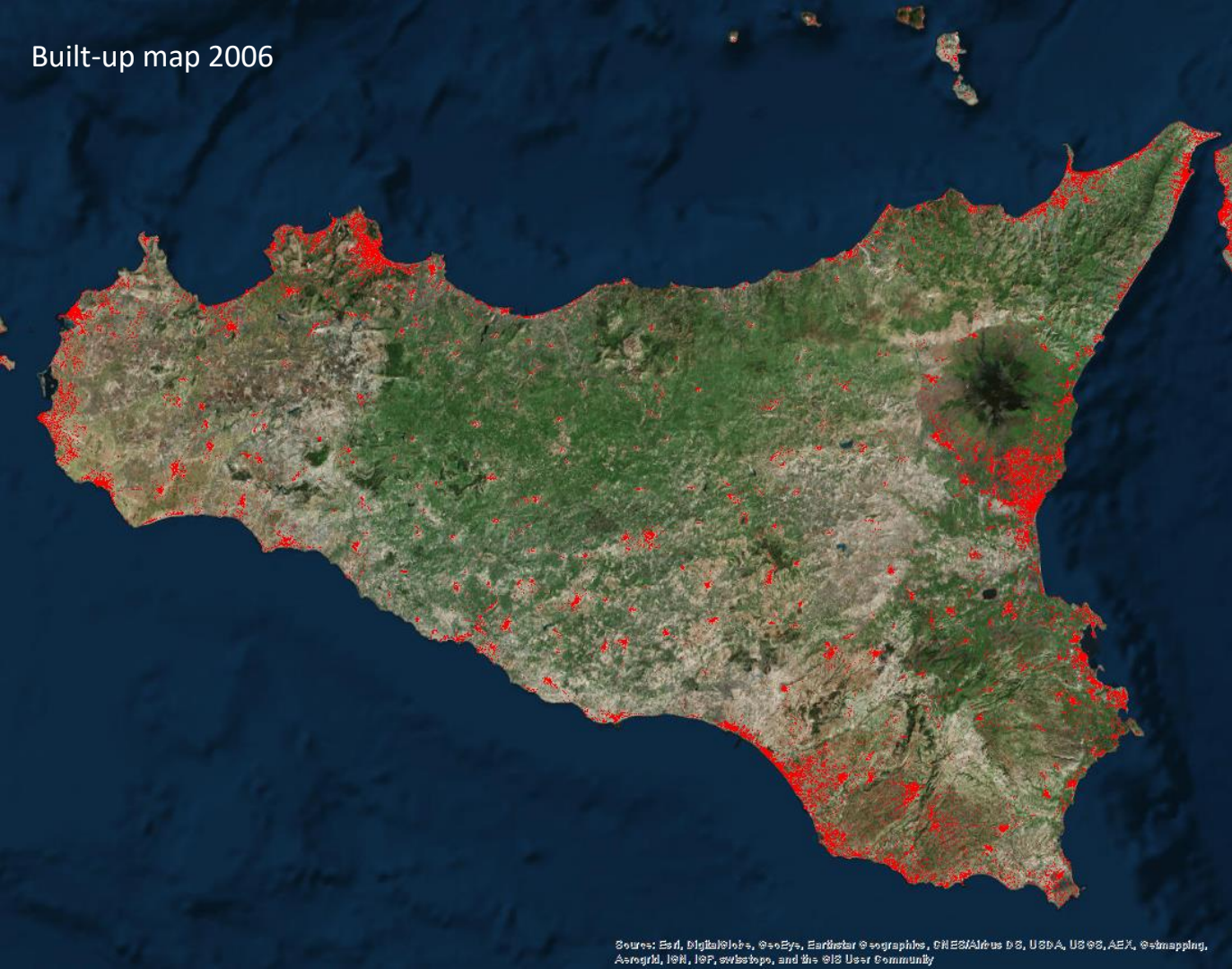
Value	New Value	Red	Green	Blue	Opacity
0	1	1.000	1.000	1.000	1.0
1	1	0.871	0.961	0.729	1.0
2	1	0.871	0.961	0.729	1.0
3	1	0.871	0.961	0.729	1.0
4	1	0.871	0.961	0.729	1.0
5	1	0.871	0.961	0.729	1.0
6	1	0.871	0.961	0.729	1.0
7	1	0.871	0.961	0.729	1.0
8	1	0.871	0.961	0.729	1.0
9	1	0.871	0.961	0.729	1.0
10	1	0.871	0.961	0.729	1.0
11	1	0.871	0.961	0.729	1.0
12	1	0.871	0.961	0.729	1.0
13	1	0.871	0.961	0.729	1.0
14	1	0.871	0.961	0.729	1.0
15	1	0.871	0.961	0.729	1.0
16	1	0.871	0.961	0.729	1.0
17	1	0.871	0.961	0.729	1.0
18	1	0.871	0.961	0.729	1.0
19	1	0.871	0.961	0.729	1.0
20	1	0.871	0.961	0.729	1.0
21	1	0.871	0.961	0.729	1.0
22	1	0.871	0.961	0.729	1.0
23	1	0.871	0.961	0.729	1.0
24	1	0.871	0.961	0.729	1.0
25	1	0.871	0.961	0.729	1.0
26	1	0.871	0.961	0.729	1.0
27	1	0.871	0.961	0.729	1.0
28	1	0.871	0.961	0.729	1.0
29	1	0.871	0.961	0.729	1.0
30	1	0.953	0.780	0.361	1.0
31	1	0.953	0.780	0.361	1.0
32	1	0.953	0.780	0.361	1.0
33	1	0.953	0.780	0.361	1.0
34	1	0.953	0.780	0.361	1.0
35	1	0.953	0.780	0.361	1.0
36	1	0.953	0.780	0.361	1.0
37	1	0.953	0.780	0.361	1.0
38	1	0.953	0.780	0.361	1.0
39	1	0.953	0.780	0.361	1.0
40	1	0.953	0.780	0.361	1.0
41	1	0.953	0.780	0.361	1.0
42	1	0.953	0.780	0.361	1.0
43	1	0.953	0.780	0.361	1.0
44	1	0.953	0.780	0.361	1.0
45	1	0.953	0.780	0.361	1.0

New Value: 1 Change Selected Rows

OK Cancel Help

- ➔ HRL Imperv. 2009
- ➔ HRL Imperv. 2012
- ➔ Zoom

Built-up map 2006



- ➡ Built-up map 2009
- ➡ Built-up map 2012
- ➡ Step 2

Built-up map 2009



- ➡ Built-up map 2006
- ➡ Built-up map 2012
- ➡ Step 2

Built-up map 2012



- ➡ Built-up map 2006
- ➡ Built-up map 2009
- ➡ Step 2

Shapefile region

➡ Create buffer zones

Buffer

Input Features
Italy_sicily

Output Feature Class
T:\Sicily_buffer.shp

Distance [value or field]
 Linear unit
-300 Meters

Field

Side Type (optional)
FULL

End Type (optional)
ROUND

Dissolve Type (optional)
NONE

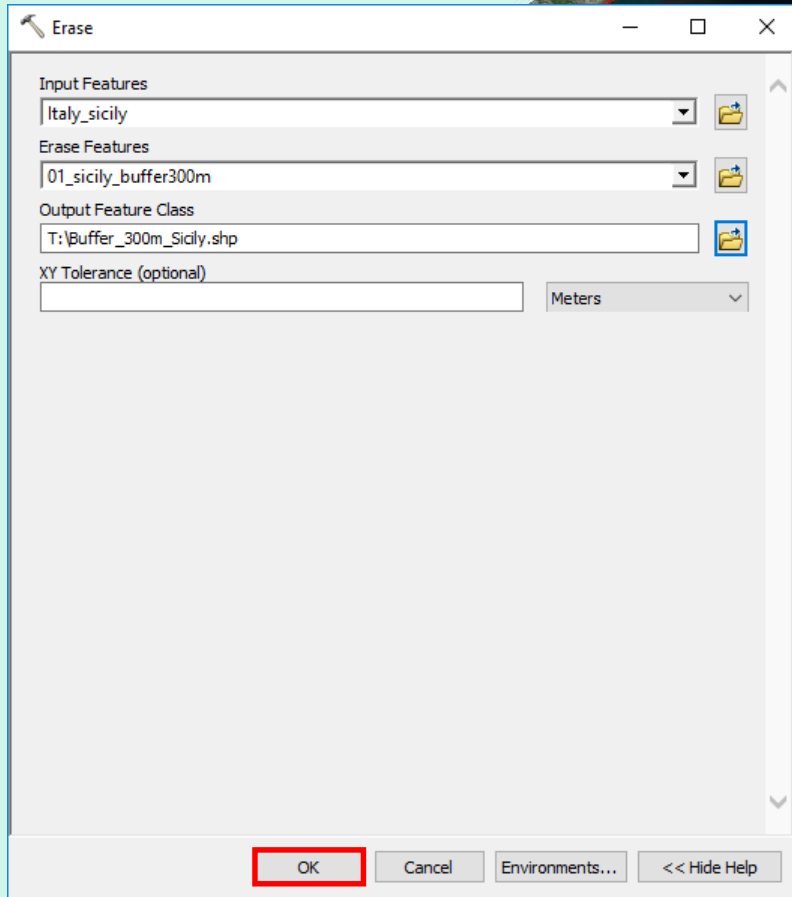
Dissolve Field(s) (optional)
 FID
 REGIONE

Select All Unselect All Add Field

OK Cancel Environments... << Hide Help



➡ Erase buffer





- ➡ 1 km buffer
- ➡ 10 km buffer
- ➡ All buffers
- ➡ Step 3

300 m buffer area



1 km buffer area

- ➡ 300 m buffer
- ➡ 10 km buffer
- ➡ All buffers
- ➡ Step 3

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroX, @xmapping, AerialGIS, IGN, ICF, Swisstopo, and the @IS User Community



- ➡ 300 m buffer
- ➡ 1 km buffer
- ➡ All buffers
- ➡ Step 3

10 km buffer area

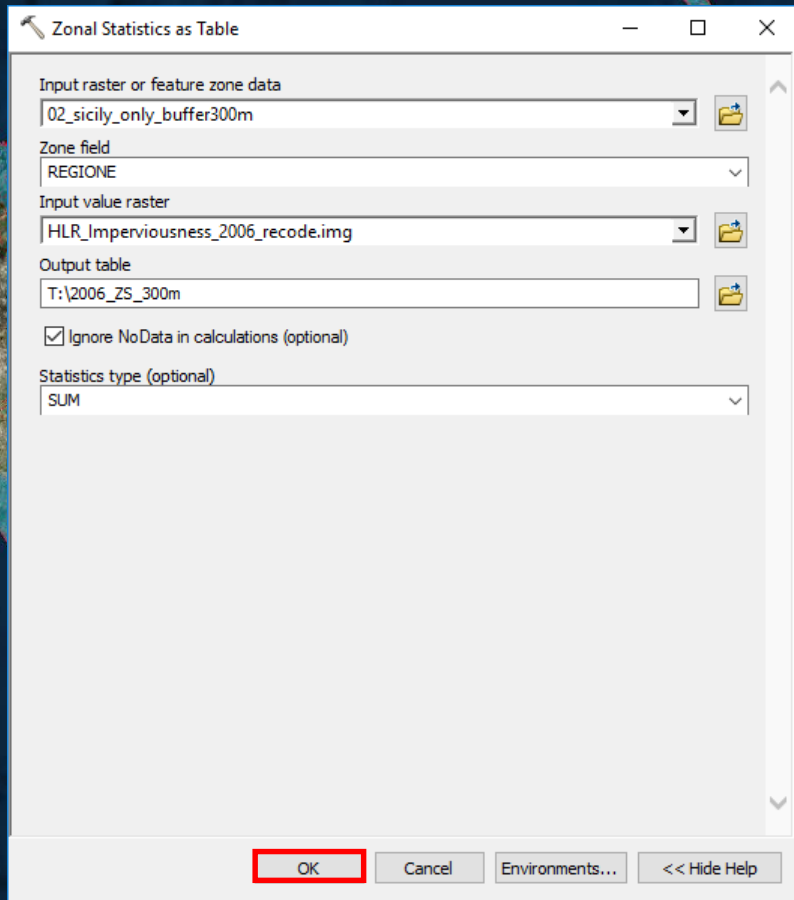


- ➡ 300 m buffer
- ➡ 1 km buffer
- ➡ 10 km buffer
- ➡ Step 3

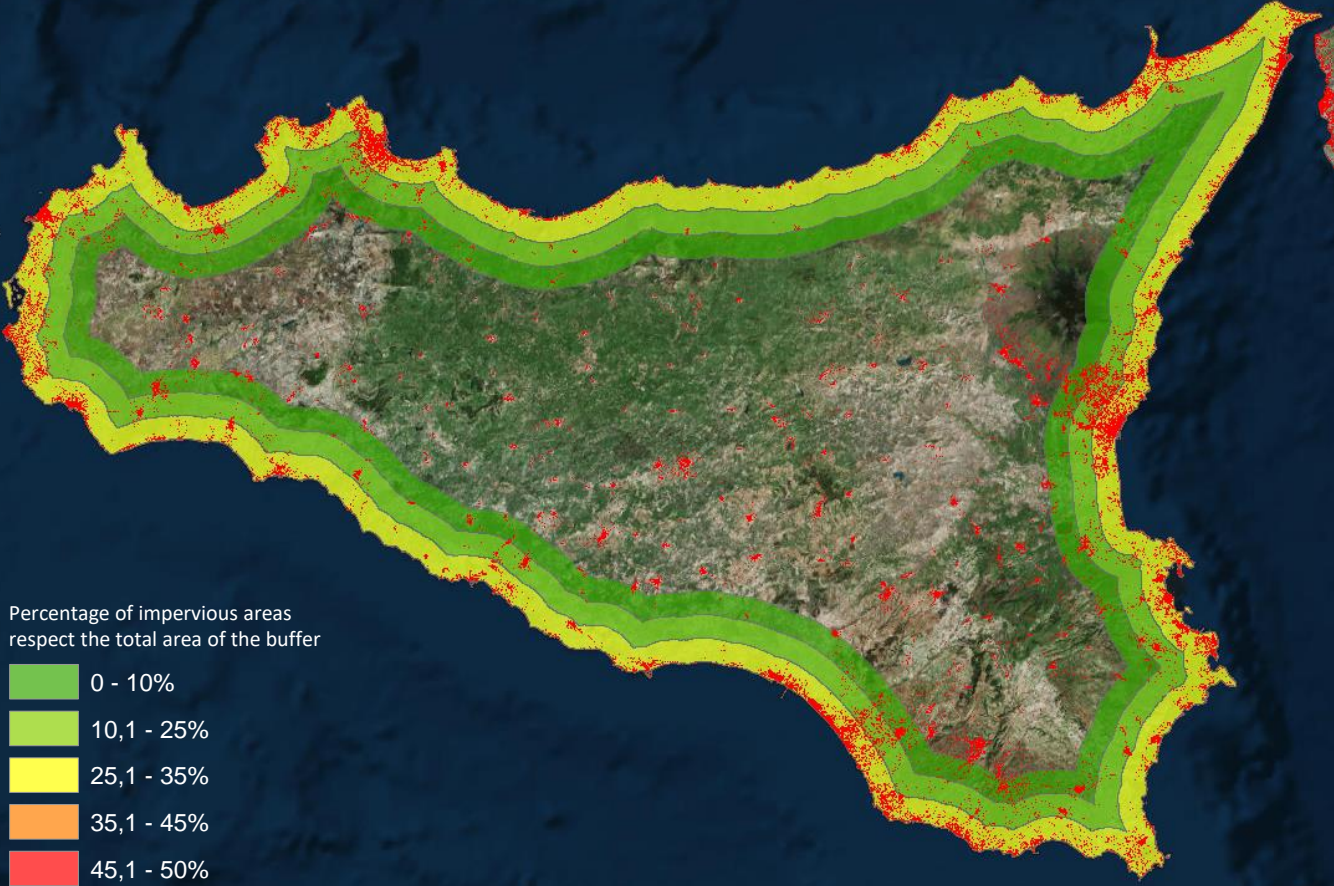
All buffer areas



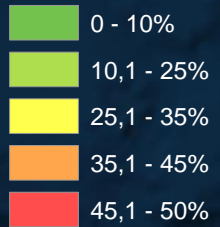
➡ Zonal statistics



2006

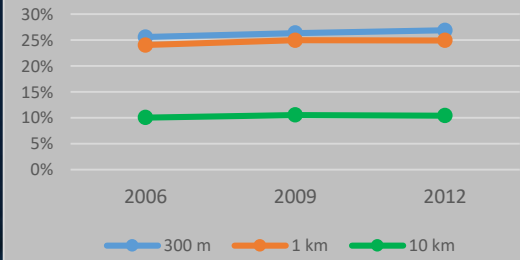


Percentage of impervious areas respect the total area of the buffer



- ➡ 2009
- ➡ 2012
- ➡ Provincial analysis

Regional percentage of built-up series by coastal buffers

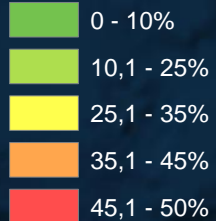


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroX, @swmapping, AerialGrid, IGN, IGN, IGF, swisstopo, and the GIS User Community

2009



Percentage of impervious areas respect the total area of the buffer



- ➡ 2006
- ➡ 2012
- ➡ Provincial analysis

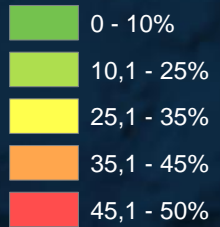
Regional percentage of built-up series by coastal buffers



2012

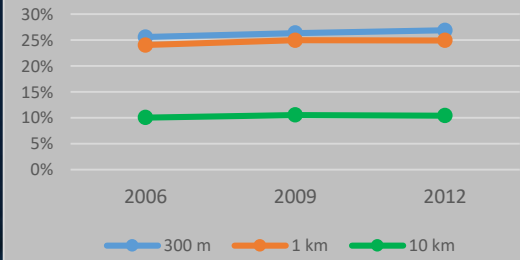


Percentage of impervious areas respect the total area of the buffer



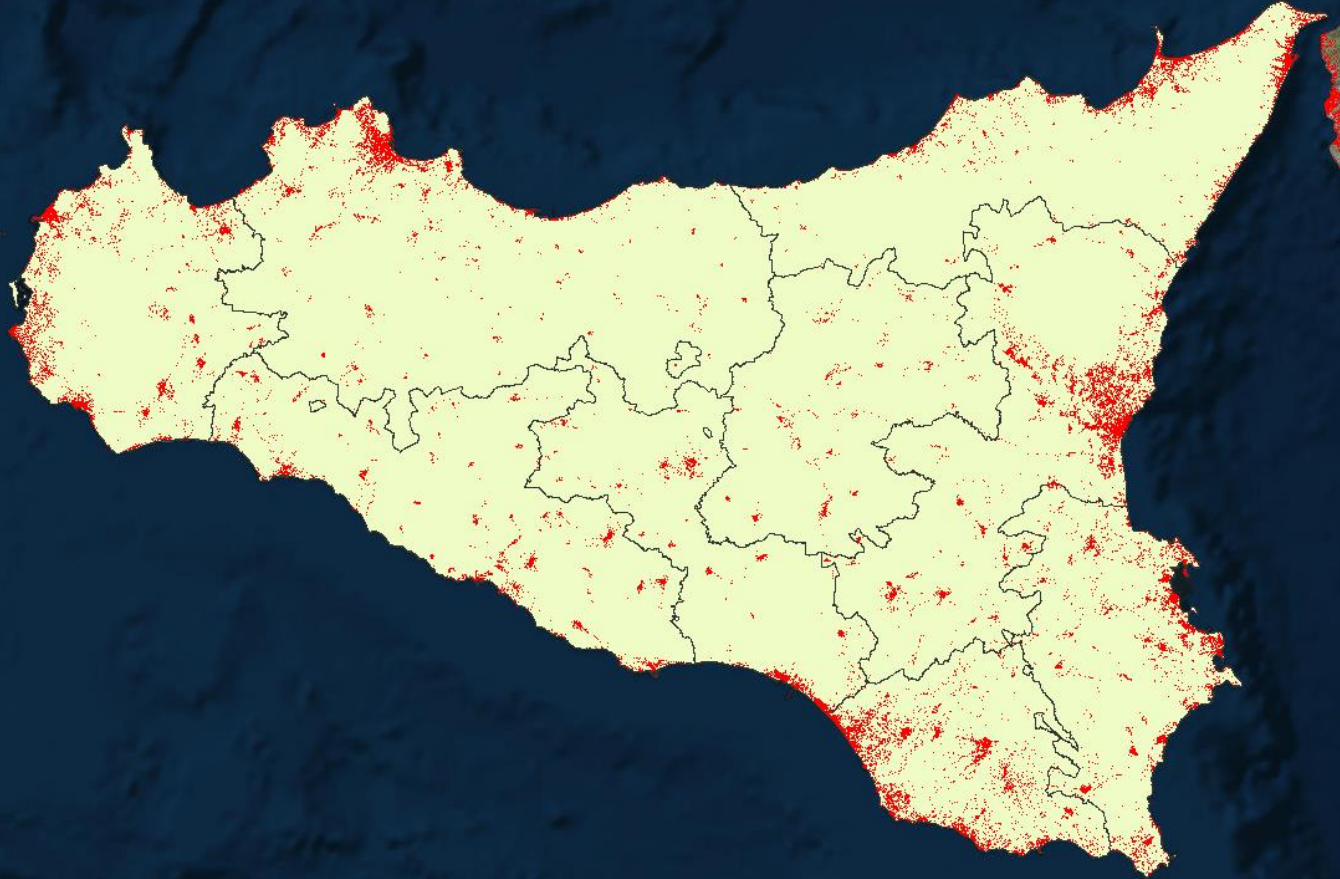
- ➡ 2006
- ➡ 2009
- ➡ Provincial analysis

Regional percentage of built-up series by coastal buffers



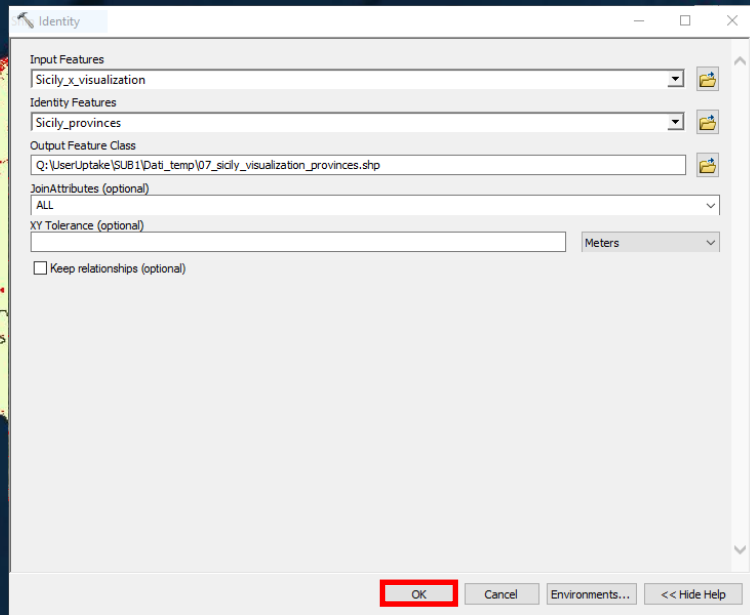
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroX, @swmapping, AerialGrid, IGN, IGN, IGF, swisstopo, and the GIS User Community

Sicilian provinces and built-up map 2006



➡ Create new buffers

Sicilian provinces and built-up map 2006

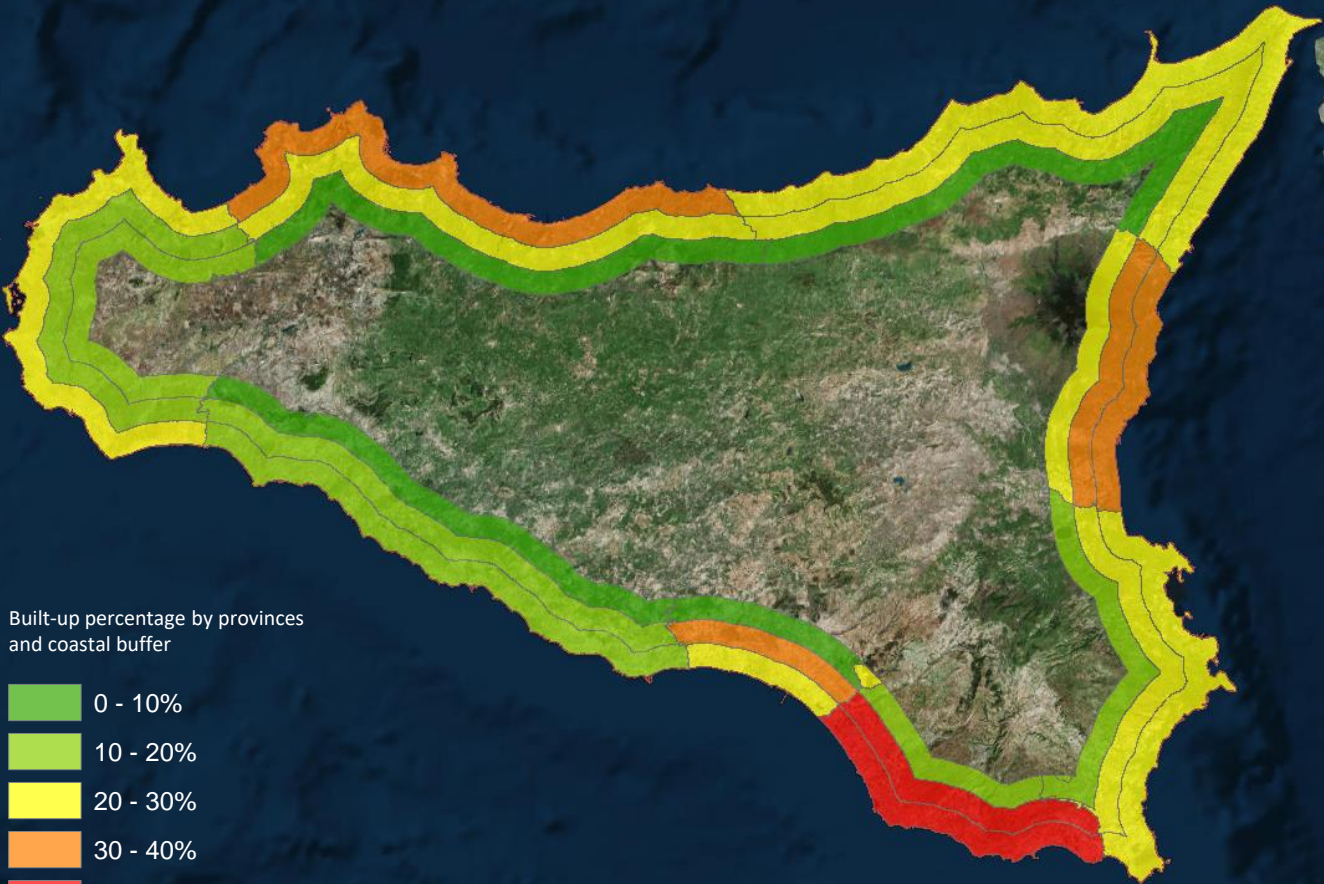




➡ Analysis results

2006

Built-up percentage by provinces and coastal buffer



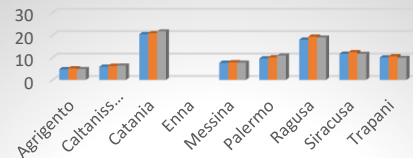
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroX, @swmapping, Aerial, IGN, IGN, IGF, swisstopo, and the GIS User Community

➡ 2009

➡ 2012

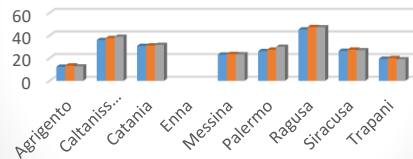
➡ Quit

10 km buffer



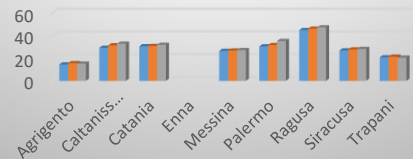
■ 2006 ■ 2009 ■ 2012

1 km buffer



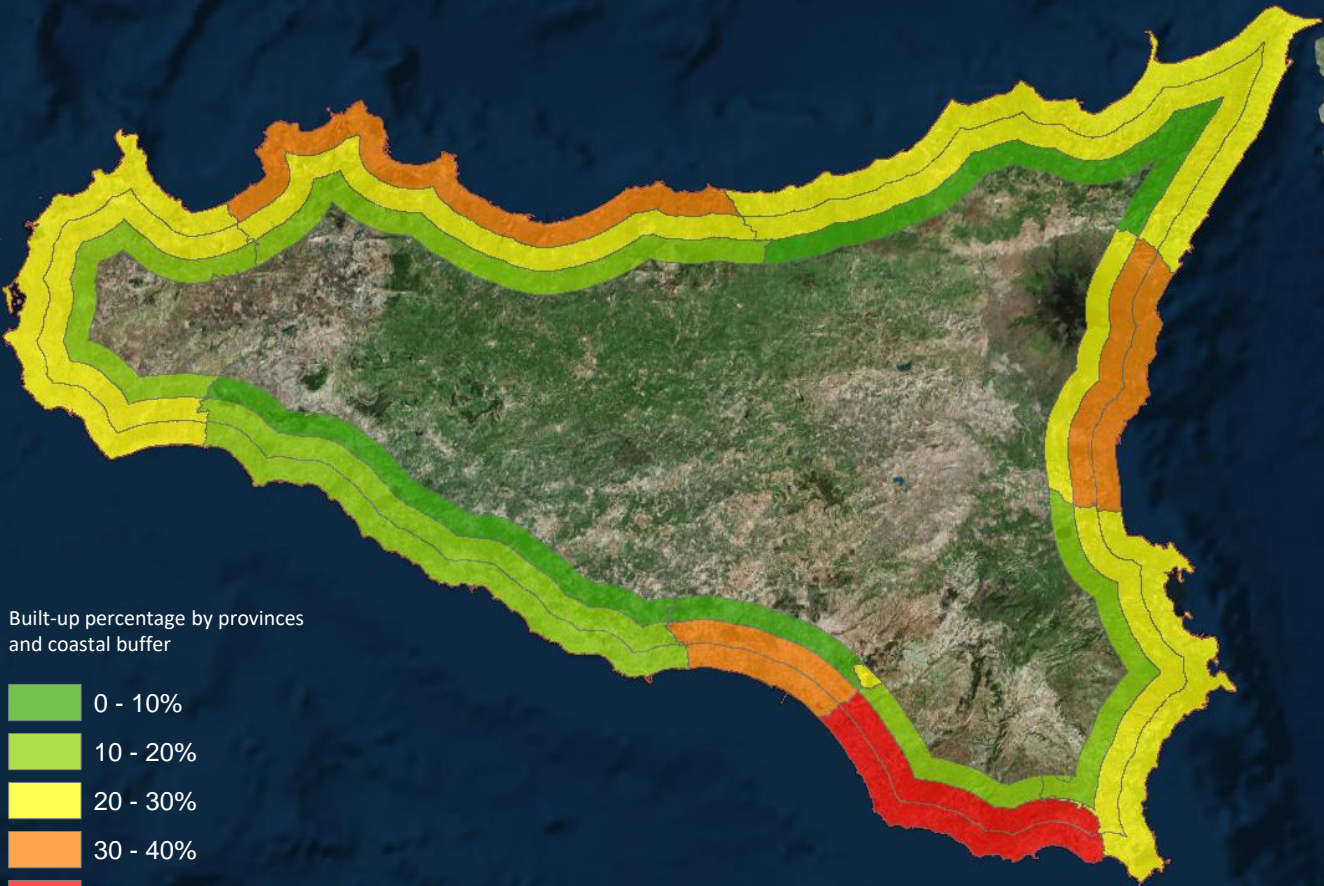
■ 2006 ■ 2009 ■ 2012

300 m buffer



■ 2006 ■ 2009 ■ 2012

2009



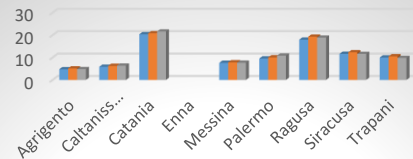
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, ICF, swisstopo, and the GIS User Community

➡ 2006

➡ 2012

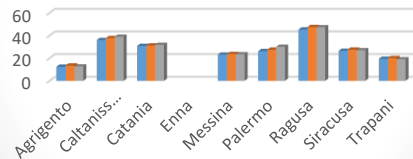
➡ Quit

10 km buffer



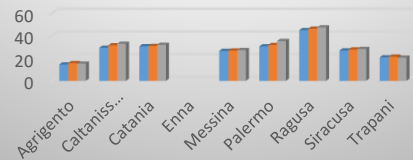
■ 2006 ■ 2009 ■ 2012

1 km buffer



■ 2006 ■ 2009 ■ 2012

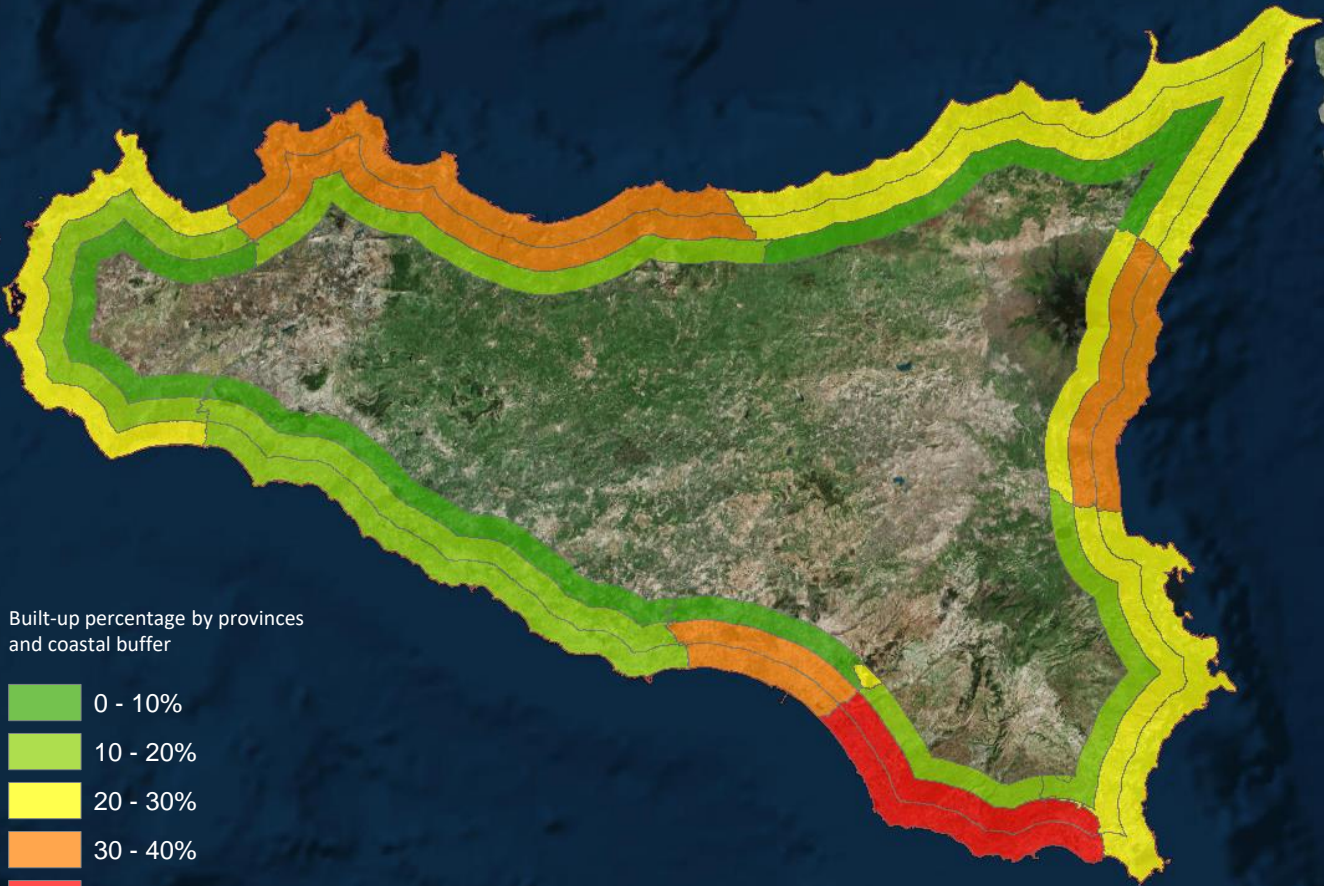
300 m buffer



■ 2006 ■ 2009 ■ 2012

2012

Built-up percentage by provinces and coastal buffer



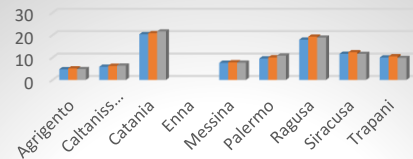
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroX, @swmapping, Aerial, IGN, IGN, IGF, swisstopo, and the GIS User Community

➡ 2006

➡ 2009

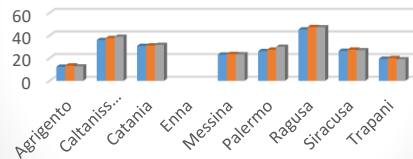
➡ Quit

10 km buffer



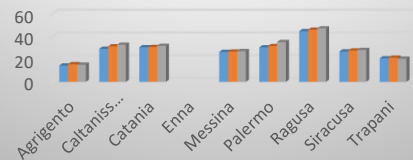
■ 2006 ■ 2009 ■ 2012

1 km buffer



■ 2006 ■ 2009 ■ 2012

300 m buffer



■ 2006 ■ 2009 ■ 2012



User
Uptake

Thank you