



# Sustainable Flood Protection measures in the Danube basin

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**EUSDR Environmental Pillar Stakeholder Seminar**

Budapest, 17 October 2017

# Floods and Danube River Basin

- Repeated devastating flood events over past decades at the Danube Basin level (Czech Republic, Hungary, Poland, Romania, Germany, Serbia, Bosnia and Herzegovina, etc.)
- Substantial efforts undertaken at the ICPDR level for the implementation of the EU Directive on assessment and management of floods risk
- Flood Risk Management Plan for the Danube River Basin has been developed and is under implementation
- Important EU funds for reconstruction works for damaged infrastructure but more resources needed for flood defence and prevention schemes
- Effects of climate change will influence floods events in the future







# Main objectives of the Flood Risk Management in the Danube River Basin

- Public safety – reducing risk to people
- Property protection – public infrastructure and private property
- Reduction in emergency response during floods
- Avoid loss of critical services – fire, police, medical etc.
- Environmental enhancement and restoration



FHA data for the Danube floodplain in BA, RO and RS was taken from the Danube Floodrisk Project. FHA data for Valika Morava floodplain in RS was taken from the SOFPAS 1 project. FHA data for SI was provided for 11 out of 21 relevant flood hazard areas (based on watershed size and national importance criteria).

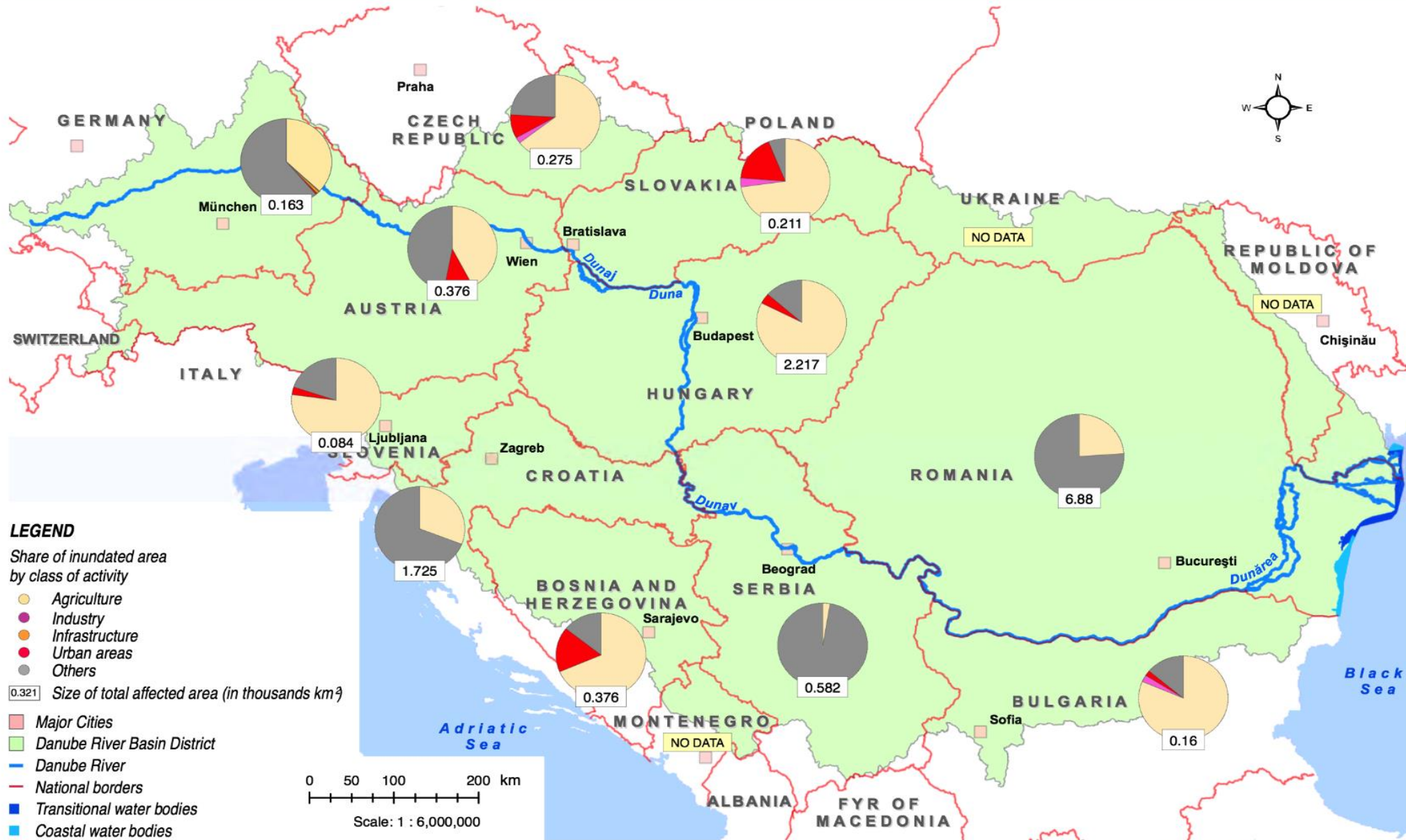
This ICPDR product is based on national information provided by the Contracting Parties to the ICPDR (AT, BA, BG, CZ, DE, HR, HU, ME, MD, RO, RS, SI, SK, UA) and CH. EuroGlobalMap data from EuroGeographics was used for all national borders except for AL, BA, ME where the data from the ESRI World Countries was used; Shuttle Radar Topography Mission (SRTM) from USGS Seamless Data Distribution System was used as elevation data layer; data from the European Commission (Joint Research Center) was used for the outer border of the DRBD of AL, IT, ME and PL.



Flood risk data in RS is roughly assessed only for the Danube River corridor. Flood risk data in BG and RO is available only for the Danube river, based on the Danube FLOODRISK project results.

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 Vienna, November 2015



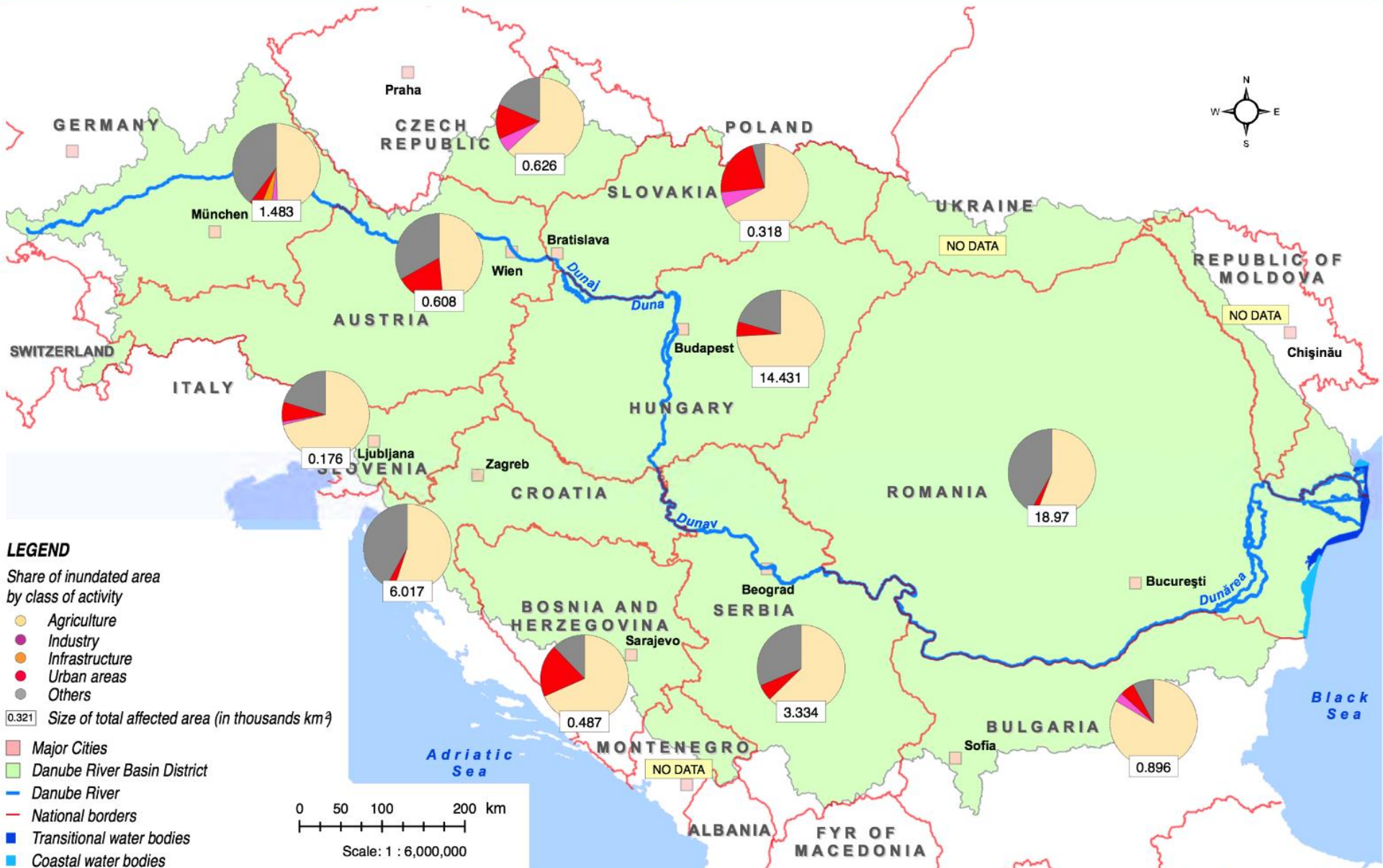


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[www.icpdr.org](http://www.icpdr.org)



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Vienna, November 2015



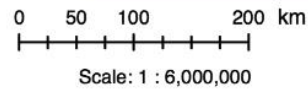
### LEGEND

Share of inundated area by class of activity

- Agriculture
- Industry
- Infrastructure
- Urban areas
- Others

0.321 Size of total affected area (in thousands km<sup>2</sup>)

- Major Cities
- Danube River Basin District
- Danube River
- National borders
- Transitional water bodies
- Coastal water bodies



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# River flooding and flash floods/ debris flow



# Main measures in the Danube River Flood Risk Management Plan

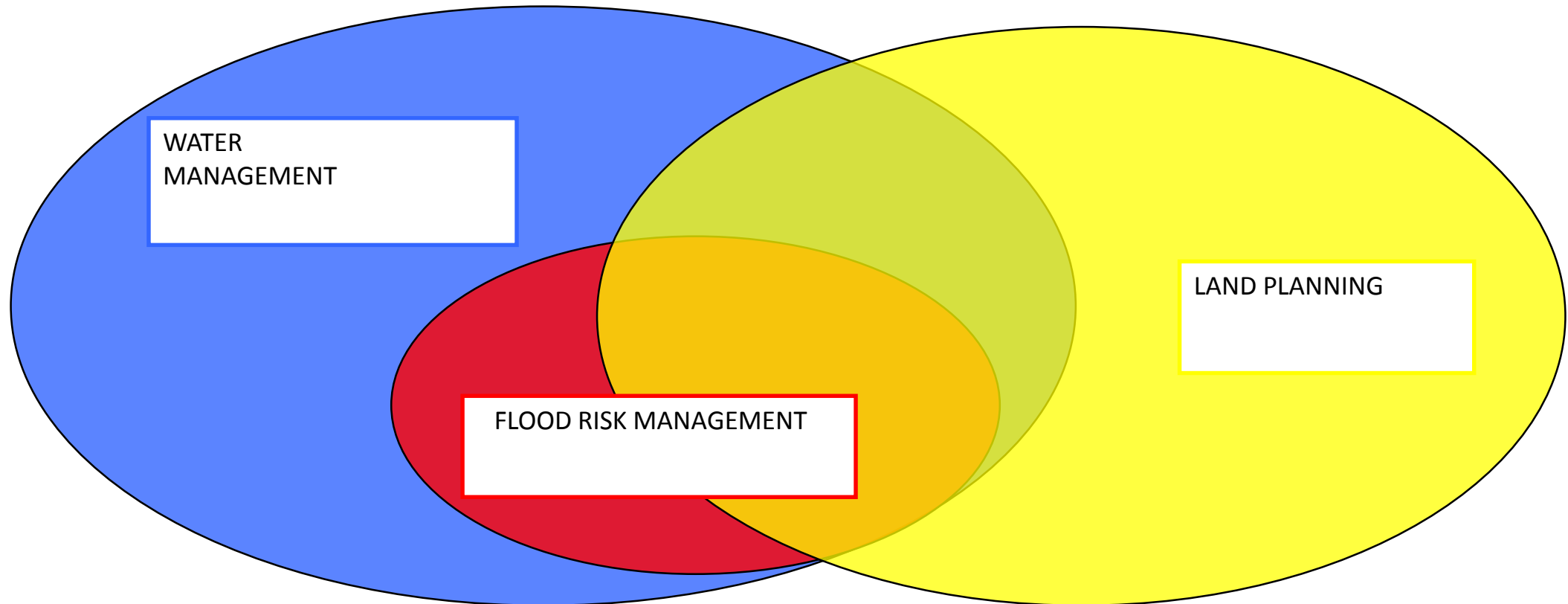
- To avoid new risks
- To reduce existing risks
- To strengthen resilience
- To increase resilience
- To apply solidarity principle

# Type of measures in the Danube River Flood Risk Management Plan

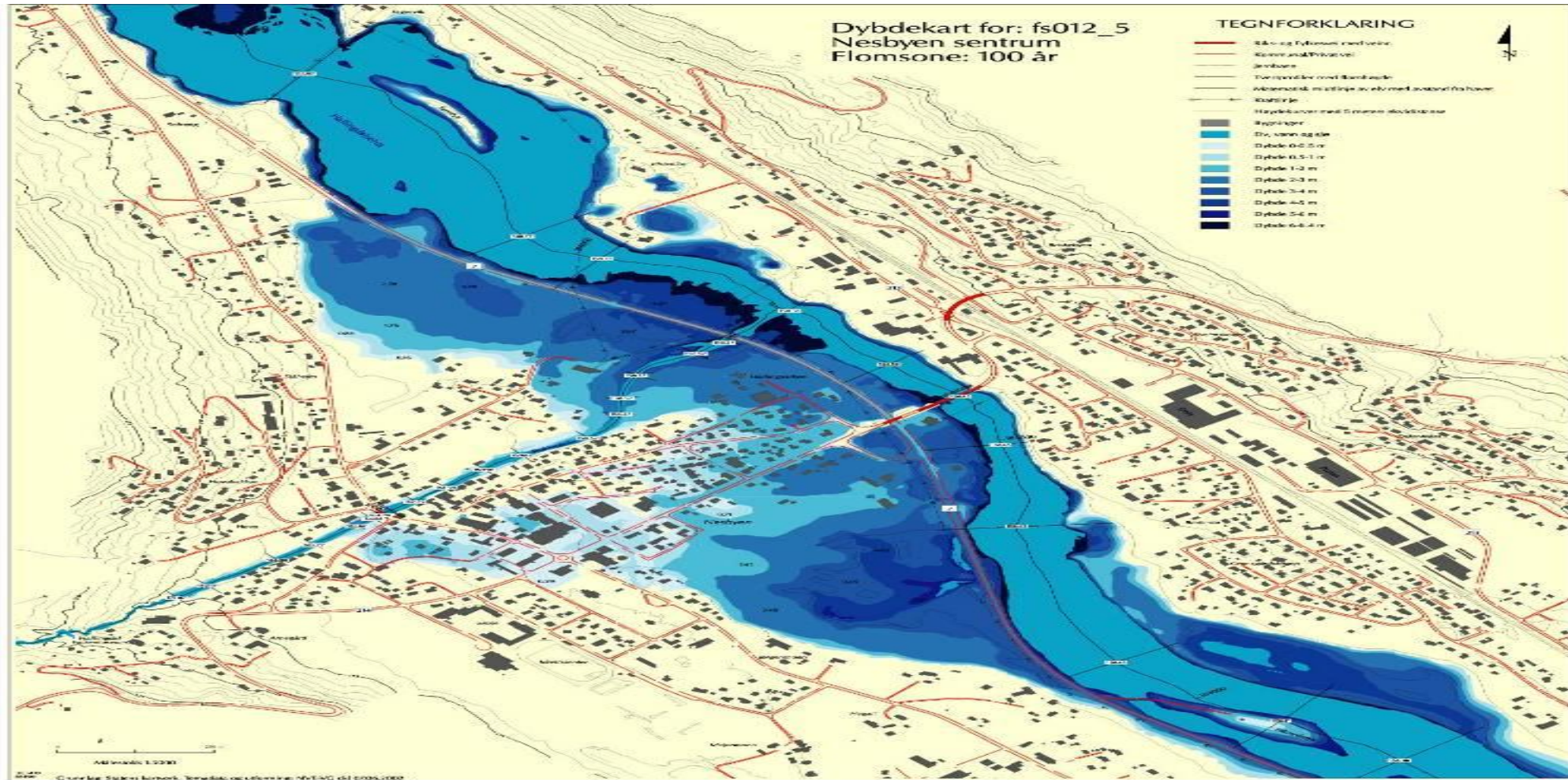
- Preventive, operational and reparatory
- Structural and non-structural
- Environmentally friendly
- Taking into account the climate change and future developments
- Involving public participation
- Planned at the basin level and implemented at the national and local level

# Land planning for flood management

Need for coordination



# Flood Risk Maps important for land planning

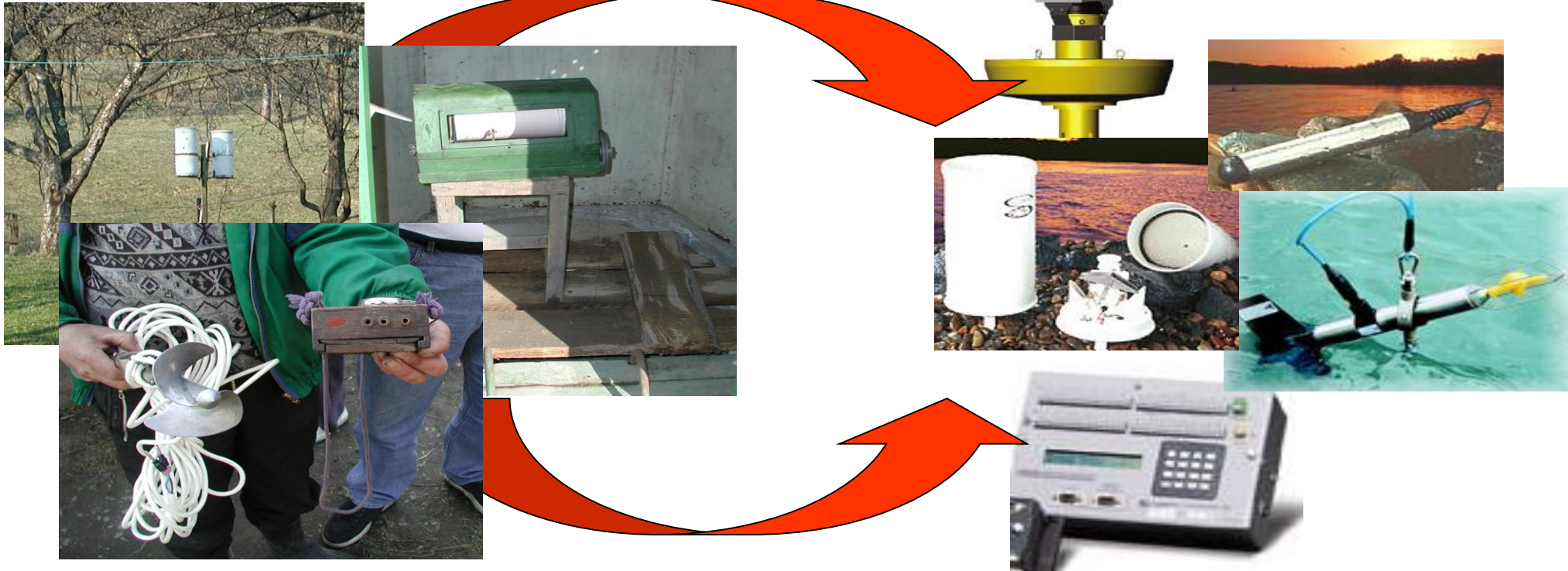




**UPGRADE OR REPLACE THE EXISTING STRUCTURES:**







### REPLACE MANUAL SENSORS WITH AUTOMATIC HYDROMETRIC STATIONS:

- ✿ Water level sensors (float, pressure, radar, soil moisture);
- ✿ Water temperature sensors;
- ✿ Precipitation sensors;
- ✿ Environmental quality sensors (dissolved oxygen, conductivity, pH, turbidity);
- ✿ Heavy metal ion (nitrates, phosphates, etc.)

```
ZCZC 001  
SRRO40 JHMM 130600  
HHXX 13061  
44216 2210042 50045 60050 3311313 51643 71383 5510010 50060=  
44218 2210102 50110 60124 3311993 72253 5511050 50000=  
44353 nil=  
44358 2210007 50009 60010 3312332 72422 5511050 50000=  
44360 2210  
44363 nil=  
44367 nil=  
44369 2210  
44373 nil=  
44376 nil=  
44378 2210  
nnnn
```

SITUAȚIA ȘI PROGNOZA HIDROLOGICĂ

Râu (Fluviu)	Starea	Prognoza
1. Danubiu	în creștere	se va menține în creștere
2. Siret	stationară	se va menține în creștere
3. Prut	în scădere	se va menține în creștere
4. Suceava	în creștere	se va menține în creștere
5. Bistrița	în creștere	se va menține în creștere
6. Ialomița	în creștere	se va menține în creștere
7. Jiu	în creștere	se va menține în creștere
8. Argeș	în creștere	se va menține în creștere
9. Dâmbovița	în creștere	se va menține în creștere
10. Teleorman	în creștere	se va menține în creștere
11. Vâlcea	în creștere	se va menține în creștere
12. Mehedința	în creștere	se va menține în creștere
13. Gorj	în creștere	se va menține în creștere
14. Hunedoara	în creștere	se va menține în creștere
15. Timișoara	în creștere	se va menține în creștere
16. Caraș-Severin	în creștere	se va menține în creștere
17. Buzău	în creștere	se va menține în creștere
18. Prahova	în creștere	se va menține în creștere
19. Ilfov	în creștere	se va menține în creștere
20. București	în creștere	se va menține în creștere

ROMANIA  
MINISTERUL APELOR ȘI PROTECȚIEI MEDIULUI  
COMPANIA NAȚIONALĂ  
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Soc. Buc. roș.Ploiești 97 București 71552 ROMANIA  
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### BULETIN HIDROLOGIC

Anul IV Nr. 60 din 01.03.2002

#### CARACTERIZAREA STĂRII RĂURILOR

în intervalul 28.02.2002 ora 07<sup>00</sup> - 01.03.2002 ora 07<sup>00</sup>

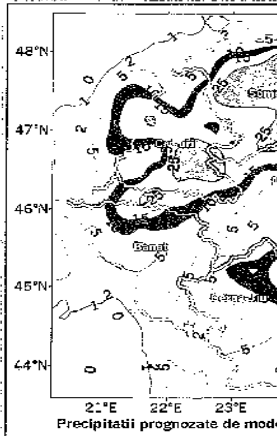
Debitele au fost în general staționare pe râurile din Banat, Oltenia, Muntenia și sudul Moldovei și în creștere, ca stec combinat al precipitațiilor cazute în interval și cedării apei din straturile de zapada din zona de munte, pe celelalte râuri, exceptând cursurile inferioare ale râurilor din Crișana, Tarnavelor și Mureșul (curs mijlociu și inferior), pe care debitele au fost în scădere. Creșteri mai importante s-au produs pe râurile din Maramureș și din bazinul Someșului. Se situau peste COTELE DE ATENȚIE: Someș-Bodan (181+0), Lapus-Lapusel (350+0) și Tur-Călinești Oas (350+20), iar în interval a fost depășită cota de atenție pe Căvanic la s.h. Căvanic (60+2) și pe Vișeu la s.h. Bistra (220) ulterior nivelurile scăzând sub această cotă. Prin explințarea sistemelor hidrotehnice s-au produs variații de debite pe: I'ur, Crișul Raped, Jiu, Argeș, Dâmbovița, și Siret. Debitelor înregistrate la ora 7 se situau peste medile multianuale lunare pe râurile din Maramureș, Crișana, Transilvania, pe Prut, Siret, Suceava, Moldova și Bistrița și sub aceste valori pe celelalte râuri, cu coeficienți moduli cuprinși între 0,30-0,80. S-a menținut gheata la maluri numai pe cursul superior al Bistriței.

Situația nivelurilor

- ↑ în creștere
- staționară
- ↓ în scădere

Situația debitelor față de debitul multianual lunar

- peste medie
- în jurul mediei
- sub medie



QFlow - [C:/QFlow/Houston/basinedit.bop]

DATA	ORA	Temperatura aerului	Temperatura apei	Presiunea aerului	Presiunea apei
28/02/2002	07	21,2	11,3	1019,2	1020,7
28/02/2002	08	21,2	11,0	1019,5	1020,5
28/02/2002	09	21,3	11,1	1019,5	1020,5
28/02/2002	10	21,0	9,8	1020,3	1021,0
28/02/2002	11	21,0	9,8	1020,3	1021,0
28/02/2002	12	21,0	9,8	1020,3	1021,0
28/02/2002	13	21,0	9,8	1020,3	1021,0
28/02/2002	14	21,0	9,8	1020,3	1021,0
28/02/2002	15	21,0	9,8	1020,3	1021,0
28/02/2002	16	21,0	9,8	1020,3	1021,0
28/02/2002	17	21,0	9,8	1020,3	1021,0

Brays Basin

Outflow from Cell(130,142)

SYNOPT

Parametru	Unitate	Valoare
U	Diracție vânt	180
V	Viteza vânt	8,3
T	Temperatura aerului	28,0
Td	Temperatura punct de rouă	9,0
P	Precipitații	992,9
Pp	Precipitații în exces la nivelul mareei	592,9
g	Tendința presiunii	4
ppp	Valoarea tendinței presiunii	690
P2	Precipitații în h	3,3
P2h	Precipitații în h codificate	4,1
h	Indicativul stării	955,0

Enhance analysis and product generation capabilities.





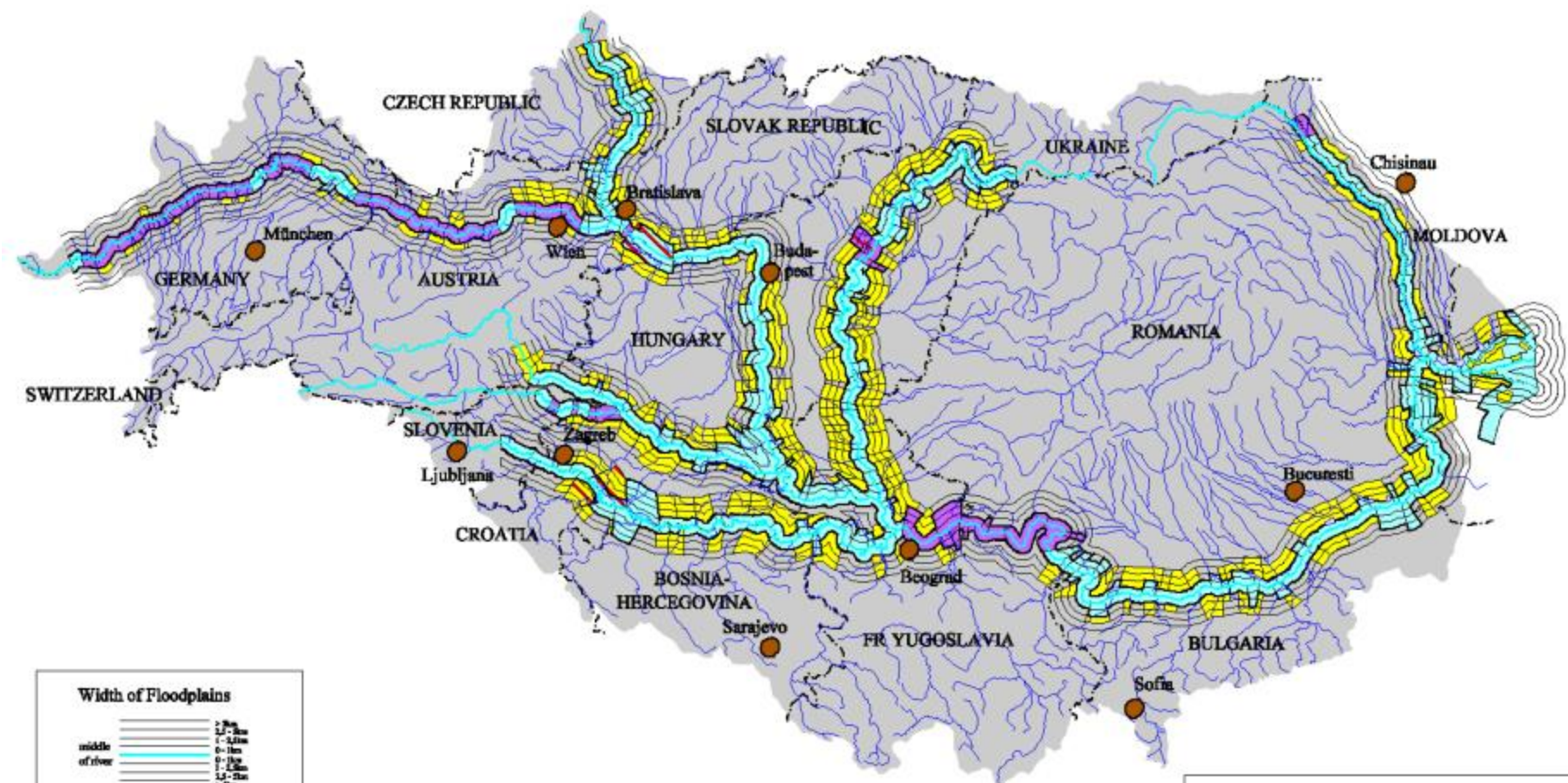
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# Symbolized view of floodplains in the Danube River Basin



**Width of Floodplains**

wide	> 2km
	1.5 - 2km
middle	1 - 1.5km
	0.5 - 1km
narrow	0 - 0.5km
	0 - 0.5km
	1.5 - 2km
	> 2km

**Type of Floodplains**

- Former Floodplains (Yellow)
- Recent Floodplains (Light Blue)
- Back water area of dams (Purple)

Scale: 1:4.500.000

0 50 100 150 kilometers

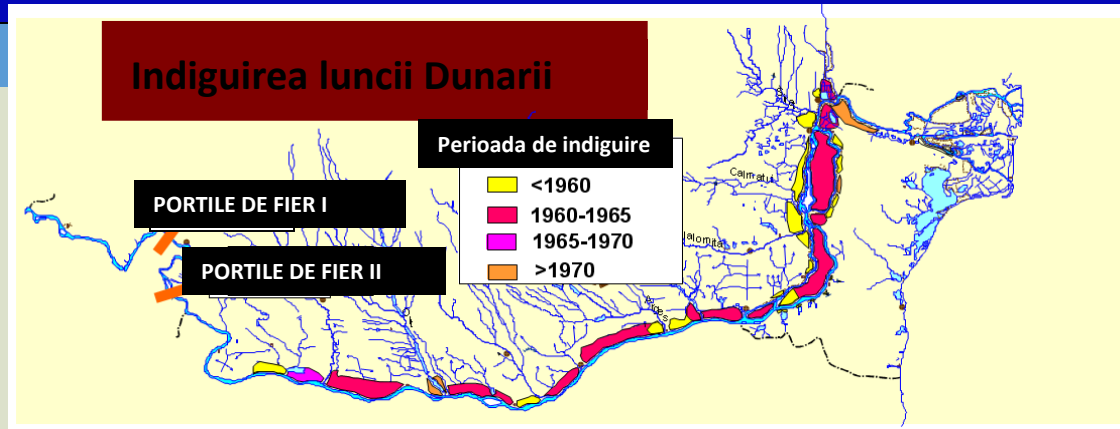
Area of historical floodplains in the study area: 41600 km<sup>2</sup>  
 Area of remaining floodplains in the study area: 8000 km<sup>2</sup>  
 A floodplain loss of more than 80%

**Danube Pollution Reduction Programme**

United Nations Development Programme  
 Global Environment Facility  
 ICPDR - Programme Coordination Unit  
 1400 Vienna, P. O. Box 500, Austria


Produced by WWF Danube-Carpathian-Programme  
 WWF-Auen-Institut (WWF-Germany)  
 Josefstr. 1, D-76437 Rastatt 1999

# Rehabilitation of the wetland areas in the Danube floodplain



# Floodplain restoration





Flood Level



# Flood related activities within EUSDR PA5

- Development and adoption of an overarching Flood Management Plan at the River Basin level
- Support for the rehabilitation of wetlands and floodplains as an effective measure to increase flood protection
- Extension of the coverage of the European Flood Alert System at the entire Danube River Basin

All activities are developed in close cooperation with the ICPDR

# Example of projects related to floods promoted by PA5

- DAREFFORT
- DANUBE FLOODPLAIN
- DAMWARM+
- JOINTISZA
- DANUBE SEDIMENT
- WATERatRISK

**THANK YOU VERY MUCH  
FOR YOUR ATTENTION!**

