European Commission

# Copernicus Emergency Management Service


## European Commission
## Joint Research Centre

*Jan Kucera*



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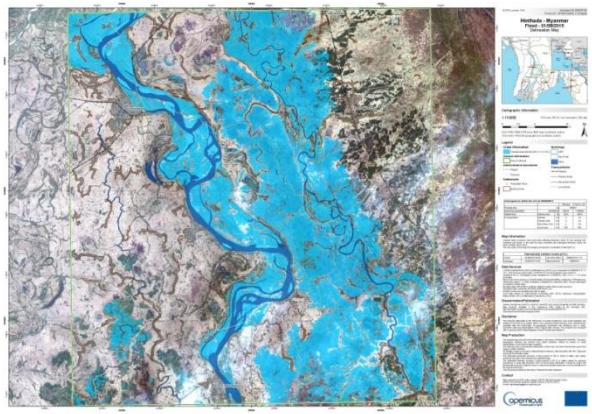
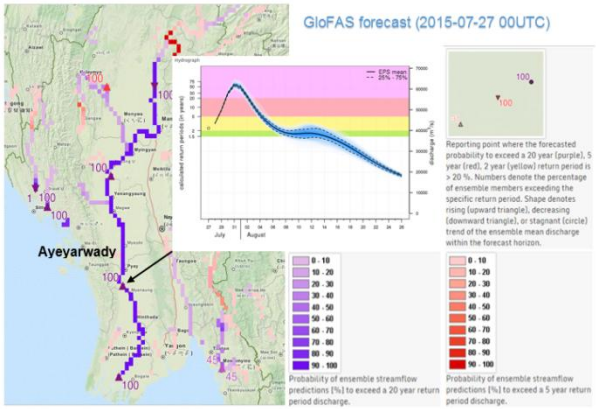
# Copernicus Emergency Management Service (EMS)

- ★ Addressing natural and man-made disasters globally
- ★ EMS components: Mapping (with Validation) and Early Warning
- ★ EMS Mapping: Provides disaster management information based on satellite imagery combined with other information
- ★ EMS Early Warning Systems: provide alerts on flood and forest fire risks

## Mapping



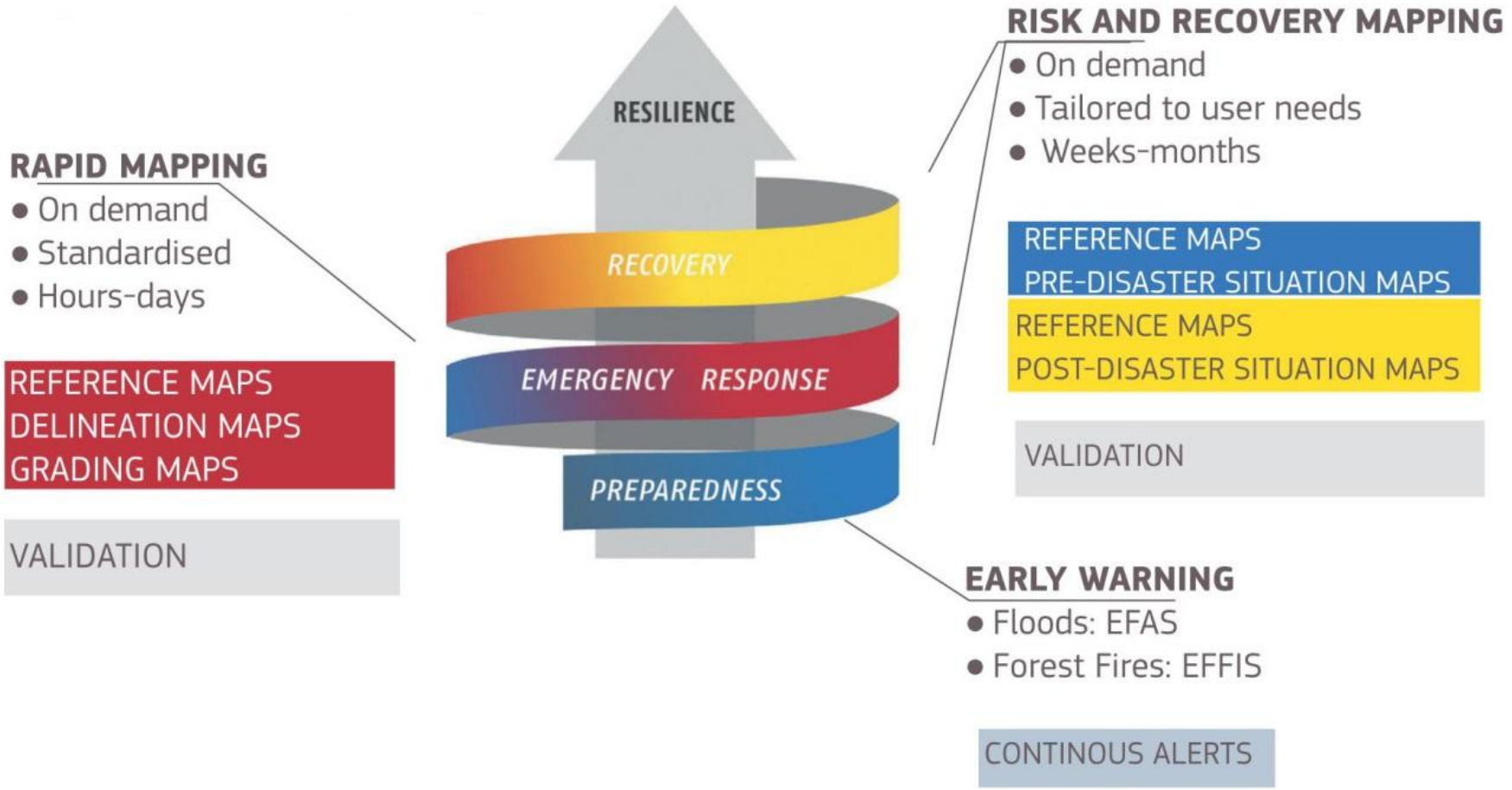
## Early Warning



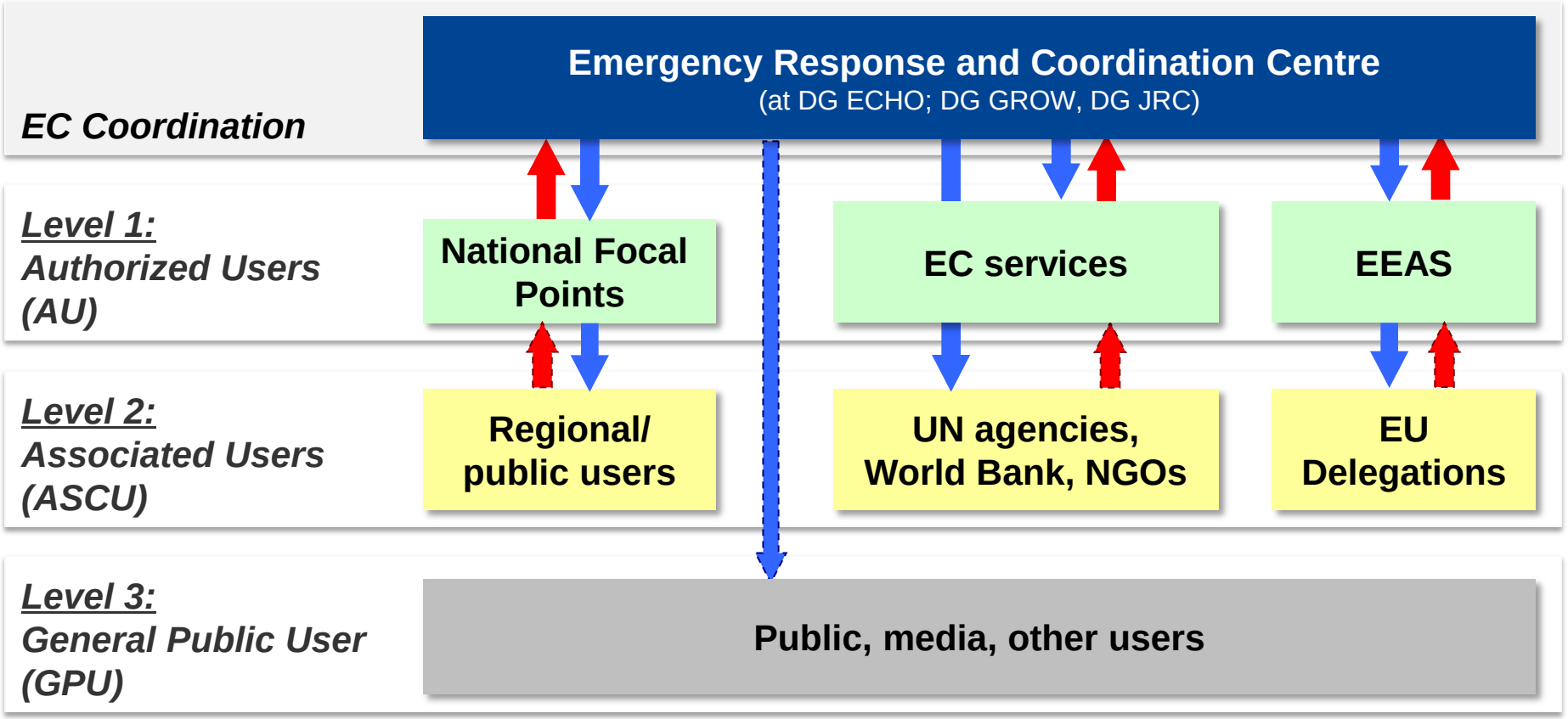

Space

Copernicus | Europe's eyes on Earth

# Service Concept



# Users and Information Flow of EMS Mapping



# Copernicus EMS-Mapping: Satellite data supply

- ★ Copernicus Contributing Missions (WorldView-2, Pleiades, Spot 6/7, Cosmo SkyMed, TerraSar, Radarsat-2 and other commercial missions) supplied by ESA (REACT – Rapid Emergency Activation for Copernicus)

- ★ Sentinel 1A/B, Sentinel 2 whenever feasible

- ★ Other: Landsat 8, Aerial Imagery, Orthomosaics, ESRI

# Rapid Mapping

- ★ 24/7 service
- ★ Standardised products (three map types)
- ★ Two production modes (service levels SL)

| MAP TYPE | CONTENT | DELIVERY TIME* | |
|---|---|---|---|
| | | SL1 | SL5 |
| **Reference** | **Detailed status of the territory & assets prior to the crisis**<br>e.g. Topographic features & specific information | 9h | 5 days |
| **Delineation** | **Assessment of the event's extent**<br>e.g. delineation of burnt area, delineation of flooded area, earthquake impact area; estimations on the exposed or affected population and assets | 12h** | 5 days |
| **Grading** | **Assessment of the damage grade & its spatial distribution**<br>e.g. for any disaster event, location of destroyed/damaged buildings and assets, and damage grading (possibly-moderately-highly affected-destroyed) | 12h** | 5 days |

* Time after satellite data reception
** First Available Map after 3h

# Timeline

## EMS Rapid Mapping

Some hours to 30h

≤12h*

~2h

Map delivery

Satellite image delivery

Satellite tasking

Activation of the service

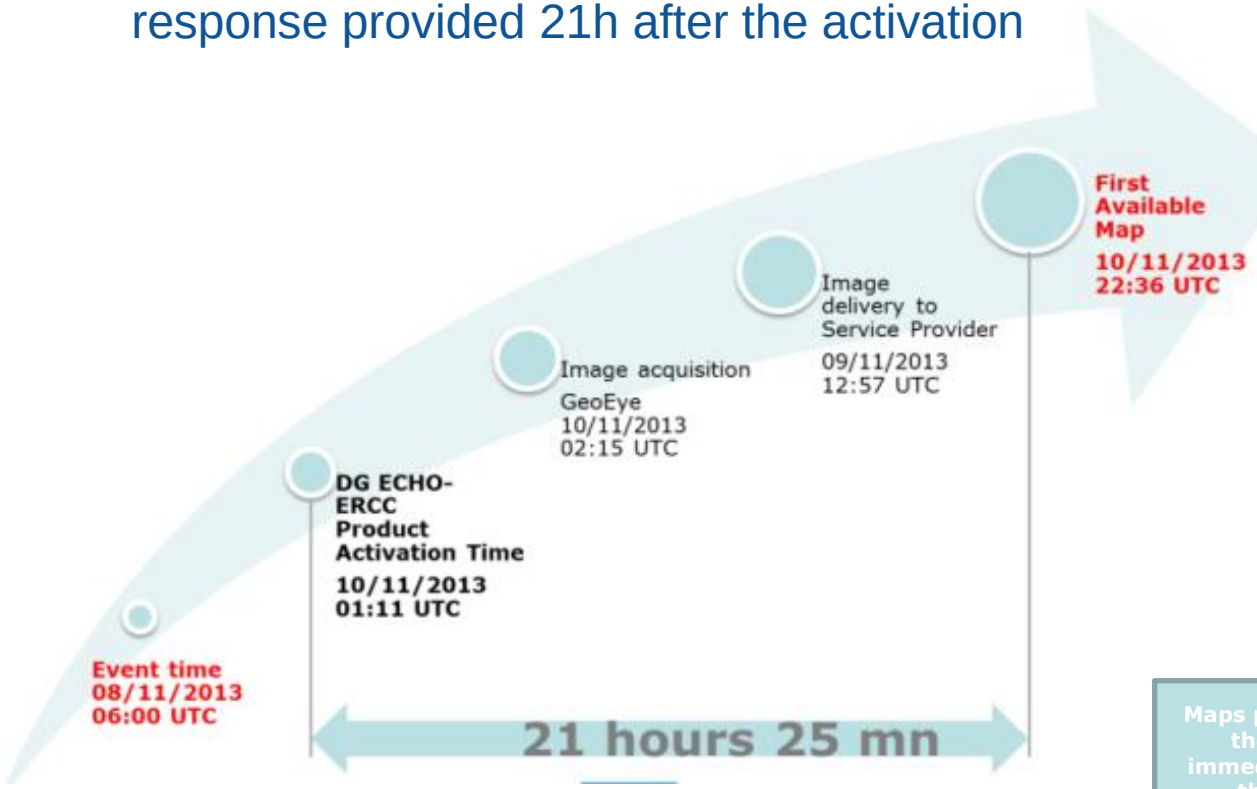
Disaster

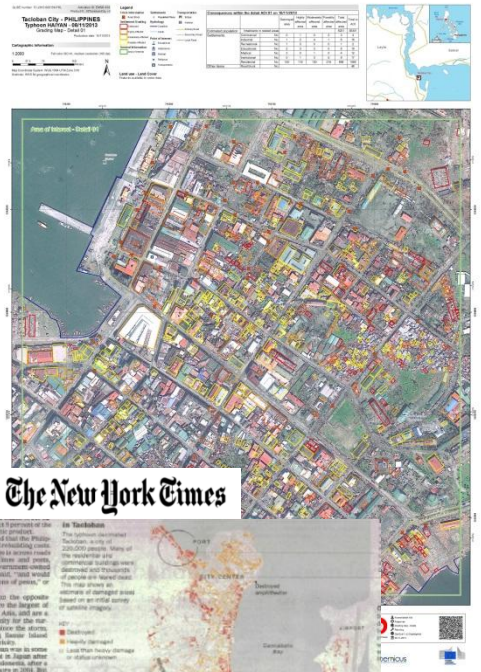
* Production time in service level 1

Space

# Timeline example: Typhoon Philippines, 2013

- Damage Assessment for emergency response provided 21h after the activation



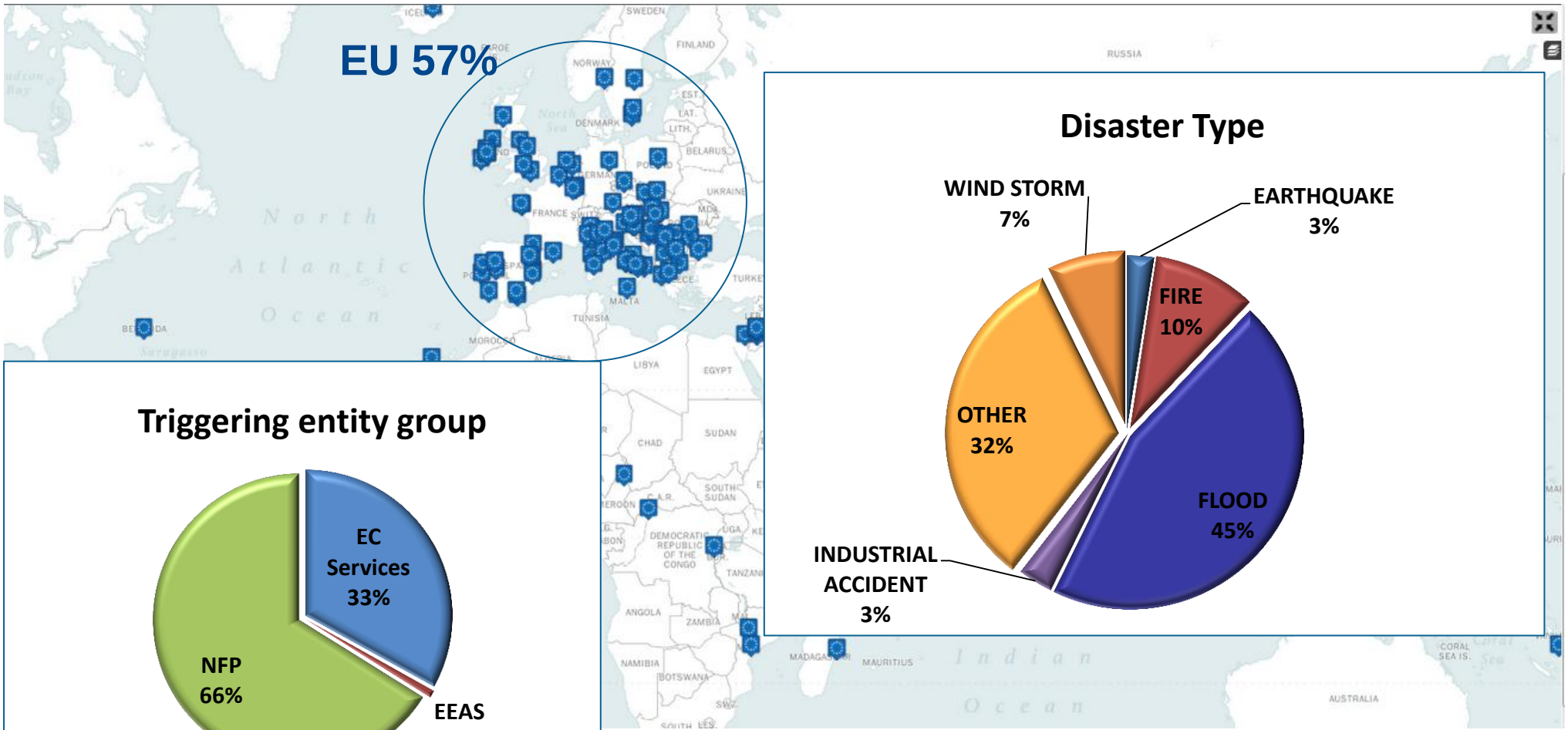

Maps picked up by the MEDIA immediately after the event


# Tanna Island, Vanuatu

Post event image 17/03/2015 Pleiades 2.5m

European Commission

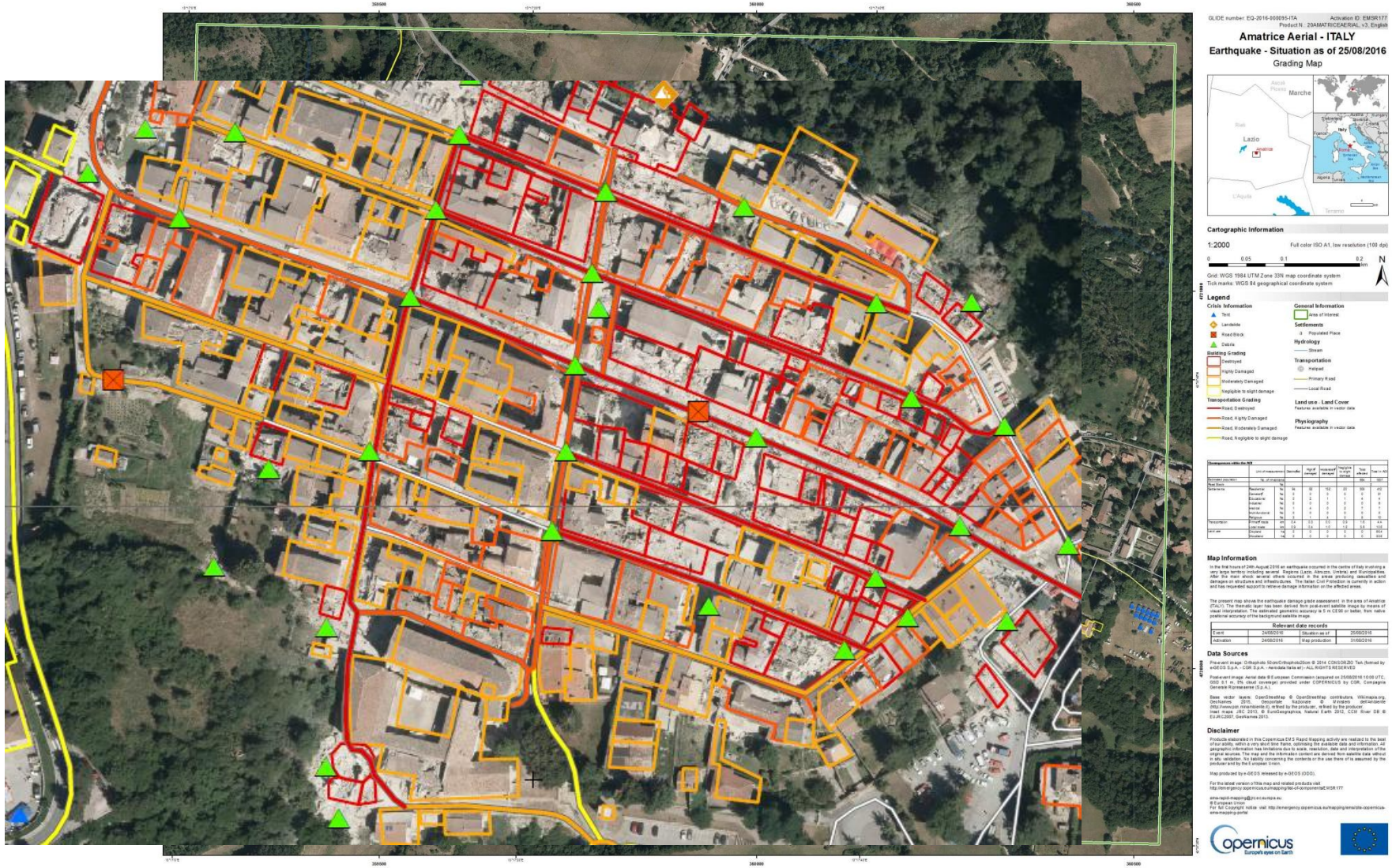
# Rapid Mapping (180 activations)




Space

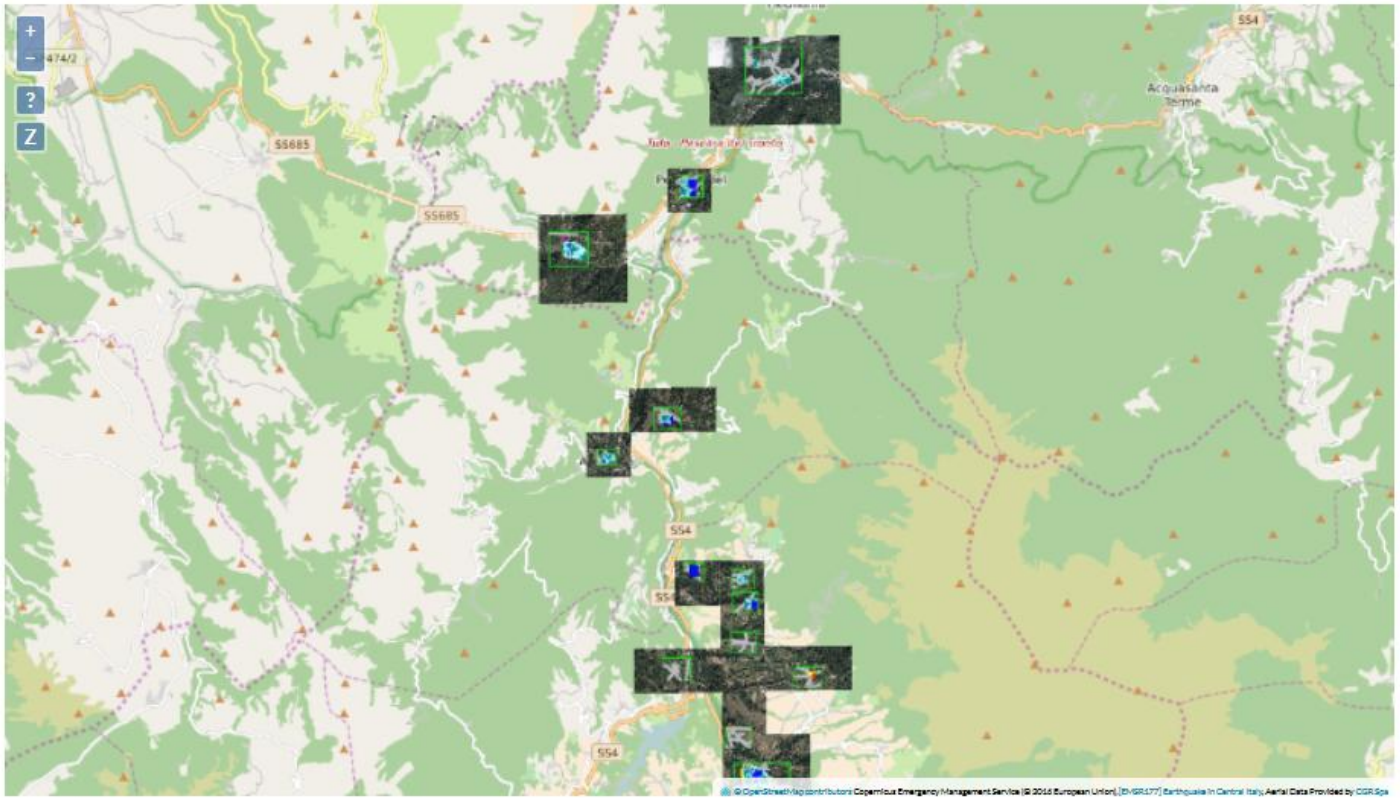
Copernicus | Europe's eyes on Earth

# EQ in Italy, 24.8.2016



# EQ in Italy, 24.8.2016

http://viewer.copernicus-ems.eu




EMSR177 Earthquake in Italy

Show Map Sets

Earthquake Aug 24, 2016

Zoom all | Hide all layers

- 26-Sant'Angelo
- 25-Accumoli
- 24-Rocchetta
- 23-San Lorenzo e Flaviano
- 22-Cornillo Vecchio
- 21-Poggio Vitellino
- 20-Amatrice
- 19-Arquata del Tronto
- 18-Saletta
- 17-Pescara del Tronto
- 16-Illica
- 15-Casale
- 14-Capodaqua

# International Working Group on Satellite based Emergency Mapping (IWG-SEM)

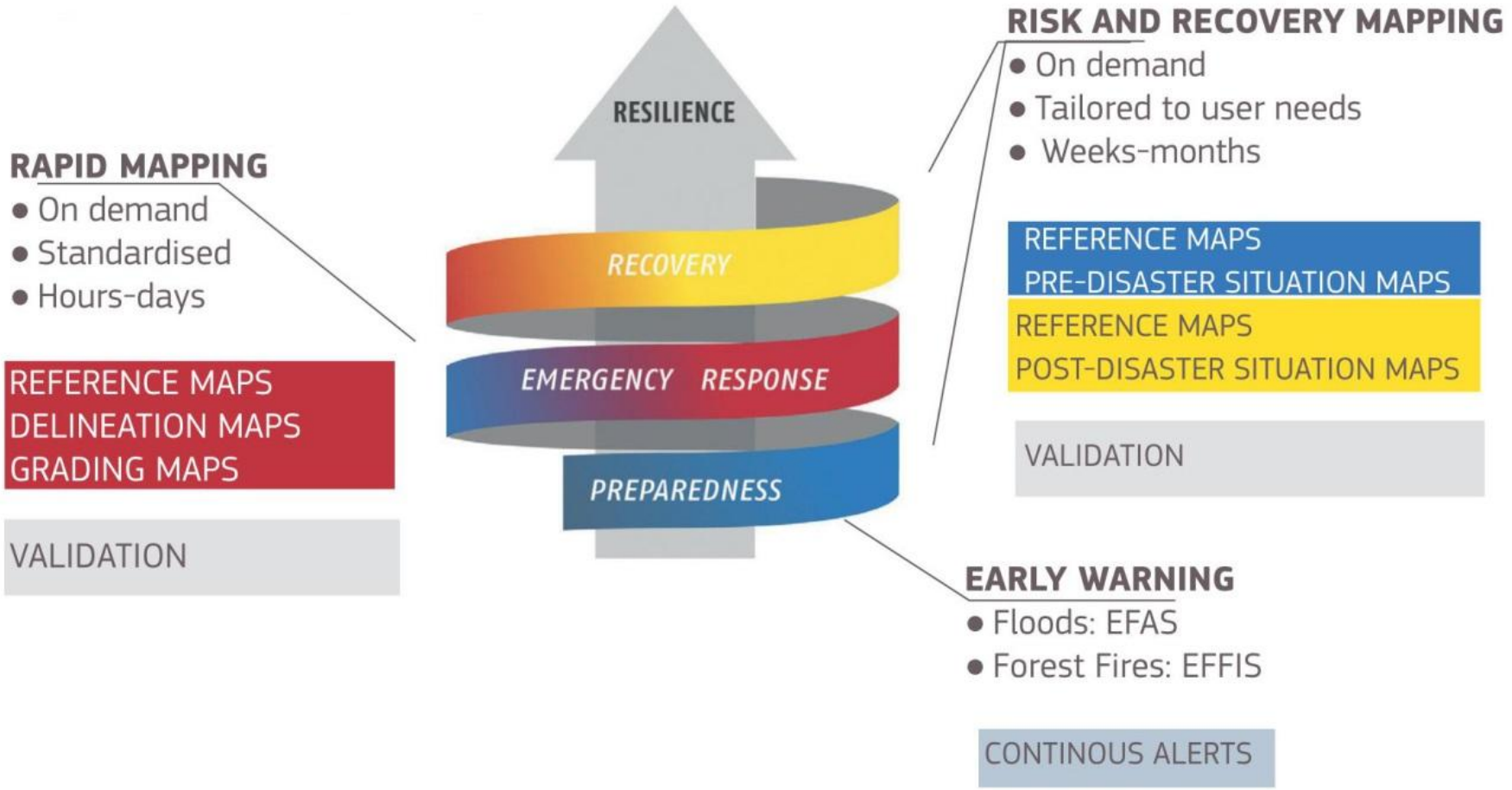
- "Supporting disaster response by improving international cooperation in satellite based emergency mapping."

- "Establish best practices between operational satellite-based emergency mapping programs, stimulate communication and collaboration, support the definition of emergency mapping guidelines, strengthen the sharing of expertise and capacities and review relevant technical standards as well as protocols. Work with the appropriate organizations to define professional standards for emergency mapping."

**iwg-sem.org**

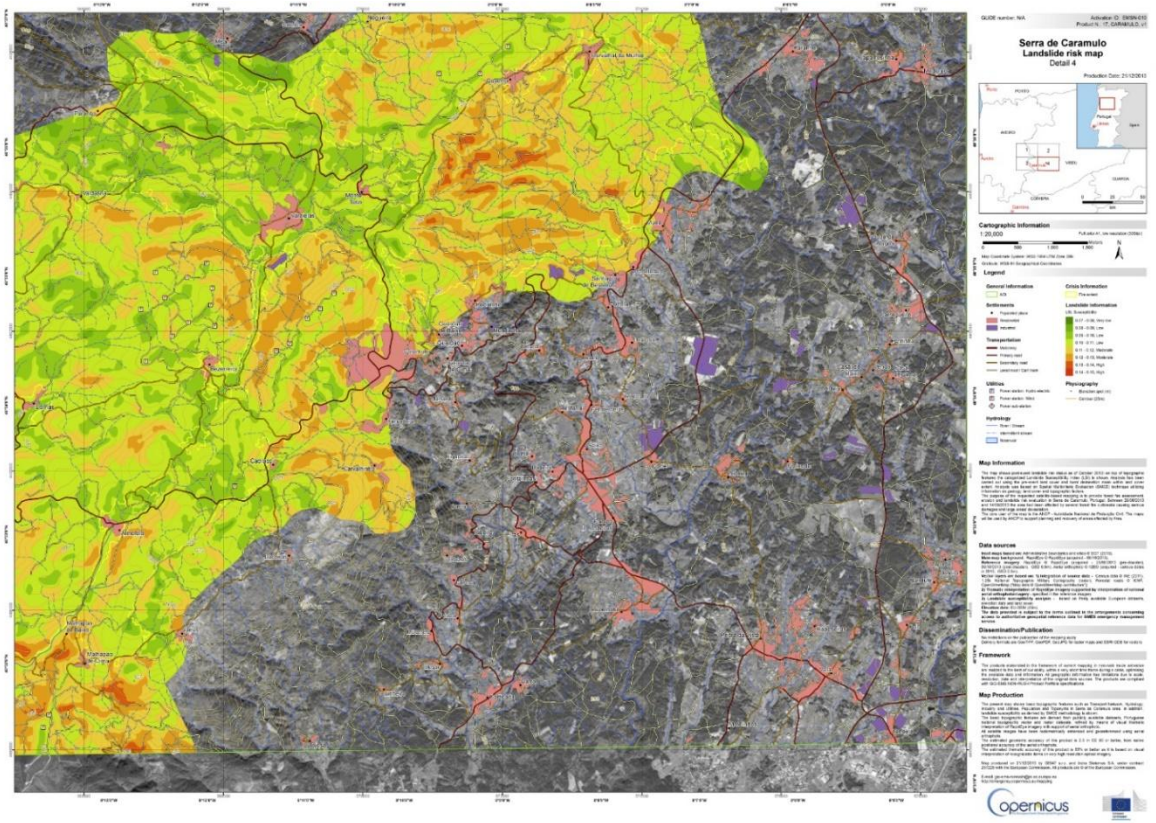
Global trends in satellite-based emergency mapping (Science, 15 Jul 2016: Vol. 353, Issue 6296, pp. 247-252)

# Service Concept

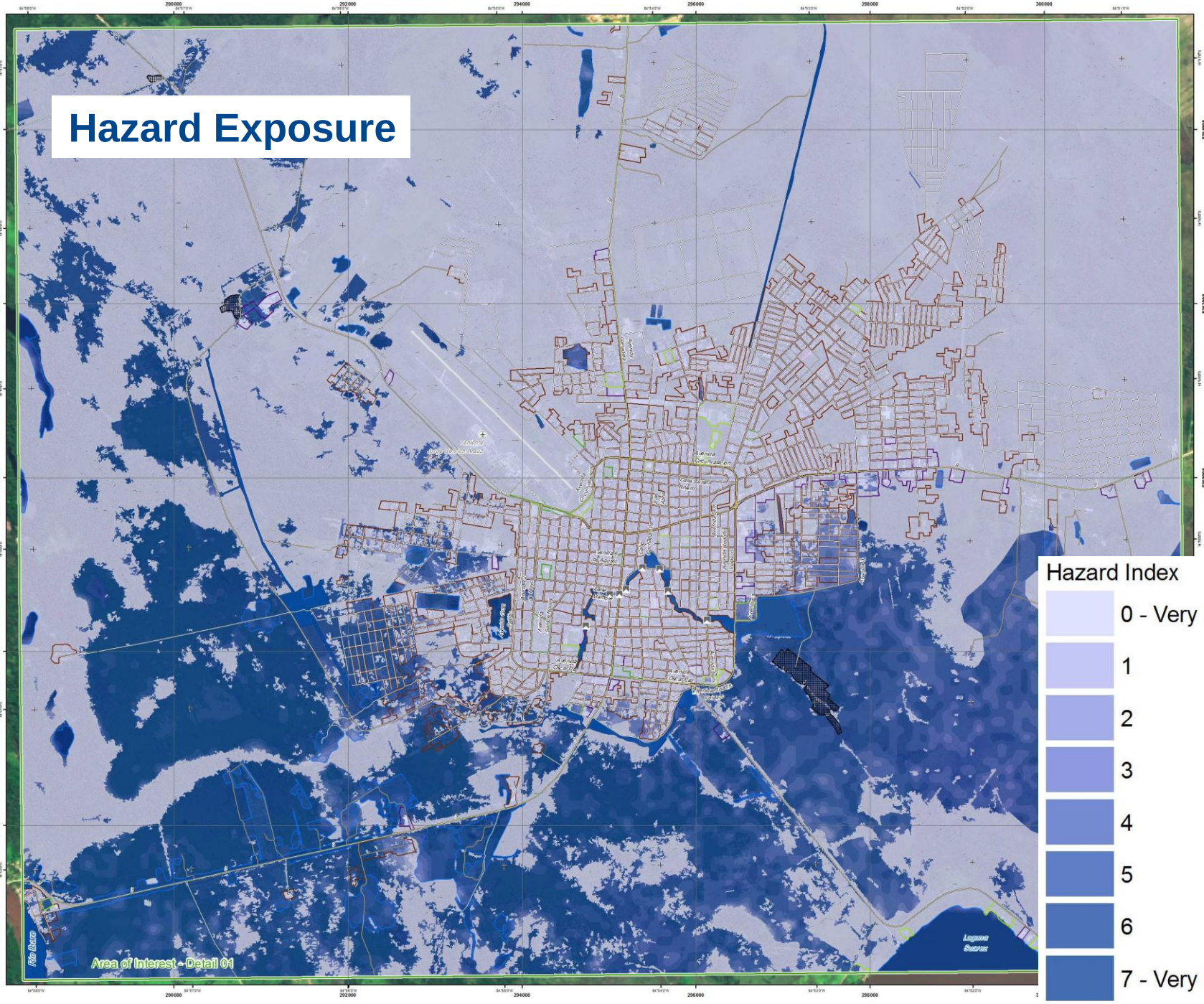


# Risk and Recovery Mapping

- ★ On-demand (activated by authorized users)
- ★ Delivery time approx. 2 months after request
- ★ Provision of:
  - ★ Reference Maps (status of territory and assets)
  - ★ Pre-Disaster Maps (Hazard, Vulnerability/resilience, Risk status, Evacuation plans)
  - ★ Post-Disaster Maps (Recovery plans, Reconstruction /rehabilitation, IDP monitoring)



# Hazard Exposure

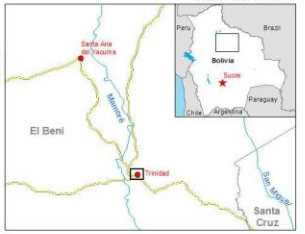



GLIDE number: N/A

Activation ID: EMSN-014
Product N.: 01RioMamore_v1

**Rio Mamore - BOLIVIA**
**Flood risk assessment - 01/11/2014**
Hazard Exposure Map - Detail 01 Trinidad

Production date: 17/11/2014




**Cartographic Information**

1:20000

Full color ISO A1, low resolution (100 dpi)

0 0.5 1 2 km

N

Grid: WGS 1984 UTM Zone 20S map coordinate system
Tick marks: WGS 84 geographical coordinate system

**Legend**

**Risk Assessment**
Hazard Index
0 - Very Low
1
2
3
4
5
6
7 - Very High

**General Information**
Area of Interest

**Settlements**
Residential
Commercial
Educational
Green Area
Industrial
Recreational

**Hydrology**
Lake
River

**Industry / Utilities**
Extraction Mine

**Transportation**
Aerodrome
Bridge
Runway
Primary Road
Secondary Road
Local Road
Track
Aerodrome

**Map Information**

ivia are regularly afflicted by massive flooding during the rainy
ason in April. Departments El Beni and La Paz (northern part)
use of extensive wetlands and the presence of large rivers such
the past decade, the floods which occurred in 2008 and 2014
ent events.
need to better know the areas prone to floods and vulnerability
ure. Proposals related to protection measures and evacuation
locations (Trinidad, Santa Ana del Yacuma, Rurrenabaque and
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nistrative boundaries (IRC 2013), Hydrology, Transportation
ents (Geonames, 2013).
, (acquired on 22/07/2014 14:43 UTC; GSD 0.4 m; 0% cloud
15, all rights reserved.
Survey (acquired on 13/07/2014; GSD 15 m; approx. 5% cloud

OpenStreetMap © OpenStreetMap contributors, Wikimapia.org,
, extracted on 01/10/2014), refined by SIRS. Source information

pating). Height in meters above mean sea level.
and with no gaps.

**ication**
, GeoPDF, GeoJPEG and vectors (shapefile and KML formats).

k framework of current mapping in non-rush mode activation are
ility within a relative short time frame, optimising the available
raphic information has limitations due to scale, resolution, date
nal data sources. The products are compliant with GIO-EMS
specifications.

flood hazard exposure in the area of Trinidad, located near
artment (BOLIVIA). The basic topographic features are derived
by means of visual interpretation of GeoEye-1 image acquired

i been evaluated combining the maximal flood extent layer
(2008 and 2014) and the physical environment (physiography

sen radiometrically enhanced and orthocorrected with RPC
ion data).
curacy of this product is 1.5 m CE90 or better, from native
ground satellite image.
racy of this product is 85% or better, as it is based on visual
ferns on very high resolution optical imagery.
Area of Interest has been analyzed
114 by SIRS under contract 257219 with the European
of the European Commission.
(quality control): SIRS (ODO).
sirs-fr.com
//emergency.copernicus.eu/mapping/list-of-components/EMSN014

I protection
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ard Exposure Map - Detail
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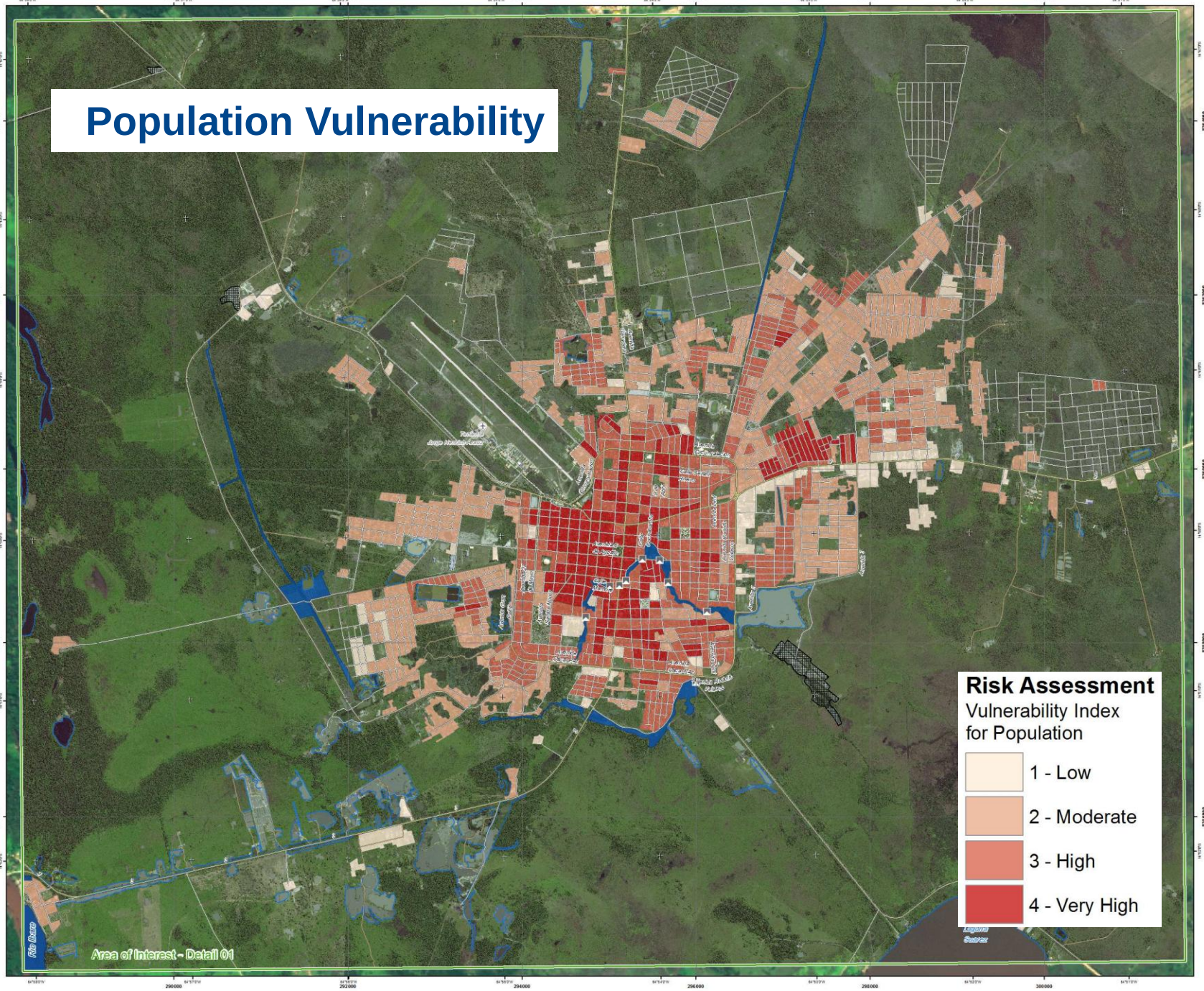
Eye-1 © DigitalGlobe
11-2014

Hazard Index

0 - Very Low
1
2
3
4
5
6
7 - Very High

# Population Vulnerability

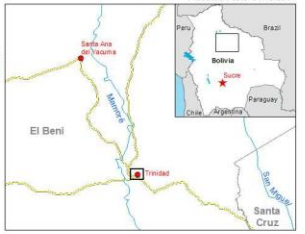



GLIDE number: N/A

Activation ID: EMSN-014
Product N.: 01RioMamore_v1

## Rio Mamore - BOLIVIA
## Flood risk assessment - 01/11/2014
Population Vulnerability Map - Detail 01 Trinidad

Production date: 31/10/2014




**Cartographic Information**

1:20000

Full color ISO A1, low resolution (100 dpi)

0 0.5 1 2 km

N

Grid: WGS 1984 UTM Zone 20S map coordinate system
Tick marks: WGS 84 geographical coordinate system

**Legend**

**Risk Assessment**
Vulnerability Index for Population
- 1 - Low
- 2 - Moderate
- 3 - High
- 4 - Very High

**General Information**
- Area of Interest

**Hydrology**
- Lake
- River

**Industry / Utilities**
- Extraction Mine

**Transportation**
- Aerodrome
- Bridge
- Runway
- Primary Road
- Secondary Road
- Local Road
- Track
- Aerodrome

**Map Information**

The northern territories of Bolivia are regularly affected by massive flooding during the rainy season, which runs from October to April. Departments El Beni and La Paz (northern part) are particularly exposed because of extensive wetlands and the presence of large rivers such as Beni and Mamore. During the past decade, the floods which occurred in 2008 and 2014 appear to be the most significant events.
Local authorities express the need to better know the areas prone to floods and vulnerability of populations and infrastructure. Proposals related to protection measures and evacuation plans for the most populated locations (Trinidad, Santa Ana del Yacuma, Riurrenabaque and Guanay) will be part of the analysis.

**Data Sources**

Inset maps based on: Administrative boundaries (JRC 2013), Hydrology, Transportation (Natural Earth, 2012), Settlements (Geonames, 2013).
GeoEye-1 © DigitalGlobe, Inc. (acquired on 22/07/2014 14:43 UTC, GSD 0.4 m, 0% cloud coverage), provided by e-GEOS, all rights reserved.
Landsat-8 © U.S. Geological Survey (acquired on 13/07/2014, GSD 15 m, approx. 5% cloud coverage).
Base vector layers based on OpenStreetMap © OpenStreetMap contributors, Wikimapia.org, GeoNames (approx. 1:10 000, extracted on 01/10/2014), refined by SIRS. Source information is included in vector data.
Elevation data: SRTM (90m posting). Height in meters above mean sea level.
All Data sources are complete and with no gaps.

**Dissemination/Publication**

Delivery formats are GeoTIFF, GeoPDF, GeoJPEG and vectors (shapefile and KML formats).

**Framework**

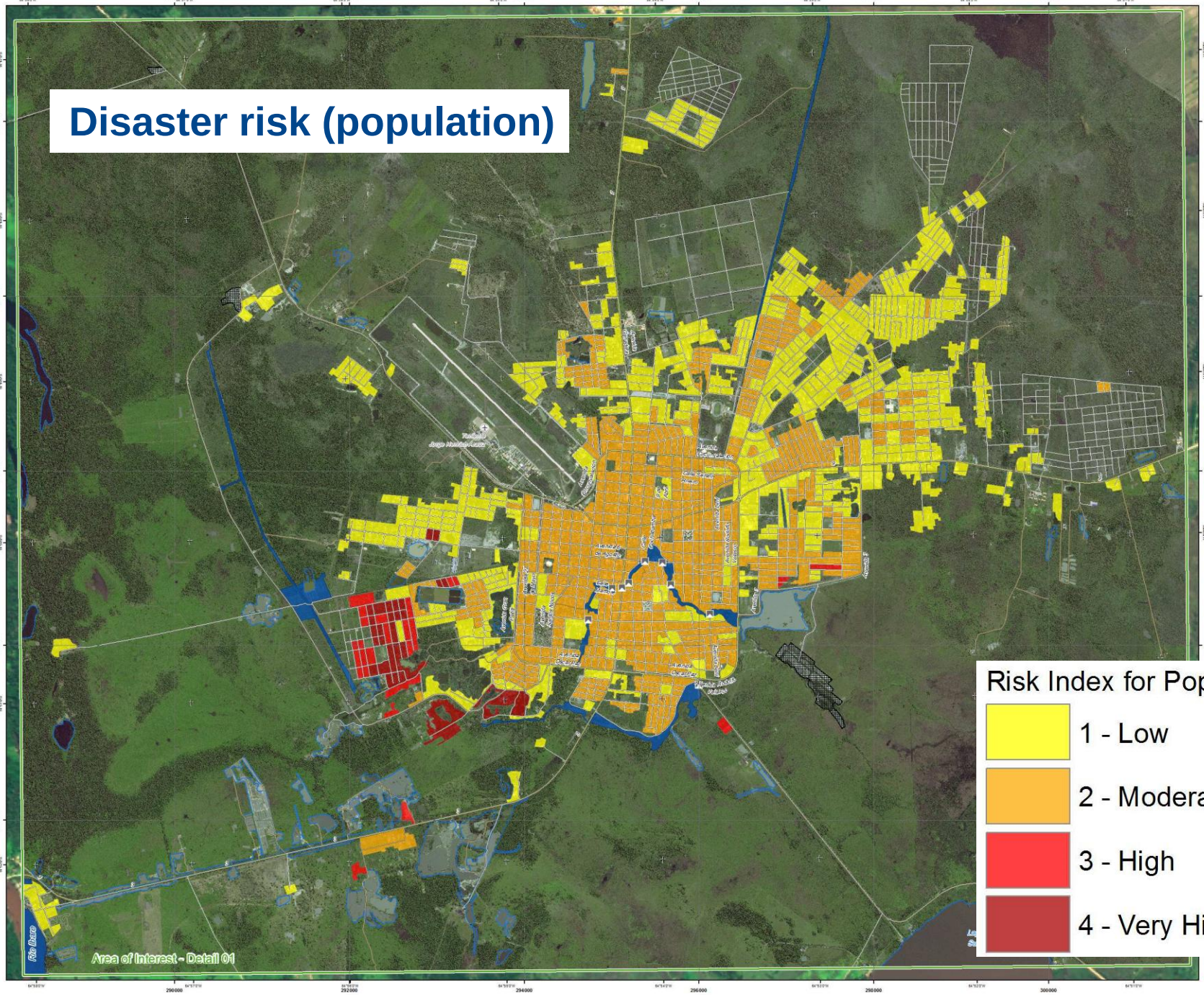
The products elaborated in the framework of current mapping in non-rush mode activation are realized to the best of our ability, within a relative short time frame, optimizing the available data and information. All geographic information has limitations due to scale, resolution, date and interpretation of the original data sources. The products are compliant with GIO-EMS NON-RUSH Product Portfolio specifications.

**Map Production**

The present map shows the population vulnerability in the area of Trinidad, located near Mamoré River in El Beni Department (BOLIVIA). The basic topographic features are derived from public datasets, refined by means of visual interpretation of GeoEye-1 image acquired on 22/07/2014.
The vulnerability index for population has been evaluated from the land cover / land use layer and the estimate of population density.
All satellite images have been radiometrically enhanced and orthocorrected with RPC approach (using SRTM elevation data).
The estimated geometric accuracy of this product is 1.5 m CE90 or better, from native positional accuracy of the background satellite image.
The estimated thematic accuracy of this product is 85% or better, as it is based on visual interpretation of recognizable items on very high resolution optical imagery.
Only the area enclosed by the Area of Interest has been analyzed.
Map produced on 31/10/2014 by SIRS under contract 257219 with the European Commission. All products are © of the European Commission.
Name of the release inspector (quality control): SIRS (ODO).
E-mail: emergency.nonrush@sirs-fr.com

Map products available at http://emergency.copernicus.eu/mapping/list-of-components/EMSN014

# Disaster risk (population)

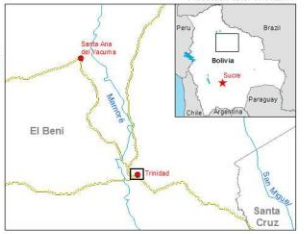



GLIDE number: N/A

Activation ID: EMSN-014
Product N.: 01RioMamore_v1

**Rio Mamore - BOLIVIA**
**Flood risk assessment - 01/11/2014**
Disaster Risk Map for Population - Detail 01 Trinidad

Production date: 17/11/2014




**Cartographic Information**

1:20000 — Full color ISO A1, low resolution (100 dpi)

0 0.5 1 2 km

N

Grid: WGS 1984 UTM Zone 20S map coordinate system
Tick marks: WGS 84 geographical coordinate system

**Legend**

**Risk Assessment**
Risk Index for Population
1 - Low
2 - Moderate
3 - High
4 - Very High

**General Information**
Area of Interest

**Hydrology**
Lake
River

**Industry / Utilities**
Extraction Mine

**Transportation**
Aerodrome
Bridge
Runway
Primary Road
Secondary Road
Local Road
Track
Aerodrome

**Map Information**

The northern territories of Bolivia are regularly afflicted by massive flooding during the rainy season, which runs from October to April. Departments El Beni and La Paz (northern part) are particularly exposed because of extensive wetlands and the presence of large rivers such as Beni and Mamore. During the past decade, the floods which occurred in 2008 and 2014 appear to be the most significant events.
Local authorities express the need to better know the areas prone to floods and vulnerability of populations and infrastructure. Proposals related to protection measures and evacuation plans for the most populated locations (Trinidad, Santa Ana del Yacuma, Rurrenabaque and Guanay) will be part of the analysis.

**Data Sources**

Base maps based on: Administrative boundaries (UNC 2013), Hydrology, Transportation (Natural Earth, 2012), Settlements (Geonames, 2013).
GeoEye-1 © DigitalGlobe, Inc. (acquired on 22/07/2014 14:43 UTC; GSD 0.4 m; 0% cloud coverage); provided by e-GEOS, all rights reserved.
Landsat-8 © U.S. Geological Survey (acquired on 13/07/2014; GSD 15 m; approx. 5% cloud coverage).
Base vector layers based on OpenStreetMap © OpenStreetMap contributors, Wikimapia.org, GeoNames (scale: 1:10.000, extracted on 01/10/2014), refined by SIRS. Source information

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SIRS under contract 257219 with the European European Commission.
control): SIRS (ODO).
m

ency.copernicus.eu/mapping/list-of-components/EMSN014

ion

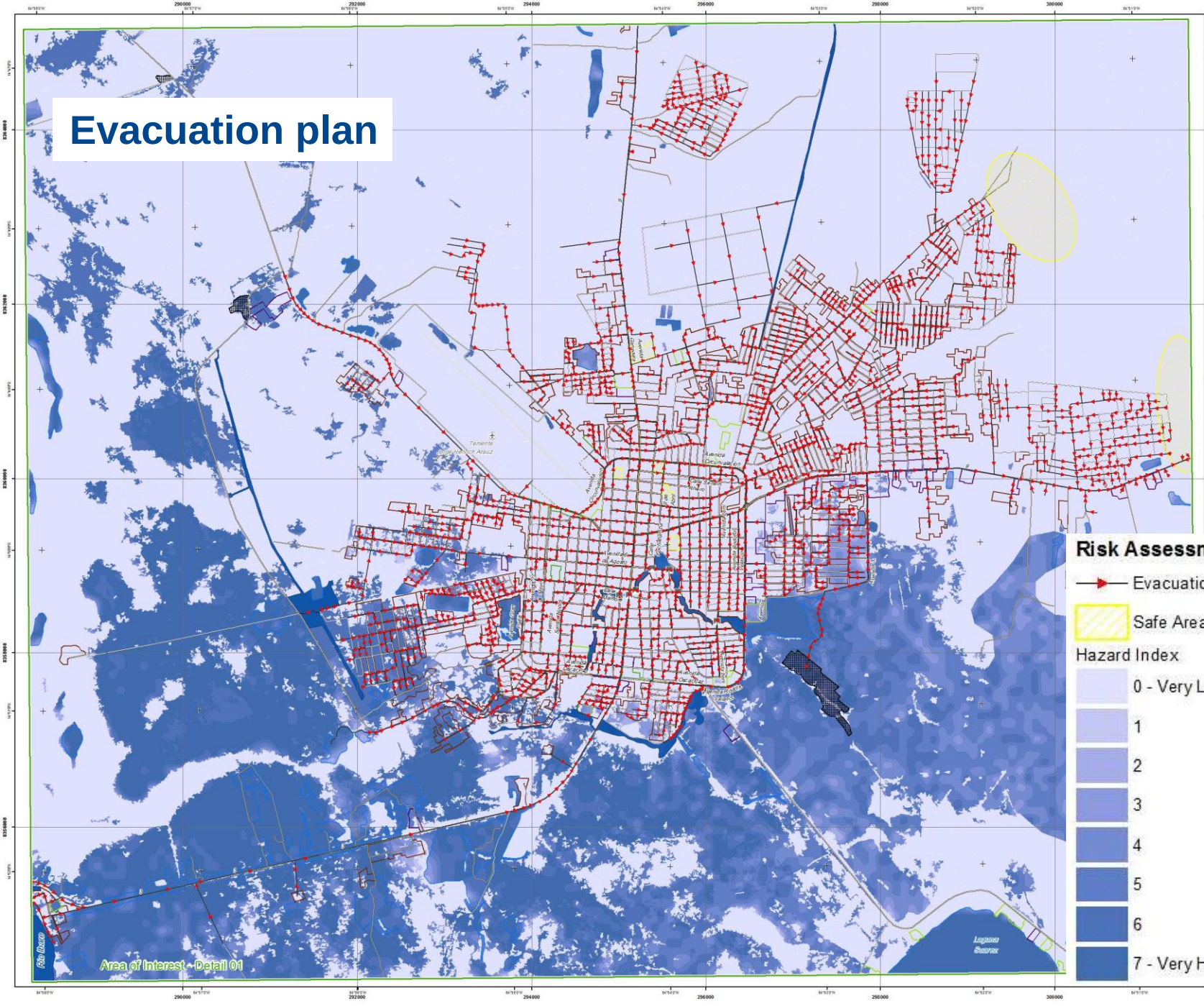
l Map for Population - Detail

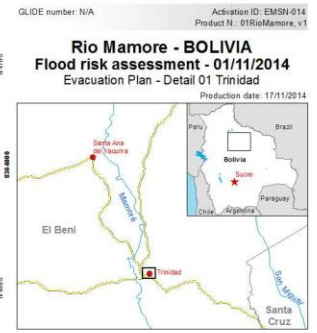
DigitalGlobe

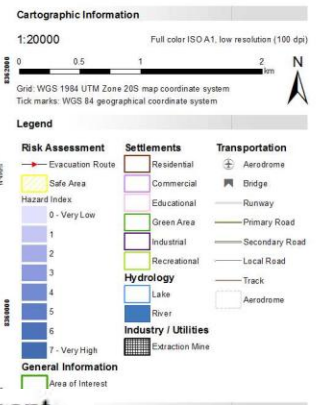
opernicus
The European Earth Observation Programme

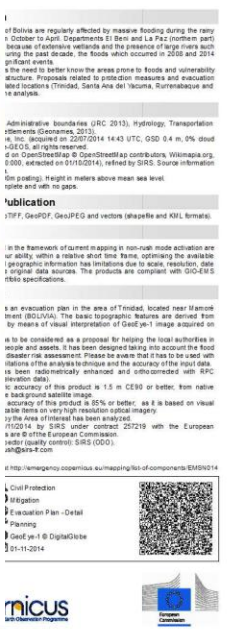
European Commission

# Evacuation plan

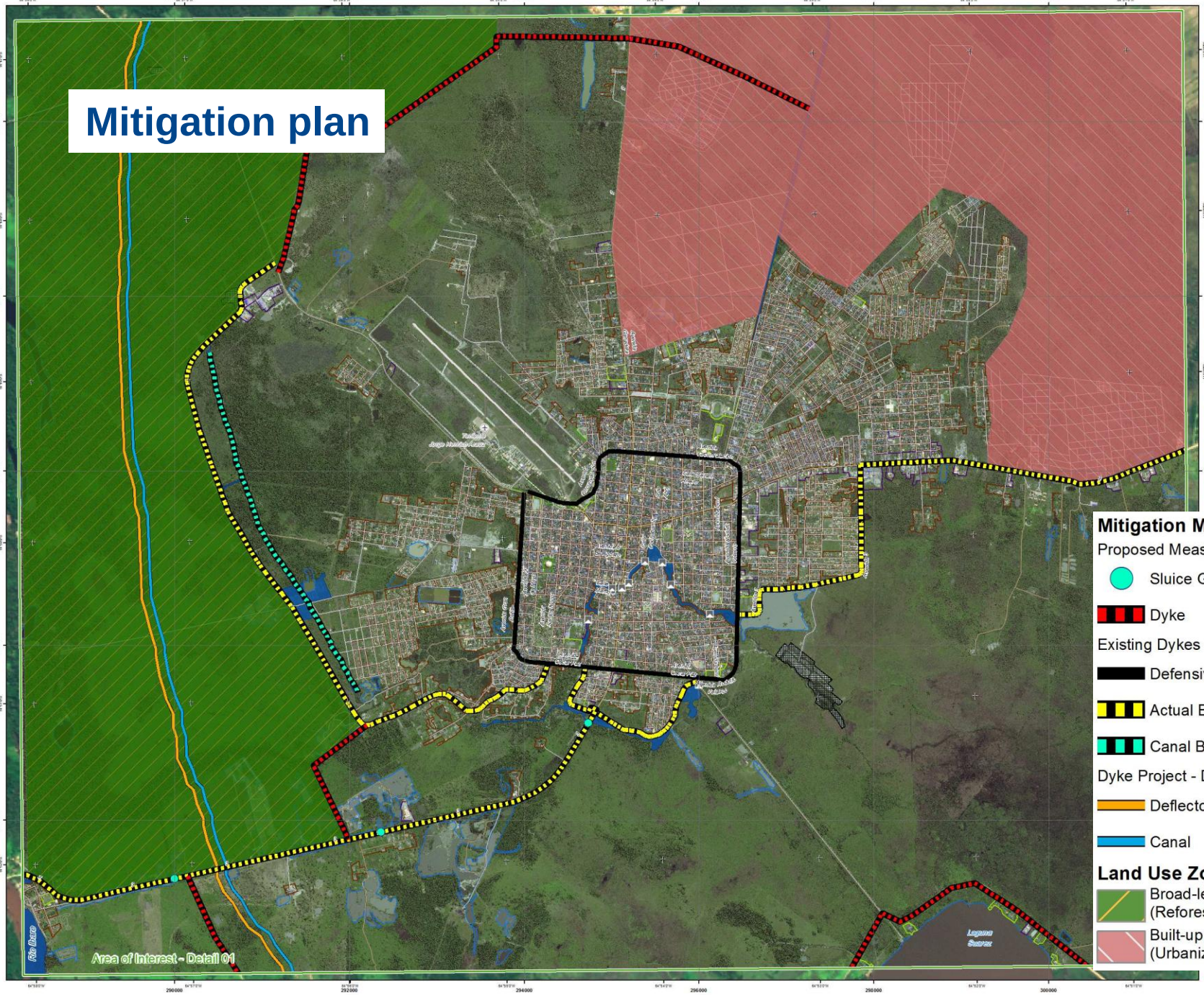


# Mitigation plan

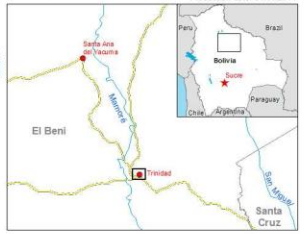



GLIDE number: N/A

Activation ID: EMSN-014
Product N.: 01RioMamore_v1

**Rio Mamore - BOLIVIA**
**Flood risk assessment - 01/11/2014**
Mitigation Measures Map - Detail 01 Trinidad

Production date: 01/11/2014




**Cartographic Information**

1:20000

Full color ISO A1, low resolution (100 dpi)

0 0.5 1 2 km

N

Grid: WGS 1984 UTM Zone 20S map coordinate system
Tick marks: WGS 84 geographical coordinate system

**Legend**

**Mitigation Measures**
Proposed Measures
Sluice Gate
Dyke
Existing Dykes
Defensivo Trinidad
Actual Bi-Nacional
Canal Bi-Nacional
Dyke Project - Deflector Trinidad
Deflector
Canal

**Land Use Zoning Plan**
Broad-leaved forest (Reforestation)
Built-up area (Urbanization)

**General Information**
Area of Interest

**Settlements**
Residential
Commercial
Educational
Green Area
Industrial
Recreational

**Hydrology**
Lake
River

**Industry / Utilities**
Extraction Mine

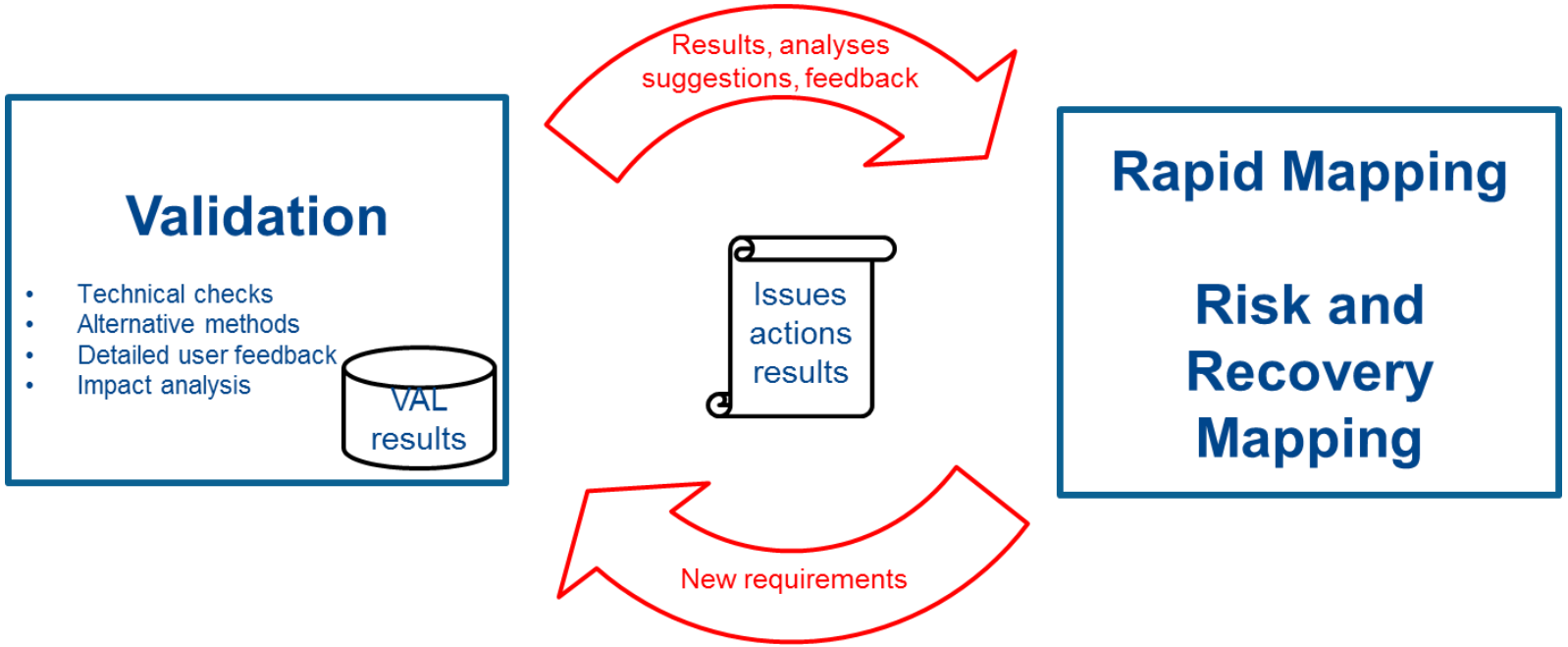
**Transportation**
Aerodrome
Bridge
Runway
Primary Road
Secondary Road
Local Road
Track
Aerodrome

**Mitigation Measures**
Proposed Measures
Sluice Gate
Dyke
Existing Dykes
Defensivo Trinidad
Actual Bi-Nacional
Canal Bi-Nacional
Dyke Project - Deflector Trinidad
Deflector
Canal

**Land Use Zoning Plan**
Broad-leaved forest (Reforestation)
Built-up area (Urbanization)

# Mapping Validation

- ★ For quality and value assessment of RM and RRM products
- ★ Activated by EC (JRC), typically 12 validation campaigns per year (field surveys, product validation and valuation)

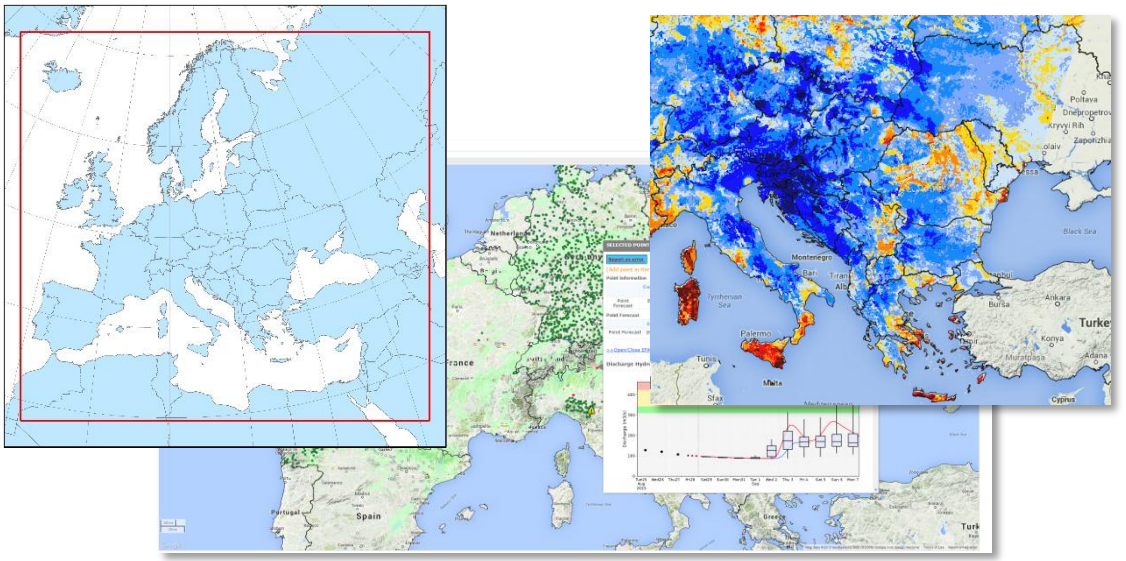


# The European Flood Awareness System

- **Need:** lack of coherent flood information and coordination in Europe for trans-national flood events, e.g. during Elbe and Danube floods in 2002
- **Aim:** EFAS provides added value, trans-national flood early warning information to EC civil protection and national authorities.
- **JRC :** started development in 2003 - since September 2012 fully operational as part of the Copernicus Emergency Management Service

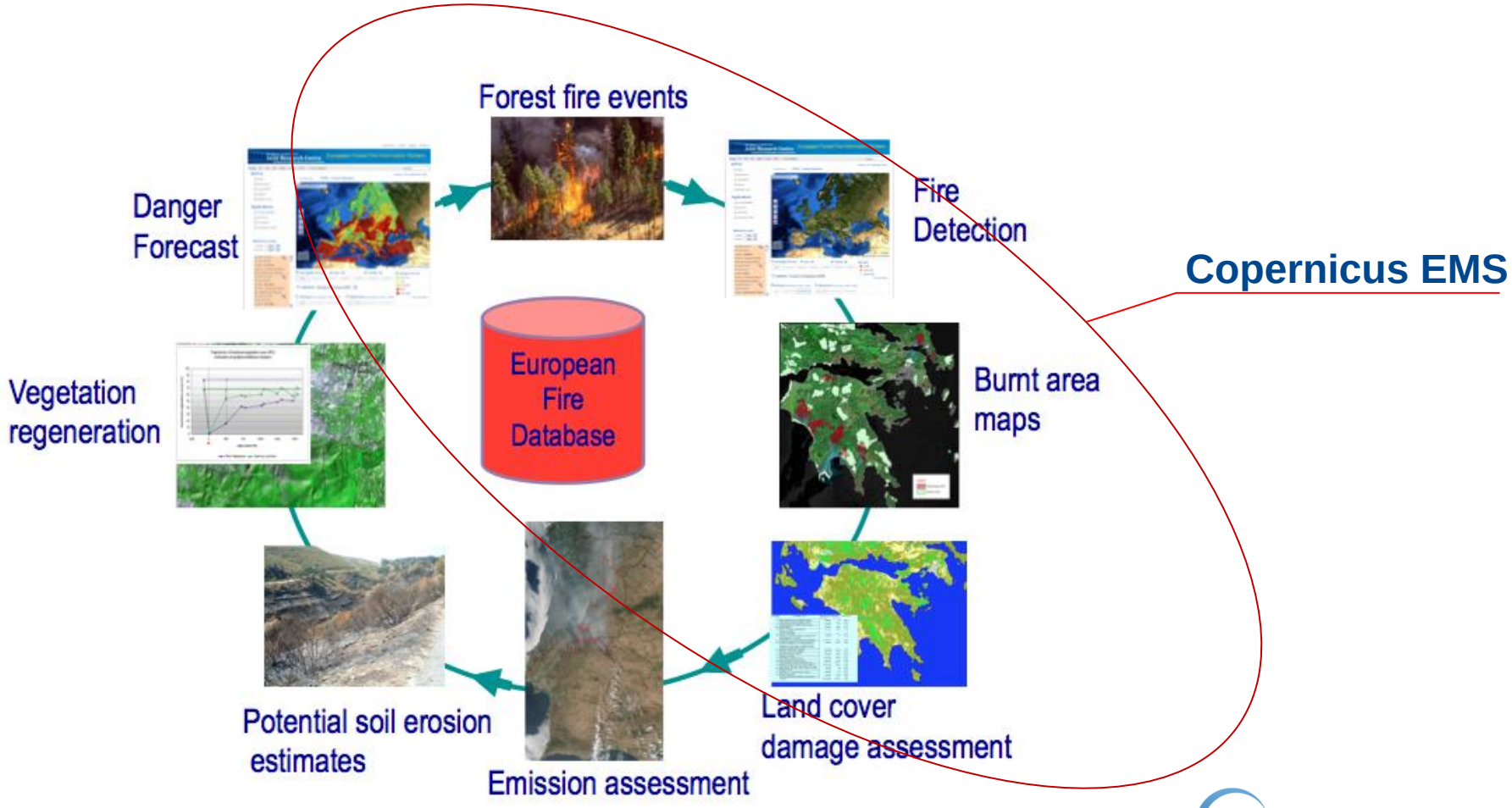
**What:**

- ✓ Flood early warning info for up to 10 days
- ✓ Probabilistic flood forecasts (different NWP models)
- ✓ River basin wide, European scale
- ✓ Flash flood specific forecasts
- ✓ Web interface: www.efas.eu
- ✓ Web services: WMS-T and SOS



European Commission

# European Forest Fire Information System (EFFIS)



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# More info:
# Copernicus EMS Portals

**emergency.copernicus.eu**

★Service overview
★Activations
★Products (maps, vector data)
★Support tools (GeoRSS, Map of Activations, Map Coverage Planner etc)

**www.efas.eu**

**www.effis.jrc.ec.europa.eu**


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# Thank you for attention

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