FLOODS IN CROATIA
Societal and economic impacts and responses in the newspapers

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Damages caused by natural hazards
Croatia, period 1981-2010

- The growing number of natural disasters in recent years is threatening the world as a whole, and it is also not rare in Croatia with climatic and seismic conditions.
- The average damage during the last 30 years was determined to be US$ 247 millions per year (1.3% of GDP annually) (Figure 1).
- About 80% of the total damage is caused by the direct impacts of natural hazards.
- They are also responsible for many untypical hazards such as wildfires, landslides, plant diseases and pests as well as for the intensity of technical and technological disasters (Figure 2).
- The relationship between different natural hazards in particular year during the long-term period in Croatia is very variable concerning frequency of appearance and damage magnitude (Figure 3).

Damages caused by floods
Counties along the Croatian Adriatic coast, period: 1995-2010

- The largest damage caused by floods in relation to total county damage (Figure 4) is indicated in the Lika-Senj county (3). It covers the part of the coast and the islands with the mountainous hinterland of Lika characterized by high precipitation amounts and complex hydrological regime in this rural area.
- The second county in relation to the damages is Primorje-Gorski kotar county located over the cyclonic area of Kirsten bay and the mountainous area of Gorski kotar which has the largest amounts of precipitation in Croatia and intense short-term rainfall [5, 6, 7].
- The third county according to flood damages is Dubrovnik-Neretva county in the very southern part of the coast. It also has the highest absolute flood damage in million USD in analysed period 1995-2010 (Figure 5, up-right panel). The frequent flooding in the town of Dubrovnik during the rain showers causes economic losses, but mainly due to the unconstructed or incomplete urban drainage system. On the other hand, the unimpeded flow of water often floods the town of Dubrovnik with intense agricultural activity (Figure 7). The percentage of river floods due to the catchment (Figure 8). The floods were mostly frequent in June, followed by August and September.

Responses in the newspapers
Causes of floods
- Meteorological and Hydrological service of Croatia (DHMZ) releases daily online newspaper articles which discuss events from the scope of DHMZ. According to the articles that reported on floods, except the flooding of the sea, there have been 334 floodings of different spatial and temporal scale and with very different amounts of damage of the period 2000-2010.
- Severe damage can be caused by flooding of the major rivers: the Danube, Sava, Drava and Mura river in the mainland, which belong to the Black Sea catchment, and the Neretva river which flows into the Adriatic Sea. They have a source outside of the Croatian territory, and the rise of the rivers levels and potential flooding, is mainly due to hydrological events in neighboring countries (Slovenia, Hungary, Bosnia and Herzegovina or even in the upper part of the river catchment in Germany, Austria or Italy)
- There are the larger number of smaller watercourses, dry river beds, canals, lakes, karst springs and underground rivers that can also cause flooding.
- Causes of flooding are usually abundant rainfall (short-and long-term), and snow melting.
- In the case of abundant convective precipitation, a short-term and spatially limited flooding appears. In the event of prolonged rainfall, the flooding is caused by this precipitation itself. There are also small mountain streams, the river beds fill and pour. Floods in this case may affect the larger area. In the karst area, the springs and rivers can also be activated. River spills are usually caused by hydrological events in neighboring countries, and can be combined with hydrological events in Croatia. Such flooding can also affect larger areas.
- Snow melting, especially rapidly, can cause increased water levels of rivers, forming a torrential watercourse, lake level rise, and outbreaks of water from underground karstic springs.

Figure 1. Damage caused by natural hazards and its relationship to the gross domestic product for Croatia, 1981-2010.

Figure 2. Types of natural hazards and their share in the total damage in Croatia, 1981-2010.

Figure 3. Types of natural hazards and their share in the total damage in particular in the period 1981-2010 in Croatia.

Figure 4. Flood damage and its share in GDP for Croatia, 1981-2010.

Figure 5. Types of natural hazards and their share in the total damage in counties along the Croatia eastern Adriatic coast, 1995-2010.

Figure 6. Total number of flood events and throughout the year in Croatian Counties at the eastern Adriatic coast and catalogued from the newspaper articles for the period 2000-2010.

Figure 7. The percentage of river floods due to the catchment.

Figure 8. Classified floods in counties along the Croatian eastern Adriatic coast.