

Report of the progress in creating flood risk cadaster

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AGENZIA REGIONALE STRATEGICA
PER LO SVILUPPO ECOSOSTENIBILE
DEL TERRITORIO



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Summary

1. Introduction	3
2. Data collection methodology	3
2.1. Public fire brigades.....	4
2.2. Civil protection, city institutions, departments, and institutions	6
2.3. Public opinion polls.....	7
2.4. Online sources and newspapers	9
2.5. The Croatian Basic Map (HOK).....	9

1. Introduction

Adequate recording of historical flood events over a period has a huge impact on the precise reliability of susceptibility mapping (Mind'je et.al, 2019) and therefore flood risk mapping. To delineate flood-prone areas and assess mitigation measures it is essential to acquire available historical flood extent data and create flood inventory containing records of floods events that happened at the research area. Flood inventory data is usually used together with different conditioning factors for risk modelling (Mind'je et.al, 2019).

Within Flood Risk Management (FMR) framework, historical information is defined as all data that allows the description and analysis of past flood events. Sources of information on floods are all documents related to the phenomenon (photographs, videos, graphics, etc.). Flood data are related to three dimensions: documentary, temporal and spatial. The documentation dimension refers to historical flood events and their characteristics (significance of the event, damages, persons involved in the management of the event) which are identified from historical documents. The time dimension refers to the event's date, period, or duration. The spatial dimension refers to each recorded event that is spatially referenced and then described through one or more spatial entities (Davoine, 2004). Such a reference can appear in various forms: line (stream, street, etc.), polygon (settlement, district, etc.), point (location of the destroyed or damaged infrastructures). In the context of a Flood cadastre, such spatial entities are connected with the temporal entities.

2. Data collection methodology

Considering that there is no official database on pluvial floods on the National level and also for research cities, to create a Flood cadastre for the city of Poreč, Zadar, Gospić, Metković, Biograd, and Split historical floods data were collected and integrated from all available sources which include: (1) Public fire brigades, (2) Civil protection, city institutions, departments, and

institutions, (3) Public opinion polls, (4) online sources, newspapers and (5) Croatian Basic Map (HOK). Collected historical floods have a temporal and spatial dimension and depending on the source, a documentary dimension.

2.1. Public fire brigades

In each city we had official meetings with firefighters who provided us a database of emergency incidents concerning the pluvial flooding in the research area. During the flood events, firefighters respond to the interventions to help the local population and have to manage the interventions database reporting locations, time, and type of event. That database encompasses various types of interventions such as technical interventions in an open and closed space (wildfires interventions, traffic accidents, rescuing people stuck in elevators, pulling cars from the sea, removing branches threatening to fall, rescuing cats from roofs or trees, etc.) and interventions on water (rescuing drowned people, pumping water from flooded areas, floods). Floods data are part of water interventions, and sometimes technical interventions.



Figure 1. Data collection with the firefighters

To obtain a specific type of flood (pluvial floods), it is necessary to perform data filtering. Also, for different fire brigades, the format of the intervention database is different, i.e. some fire brigades have a database in digital form while some have only data in analogue form. All available data from the fire brigade were digitized, then filtered (pluvial floods were isolated), geocoded, and transferred to GIS format. In addition, at the meetings, firefighters plotted polygons or points (spatial dimension) on an analog orthophoto map and marked the frequency of the flooding. These locations were geocoded and converted to GIS format. Also, the firefighters guided us within the city area to show the critical locations, which we collected with the GPS device (spatial dimension) and inserted into the GIS database/flood cadastre.



Figure 2. Meetings with the firefighters

2.2. Civil protection, city institutions, departments, and institutions

In addition to meetings with firefighters, to develop a flood cadastre and flood risk cadastre, official meetings were held with representatives of:

- Civil Protection
- City Administration
- Various city departments (eg Department of Physical Planning and Construction, Department of Public Utilities)
- Institutions (eg. Vodovod, Nasadi, Odvodnja, County Development Agencies)
- Legal entities (Hrvatske vode).

Representatives of these institutions plotted historical floods on the analog orthophoto map and filled out a public opinion poll in which they highlighted the most critical locations within the study area. The mentioned data were geocoded and the existing GIS database was updated. These institutions also provided us the data necessary to generate the pluvial flood risk model: critical urban elements (eg schools, hospitals, hotels, churches, clinics, shops, roads, protected cultural monuments, housing, and commercial buildings) and elements of urban infrastructure (stormwater drainage system, wastewater drainage system).



Figure 3. Meeting in Gospić



Figure 4. Meetings with the representatives of Civil Protection, City Administration, various city departments, institutions, and legal entities in the city of Poreč, Metković, Biograd, Zadar, and Split

2.3. Public opinion polls

Public opinion survey was conducted only at the meso-level of research. The survey was conducted among adults (18+ years old) and included 0,5% of the total population in each city. Each questionnaire was filled out at a different address. The type of sample was stratified, and

the selection was random. Particular care was taken to include respondents living in different zones of potential vulnerability and to have an equal representation of the male and female population. Guests, tourists, and passers-by could not be respondents

The key issues in the development of the flood cadastre are:

- Has there been any damage to your property from pluvial floods in the last 10 years?
- Has there been any damage to the infrastructure in the vicinity of your residential building in the last 10 years from pluvial floods?
- Which city district or street is particularly endangered by pluvial floods?



Figure 5. Public opinion polls

Along with the questionnaire of the respondents, critical locations regarding pluvial floods were plotted on an analog orthophoto, and all the listed locations were geocoded and entered into the GIS database of pluvial floods.

2.4. Online sources and newspapers

National and local newspapers were researched in-depth for articles describing flood damages and conditions. Their archive was easily accessible with good quality and coverage through the years. Pictures and videos obtained from national channels, newspapers, websites, and residents were exceptionally revealing of the conditions of flooding.

2.5. The Croatian Basic Map (HOK)

The Croatian Basic Map (HOK) is the basic official state map and is made at a scale of 1: 5000. The official state map is a coded image of natural and constructed objects of the earth's surface, which is made for the entire territory of the Republic of Croatia. The HOK was produced from the 1960s (1954) until 2009, when the last papers were released for official use. From the Croatian basic map, water surfaces that indicate flooding throughout history have been vectorized.

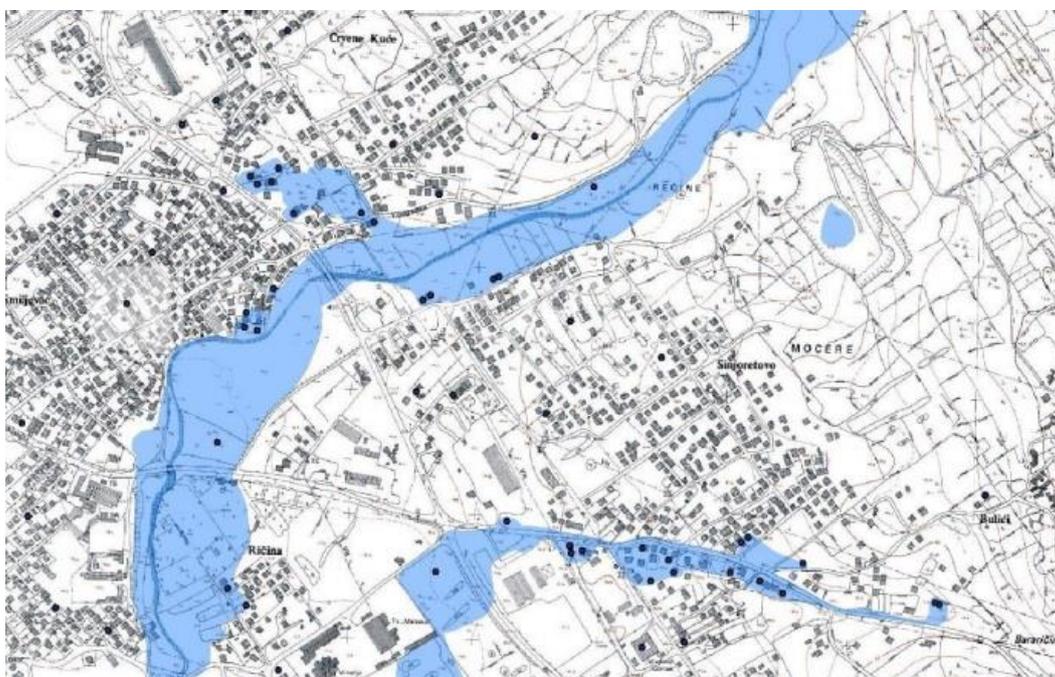


Figure 6. Water surfaces on Croatian basic map