![Biodiversity Knowledge logo]

Creating a Network of Knowledge for biodiversity and ecosystem services
www.biodiversityknowledge.eu

Multifunctionality of floodplain landscapes: the effects of management options on ecosystem services

Stefan Schindler

Department of Conservation Biology, University of Vienna, Austria
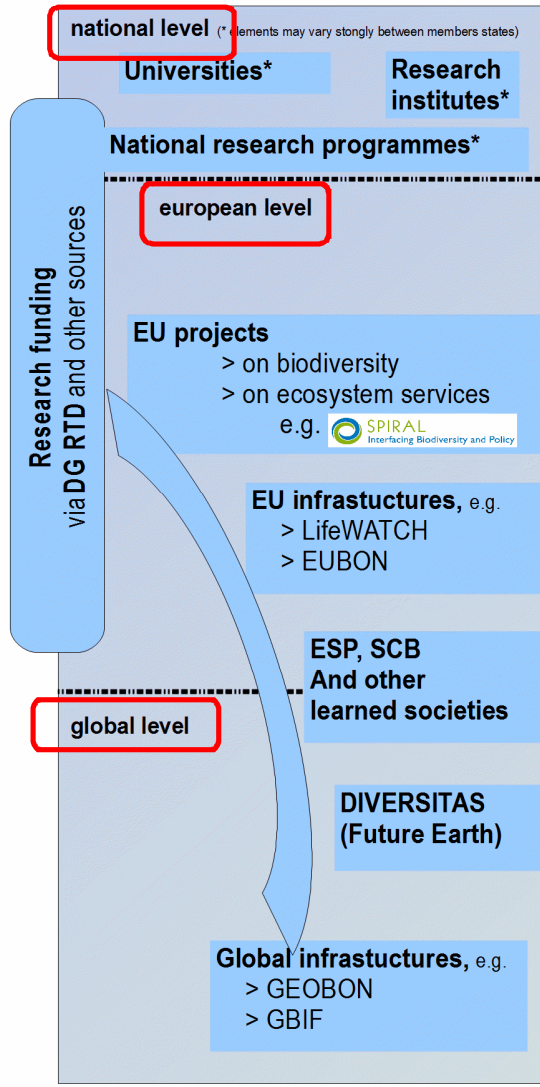**Environment Agency Austria, Vienna, Austria**

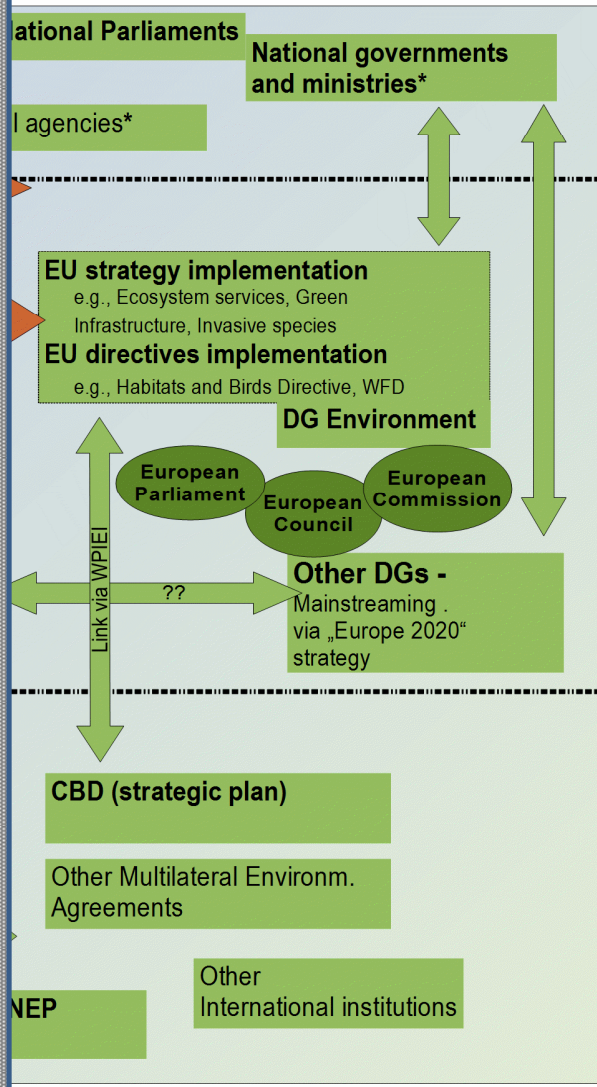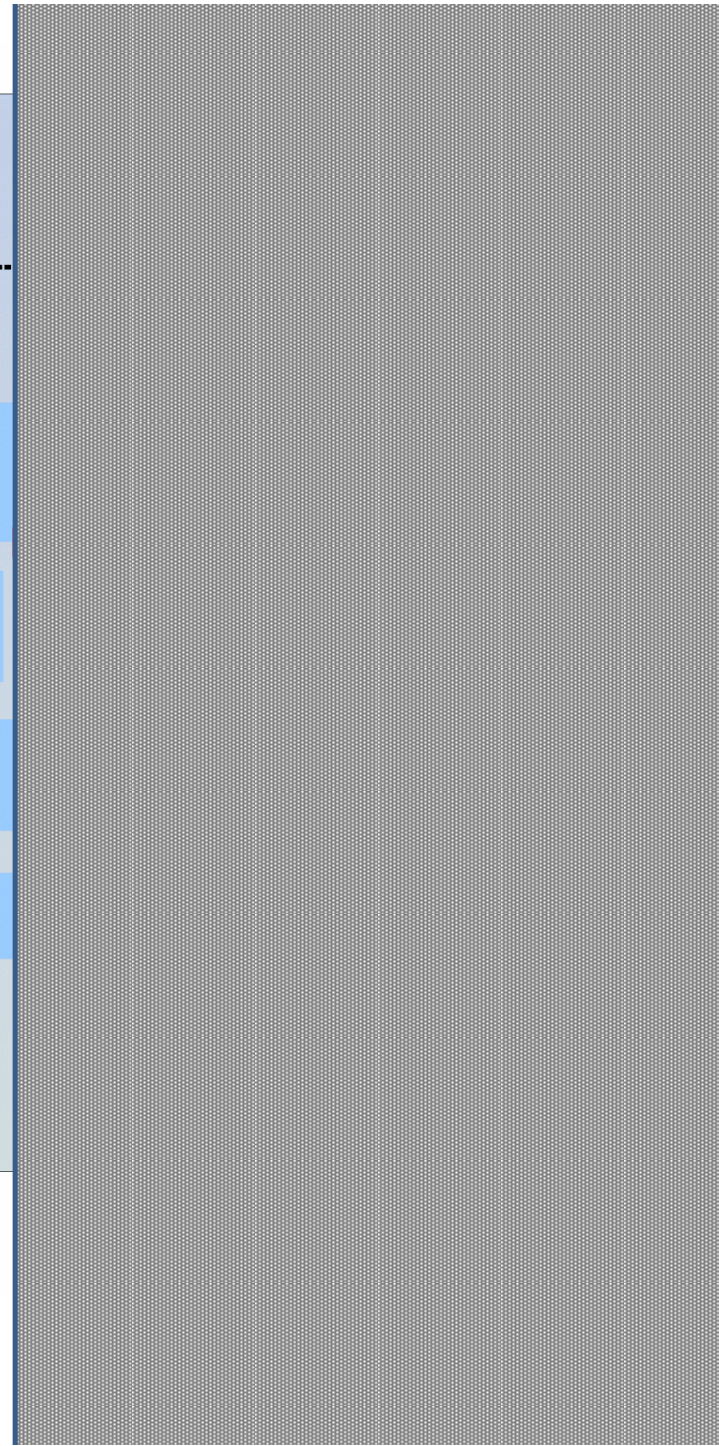# *BiodiversityKnowledge (KNEU)*
Coordination Action Project in FP7

Project Aim:

Developing a Knowledge Network for European expertise on biodiversity and ecosystem services to inform policy making
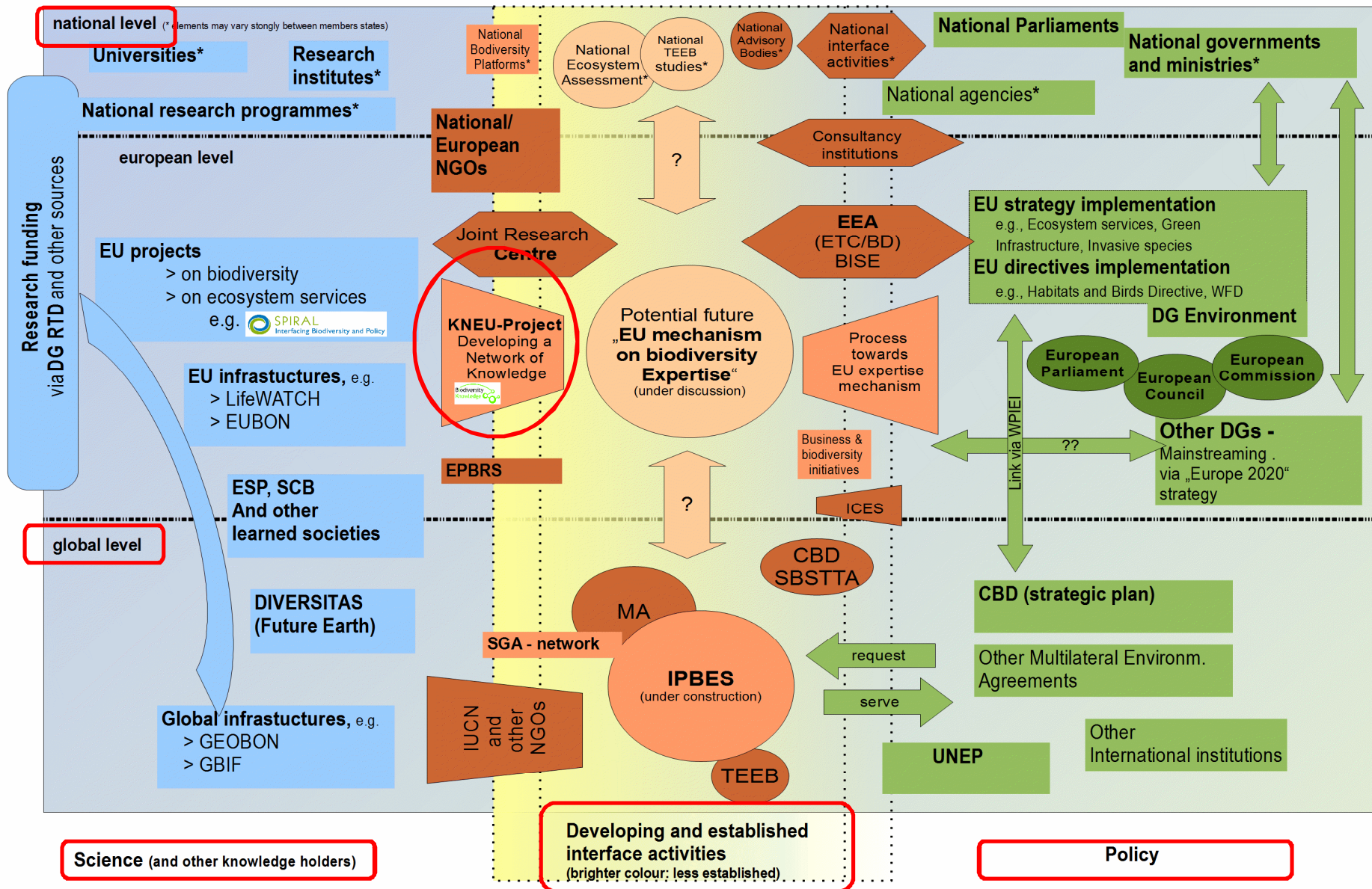
national level (* elements may vary strongly between members states)

Universities*

Research institutes*

National research programmes*

european level

Research funding via **DG RTD** and other sources

EU projects
> on biodiversity
> on ecosystem services
e.g. SPIRAL Interfacing Biodiversity and Policy

EU infrastuctures, e.g.
> LifeWATCH
> EUBON

ESP, SCB And other learned societies

global level

DIVERSITAS (Future Earth)

Global infrastuctures, e.g.
> GEOBON
> GBIF

Science (and other knowledge holders)

National Parliaments

National governments and ministries*

al agencies*

EU strategy implementation
e.g., Ecosystem services, Green Infrastructure, Invasive species

EU directives implementation
e.g., Habitats and Birds Directive, WFD

DG Environment

European Parliament

European Council

European Commission

Other DGs - Mainstreaming . via „Europe 2020" strategy

Link via WPIEI

??

CBD (strategic plan)

Other Multilateral Environm. Agreements

NEP

Other International institutions

Policy

Biodiversity Knowledge

national level (* elements may vary stongly between members states)

Universities*

Research institutes*

National research programmes*

National/ European NGOs

european level

EU projects
> on biodiversity
> on ecosystem services
e.g. SPIRAL *Interfacing Biodiversity and Policy*

Joint Research Centre

KNEU-Project Developing a Network of Knowledge

EU infrastuctures, e.g.
> LifeWATCH
> EUBON

EPBRS

ESP, SCB And other learned societies

global level

DIVERSITAS (Future Earth)

SGA - network

Global infrastuctures, e.g.
> GEOBON
> GBIF

IUCN and other NGOs

Research funding via DG RTD and other sources

National Biodiversity Platforms*

National Ecosystem Assessment*

National TEEB studies*

National Advisory Bodies*

National interface activities*

Consultancy institutions

?

EEA (ETC/BD) BISE

Process towards EU expertise mechanism

Potential future „EU mechanism on biodiversity Expertise" (under discussion)

Business & biodiversity initiatives

ICES

?

MA

CBD SBSTTA

IPBES (under construction)

TEEB

National Parliaments

National governments and ministries*

National agencies*

EU strategy implementation
e.g., Ecosystem services, Green Infrastructure, Invasive species

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Other DGs - Mainstreaming . via „Europe 2020" strategy

Link via WPIEI

??

CBD (strategic plan)

request

serve

Other Multilateral Environm. Agreements

UNEP

Other International institutions

Developing and established interface activities
(brighter colour: less established)

Science (and other knowledge holders)

Policy

Drafted by UFZ Science-Policy Expert Group, 2nd revision, 1.8.2012

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Work flow

Timeline (vertical arrow pointing upward)

Evaluation

- Future "Network of Knowledge" framework
- Testing the prototype in case studies
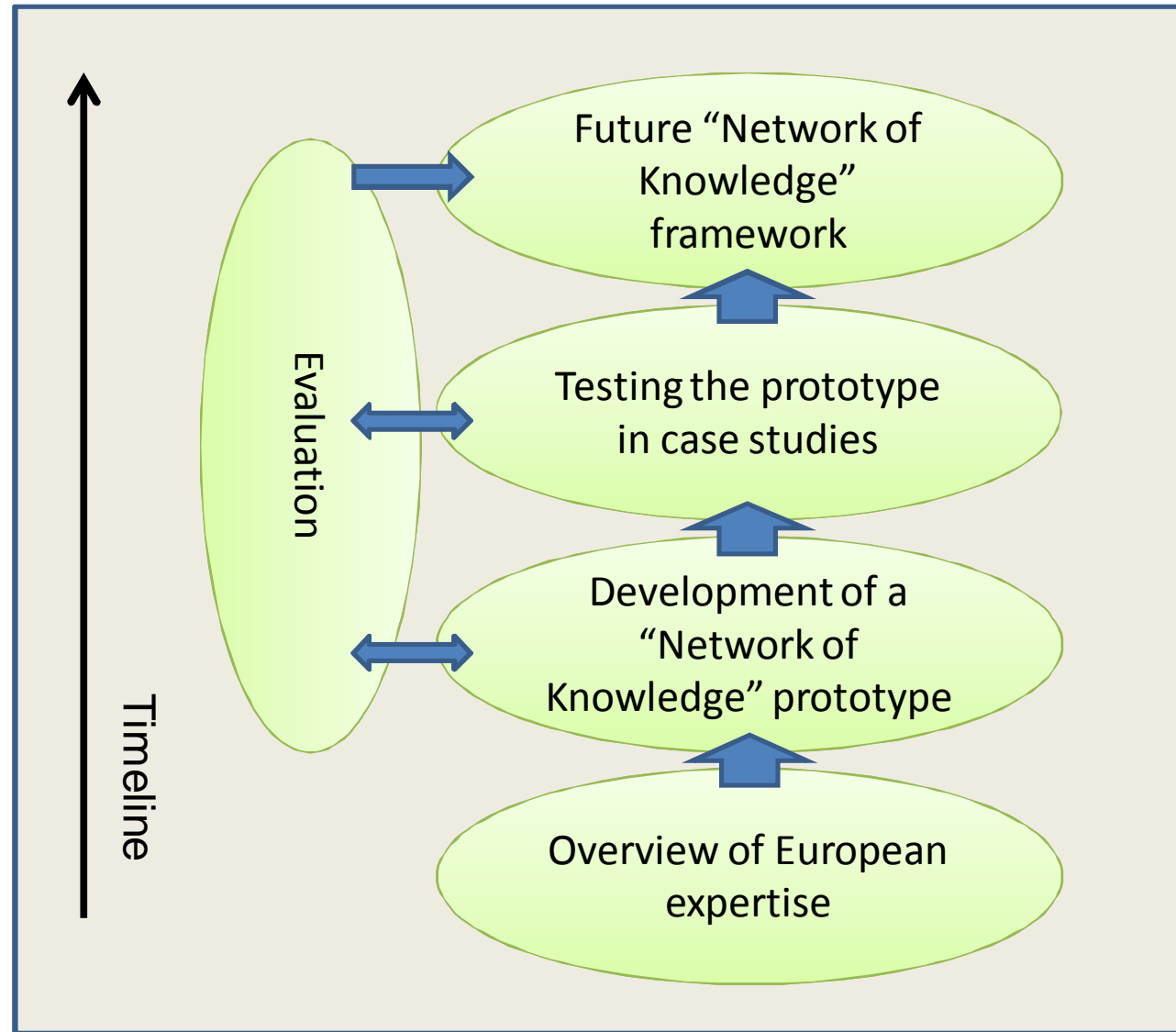- Development of a "Network of Knowledge" prototype
- Overview of European expertise

Testing the prototype: the demonstration cases

Objectives

perform **three** policy-relevant demonstration cases to:

- test the Network of Knowledge (NoK) prototype in praxis
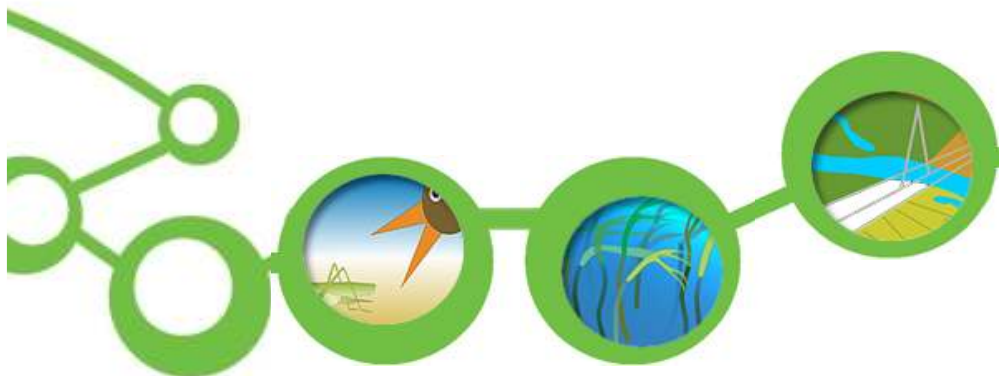- produce policy relevant output in the topics of the demonstration cases

Demonstration cases:

should cover different sectors and test the NoK prototype ->

„Marine case"
„Agriculture case"
„Conservation case"

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Policy context: "Conservation case"

- **DG Environment** involved in the selection of the topic

- **EU Biodiversity Strategy 2020**

  6 Targets... –

  Target 2: "By 2020, ecosystems and their services are maintained and enhanced by establishing Green Infrastructure and restoring at least 15% of degraded ecosystems"

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Broad Context:

How does Green Infrastructure contribute to multifunctional land-use and well balanced delivery of ecosystem services

Specific Question:

What is the impact of multifunctional floodplain management on biodiversity

Setting of the Question for the reviewing work:

What is the impact of floodplain management measures on biodiversity and how does the impact vary according to the level of multifunctionality of the measures

Assessments

1) Systematic review protocol and systematic map dealing with the impact of floodplain management measures on biodiversity

2) Country specific expert consultation covering IRE, NL, D, SLK, H and UKR to assess regulation history, multifunctional management projects and biodiversity effects

3) Expert consultation that elaborated a matrix specifying the effects of 38 bundles of floodplain interventions to 21 ecosystem services

Biodiversity Knowledge

1) Systematic review (SR) and SR protocol

Primary question:

What is the impact of floodplain management measures on biodiversity and how does the impact vary according to the level of multifunctionality of the measures?
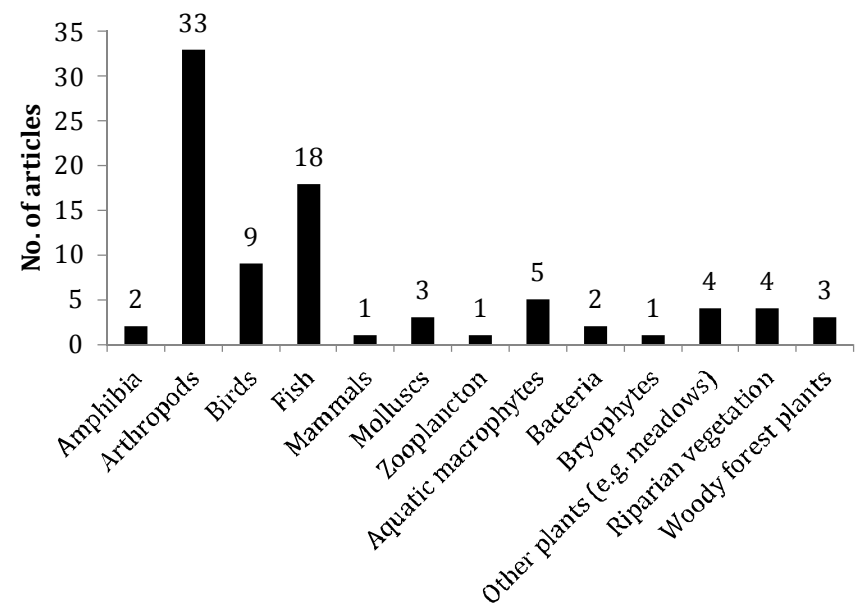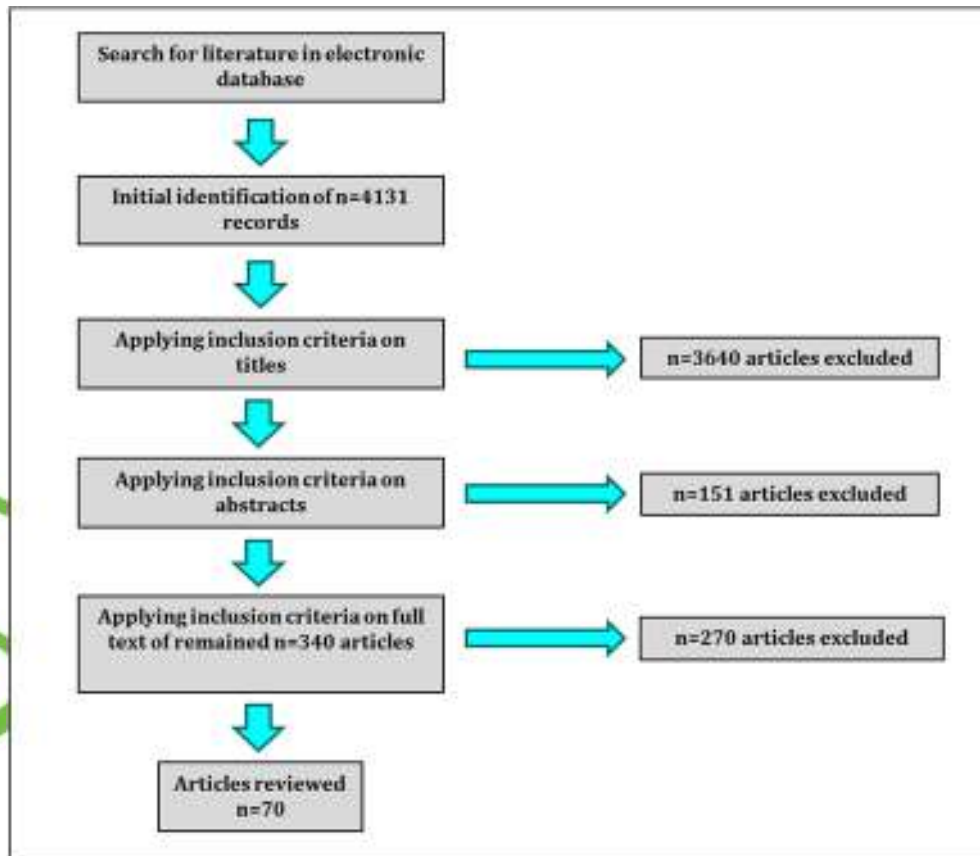
2) Country specific expert consultation
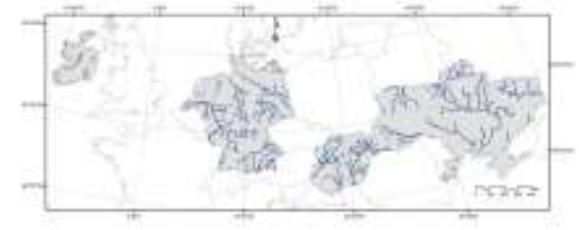
Biophysical conditions

SK   Dense network of streams including mountain brooks, upland small rivers and mighty rivers in lowlands

HU   Meandering rivers in a flat landscape

Main land uses in floodplain

SK   Hydropower, settlements, agriculture nature protection, recreation

HU   Agriculture, forestry, nature conservation

Governance level responsible for floodplain management

SK   Case dependent, mostly local, except for the big rivers

HU   Centralized, but involvement of regional and local stakeholders

Main strategic approaches / management aims

SK   Decrease of water pollution, nature conservation, flood protection

HU   Flood protection is the top priority, forestry is the second

## Multifunctional management approaches

SK   Creation of multimodal transport corridors respecting nature values

HU   Multifunctional projects for reintroduction of grazing, mitigation of invasive species and hydrological rehabilitation
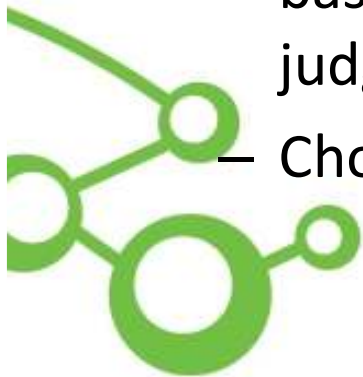
Evidence for biodiversity impact

SK   Rich evidence of diverse effect mainly from Gabčíkovo and the Váh cascade

HU   Bird and fish diversity increased, plant diversity could be conserved

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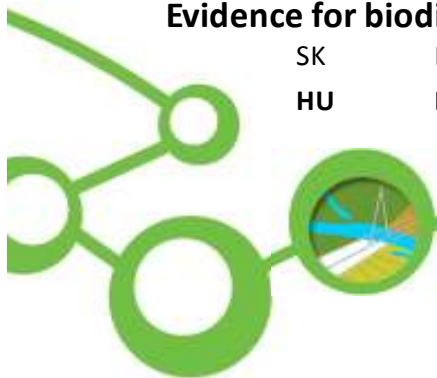
3) Intervention – ES matrix

- **Developing a matrix to relate floodplain management interventions to ES**
  - Compilation of a list of the most relevant floodplain management measures (n=38)
  - List of ES based on the CICES/MAES classification
  - Compilation of a capacity matrix: relates 38 bundles of interventions to 21 ES
  - based on expert knowledge (at least 3 experts per judgment)
  - Choices (0, +, -, +/-) combined with explanation

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Bundle of intervention	Intervention	Terrestrial plants and animals for food	Freshwater plants and animals for food	Water for human consumption	Water for agricultural use	Water for industrial and energy uses	Biotic materials	Biomass based energy	Bioremediation	Dilution and sequestration	Air flow regulation	Water flow regulation	Mass flow regulation	Atmospheric regulation	Water quality regulation	Pedogenesis and soil quality regulation	Lifecycle maintenance, habitat and gene pool protection	Pest and disease control (incl. invasive alien species)	Aesthetic, Heritage	Spiritual	Recreation and community activities	Information & knowledge
1	Surface water extraction	↘↗	↘	↘↗	↘↗	↘↗	↘	↘↗	↘	↘	0	↘↗	↘	↘	↘	↘	↘	↘↗	↘	↘	↘	↘↗
1	Groundwater extraction	↘↗	↘	↘↗	↘↗	↘↗	↘	↘↗	↘	↘	0	↘	0	↘	0	↘	↘	0	0	0	0	0
1	Mineral resource extraction	↘	↘↗	↘	↘↗	0	↘	↘	↘	↘	0	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘↗	↘↗
2	Settlement and traffic infrastructure	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	0	↘	↘	↘	↘	↘	↘	↘	↘
2	Energy conversion	↘	↘	↘	↗	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘↗	↘↗
2	Navigational infrastructure	↘	↘	↘	↘	↘	↘	0	↘	↘	0	↘	↘	0	↘	↘	↘	↘	↘	↘	↘↗	↘
3	Forestry intensive	↘	↘	↘	↘	↘	↘↗	↗	↘	↘	0	↘	↘	↘↗	↘	↘	↘	↘	↘	↘	↘	↘
3	Agriculture intensive	↗	↘	↘	↘	↘	↘↗	↗	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘	↘
3	Fishery intensive	↘	↘↗	↘	0	0	↘	0	0	0	0	↘	↘	0	↘	0	↘	↘	↘	↘	↘	↘
4	Forestry extensive	0	0	0	0	0	↗	↗	0	0	0	0	0	0	0	0	↘	0	0	↘	↗	↘↗
4	Agriculture extensive	↗	0	↘	0	0	↗	0	0	0	0	0	0	0	0	0	↘↗	↘	↘↗	↘	↗	0
4	Fishery extensive	0	↗	0	0	0	0	0	0	0	0	0	0	0	0	0	↗	0	↗	↗	↗	↗
4	Hunting	↗	0	0	0	0	↗	0	0	0	0	0	0	0	0	0	↘	↘↗	0	↘	↘↗	0
5	Channel corrections	↘↗	↘	↘	↘	↘	↘↗	↗	↘	↘	0	↘	↘	↘	↘	↘↗	↘	↘	↘	↘	↘↗	↘
5	Dike construction	↗	↘	↘	0	↗	↗	↗	↘	↘	0	↘↗	↘	↘	↘	↘	↘	↘	↘	↘	↗	↘↗
5	Bank/bed stabilization	↗	↘	↘↗	↘↗	↘↗	↘↗	↗	↘	↘	0	↘	↘	↘	↘↗	↘	↘	↘	↘	↘↗	↘	
5	Sediment removal/dredging	0	↘	↘	↘	↘	0	0	0	↘↗	0	↘	↘	↘	↘↗	0	↘	0	0	↘	↘↗	0
5	Detention basins	↘	↘	0	0	0	↘	↘	↘	↘	0	↘↗	↘	↗	↘	↘	↘	↘↗	↘	↘↗	↘↗	
5	Controlled retention areas	↘	↘	↘	↘	↘	↘	0	↘	↘	0	↗	0	0	↘	↘	↘	↘	↘	↘	↘	0
6	Dike relocation	↘↗	↗	↗	↗	↗	↘↗	↘	↗	↗	0	↗	↗	↗	↗	↗	↘↗	↗	↗	↘↗	↗	
6	Ecologically improved groynes	0	↗	0	0	0	0	0	0	0	0	0	0	0	0	0	↗	0	0	0	↘	0
6	Lowering floodplain/foreland	↘↗	↗	↗	↗	↗	↘↗	↘↗	↘↗	↗	0	↗	↗	↗	↗	↘↗	↘↗	↘↗	↘↗	↘↗	↗	↘↗
6	Sediment addition into river bed	0	↗	0	0	0	↗	↗	↗	↗	0	↗	↗	↗	↗	↗	↗	0	↗	↗	↘↗	↗
6	Removing obstacles	0	↗	0	0	0	↗	0	↗	0	0	↗	↗	0	↗	↗	↗	0	↗	↗	↘	0
7	Removal of bank fixations	↘	↗	↘↗	↗	↗	↘↗	↘	↗	↗	0	↗	↗	0	↗	↘↗	↗	↘↗	↗	↘↗	↗	
7	Removal of dams and weirs	0	↗	0	0	0	0	0	↗	0	0	0	↗	0	↗	0	↗	↘↗	↘↗	↗	↘↗	0
7	Lateral floodplain reconnection	0	↗	↗	↗	↗	↘↗	↘	↗	↗	0	↗	↗	↗	↗	↘↗	↗	↗	↗	↗	↘	↗
7	Channel, oxbow and pond creation	↘	↗	↗	↗	↗	↘↗	↘	↗	↗	0	↗	↗	↗	↗	↗	↘	↗	↗	↗	↗	
7	Construction of fish passages	0	↗	0	0	0	↗	0	0	0	0	0	0	0	0	0	↗	↘	0	0	↗	0
8	Creating natural habitat from forest	↗	↗	↗	↗	↗	↘↗	↘	↗	↘↗	0	↗	↗	0	↗	↗	↗	↗	↗	↘↗	↗	
8	Creating natural habitat from agro land	↘	↗	↗	↗	↗	↘↗	↘	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↘↗	↗	
8	Creating nat. habitat from extraction sites	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↗	↘↗	↗	
8	Control of invasive alien species	↗	↗	↘	0	0	↘↗	↘↗	↗	↘↗	0	↗	↗	0	0	↗	↗	↗	↗	↗	↗	
8	Creation of gravel banks	0	↗	0	0	0	0	0	↗	0	0	0	↗	0	0	↗	↗	↘	0	↗	↗	↗
8	Elimination of top soil	↘	0	↘	0	0	↘	↘	↘	0	↗	↗	↘	↗	↘↗	↗	↘↗	↘	0	0	↘↗	
8	Land use extensification	↘	↘↗	↗	0	0	↘↗	↘	↗	↗	0	0	↘	↗	↗	↗	↗	↗	↗	0	↗	↗

Bundle of intervention	Intervention	Terrestrial plants and animals for food	Freshwater plants and animals for food	Water for human consumption	Water for agricultural use	Water for industrial and energy uses	Biotic materials	Biomass based energy	Bioremediation	Dilution and sequestration	Air flow regulation	Water flow regulation	Mass flow regulation	Atmospheric regulation	Water quality regulation	Pedogenesis and soil quality regulation	Lifecycle maintenance, habitat and gene pool protection	Pest and disease control (incl. invasive alien species)	Aesthetic, Heritage	Spiritual	Recreation and community activities	Information & knowledge
6	Dike relocation	↘↗	↗	↗	↗	↗	↘↗	↘	↗	↗	0	↗	↗	↗	↗	↗	↗	↘↗	↗	↗	↘↗	↗
6	Ecologically improved groynes	0	↗	0	0	0	0	0	0	0	0	0	0	0	0	0	↗	0	0	0	↘	0
6	Lowering floodplain/foreland	↘↗	↗	↗	↗	↗	↘↗	↘↗	↘↗	↗	0	↗	↗	↗	↗	↘↗	↘↗	↘↗	↘↗	↘↗	↘↗	↘↗
6	Sediment addition into river bed	0	↗	↗	↗	↗	↗	↗	↗	↗	0	↗	↗	↗	↗	↗	↗	0	↗	↗	↘↗	↗
6	Removing obstacles	0	↗	0	0	0	↗	0	↗	0	0	↗	↗	0	↗	↗	↗	0	↗	↗	↘	0
7	Removal of bank fixations	↘	↗	↗	↗	↗	↘↗	↘	↗	↗	0	↗	↗	0	↗	↘↗	↗	↘↗	↗	↗	↘↗	↗
7	Removal of dams and weirs	0	↗	0	0	0	0	0	↗	0	0	0	↗	0	↗	0	↘↗	↘↗	↗	↘↗	↘↗	0
7	Lateral floodplain reconnection	0	↗	↗	↗	↗	↘↗	↘	↗	↗	0	↗	↗	↗	↗	↘↗	↗	↗	↗	↗	↘	↗
7	Channel, oxbow and pond creation	↘	↗	↗	↗	↗	↘↗	↘	↗	↗	0	↗	↗	↗	↗	↗	↗	↘	↗	↗	↗	↗
7	Construction of fish passages	0	↗	0	0	0	↗	0	0	0	0	0	0	0	0	0	↗	↘	0	0	↗	0

Multifunctionality index of intervention types

equals the difference of the number of positively and negatively affected ESS divided by the overall numbers of considered ESS.

ranges between -1 (all ESS were negatively affected) and +1 (all ESS were positively affected), and received the value of ±0 when the number of positively affected ESS equaled the number of negatively affected ones.

Interventions with positive values of the multifunctionality index are supposed to increase the level of multifunctionality of the landscape, by a larger variety of ESS provided as a result of the intervention.

Multifunctionality index of intervention types

| Bundle of inter-vention	Intervention	Provisioning services	Regulation/ maintenance services	Cultural services	Overall (all 21 ESS)
1	surface water extraction	-0.29	-0.70	-0.75	-0.57
1	groundwater extraction	-0.29	-0.60	0.00	-0.38
1	mineral resource extraction	-0.57	-0.90	-0.50	-0.71
2	settlement and traffic infrastructure	-1.00	-0.90	-1.00	-0.95
2	energy conversion	-0.43	-1.00	-0.50	-0.71
2	navigational infrastructure	-0.86	-0.80	-0.75	-0.81
3	forestry intensive	-0.57	-0.80	-1.00	-0.76
3	agriculture intensive	-0.29	-1.00	-1.00	-0.76
3	fishery intensive	-0.43	-0.50	-1.00	-0.57
4	forestry extensive	0.29	-0.10	0.00	0.05
4	agriculture extensive	0.14	-0.10	0.00	0.00
4	fishery extensive	0.14	0.10	1.00	0.29
4	hunting	0.29	-0.10	-0.25	0.00
5	channel corrections	-0.43	-0.80	-0.75	-0.67
5	dike construction	0.29	-0.80	-0.25	-0.33
5	bank/bed stabilization	0.14	-0.80	-0.75	-0.48
5	sediment removal/dredging	-0.57	-0.40	-0.25	-0.43
5	detention basins	-0.57	-0.60	-0.25	-0.52
5	controlled retention areas	-0.86	-0.50	-0.75	-0.67

Summarizing per categories
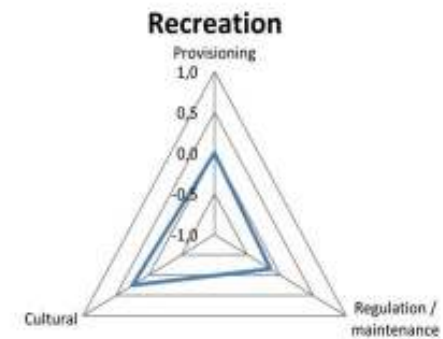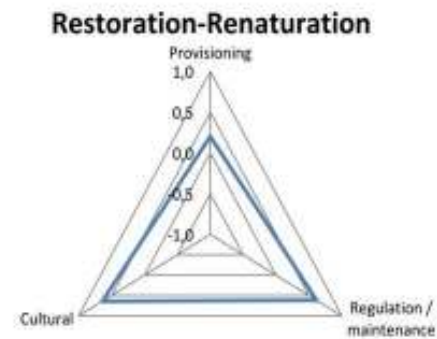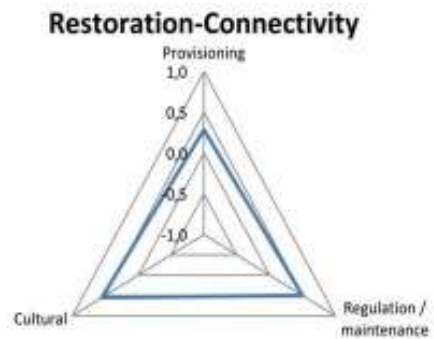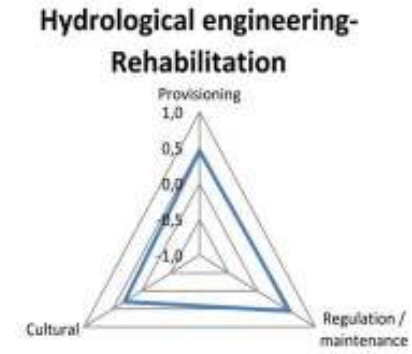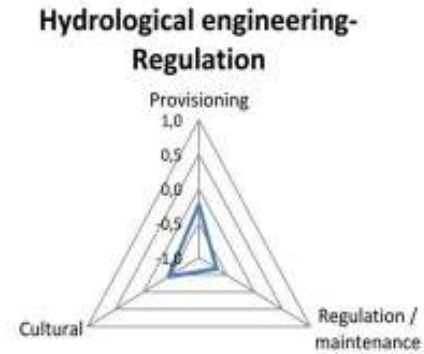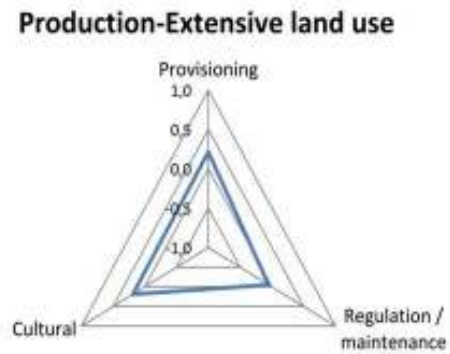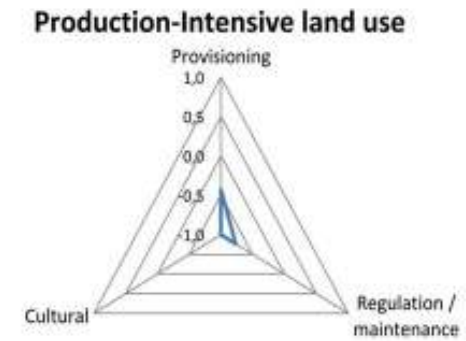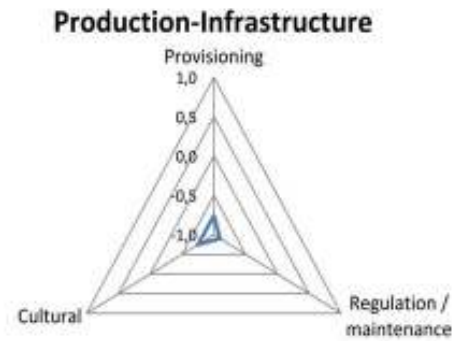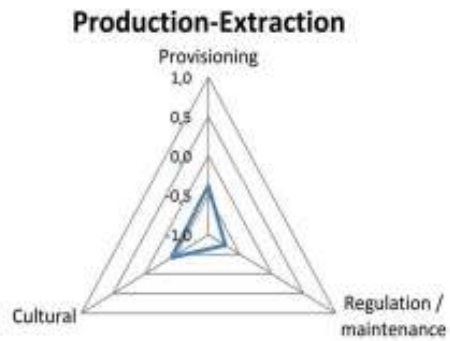
Conclusions 1

- **Restoration and rehabilitation measures** strongly improve the multifunctionality of the landscape and cause win-win situations for enhancing overall ecosystem supply from all three sections, i.e. provisioning, regulation/maintenance, and cultural services.

- **Conventional regulation** but also interventions related to extraction, infrastructure and intensive land use cause lose-lose situations.

Biodiversity
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Conclusions 2

- **Multifunctional floodplain management:**
  issue of growing attention in several European countries;
  complex and still underresearched

- **Evidence for biodiversity effects of floodplain management interventions:**
  still scarce and scattered,
  focusing on few interventions, countries and taxa.
  Analytical research often fails to assess the large (spatial and temporal) scale effects on biodiversity.

Biodiversity
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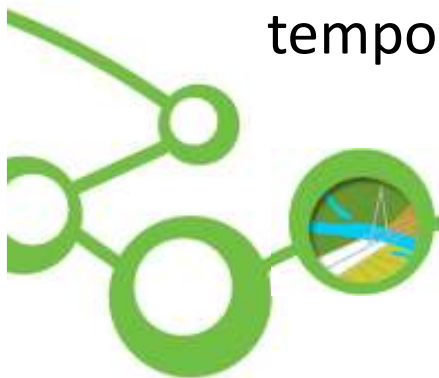
Issues to be discussed

- Which results are useful for practical purposes?
  - For local conservation managers planning specific restoration actions
  - For local/national policy makers deciding for one or the other function/use/project
  - For EU-level policy maker
- Problems with systematic review
  - Evidence scarce, scattered
  - Spatial and temporal scales of available studies doesn´t necessarily meet the policy needs

Biodiversity
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Acknowledgements

Expert Group:

Sebesvari Z, Damm C, Hermann A, Euller K, Mauerhofer V, Kropik M, **Biro M,** Kanka R, Gasso V, Krug A, Lauwaars S, Pusch M, Schulz-Zunkel C, van der Sluis T, Zulka K-P, Lazowski W, Franz E, Hainz-Renetzeder C, Wrbka T, Bunting SW, Henle K, Hoffmann M, Jaquier S, **Balázs L, Borics G**, Hudin S, O'Neill FH, Baranovsky B, Ehlert T, Neukirchen B, Martin JR

Biodiversity Knowledge

stefan.schindler@univie.ac.at

www.biodiversityknowledge.eu

Thank you for your attention!

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