EUGEO 2009 Congress
Bratislava, Slovakia

Some problems of fluvial geomorphological research in Slovakia

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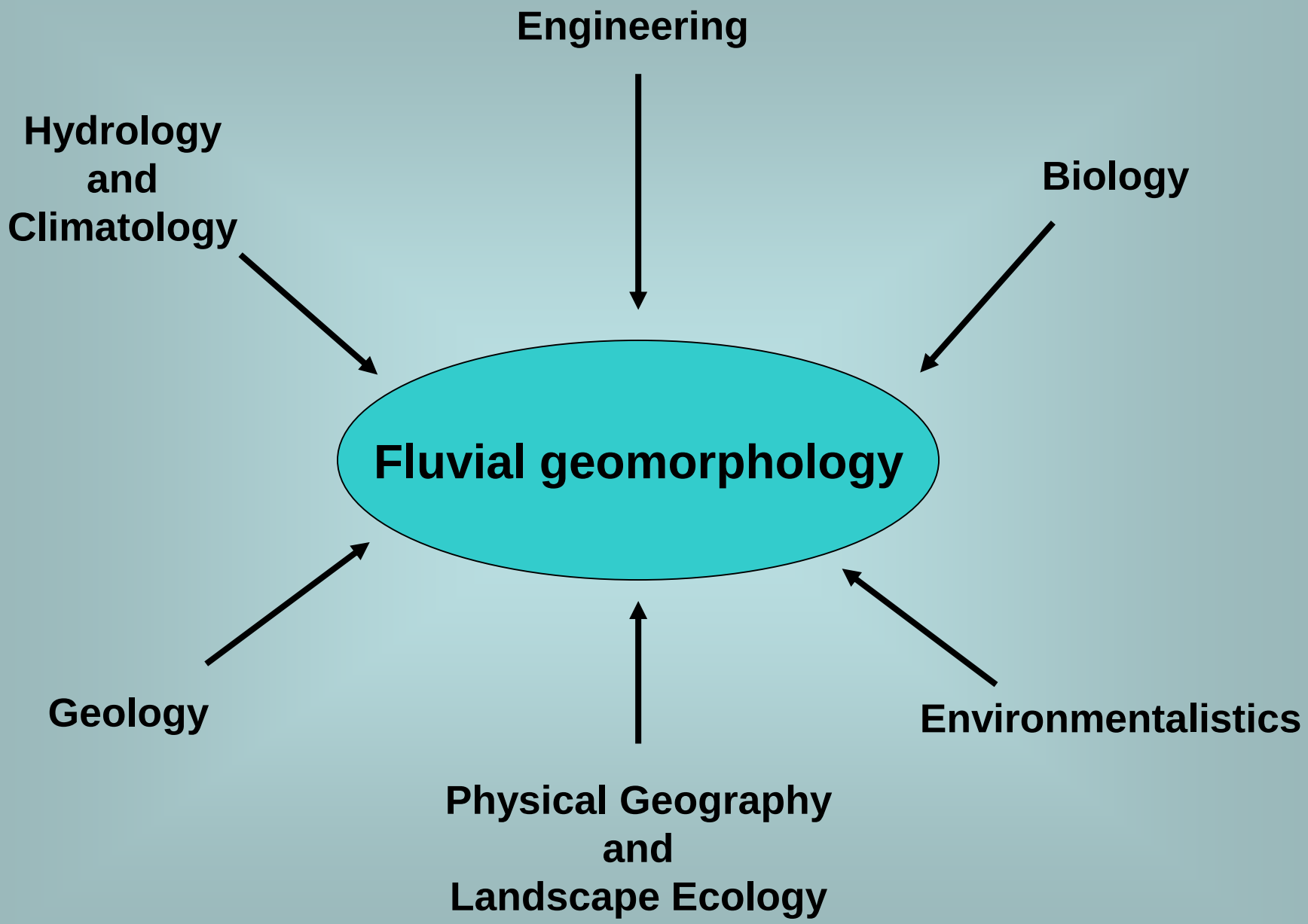
Institute of Geography, Slovak Academy of Sciences

„Why?“ fluvial geomorphology

- **sustainability, ecological stability, environmental planning and management**
- **flowing water (rivers) – important landscape element**
- **The EU Water Framework Directive; The European Landscape Convention**
- **practical interest - protection and revitalisation, flood measures, dams, channelization**
- **scientific (e.g. biology, ecology, hydrology) and public (e.g. recreation, transportation, water sources) interest**
- **relief – basis of the landscape**


Engineering
Hydrology and Climatology
Biology
Fluvial geomorphology
Geology
Environmentalistics
Physical Geography and Landscape Ecology

situation worldwide

- long tradition
- theory, methodology, classification systems
- tools, methods, fieldwork procedures
- quantitative data, modelling
- interest in improvement of the condition of streams
- legislation, great attention to rivers and their environs

Channel Conditions and Prescriptions Assessment (Interim Methods)

by

D.L. Hogan, S.A. Bird and D.J. Wilford

Watershed Restoration Technical Circular No. 7
July 1996

Draft #1, Subject to Revision

British Columbia
Funded by:
Forest Renewal BC

Watershed Restoration Program
Ministry of Environment, Lands and Parks
and Ministry of Forests

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National Aquatic Ecosystem Biomonitoring Programme

Development of an index of stream geomorphology for the assessment of river health

NAEBP Report Series No 7

Department of Water Affairs and Forestry

Department of Environmental Affairs and Tourism

Water Research Commission

DNR

STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES

Number 2036

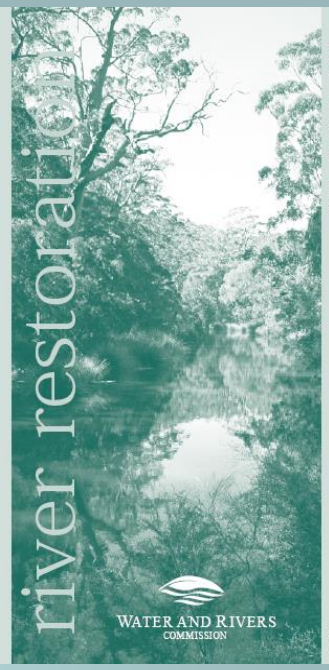
December 31, 1997

A Landscape-Based Ecological Classification System For River Valley Segments in Lower Michigan (MI-VSEC Version 1.0)

Paul W. Seelbach
Michael J. Wiley
Jennifer C. Kotanchik
and
Matthew E. Baker

FISHERIES DIVISION

RESEARCH REPORT



Stream channel processes

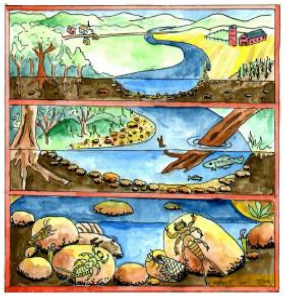
Fluvial Geomorphology

WATER AND RIVERS COMMISSION

July 2000
Report No. RR6

Vermont Agency of Natural Resources
Stream Geomorphic Assessment

Protocol Handbooks



Remote Sensing and Field Surveys Techniques for conducting Watershed and Reach Level Assessments

Vermont Agency of Natural Resources
April, 2004

Twinning light Project No. TLP 01 – 29
SR.0110/01/01 0009

Establishment of the Protocol on Monitoring and Assessment of the Hydromorphological Elements

Final report
September 2004

SHMÚ
Bratislava

ERDC/CHL CR-01-1

Coastal and Hydraulics Laboratory

US Army Corps of Engineers®
Engineer Research and Development Center

Channel Restoration Design for Meandering Rivers

Philip J. Soar and Colin R. Thorne

September 2001

situation in Slovakia

- tradition of hydrology and hydrogeology
- engineering, water management, NATURA 2000
- strong geomorphologic school – mapping, palaeogeography, morphostructures, slope processes, morphometry, karst
- fluvial geomorphology was not given sufficient attention
- missing methodology and techniques for research
- missing classification and data

Fluvial geomorphology
-
challenge for the Slovak geomorphology in the 21st century

- last ten years
- Institution of Geography, Slovak Academy of Sciences
- research group (Milan Lehotský and Anna Grešková)
- discovery and the greatest amount of work in the field of Slovak fluvial geomorphology

adaptation of terminology and basic assessment methods

Slovak-English dictionary of fluvial geomorphology

HYDROMORFOLOGICKÝ SLOVNÍK

(Slovensko – anglický výkladový slovník hydromorfologických termínov)

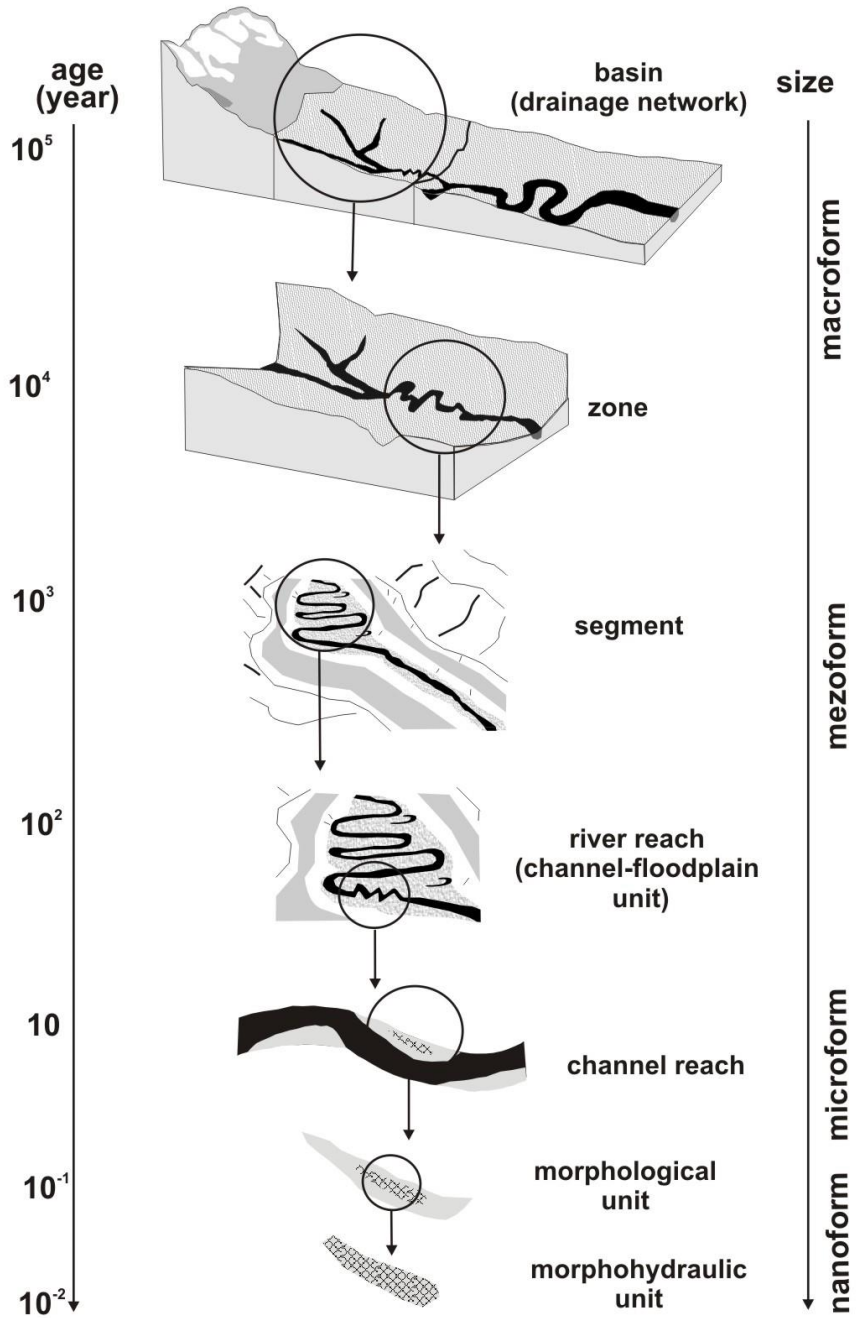
MILAN LEHOTSKÝ, ANNA GREŠKOVÁ

Bratislava 2004

Hydromorphological assessment protocol for the Slovak Republic

Bratislava 2005

Authors:
Morten Lauge Pedersen, Niels Bering Ovesen, Nikolai Friberg, Bente Clausen, Milan Lehotský and Anna Grešková



adaptation of classification systems

River Morphology Hierarchical Classification (Lehotský 2004)

case studies

- to know different types of Slovak rivers and streams
- two basic clusters
- large lowland rivers
- small mountain catchments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Liptovský Sv.
Mikuláš
Poprad
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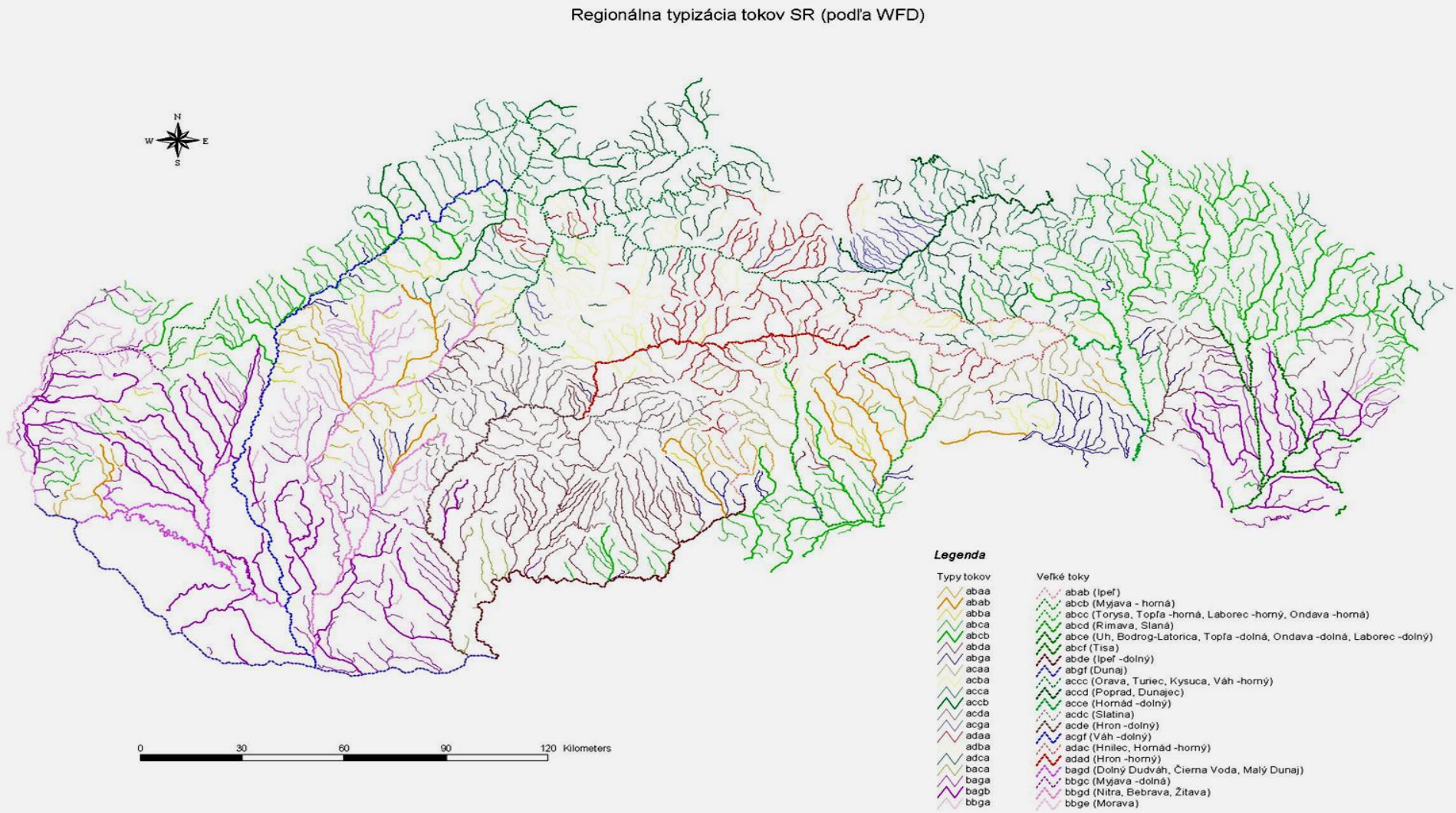
regional types of rivers and streams



The Danube River (Bratislava)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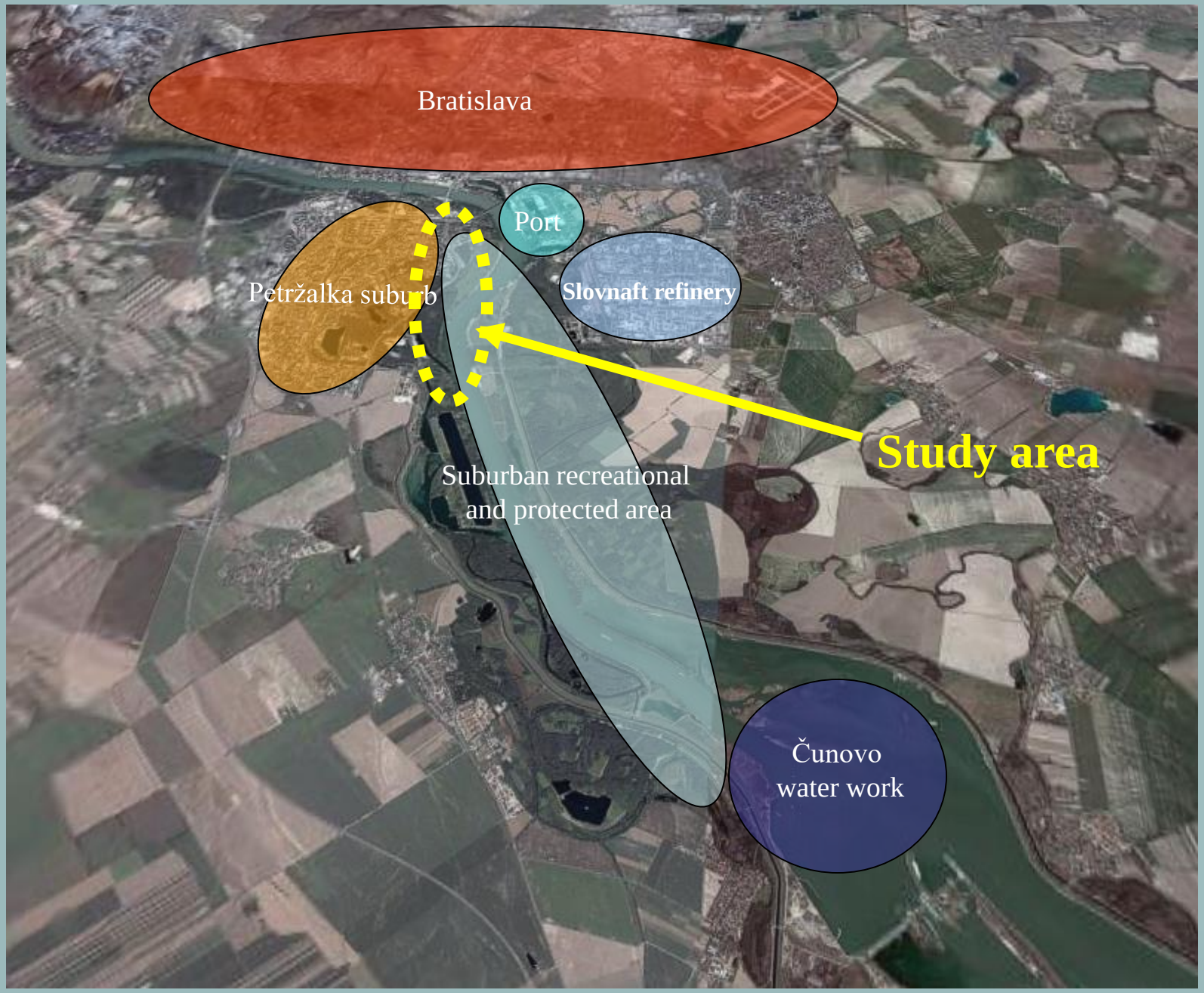
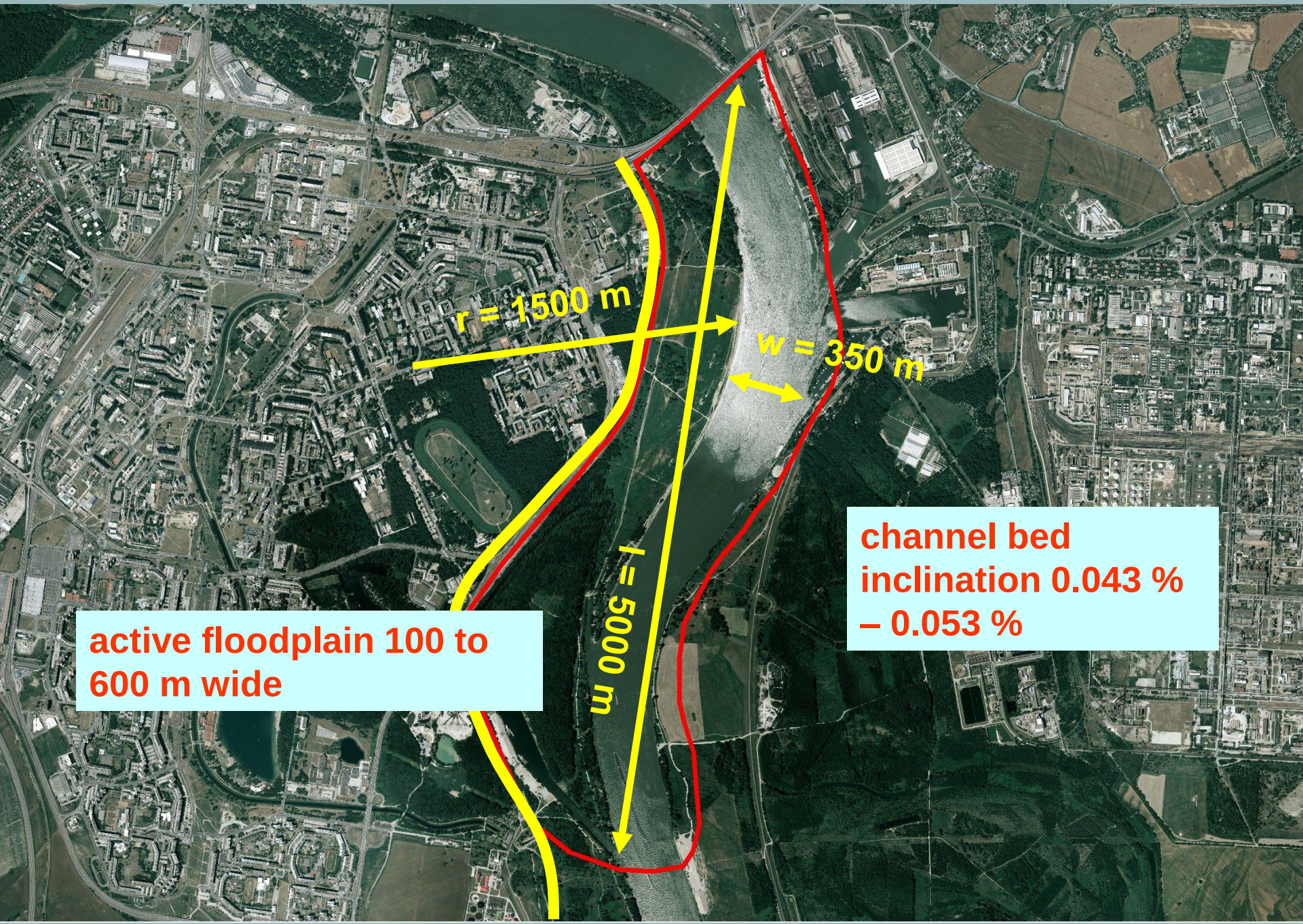
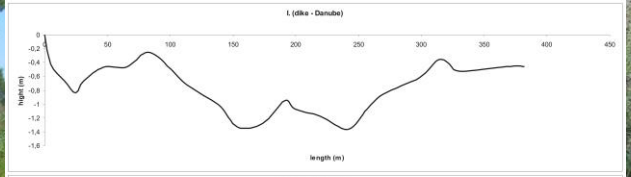
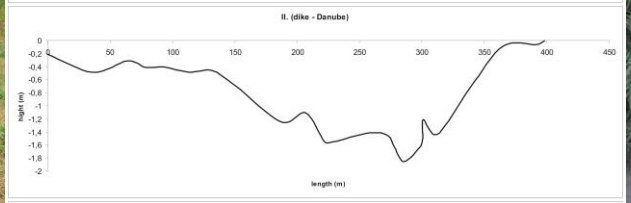
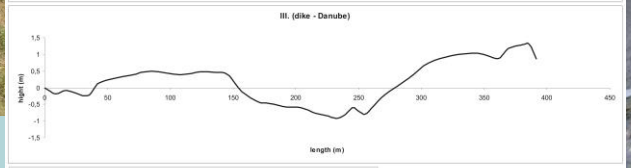
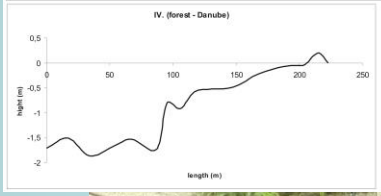

Bratislava
Port
Petržalka suburb
Slovnaft refinery
Study area
Suburban recreational
and protected area
Čunovo
water work


r = 1500 m
w = 350 m
l = 5000 m
active floodplain 100 to 600 m wide
channel bed inclination 0.043 % – 0.053 %


I. (dike - Danube)
hight (m)
length (m)


II. (dike - Danube)
hight (m)
length (m)

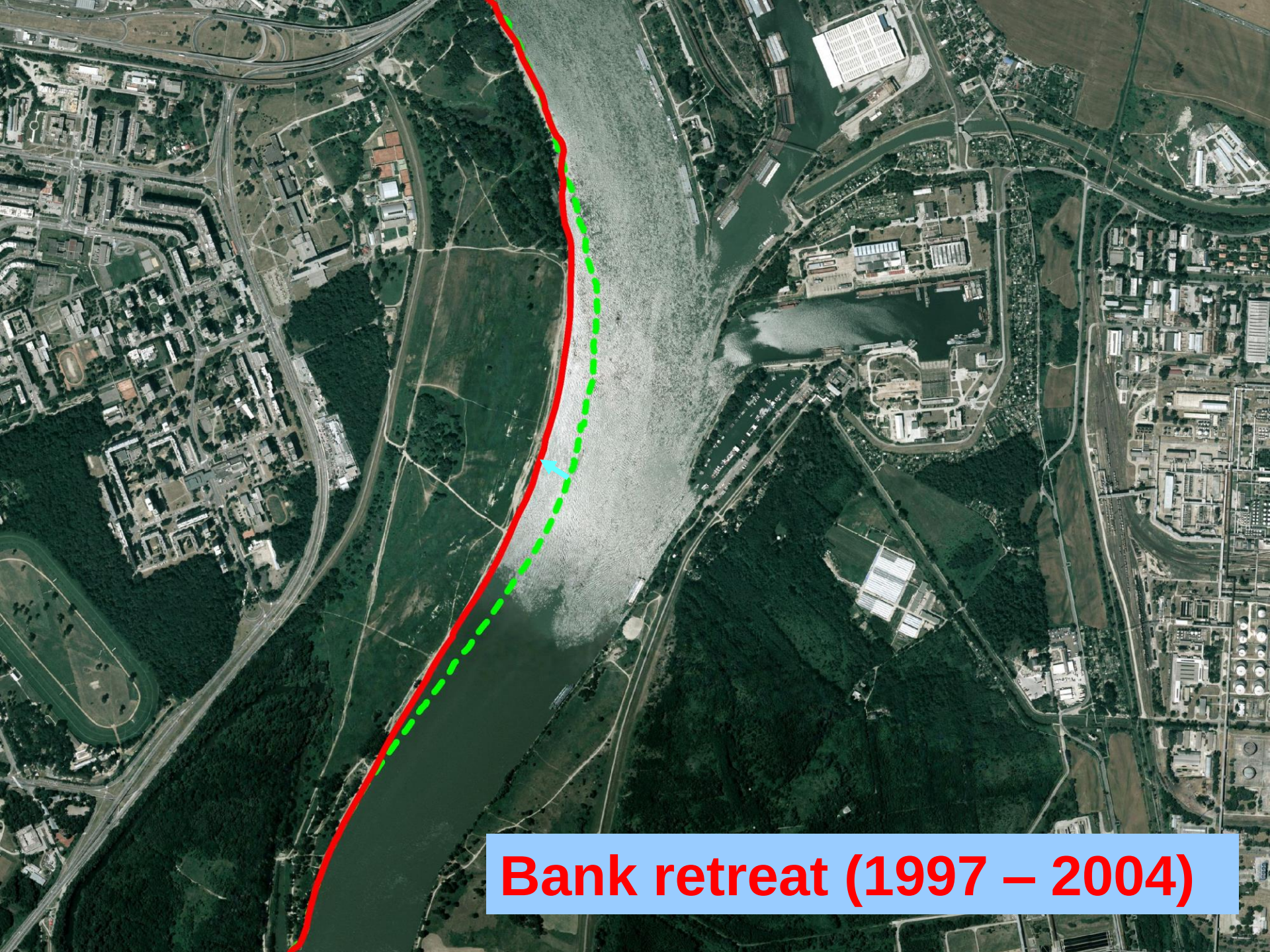

III. (dike - Danube)
hight (m)
length (m)


IV. (forest - Danube)
hight (m)
length (m)

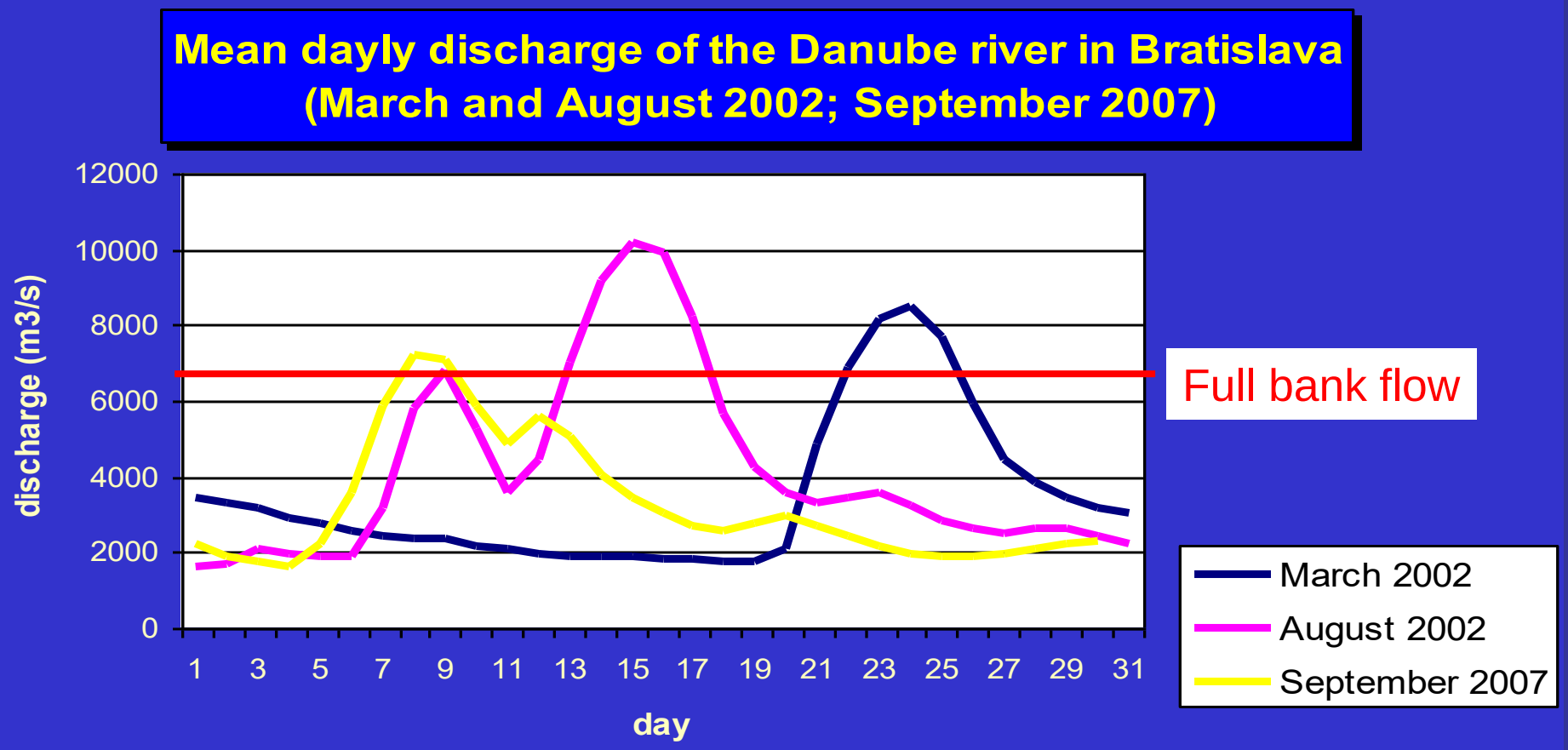
landforms

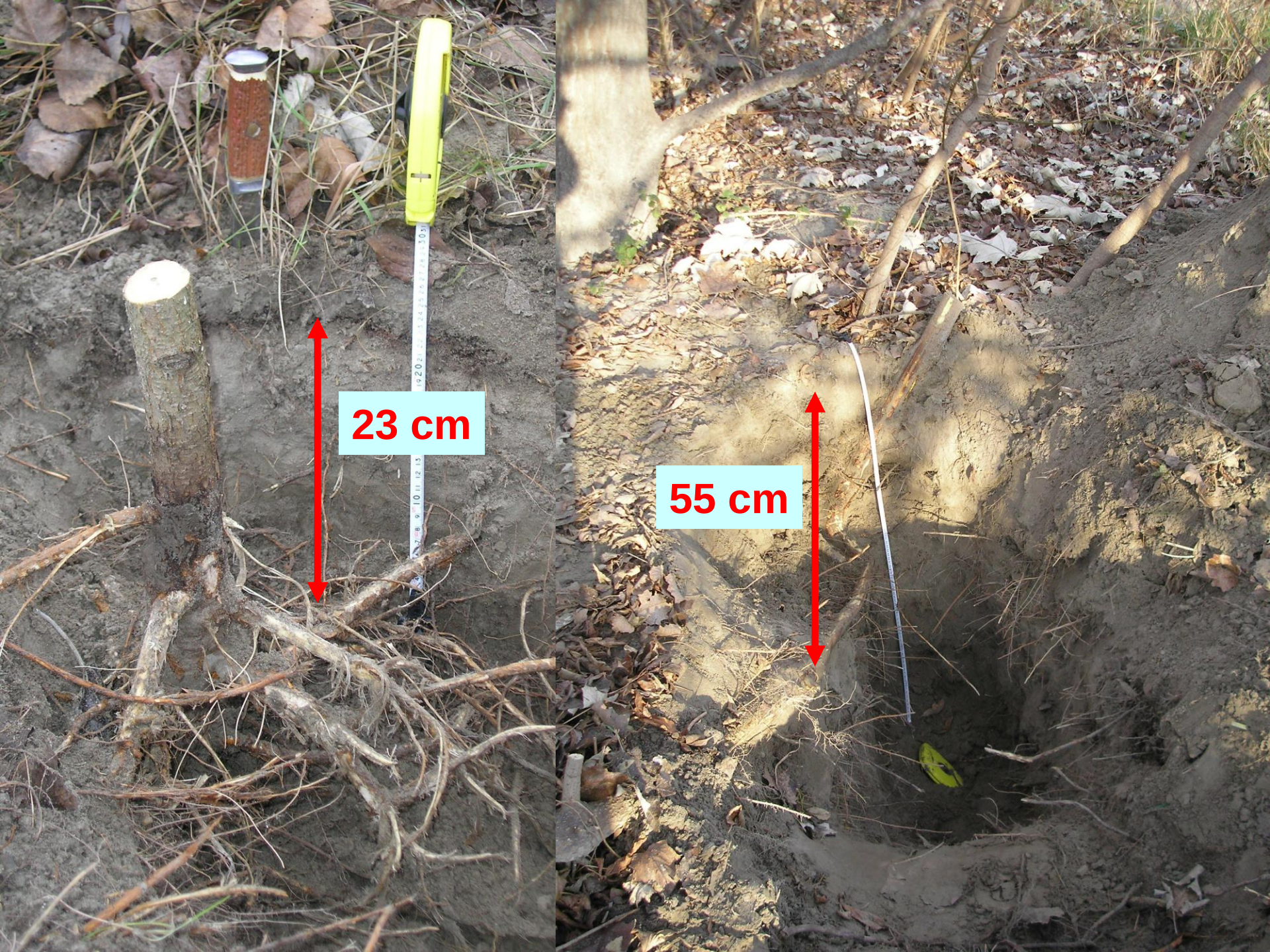

legend
natural levee
crevasse splay
naturally infilled paleochannel
abandoned channel
flat floodplain
exposed gravel bar
former island
0
0.2
0.4
0.6
0.8
1
km
N

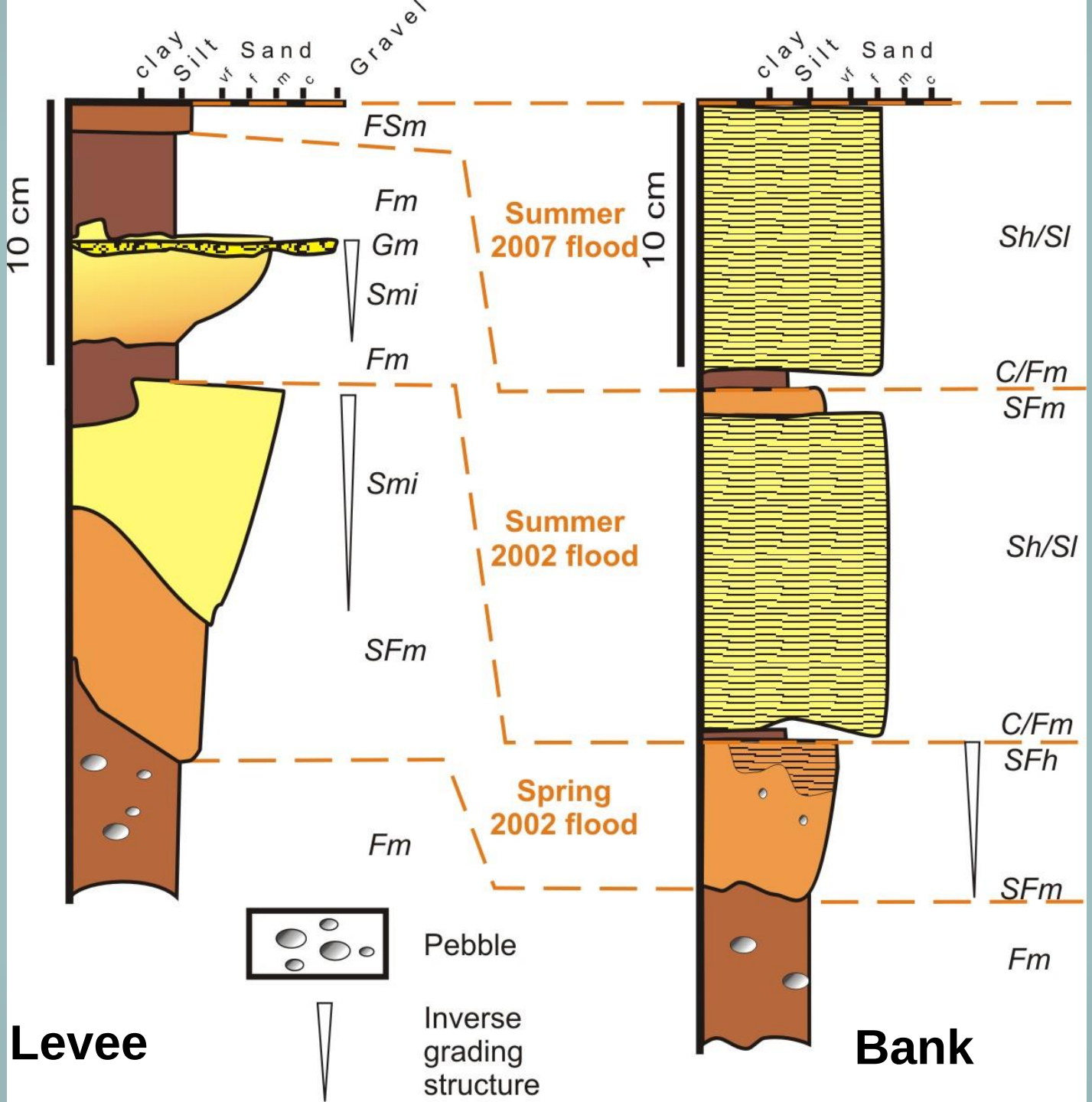

legend
natural levee
crevasse splay
naturally infilled paleochannel
abandoned channel
flat floodplain
exposed gravel bar
former island

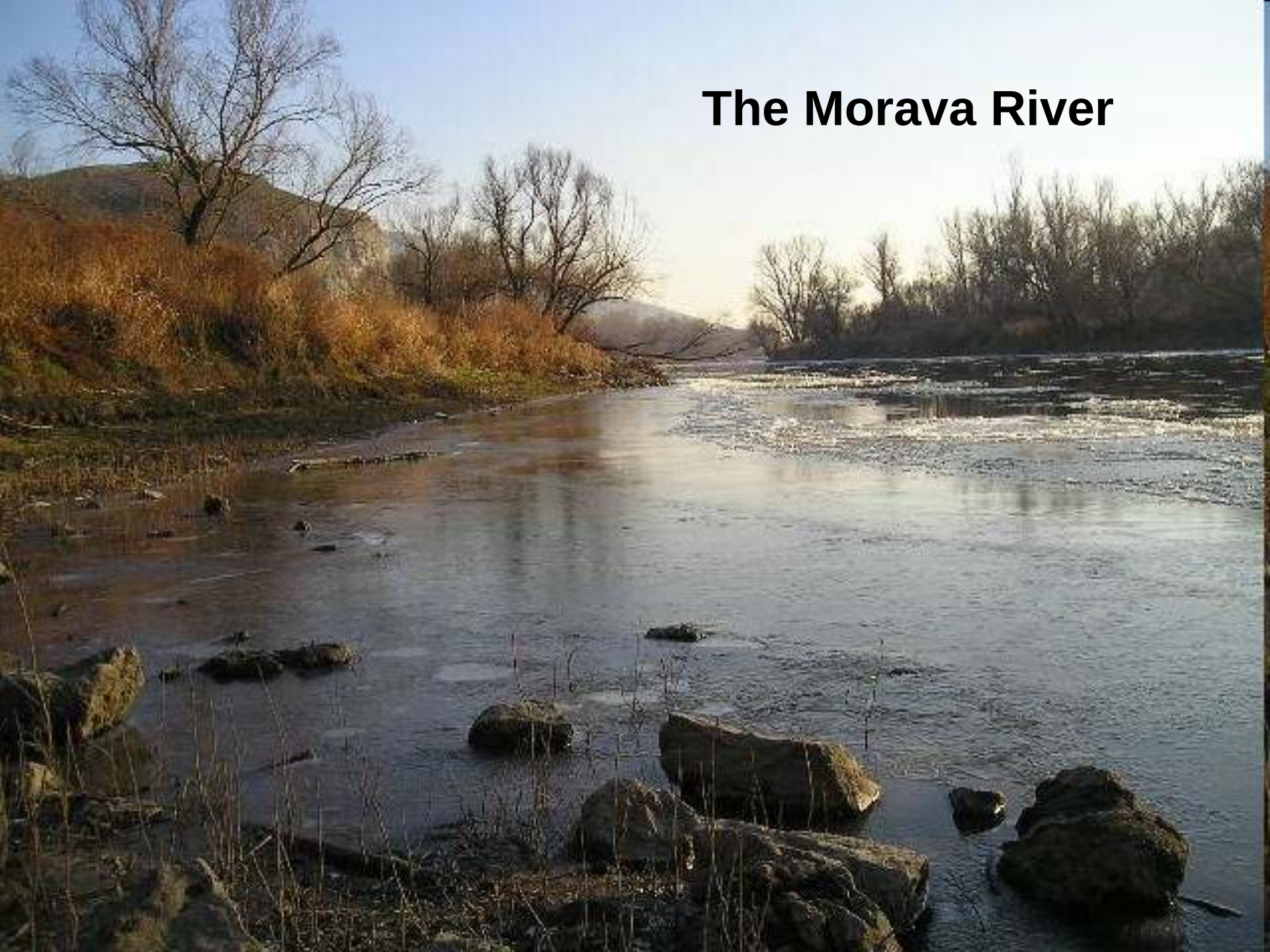

Bank retreat (1997 – 2004)

analysed floods




23 cm
55 cm


clay
Silt
Sand
vf
f
m
c
Gravel
10 cm
FSm
Fm
Gm
Smi
Fm
Smi
SFm
Fm
Summer
2007 flood
Summer
2002 flood
Spring
2002 flood
Pebble
Inverse
grading
structure
Levee
10 cm
Sh/Sl
C/Fm
SFm
Sh/Sl
C/Fm
SFh
SFm
Fm
Bank


The Morava River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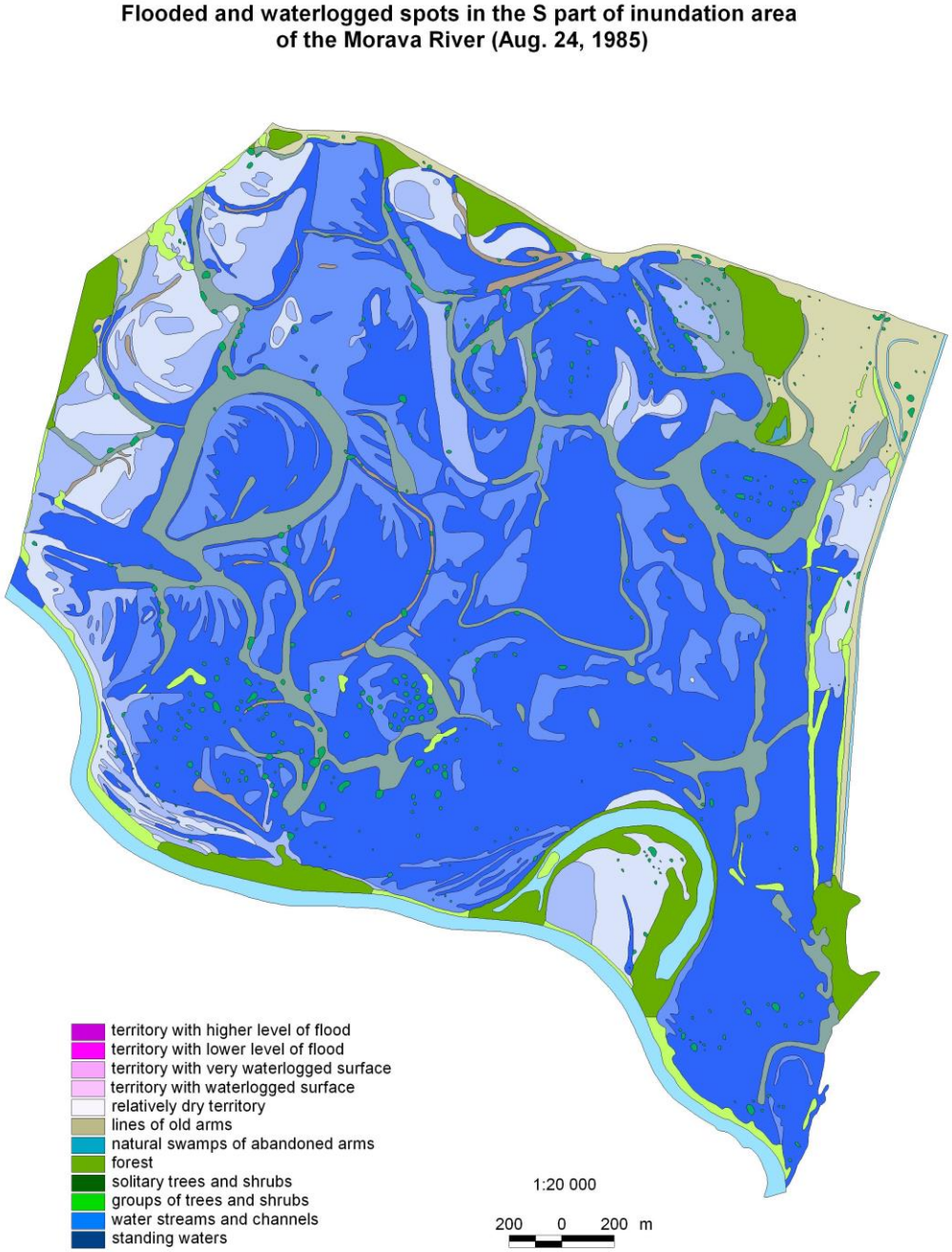
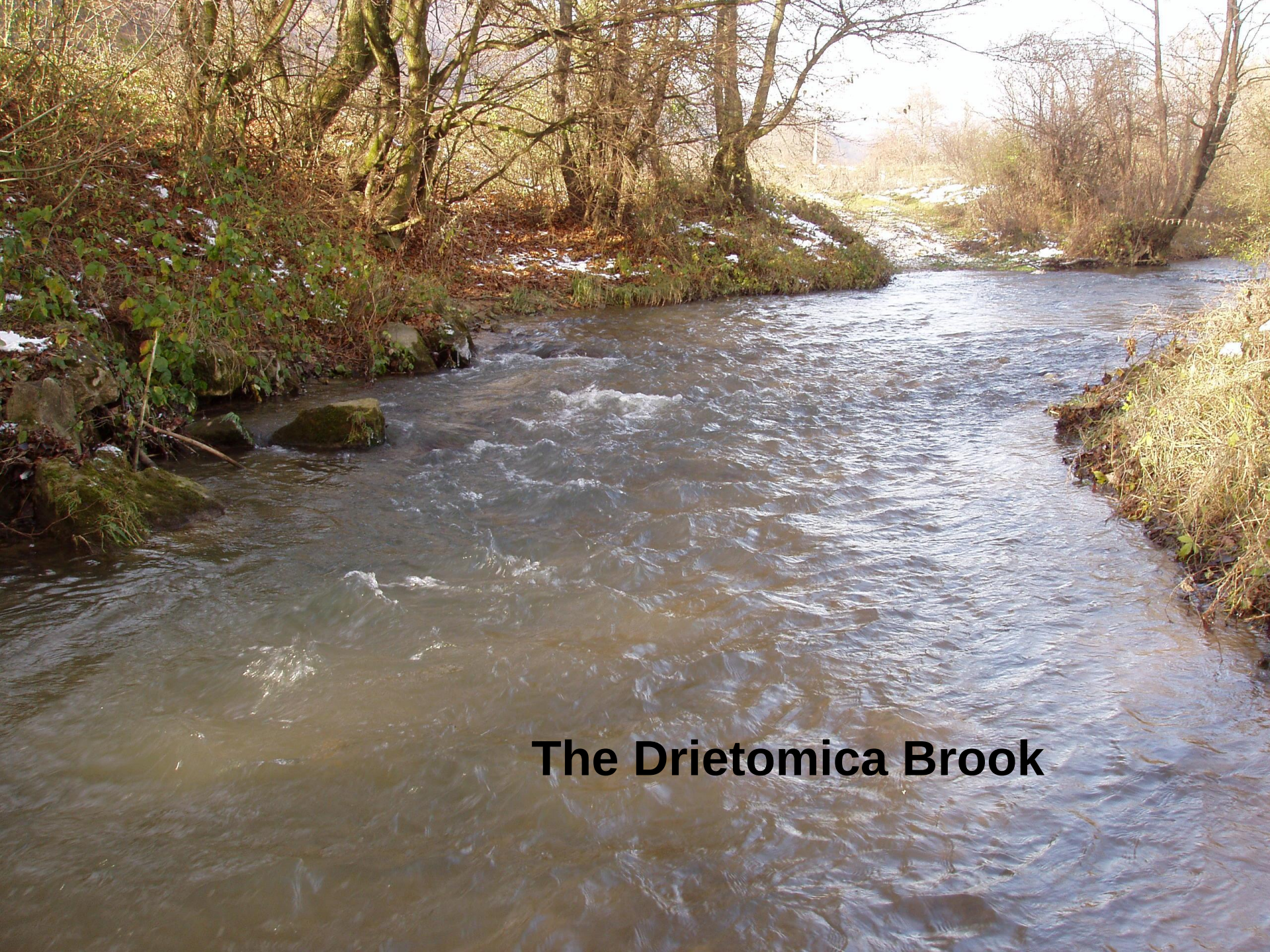
Poprad
Prešov
Trenčín
Banská Bystrica
Košice
Michalovce
Malacky
Trnava
Nitra
Lučenec
Bratislava
Levice
Komárno



Flooded areas – aerial photos analyses


The Drietomica Brook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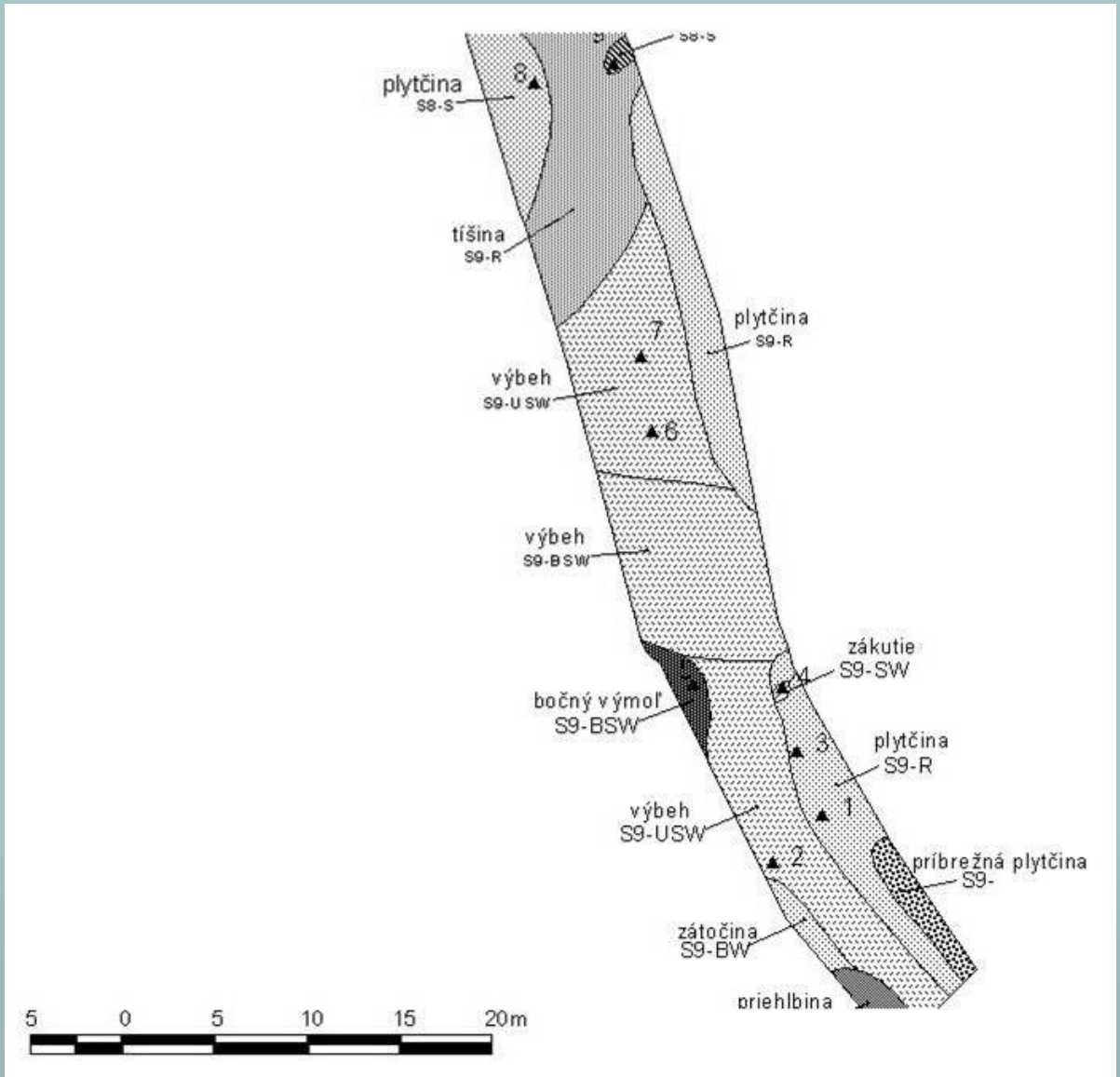
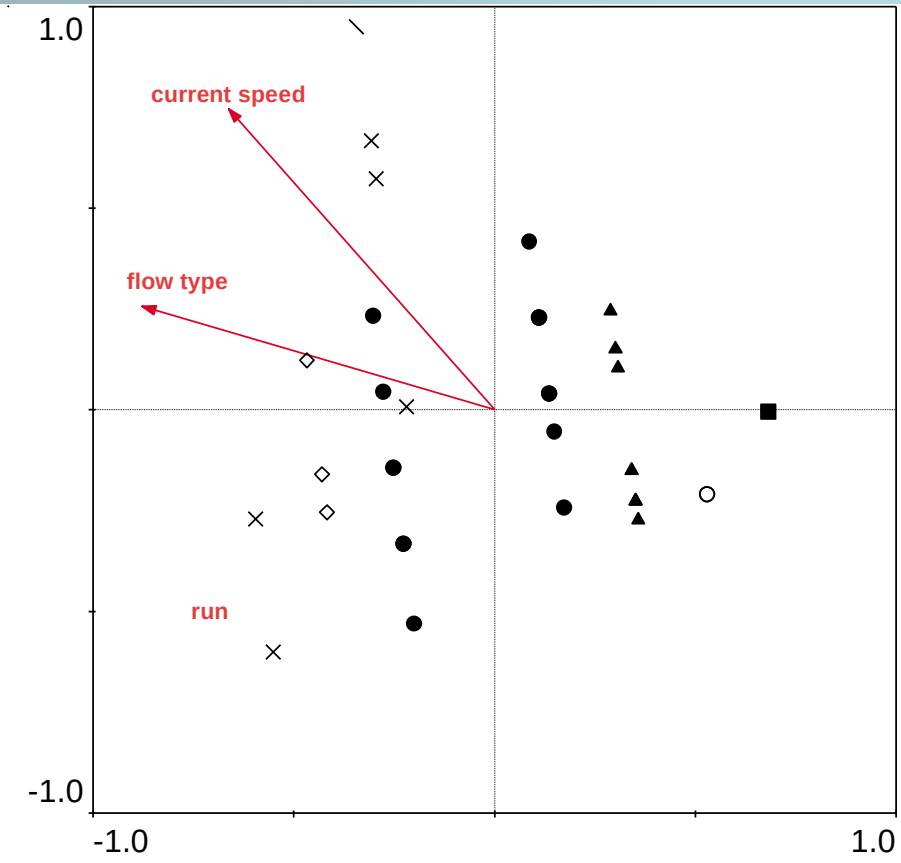
Nitra
Lučenec
Bratislava
Levice
Komárno

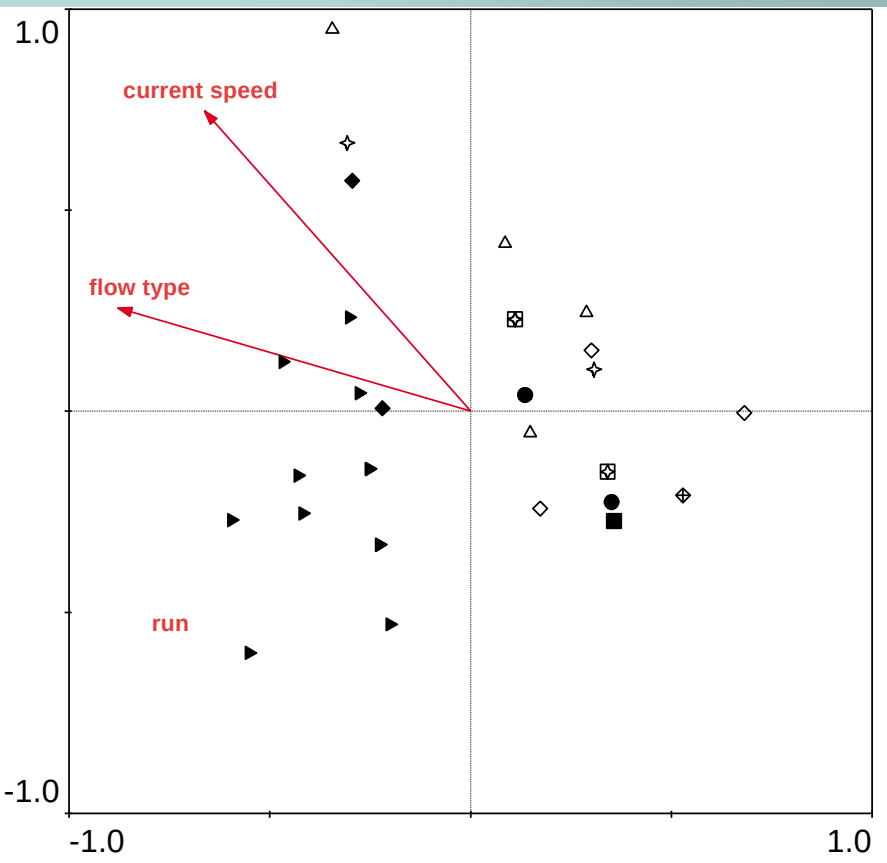
Application of the fluvial geomorphology methods in the hydrobiological research - habitats for benthic macroinvertebrates

morphohydraulic units

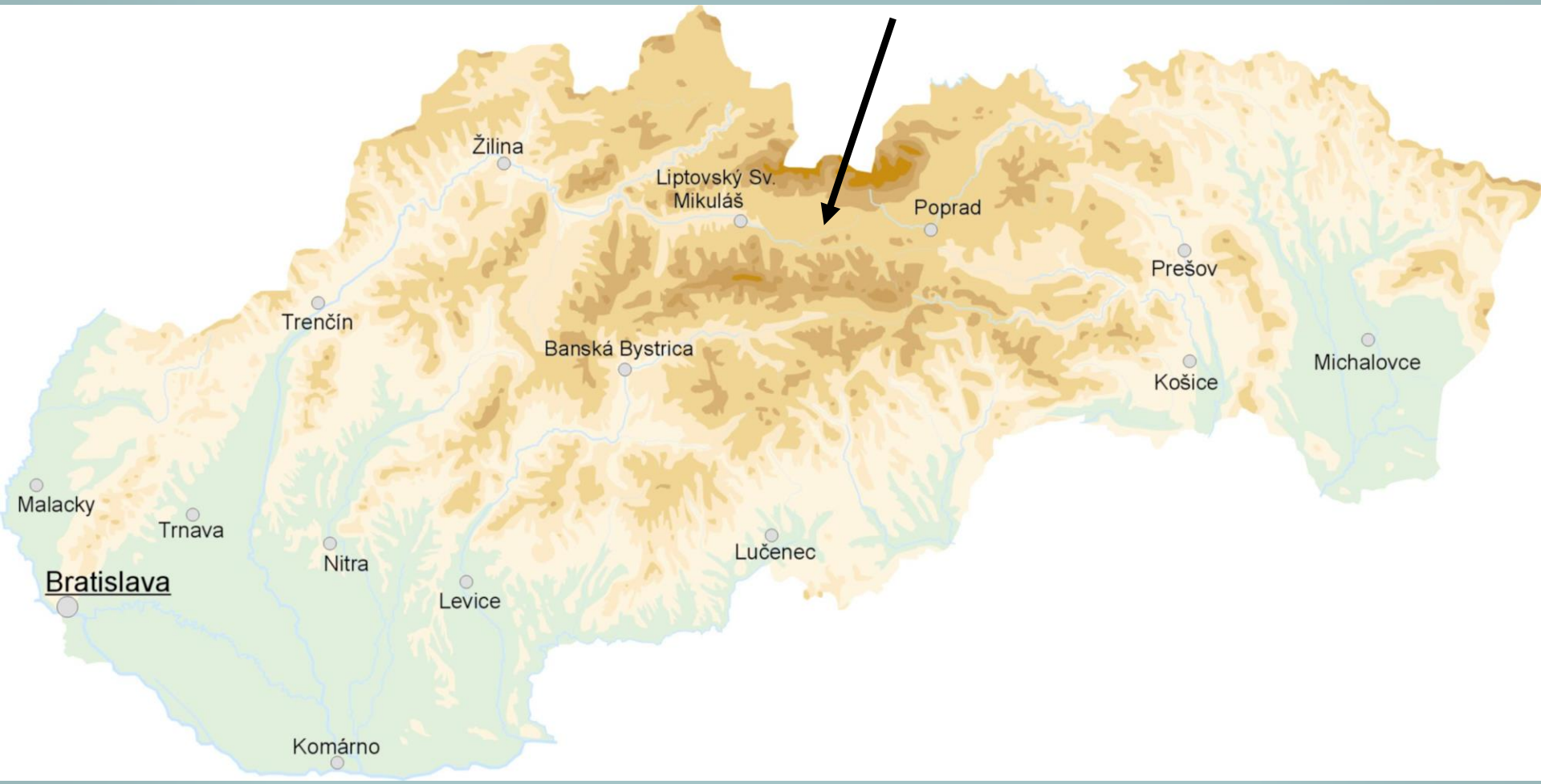


Relation between occurrence of species and morphohydraulic characteristics (e.g. current velocity, flow type, depth, substratum)





The Hybica Brook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Liptovský Sv.
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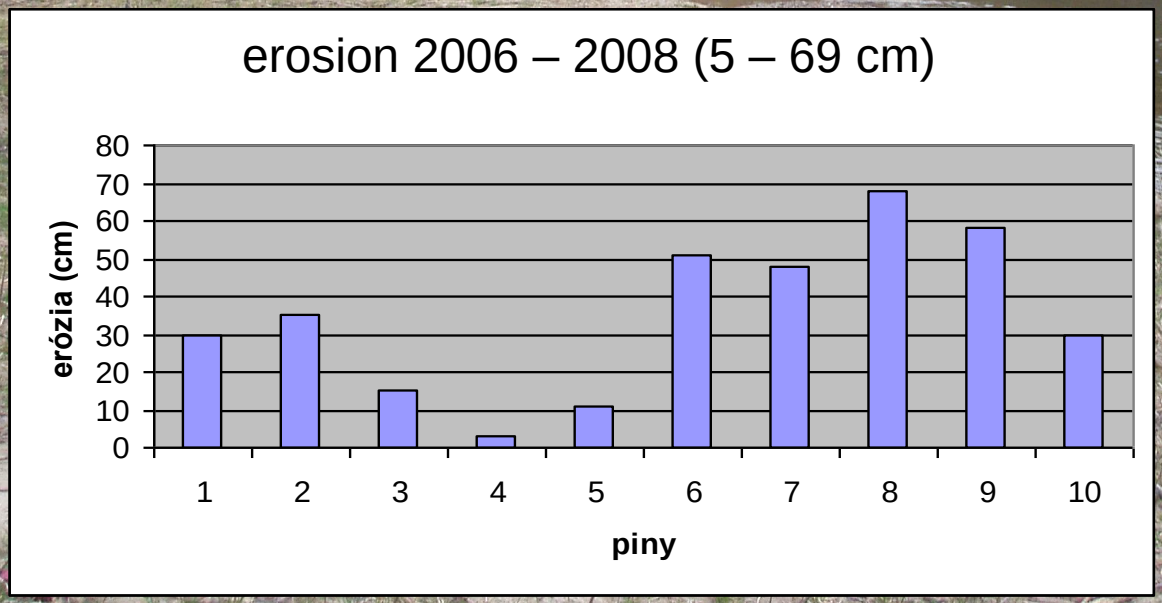
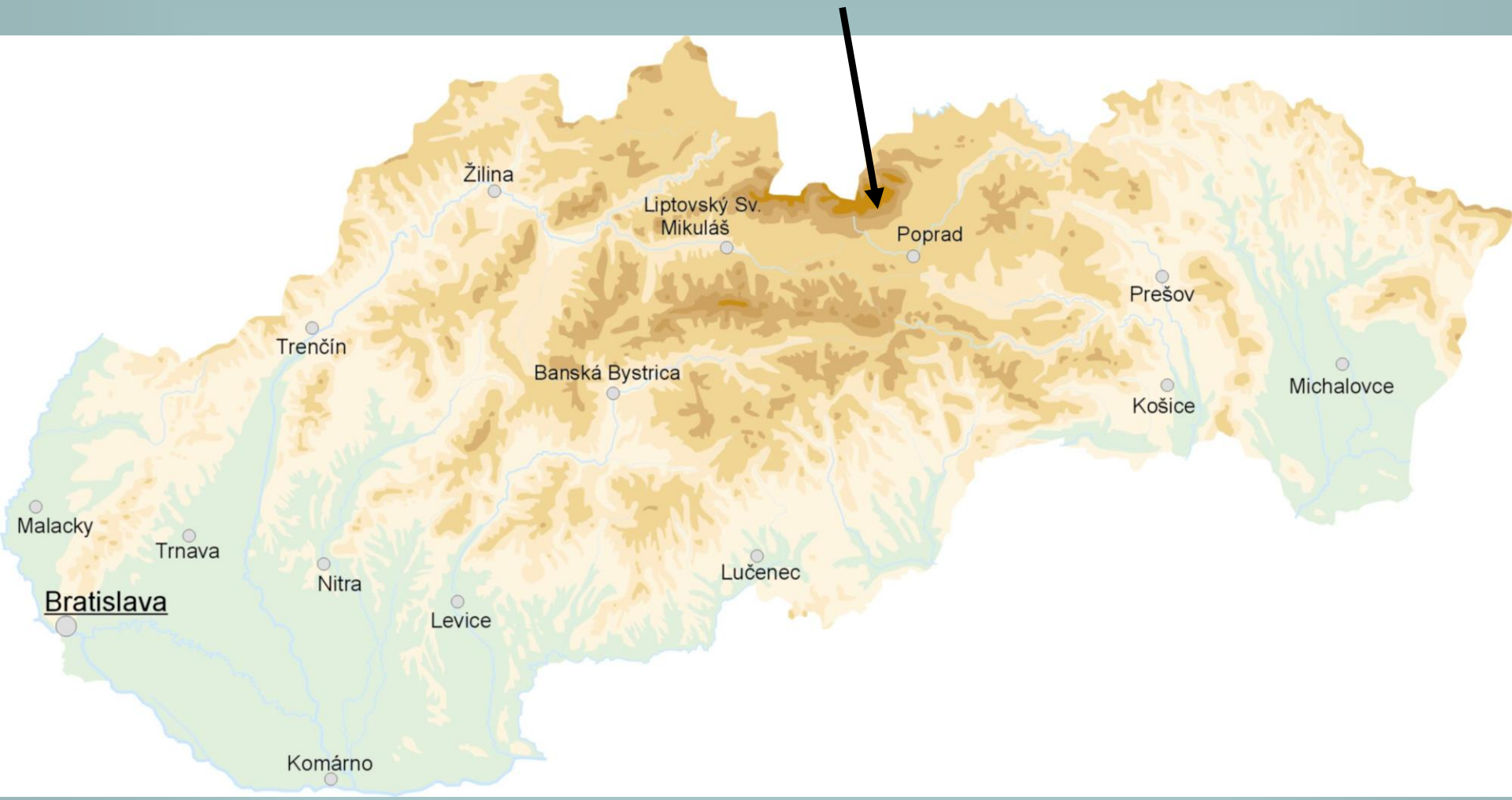
hierarchical classification - reaches

bank erosion


erosion 2006 – 2008 (5 – 69 cm)
erózia (cm)
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
piny


The Studený potok Brook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Košice
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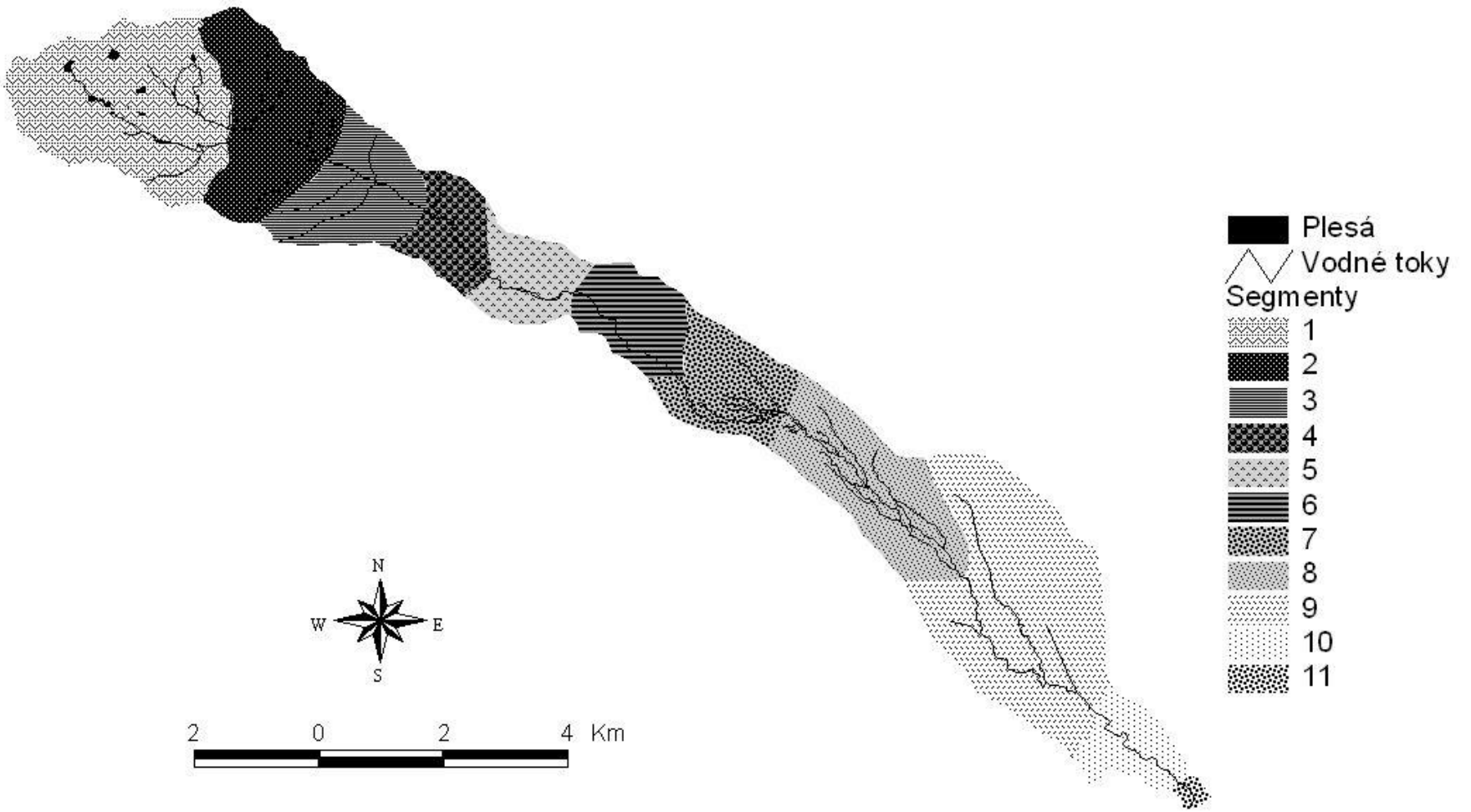
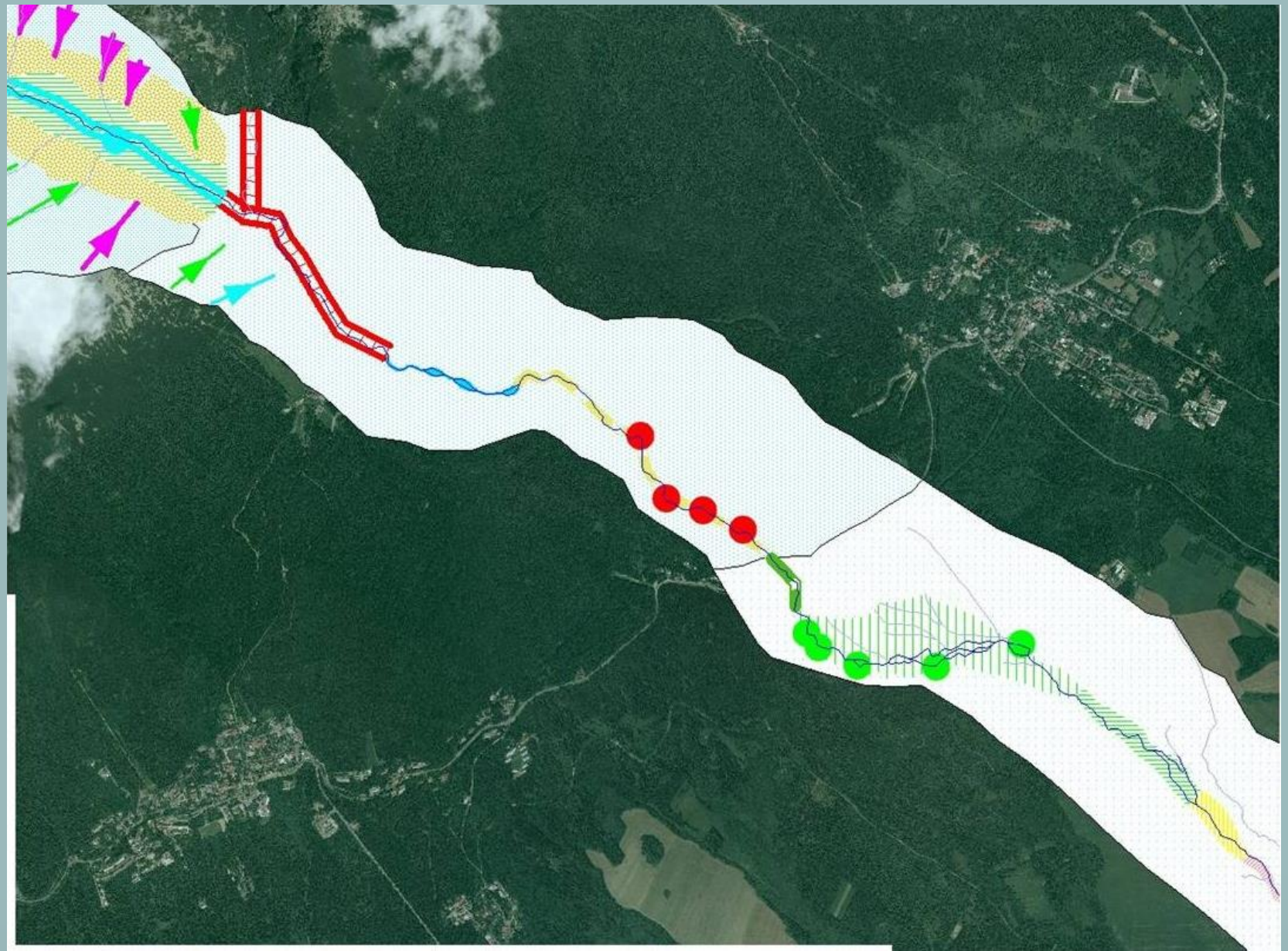
classification - segments



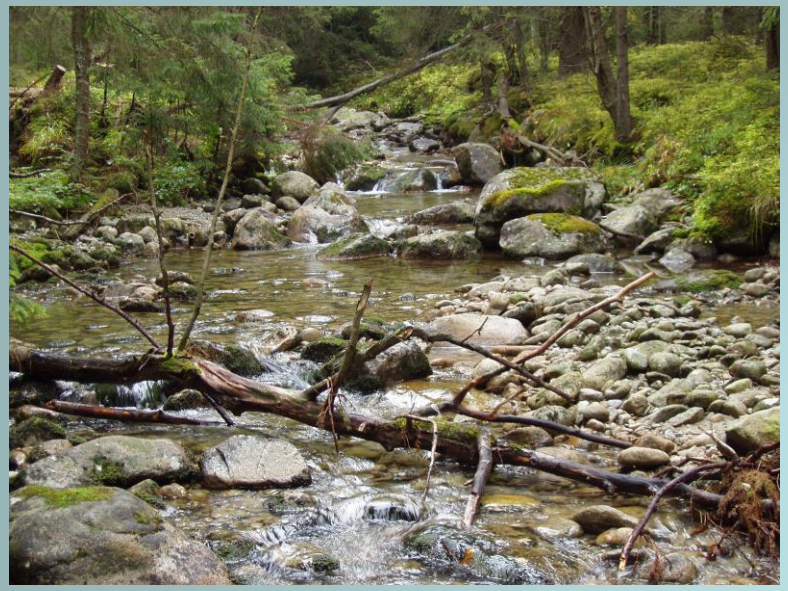
sediments connectivity

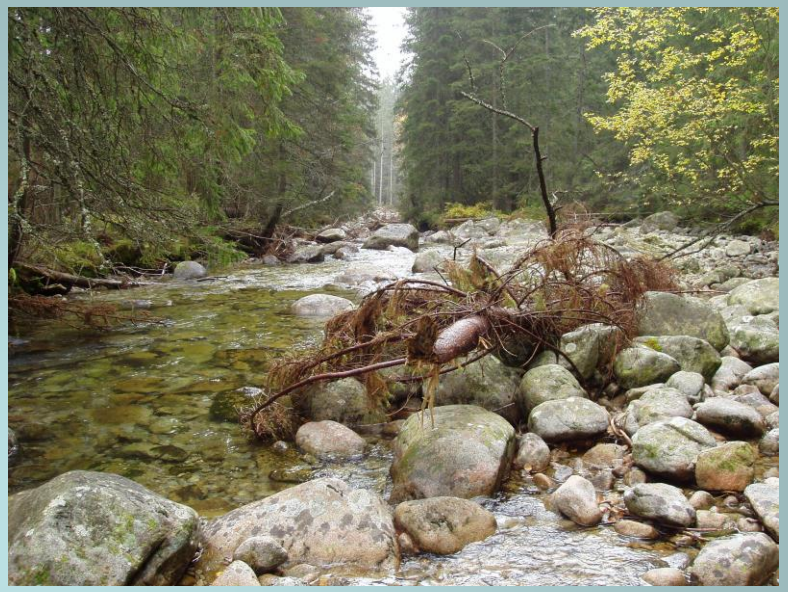


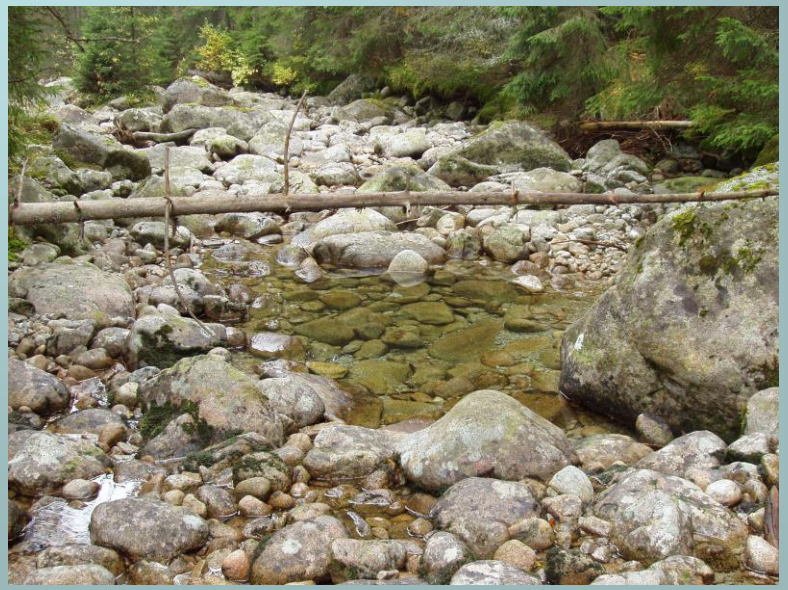
RESPONSE OF RIVER CHANNEL SYSTEM TO WINDBLOWN FOREST

The windstorm (19th of November 2004) in the Tatras damaged strip of forest (width 2.5 km, length 50 km, area 50 000 ha)

Studený potok brook – undisturbed river reaches







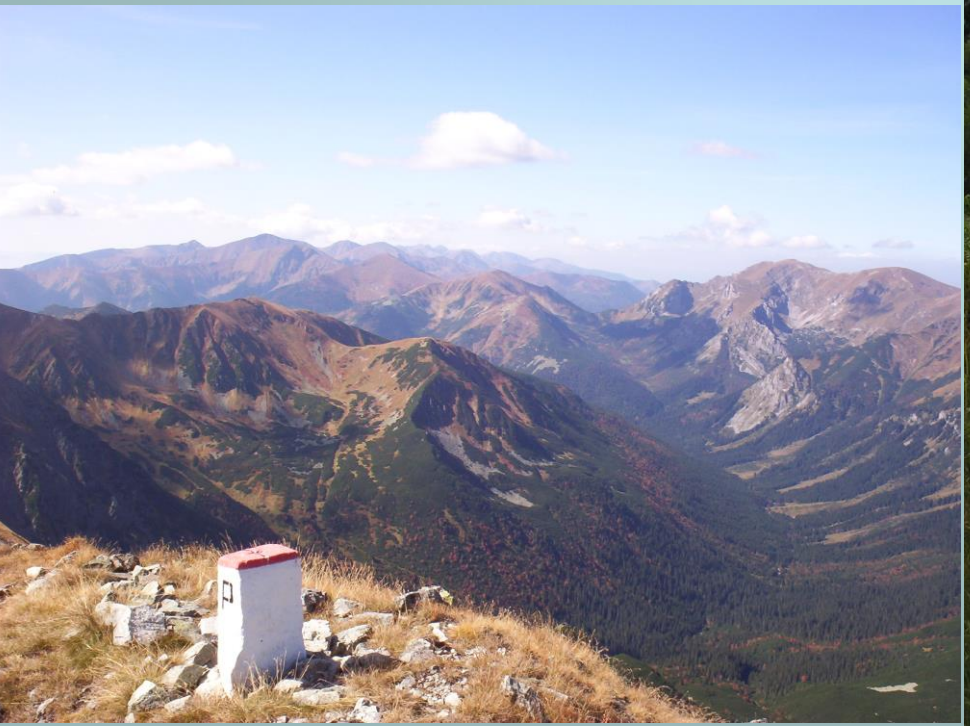
Studený potok brook – damaged river reaches

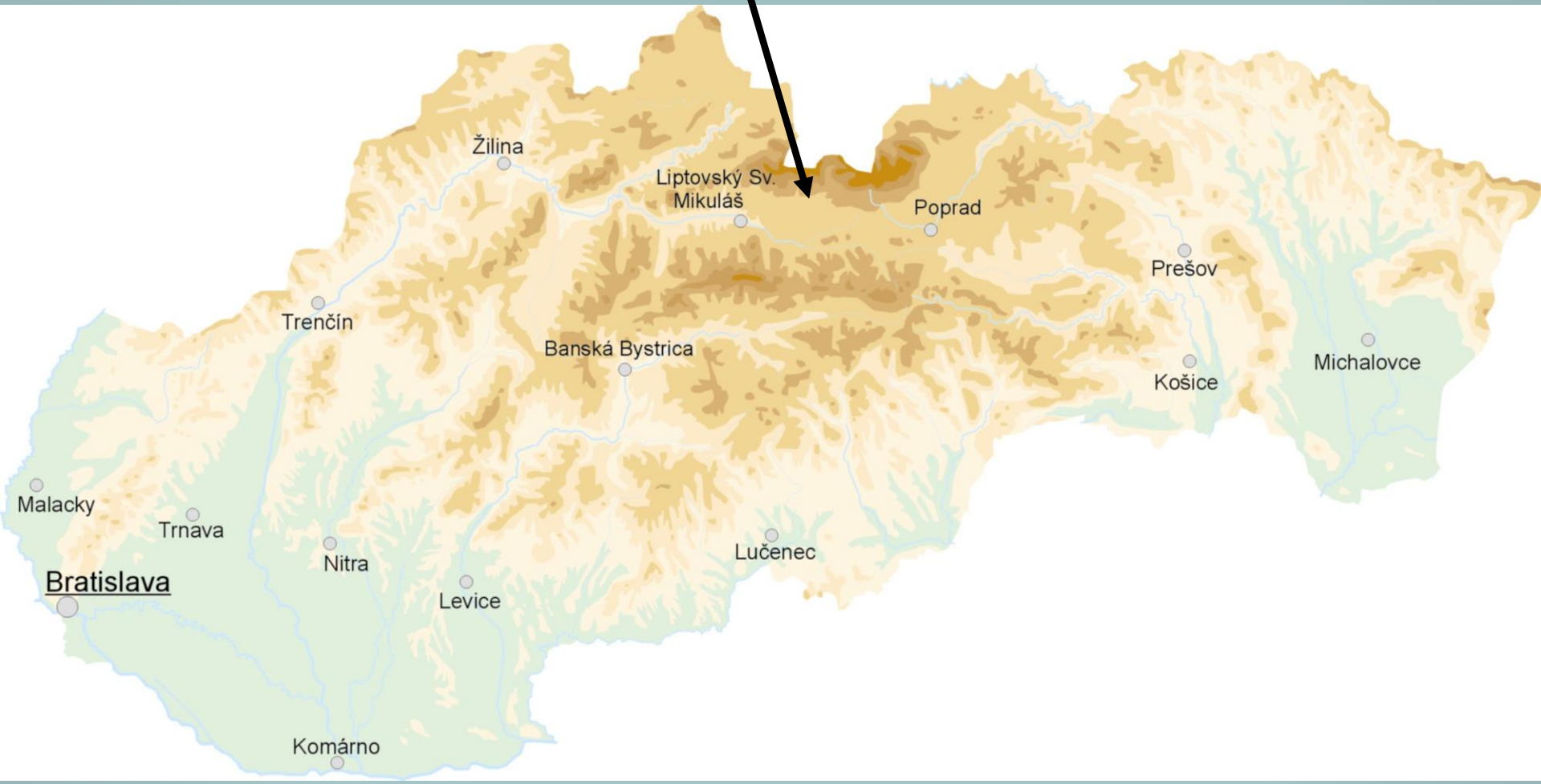
2005

2006

Changes of bar pattern and sediment size

The Belá River – study of the channel dynamics

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Liptovský Sv. Mikuláš
Poprad
Prešov
Trenčín
Banská Bystrica
Košice
Michalovce
Malacky
Trnava
Nitra
Lučenec
Bratislava
Levice
Komárno


2003

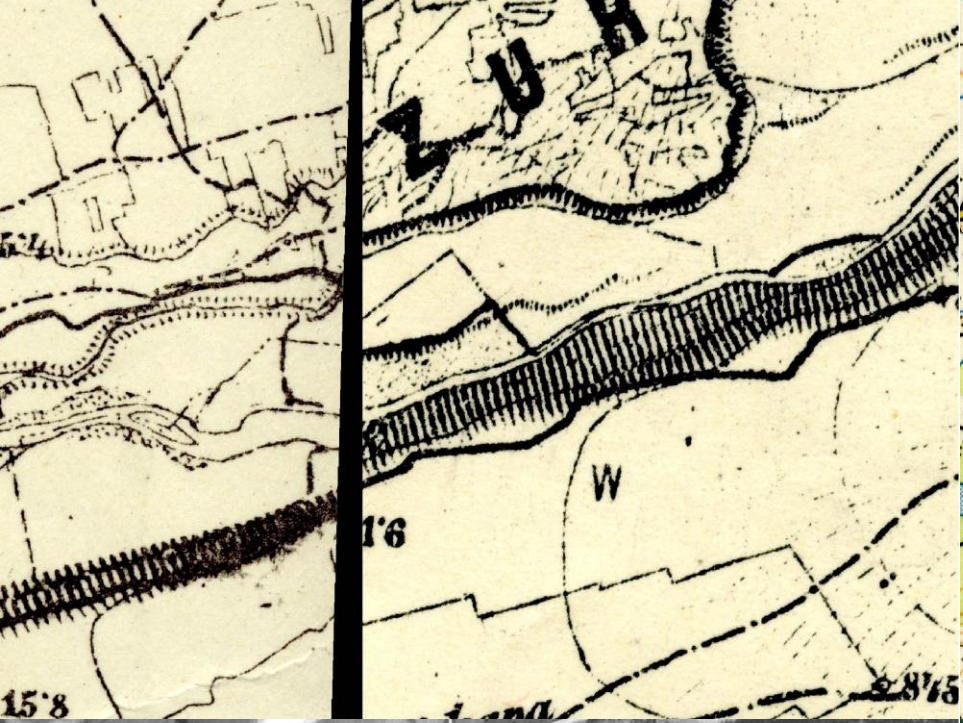

2005

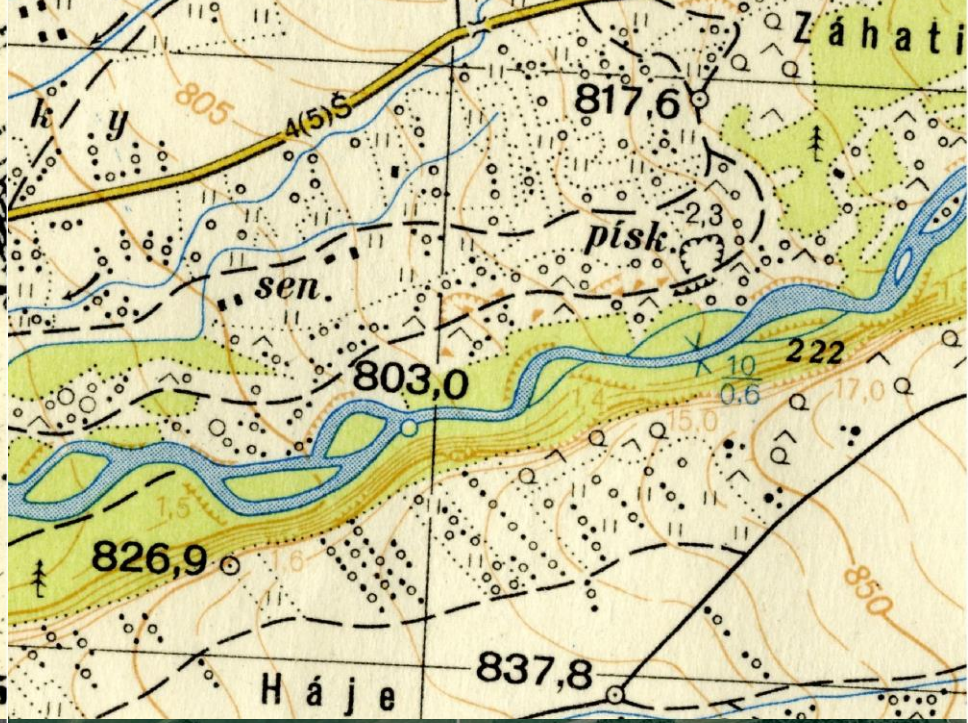

2006


2008

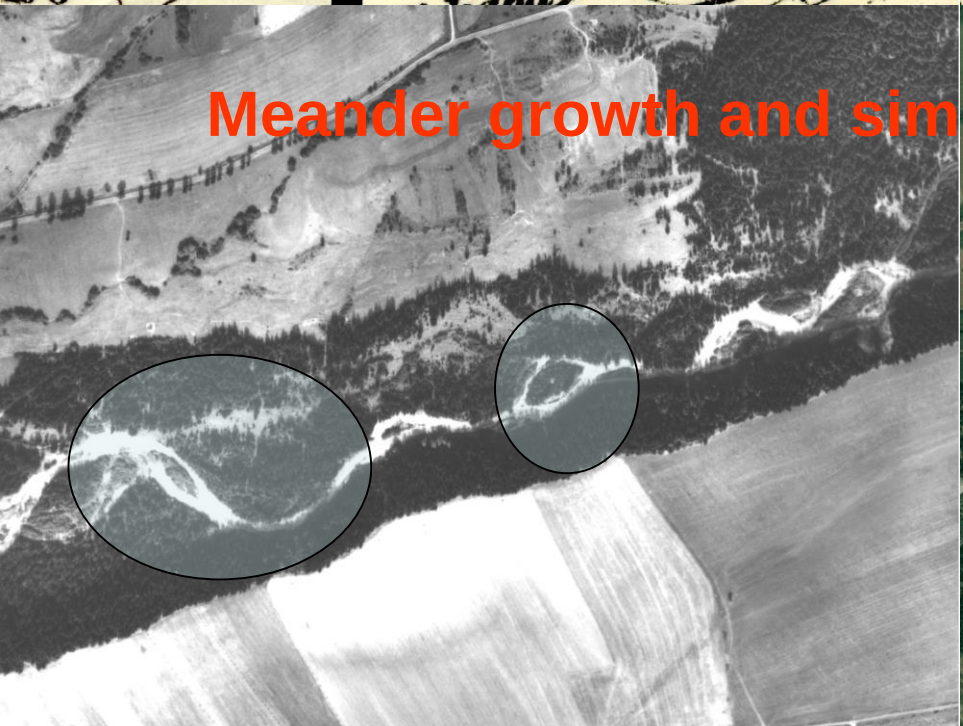
Destruction and recreation of meander bend
1950 – 1985: 20 m; 1985 – 2004: 40 m


Pribilina (Pl.)
793·3
Pribylina
378 MNV
774,6
773,8
754,3
1,0
Meander growth
1985 – 2004: 40 m





Meander growth and simple channel development



future challenges

- to widen fluvial-geomorphologic research group
- to widen international co-operation
- to widen relevant knowledge about morphology of all basin/river types
- to introduce modern research tools and methods
- to widen interdisciplinary co-operation
- to widen influence on decision makers


Thank you for your attention!