Comparison between flooding events of Seveso river and their impact on urbanized areas

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Abstract

The goal of the analysis is to make a comparison between three different flooding events that affected Seveso river, in order to understand the impact on the urbanized areas.

In order to perform the analysis we collect some data from the Geoportal of Lombardy Region and we elaborate them with Qgis.

At the end we were able to compare the different flooding events not only quantitatively from the data we obtained but also visually from the maps.

Dataset

Historical flooding between Ticino and Adda Rivers

In particular, we took into account only the ones related to the Seveso river:

- 27 November 2002, released by Lombardy Region
- 8 July 2014, released by Lombardy Region
- 15 November 2014, released by the authority of Po river basin

Water system of Lombardy Region

Land cover (DUSAF of 1999 and 2015)

All the data are vector shape files and the reference system is WGS84/UTM32

Metodology

1. Manual selection of Seveso river and its inflowing and outflowing streams

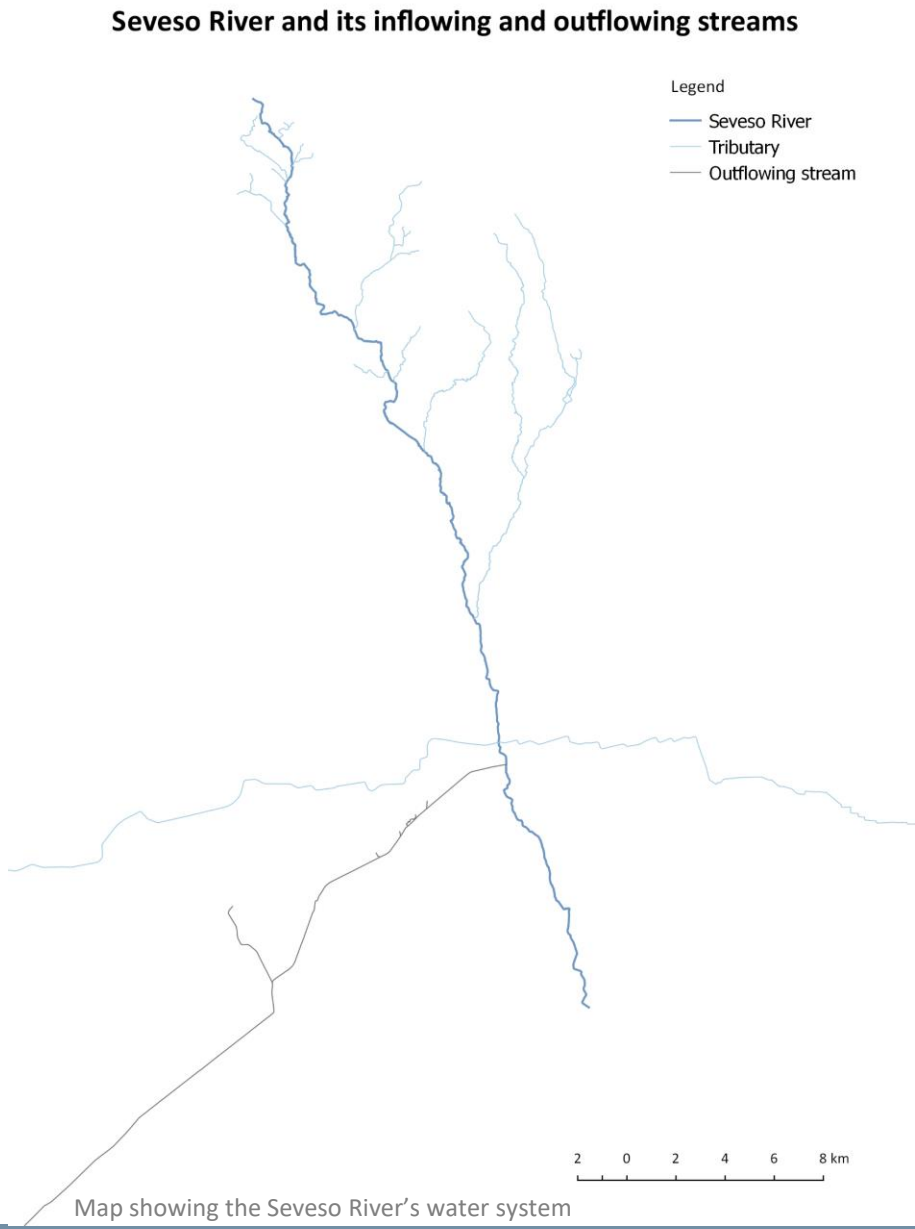
2. Clipping the Dusaf shape file on the flooding areas' polygons (for the three events with the two different Dusaf)

3. Selection by attributes of the urbanized areas and division into categories

4. Calculation of the total area affected by flood in the different years and the percentage for each categories

1. Manual selection of Seveso river and its inflowing and outflowing streams

Starting from the shape file of the water system we exported the Seveso river and its tributaries and outflowing stream by a manual selection. From this selection we discovered the presence of an artificial by-pass channel (Canale scolmatore nord ovest) realized in 1954 to decrease the capacity of the Seveso river.

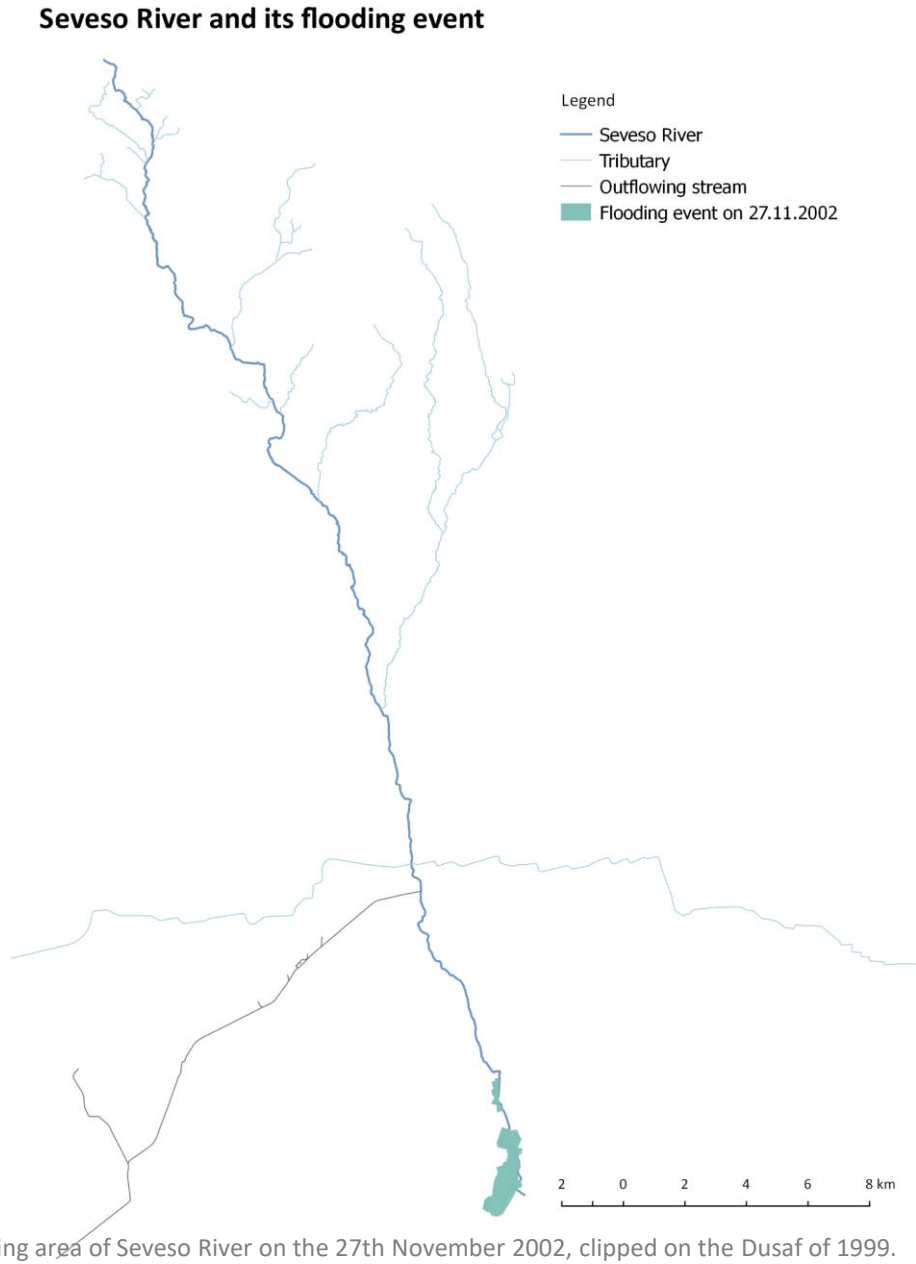


Map showing the Seveso River's water system

2. Clipping the Dusaf shape file on the flooding areas' polygons

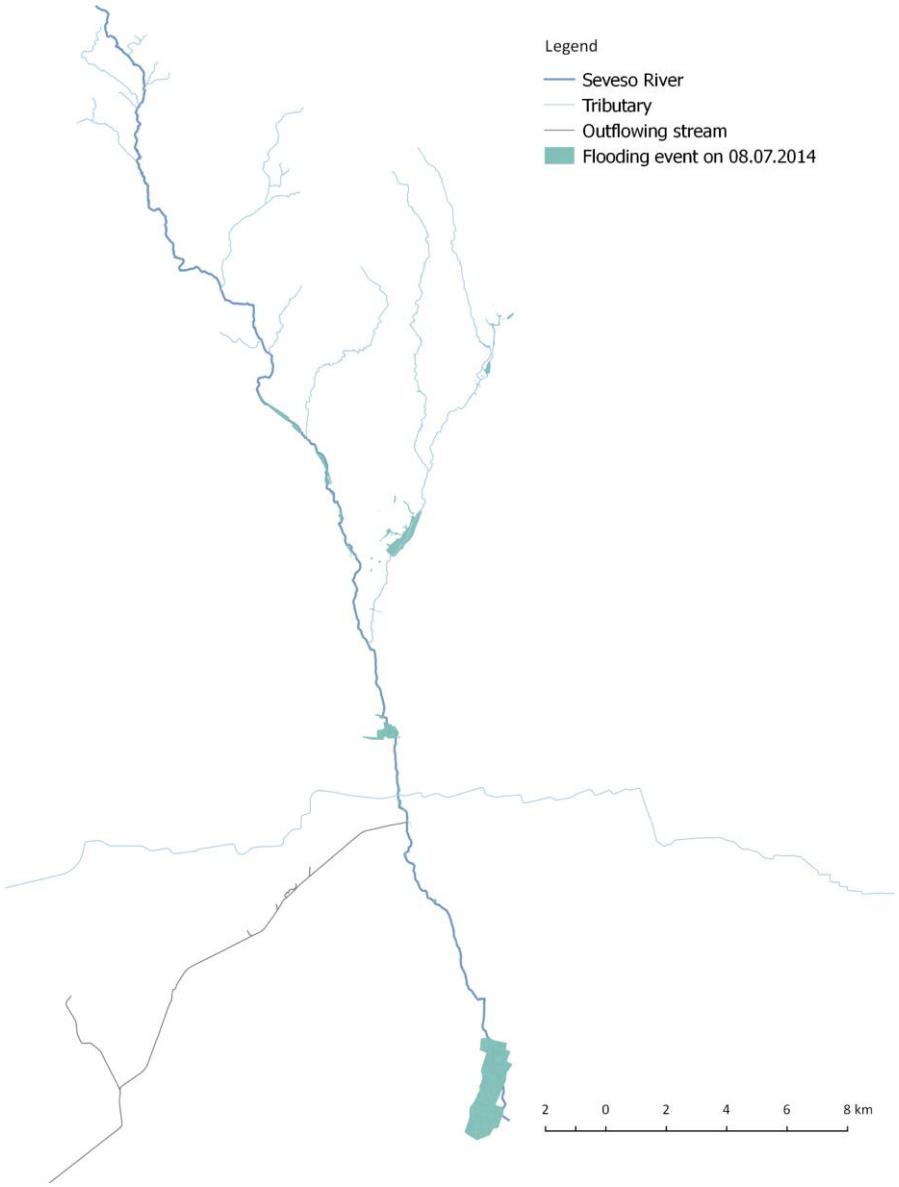
In order to understand the impact of Seveso River flooding events on the urbanized areas, we took the DUSAF shape file related to the years close to the flooding events: DUSAF 1999 for the flooding event of 2002 and DUSAF 2015 for the two flooding events in 2014 (because was impossible to find a DUSAF dataset before 2014 except for the DUSAF of 1999).

At this point, with the clip tool we cut the DUSAF only in the flooding areas, in order to have information about the land cover. To perform this operation we placed the DUSAF as input layer and the flooding area polygon as clip layer.
We repeated the same procedure for the other two flooding events with the corresponding DUSAF files.

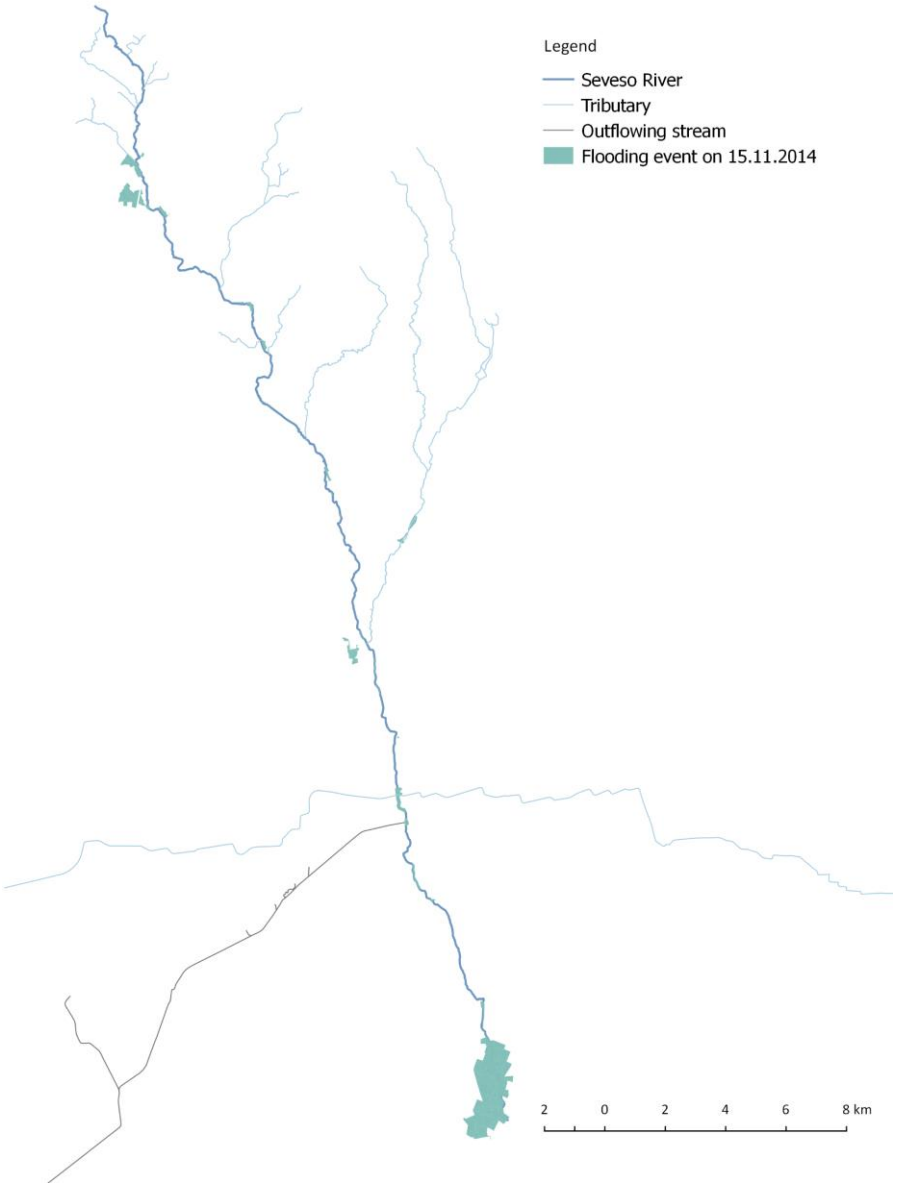


Map showing the flooding area of Seveso River on the 27th November 2002, clipped on the Dusaf of 1999.

Seveso River and its flooding event



Seveso River and its flooding event



Maps showing the flooding area of Seveso River on the 8th July 2014 and 15th November 2015, clipped on the Dusaf of 1999.

3. Selection by attributes of the urbanized areas and division into categories

Then, we did a selection by attributes, for each clipped shape file, decodifying the DUSAF5 (according to the common legend) and considering only the urbanized areas that we divided into 3 categories.

Each one of these categories has been exported as single shape file for the three different flooding events we analysed, then we assigned a different colour to each category.

Each one of these categories has been subdivided as follow:

A) Residential areas and public services

- Impianti di servizi pubblici e private
- Tessuto residenziale denso
- Tessuto residenziale discontinuo
- Tessuto residenziale continuo mediamente denso
- Tessuto residenziale sparso
- Impianti sportivi
- Cantieri
- Insediamenti ospedalieri
- Tessuto residenziale rado e nucleiforme
- Cimiteri

B) Industrial areas

- Insediamenti industriali artigianali commerciali
- Insediamenti produttivi agricoli

C) Urban green spaces

- Parchi e Giardini

D) Infrastructures

- Aeroporto ed eliporti
- Reti stradali e spazi accessori
- Reti ferroviarie e spazi accessori

4. Calculation of the total area affected by flood in the different years and the percentage for each categories

At this point, using the Statistic Panel, we calculated the **area** of the total flood and we subtracted the urbanized area affected by the natural event (A,B,C,D categories), in order to obtain the area of not-urbanized land involved in the flooding event.

Later, we focused on the urbanized area affected and we calculated the **percentages** of each categories using a proportion.

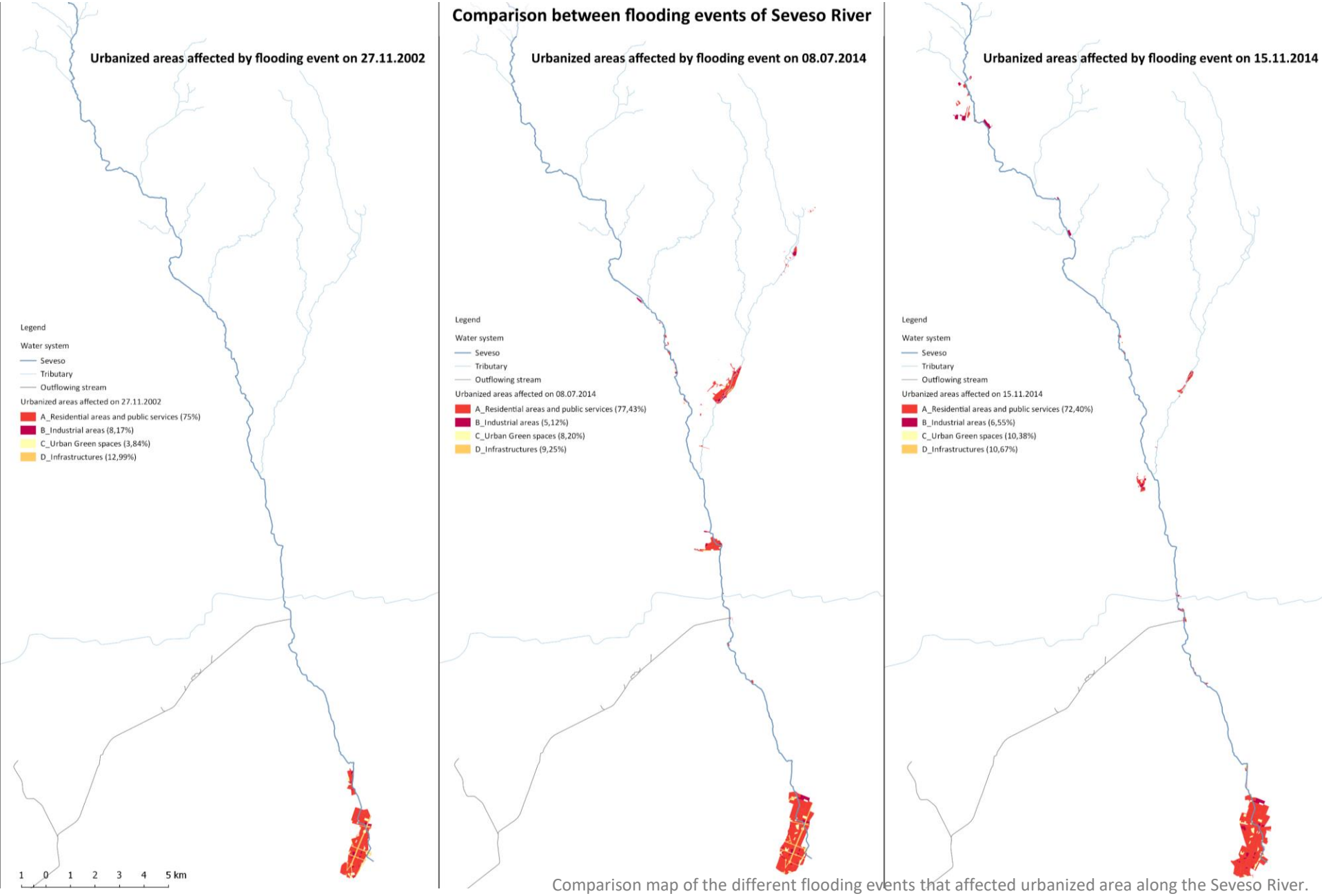
	Overflow November 27, 2002	**Overflow July 8, 2014**	**Overflow November 15, 2014**
Total area of overflow	2,103 km^2	4,38 km^2	4,35 km^2
Built environment	2,08 km^2= 98,90% of total	3,90 km^2=89,04% of total	3,66 km^2=84,13% of total
A* - *Residential areas and public services	75%	77,43%	72,40%
B* – *Industrial areas	8,17%	5,12%	6,55%
C* – *Urban green	3,84%	8,20%	10,38%
D* – *Infrastructures	12,99%	9,25%	10,67%

Table showing the data we obtained.

Conclusions

During the three floods taken into account, the percentage that represents the area of the built environment has decreased significantly. In fact, it goes from 98.90% referred to the flood of 2002 to 84.13% of the flood of November 15, 2014: this means that the appropriate measures to control the flow of the River Seveso have been efficient.

In conclusion, looking at the data we can say that the categories most involved during the flooding events are the residential areas and infrastructure. Moreover, as far as the second flood is concerned urban green areas are also significantly affected: figures of urban green areas involved in the flood of November 15, 2014 are very similar to those of infrastructure.



Comparison map of the different flooding events that affected urbanized area along the Seveso River.