PILOT PROJECT ON CLIMATE CHANGE ADAPTATION: BUILDING THE LINK BETWEEN FLOOD RISK MANAGEMENT PLANNING AND CLIMATE CHANGE ASSESSMENT IN THE SAVA RIVER BASIN

Program for development of Flood Risk Management Plan in the Sava River Basin

SERBIA
REMINDER


- **Dates set by the Law:**
  - The flood risk management plans for the territory of the Republic of Serbia and for its water districts shall be delivered in 2017
  - The timetable of the interim steps (preliminary flood risk assessment, preparation of flood hazard and flood risk maps) is not set in the Law

- **Present status:**
  - PFRA is finished, but not published
  - APSFR determined, but not published
  - Flood maps are prepared only for a part of Serbia (EU funded project) – **not for the Sava River basin**
  - Official Methodology for the Preparation of Flood Hazard Maps and Flood Risk Maps is in preparation
PFRA - CONTENT

- maps of the river basin district, including sub-basin boundaries, topography, land use
- description of the floods which have occurred in the past
- assessment of the potential adverse consequences of future floods.

APSFRs are watercourses or settlements where:
- significant flood occurred in the past, or
- significant flood may occur in the future

PFRA - STATUS

- **December 2011**: PFRA and identification of APSFRs for the territory of RS completed
- **December 2012 (expected)**: PFRA and APSFRs for the territory of RS adopted
## APSFRs in the Sava River Basin in Serbia

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<th>Catchment area &gt; 500 km²</th>
<th>APSFR</th>
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<td>Bačevačka reka</td>
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<td>Barajevska reka</td>
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Current status of flood mapping in Serbia

- SoFPAS project (*Study of flood prone areas in Serbia – phase 1, IPA 2007*) – 2010-2012

- SoFPAS phase 2 – possible extension to all APSFR in Serbia, including the Sava, Drina and Kolubara rivers - in 2013?

- Left and right side of the Danube River between Belgrade municipality Zemun (km 1175) and the upstream end of the Iron Gate gorge (km 1040)

- Larger rivers in the Velika Morava river basin
Flood hazard maps

- Atlas 1:25.000 + WMISS
- Digital ortofoto
- Boundaries of flood zones for chosen scenarios ($Q_{1\%}$, $Q_{0.1\%}$)
- Raster layer with flood depths in 4 classes
  ($<0.5\ m; 0.5-1.5\ m; 1.5-4\ m; >4\ m$)
Maps of flood risk receptors

- **Population**: the number and age structure, movable and immovable property, particularly sensitive areas (hospitals, homes for the elderly and the people with special needs, facilities for children: schools, kindergartens)
- **Infrastructure**: road and railroad networks, river ports and airports, power lines above ground and substations; flood protection and water control structures (dams, embankments, pumping stations etc.)
- **Economic activity**: industrial and commercial zones, agricultural areas (differentiated by type), services etc.
- **Protected environment**: protected habitats, water supply, recreation
- **Sources of pollution**: IPPC, waste disposal and other major polluters.
- **Cultural heritage**: monuments, monasteries, museums, castles and archaeological sites.
Flood risk maps

- SoFPAS methodology developed and accepted by beneficiaries
- Official methodology for Serbia should be published in 2013 – it might be simpler?

SoFPAS methodology

Risk $R = V \cdot P$

$V$ – probability of a flood event (0 – 100%),
$P$ – potential adverse consequences of flood

Probability of a flood event $V = V_p (1 - V_s)$

$V_p$ – probability of a flood
$V_s$ – reliability of flood protection system (0 none – 0.99 highly reliable)

Pot. adverse consequences of floods $P = k \cdot s(h) \cdot e$

$k$ - value of risk receptor,
$s(h)$ – damage function
$e$ - exposure of risk receptor to flood

Total risk $R_T = \text{Sum}(R)$
determined for cadastral municipalities (CM) to enable prioritization within the risk management plans

The total risk for CM is calculated by multicriteria analysis (MCA) and includes total risk for specific classes of risk: population, economic activities, infrastructure, environment and cultural heritage

$R_T = MCA(R_{T, \text{popul}}, R_{T, \text{econ}}, R_{T, \text{inf}}, R_{T, \text{envir}}, R_{T, \text{cult}})$
Flood risk maps (SoFPAS)

Risk maps for all risk receptors

- Population
- Economic activity
- Infrastructure
- Environment
- Cult. heritage

Flood risks are aggregated on the cadastral municipality level

Multicriteria analysis

Total risk map