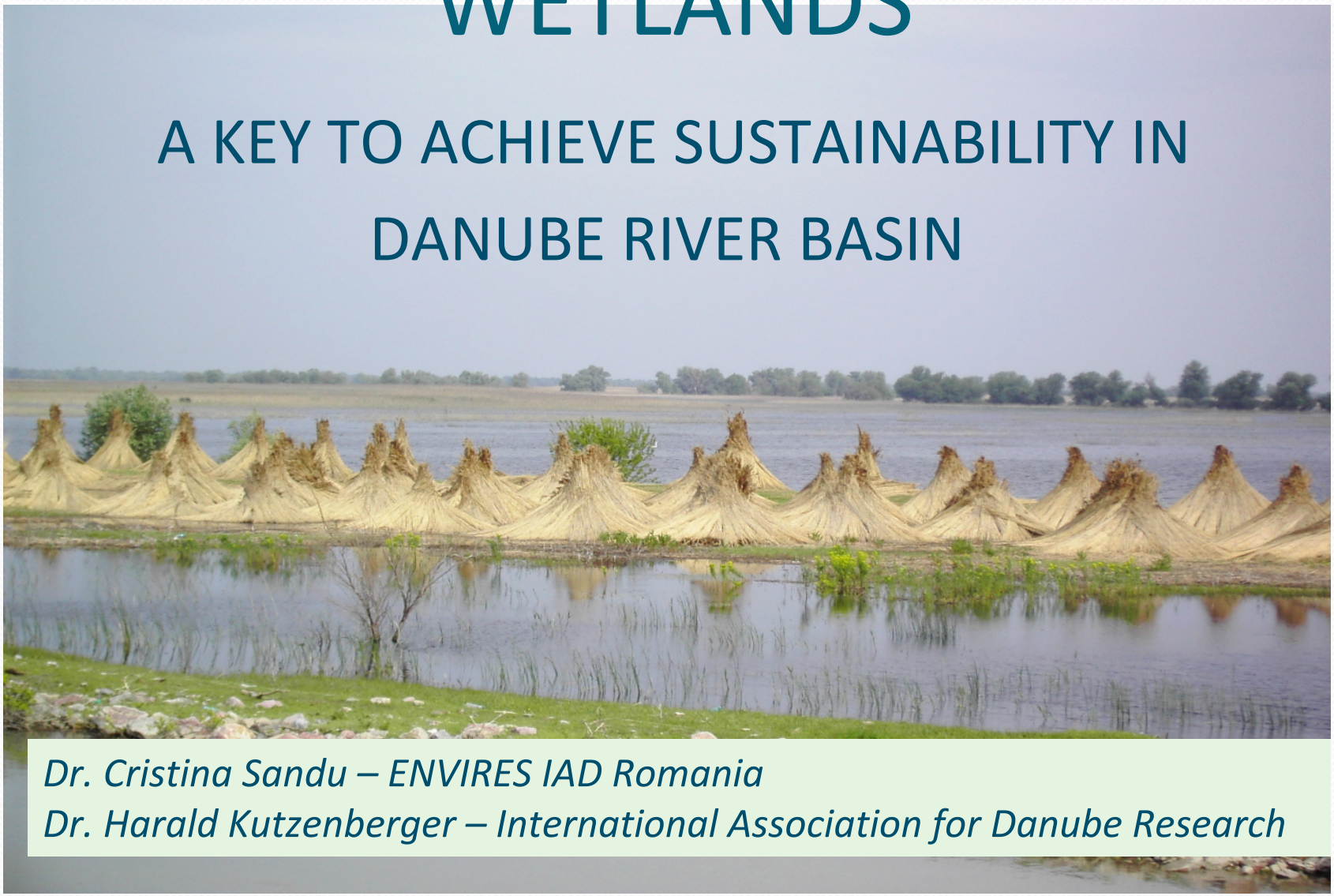
WETLANDS

A KEY TO ACHIEVE SUSTAINABILITY IN DANUBE RIVER BASIN



Dr. Cristina Sandu – ENVIRES IAD Romania
Dr. Harald Kutzenberger – International Association for Danube Research

DRBMP – support for WFD implementation

WFD aim: “to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which:

(a) prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and **wetlands** directly depending on the aquatic ecosystems;

(b) promotes **sustainable water use** based on a long-term protection of available water resources

……

Art.1, Water Framework Directive, 2000/60/EC

What are "wetlands"?

"Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres"

Art.1, The Ramsar Convention on Wetlands

Why are they important ?

• Considered as low-use areas, wetlands were drained, filled, embanked and converted to agricultural or construction land

• Consequent habitat alteration and system fragmentation led to disrupted structures and functions

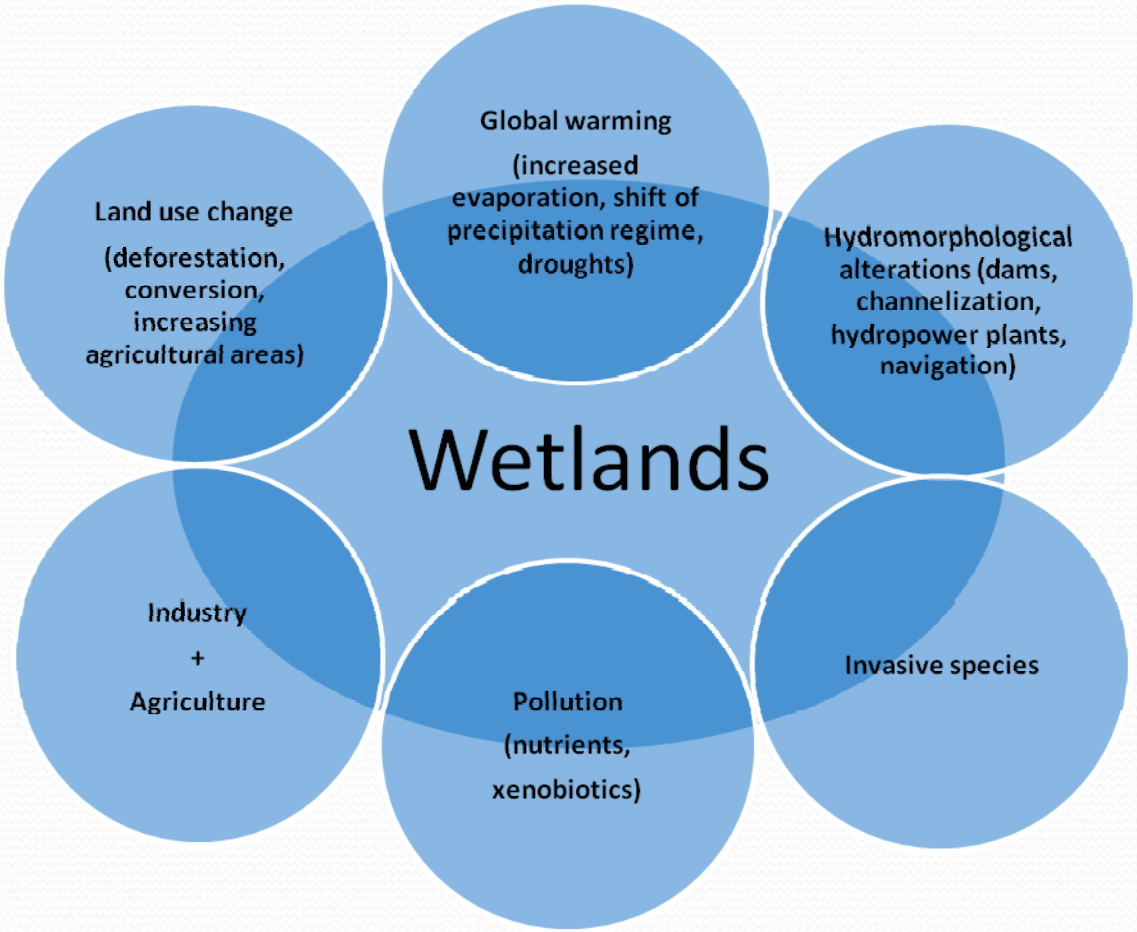
- US > 50% of wetlands drained between 1780s and 1980s (Meyer, 1995)
- DRB – over 80% of the floodplains lost or functionally extinct (WWF 1999)

• Besides a direct value (estimated from commercial fishing, hunting, tourism, etc.), wetlands provide essential life-support services (e.g. water purification, flood retention, climate moderation, wildlife habitat)

• Loss of their functions led to a significant decrease of human well-being

What caused their degradation?

Major cause: Increasing anthropogenic pressures



Chemical pollution

- 300 mio tons synthetic compounds used annually
- In the European Union > 100,000 registered chemicals
- 30,000 - 70,000 - in daily use (Schwarzenbach et al. 2006)

Impact:

- Not all can be retained in WWTP
- Some bioaccumulate
- Dramatic effects along the food webs (e.g. endocrine disruptors, pharmaceuticals)
- Nutrients (nitrogen and phosphorus) → eutrophication

Hydromorphological alterations

Disruption of natural river flows:

- alteration of lateral, longitudinal and vertical connectivity

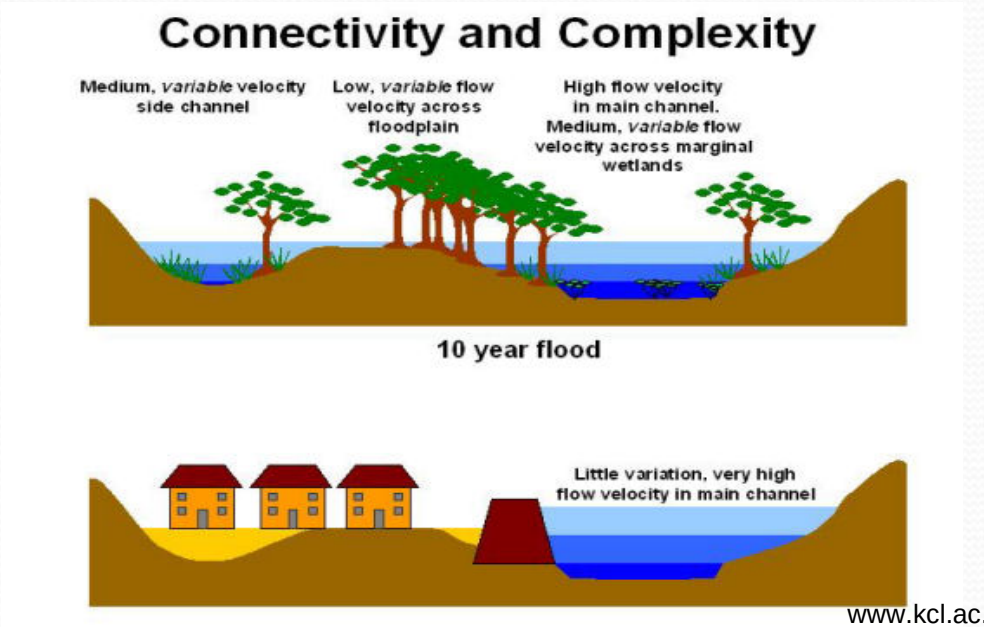
-changed hydrology (discharge, flow)

-habitat fragmentation,

-loss of floodplains and adjacent wetlands,

-changes of sediment flux - deterioration of river deltas and estuaries,

-decrease of water quality



www.kcl.ac.uk

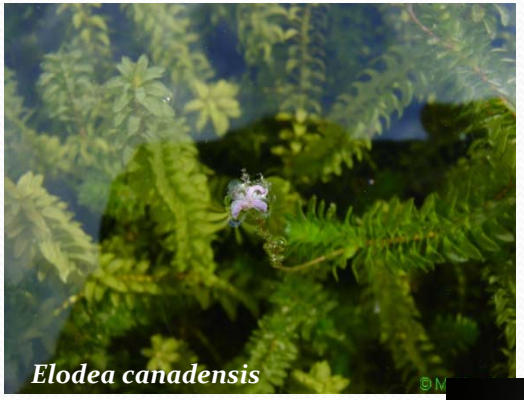
Impact of invasive species

E.g. Introduction of *Procambarus clarkii* for aquaculture

- After the crayfish introduction, Chozas Lake (Spain) switched from clear to turbid
- Trophic cascade effect
  - 99% macrophytes coverage reduction
  - 71% losses in macroinvertebrate genera,
  - 83% reductions in amphibian species
  - 52% reduction of waterfowls
  - Plant-eating birds - negatively affected (75% losses in ducks species)
  - Fish and crayfish-eating birds increased their presence
- Removal of *P. clarkii* from lakes mesocosms → plant recovery up to 95%;
- After reintroduction → 60% of the plant biomass destroyed in 2 weeks.
- Even relatively low crayfish densities (<1 ind/m^2) can completely remove submerged vegetation from shallow lakes and streams in the Iberian Peninsula

(Rodrıguez et al, 2005)

Invasive species along the Danube River (Puky et al., 2008)


Elodea canadensis


Azolla filiculoides


Orconectes limosus

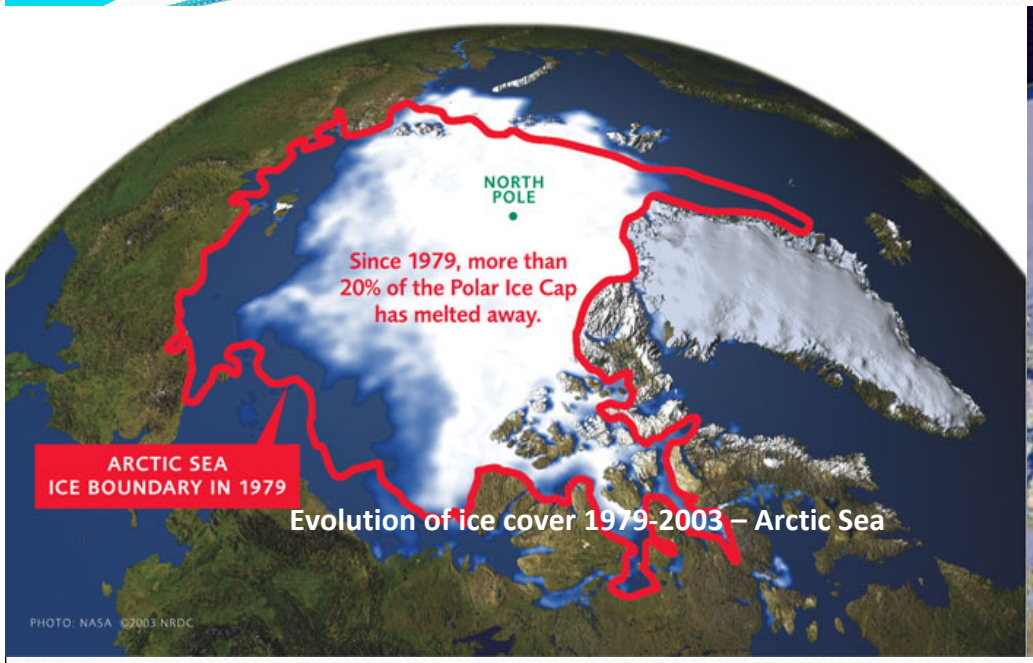

Hemimysis anomala

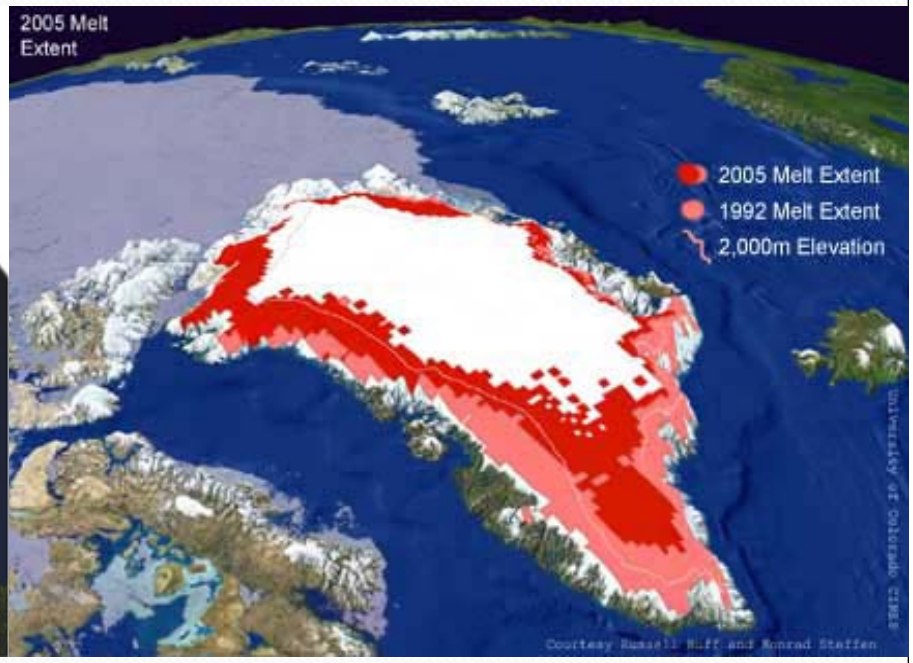

Corbicula fluminea


Katamysis warpachowskyi


Dreissena polymorpha

Global warming





Evolution of ice cover 1979-2003 – Arctic Sea

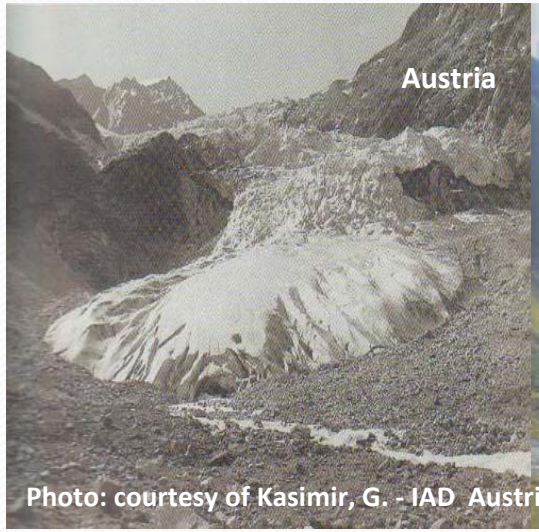
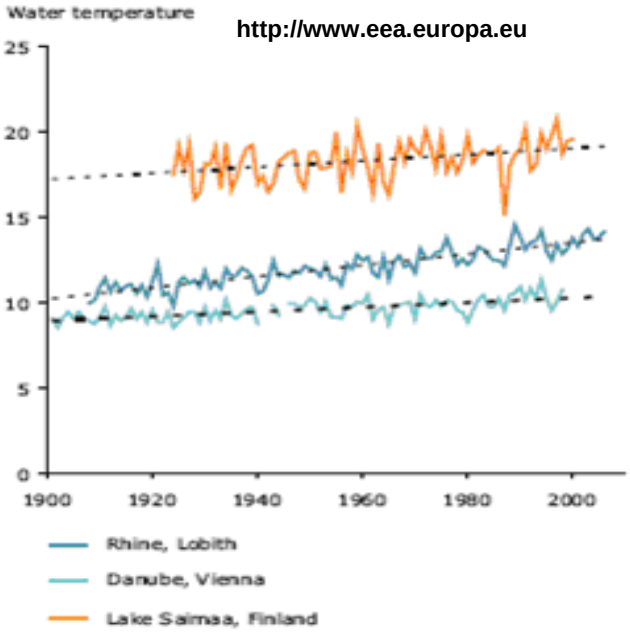
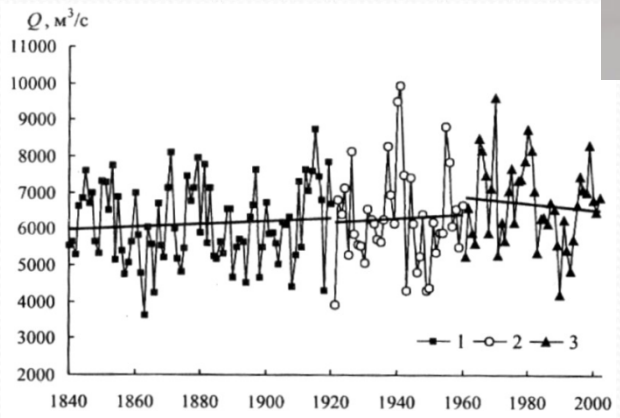


Photo: courtesy of Kasimir, G. - IAD Austria

Impact of global warming on Danube River

- Decreasing discharge of Danube River
- Increasing water temperature
- Increasing frequency of weather extreme events





Danube discharge between 1840 – 2002 at Reni (source : Michaylov, 2004)

Climate change - Predictions for the near future

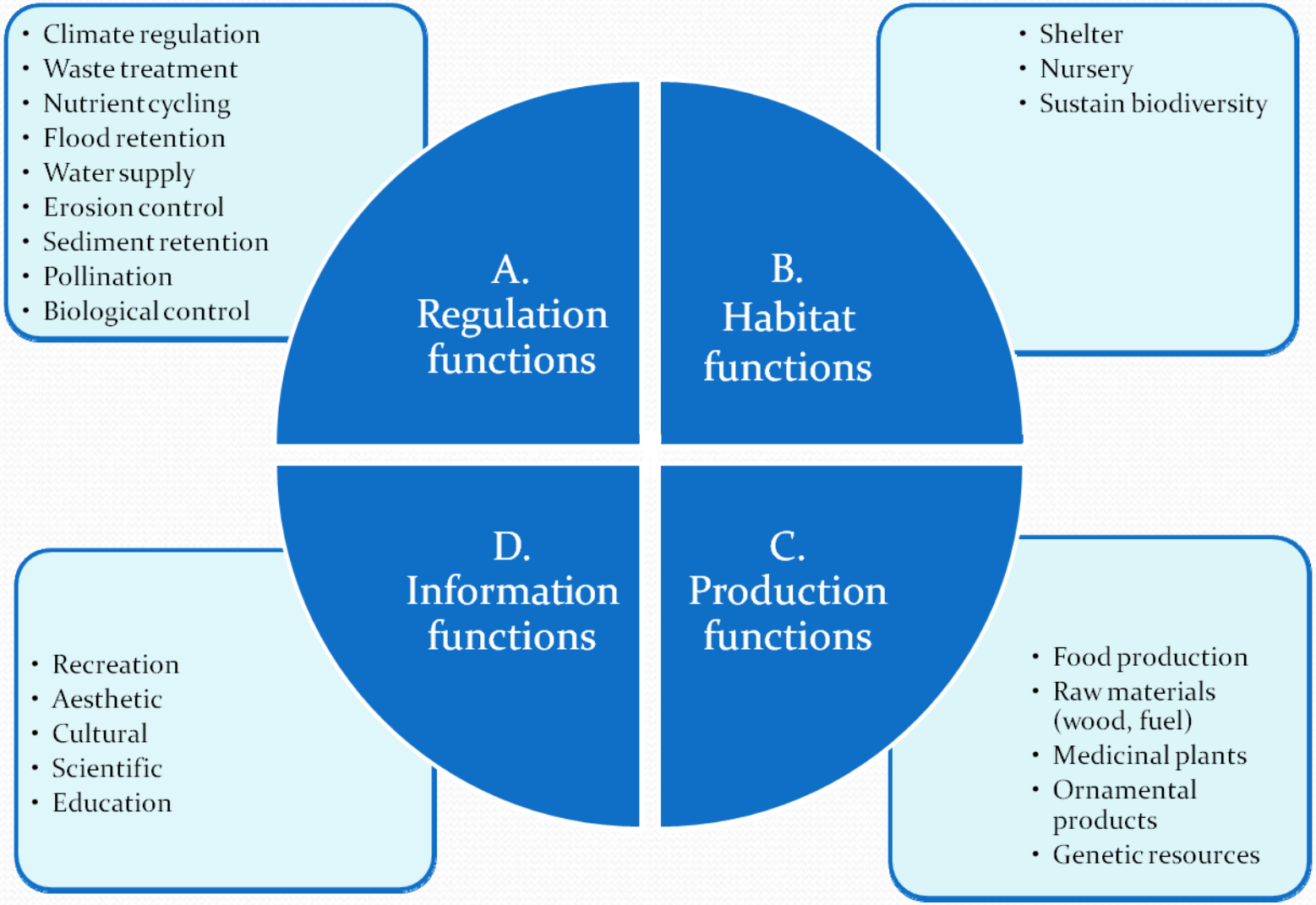
CLAVIER – Climate change and variability: Impact on Central and Eastern Europe – Institute of Geography, RA
CECILIA – Central and Eastern Europe Climate Change Impact and Vulnerability Assessment - National Administration of Meteorology

Trend induced by climate change 2021 – 2050 vs. 1961 – 1990

- General trend of climate warming in all seasons
- Transition towards milder winters
- More precipitation in winter
- Summer: likely precipitation decrease => severe droughts in the southern and south-eastern regions + higher frequency of heavy rains

Source: Balteanu et al., 2009; Boroneant et al., 2009 – Biowetman wks Bucharest

Wetlands – essential role in WFD implementation



Major ecosystem services provided by wetlands (after de Groot et al, 2002)

What do we know already?

Water scarcity has affected Europe – damages > 100 billion euro in the last three decades (EEA, 2009) – urgent measures are needed.

Wetlands/floodplains play a key role in the management of the freshwater resources

Connectivity is essential for sustaining functional processes.

Nowadays we can estimate the consequences of wetlands loss.

For altered wetlands, compensations must be provided to mitigate the impact…
..BUT…loss of some species might be irreversible (e.g. *Atlantic sturgeon* failed to be restocked in Rhine, Oder, Elbe, etc)

Implementation of scientific knowledge - changing policies across the globe -

LT studies – floods – up to 80 percent higher in watersheds without wetlands than in basins with large wetland areas (U.S. ACOE 1976)

US – dikes for flood prevention replaced by the "living river" approach and wetlands restoration on Napa River (Turner & Daily, 2008)

China - flooding in 1998 (damages of 20 billion US$) – the government promoted a new land-use policy - National Forest Conservation Program (Turner & Daily, 2008)

US – Waste water treatment plant was replaced by watershed restoration in New York area (Daily & Elisson, 2002)

Good solutions by joint efforts in DRB

- Promote the “catchment approach” – besides aquatic, terrestrial ecosystems should be considered as well
- Enhance the protection of Green Corridor and of the remaining wetlands
- Conserve and restore wetlands across the whole catchment
- Diminish the anthropogenic impact:
    - Decrease water abstraction and hydropeaking during droughts
    - Reduce pollution
    - Respect the “environmental window” concept
    - Limit deforestation and habitat fragmentation
    - SEA before any future projects who could impact wetlands
- Joint lobby at EU level for **equal weight** of the environment and the infrastructure projects

Balance the human and the environmental needs

Thank you

Contact: International Association for Danube Research, www.iad.gs