The Elbe (source: picture alliance/dpa)

THE ELBE CONCEPT

Recommendations for a good sediment management practice in the Elbe

Ilka Carls & Peter Heininger

Helmholtz-Zentrum Geesthacht
Zentrum für Material- und Küstenforschung

Hamburg

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01 The Concept

- The Elbe – an international river
- View on the system and methodological approach
- Aspect Quality – Managing contaminated sediments

02 Working with the Concept

- Progress
- Practice
- Challenges & needs

The Elbe – an international river

- **Length:** 1,091 km
- **Area:** 148.268 km²
- **$MQ_{North\ Sea}$:** 877 m³
- **Population:** 25 Mio people (D, CZ)
- **Industry/Mining**: over centuries
- **Agriculture:** 56% of the catchment

source: 1 & 4: ELSA; 2: HPA; 3: WGE; Map: Wikipedia

Integrated sediment management concept (2014)

1st Elbe management plan (2010-15)

Deficient hydromorphological conditions and contamination as supra-regional issues

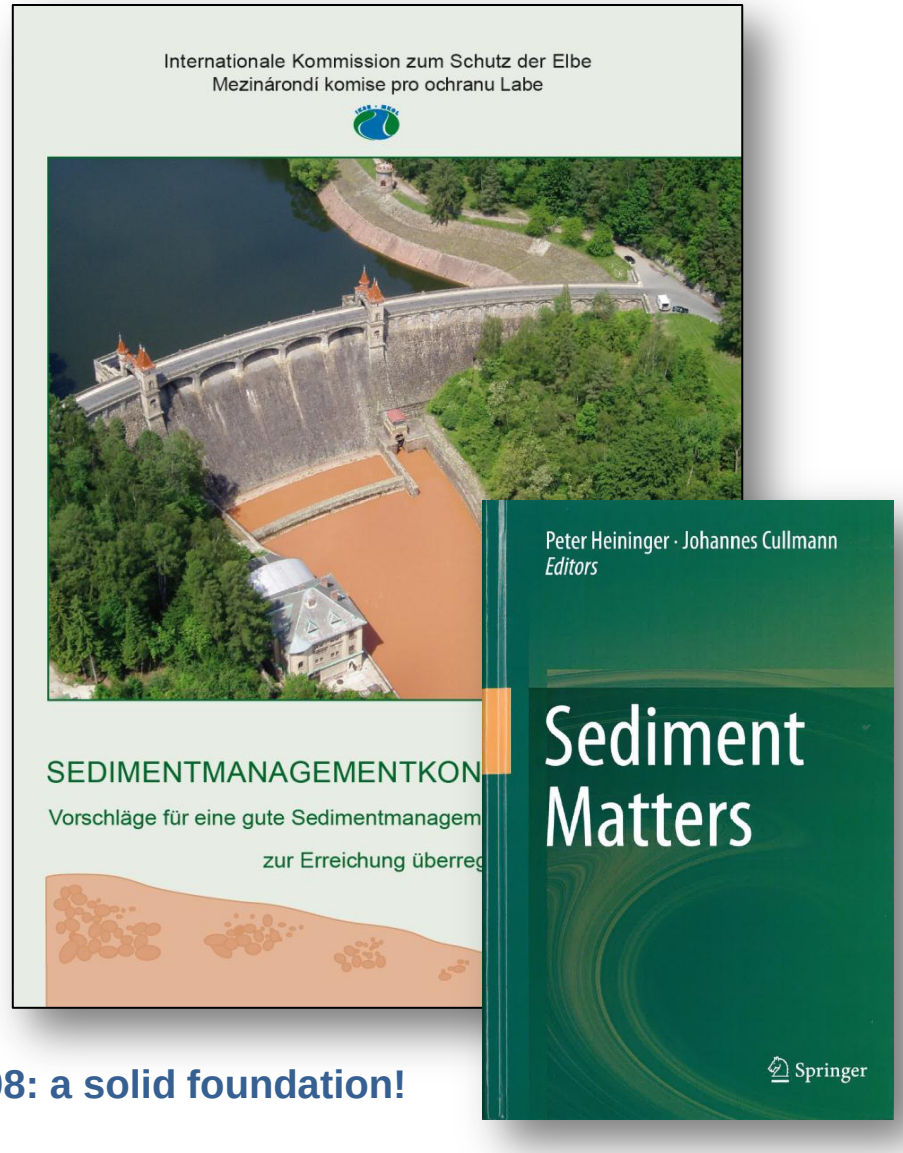
Unbalanced sediment conditions and contaminated sediments among main reasons

ICPER/ RBC Elbe (2009): Sediment management concept in preparation of the 2nd management cycle (2016-2021)

The Sediment Management Concept of the ICPER - Recommendations for a good sediment management practice in the Elbe

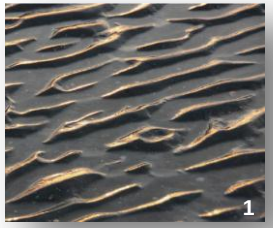
➡ IKSE / MKOL, Magdeburg, 2014 (DE/CZ)

➡ Heininger et al. in Heininger & Cullmann (Eds.) “Sediment matters”, Springer, 2015



Many works 1990 – 2008: a solid foundation!

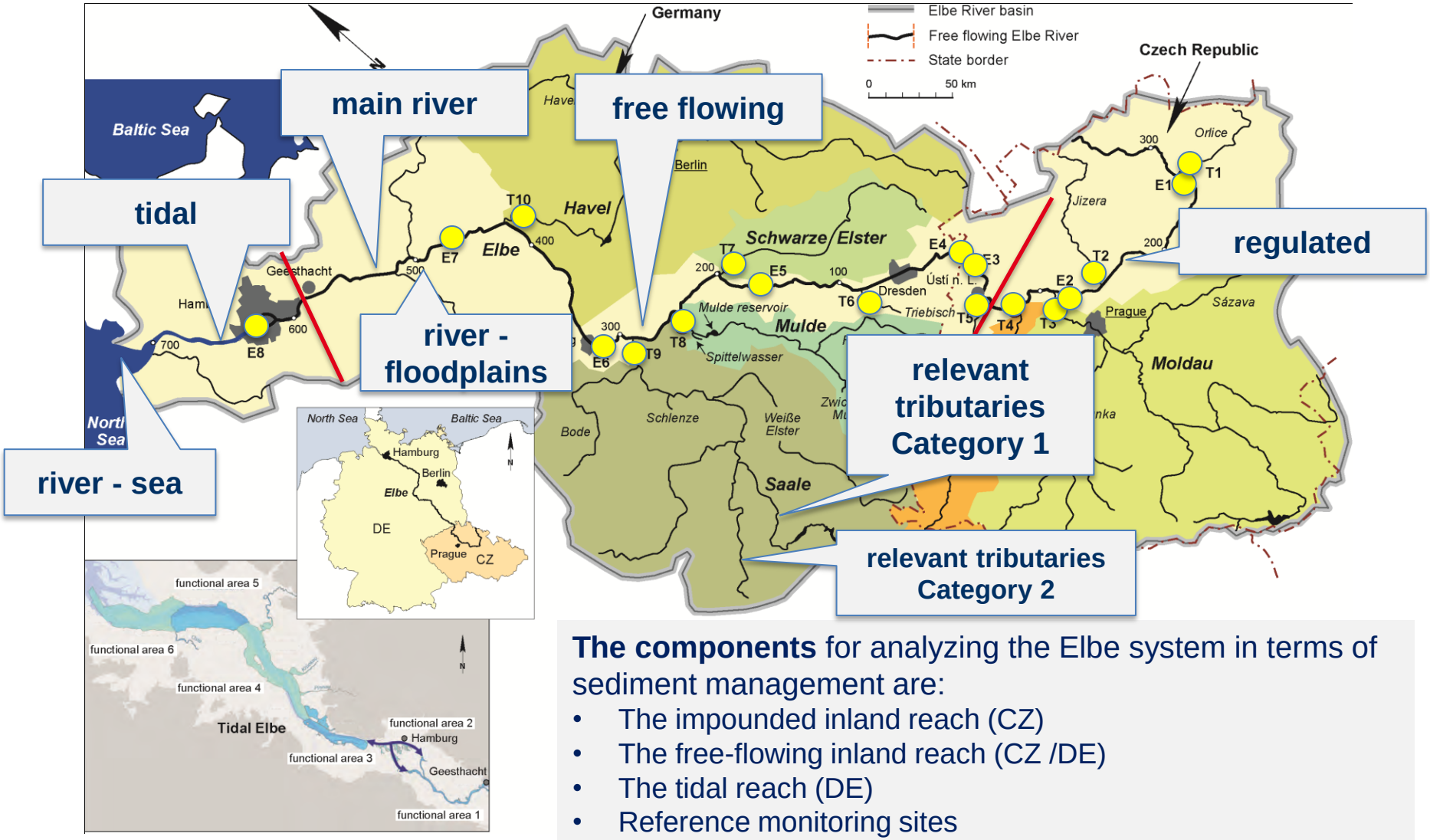
Integrated Concept for the whole River Basin



- Considers management goals – management planning – planning of measures – implementation of measures
- Risk-based, i.e. conclusions rely on the analyses of risks from insufficient status of the sediment budget, ecological functions, ecosystem services / uses depending on sediments
- Considers and integrates the spatial interdependencies of the catchment (upstream – downstream, main river - tributaries, river – sea, river – floodplain …)
- Considers sediment in terms of quantity, quality, and hydro-morphology and their interaction
- Integrates environmental and use-oriented aspects (example: navigation!)
- Takes a participative approach within institutional framework set by the WFD

source: 1 & 3: HPA; 2 & 5: ELSA, 4 & 6: WGE

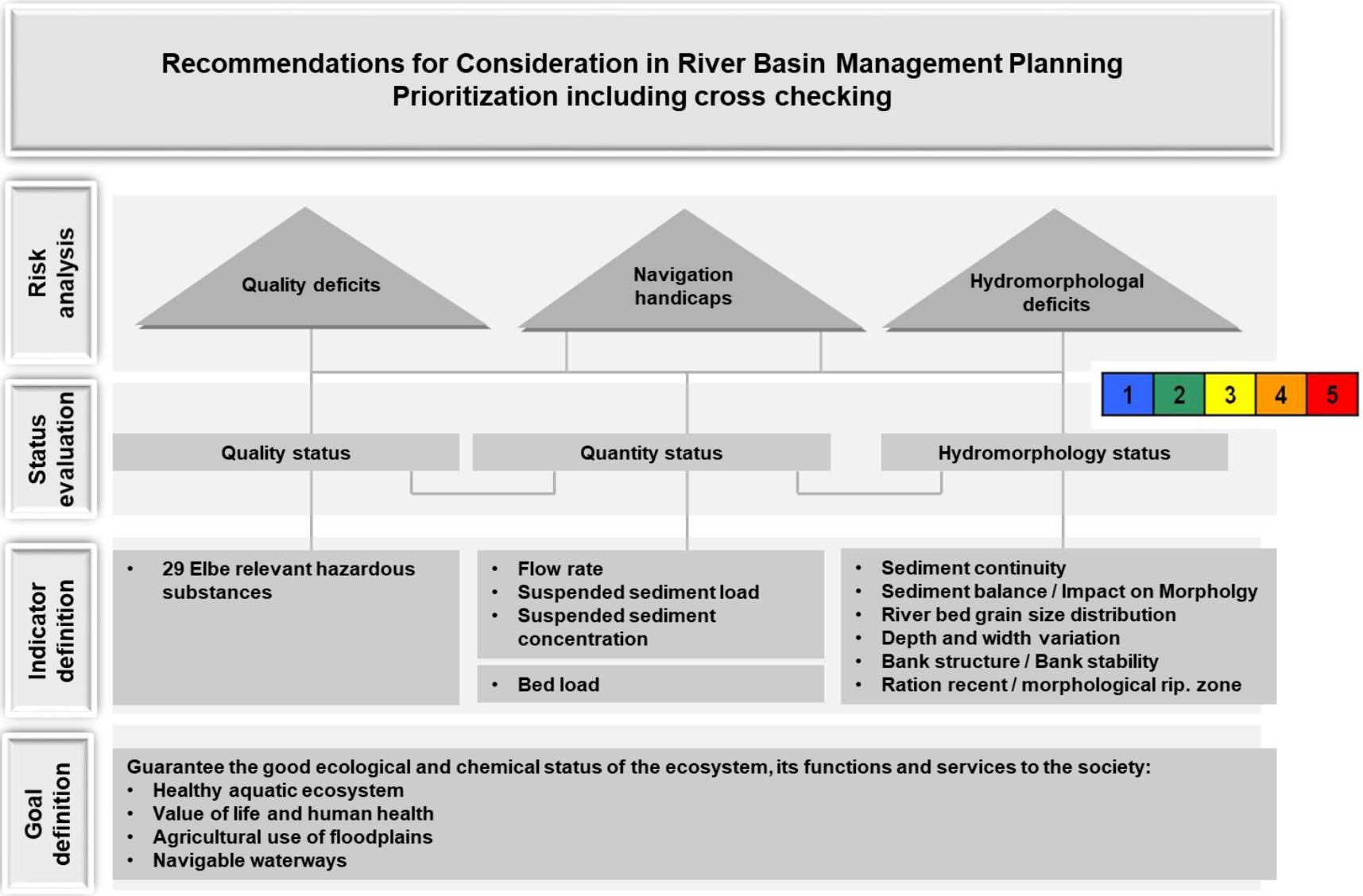
View on the system – the system components



The components for analyzing the Elbe system in terms of sediment management are:

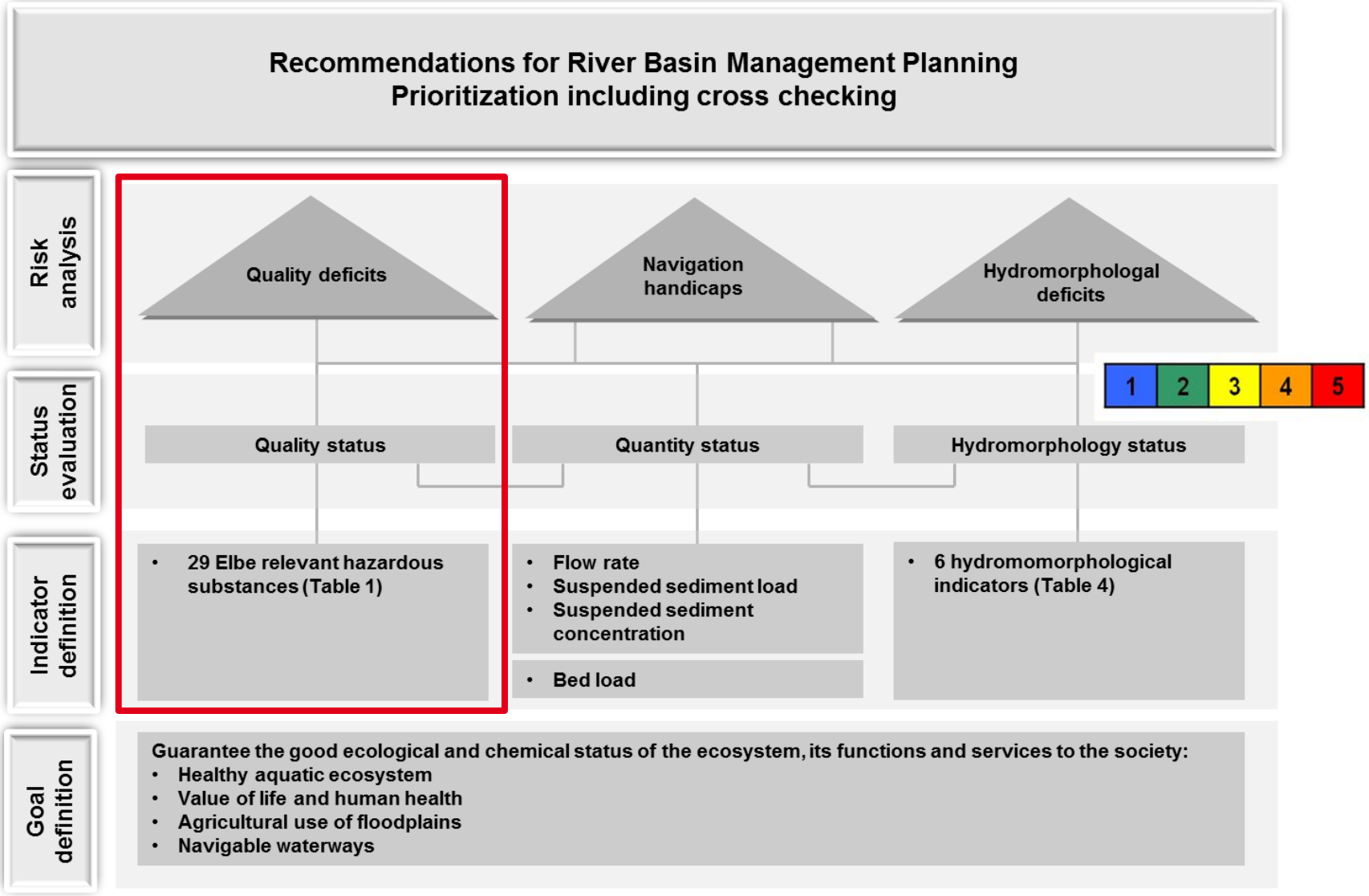
- The impounded inland reach (CZ)
- The free-flowing inland reach (CZ /DE)
- The tidal reach (DE)
- Reference monitoring sites
- Relevant tributaries

Conceptual set up – Overview



source: ICPER 2013; Heininger et al. 2015

Conceptual set up – Overview



source: ICPER 2013; Heininger et al. 2015

Aspect Quality – Managing contaminated sediments

Relevant issues with regard to sediment quality

- Good chemical and ecological status / integrity of the aquatic community
- Protection of floodplain soils against pollution
- Protection of humans against contaminant uptake.

Identification of indicators

Step 1 – potentially relevant contaminants

- Review of all Czech, German and international (e.g. OSPAR) regulations (laws, ordinances, guidelines) for their chemical risk requirements
- Resulting pool of chemicals which are persistent, bio-accumulative, adsorptive

Step 2 – Elbe-relevant contaminants

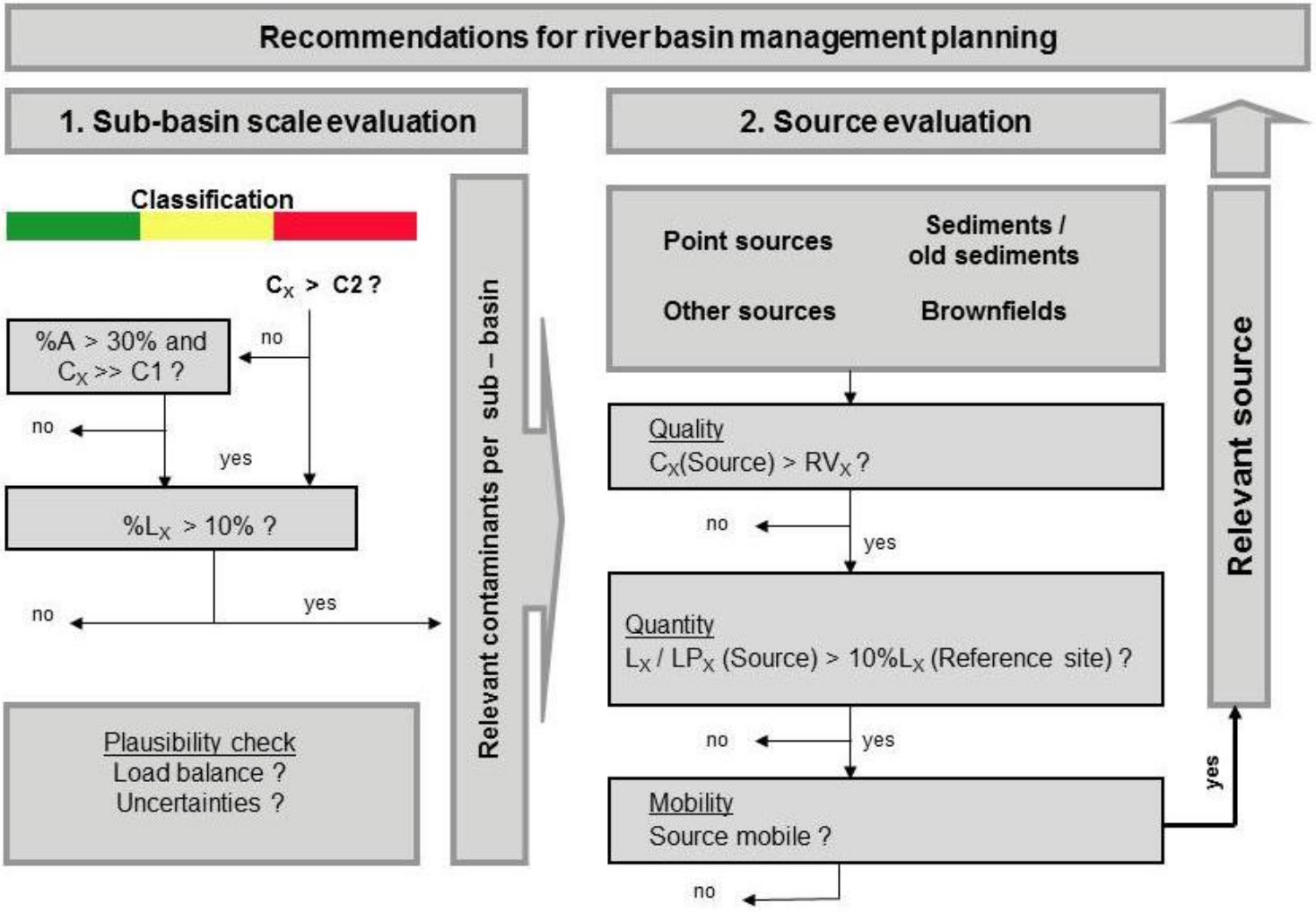
- Those contaminants from Step 1 which occur in the Elbe basin (data 2003 – 2008; reference monitoring sites; minimum one year (mean); at least one Elbe site or one site of Category 1 tributary)

29 Elbe-relevant contaminants & classification scheme

Pollutant	Measure-ment unit	Lower threshold value (LTV)	Source	Upper threshold value (UTV)	Source
Mercury	**mg/kg**	**0,15**	OSPAR	**0,47**	23/2011 Sb.
Cadmium	**mg/kg**	**0,22**	EU standard fish	**2,3**	23/2011 Sb.
Plumb	**mg/kg**	**25**	de Deckere et al. 2011	**53**	23/2011 Sb.
Zinc	**mg/kg**	**200**	BBodSchV	**800**	OGewV 2011
Copper	**mg/kg**	**14**	de Deckere et al. 2011	**160**	OGewV 2011
Nickel	**mg/kg**	**3**	23/2011 Sb.	**53***	HGW nach Prange et al. 1997
Arsenic	**mg/kg**	**7,9**	de Deckere et al. 2011	**40**	OGewV 2011
Chrome	**mg/kg**	**26**	de Deckere et al. 2011	**640**	OGewV 2011
α-HCH	**µg/kg**	**0,5**	GÜBAK	**1,5**	GÜBAK 2009
β-HCH	**µg/kg**	**5**	RHmV	**5**	RHmV 2009
y-HCH	**µg/kg**	**0,5**	GÜBAK	**1,5**	GÜBAK 2009
p,p´ DDT	**µg/kg**	**1**	GÜBAK	**3**	GÜBAK 2009
p,p´ DDE	**µg/kg**	**0,31**	de Deckere et al. 2011	**6,8**	de Deckere et al. 2011
p,p´ DDD	**µg/kg**	**0,06**	de Deckere et al. 2011	**3,2**	de Deckere et al. 2011
PCB-28	**µg/kg**	**0,04**	de Deckere et al. 2011	**20**	OGewV 2011
PCB-52	**µg/kg**	**0,1**	de Deckere et al. 2011	**20**	OGewV 2011
PCB-101	**µg/kg**	**0,54**	de Deckere et al. 2011	**20**	OGewV 2011
PCB-118	**µg/kg**	**0,43**	de Deckere et al. 2011	**20**	OGewV 2011
PCB-138	**µg/kg**	**1**	de Deckere et al. 2011	**20**	OGewV 2011
PCB-153	**µg/kg**	**1,5**	de Deckere et al. 2011	**20**	OGewV 2011
PCB-180	**µg/kg**	**0,44**	de Deckere et al. 2011	**20**	OGewV 2011
PeCB	**µg/kg**	**1**	GÜBAK	**400**	23/2011 Sb.
HCB	**µg/kg**	**0,0004**	de Deckere et al. 2011	**17**	23/2011 Sb.
Benzo(a)pyrene	**mg/kg**	**0,01**	EU standard fish	**0,6**	de Deckere et al. 2011
Anthracene	**mg/kg**	**0,03**	de Deckere et al. 2011	**0,31**	23/2011 Sb.
Fluoranthene	**mg/kg**	**0,18**	23/2011 Sb.	**0,25***	de Deckere et al. 2011
Σ 5 PAK	**mg/kg**	**0,6**	GÜBAK	**2,5**	23/2011 Sb.
TBT	**µg/kg**	**0,02**	23/2011 Sb.	**20***	GÜBAK 2009
Dioxins/Furans	**ng TEQ/kg**	**5**	2. Bericht der BLAg Dioxine 1993	**20**	Evers et al. 1996

source: ICPER 2013

System view – Risk analysis of contaminated sediments



source: ICPER 2013; Heininger et al. 2015

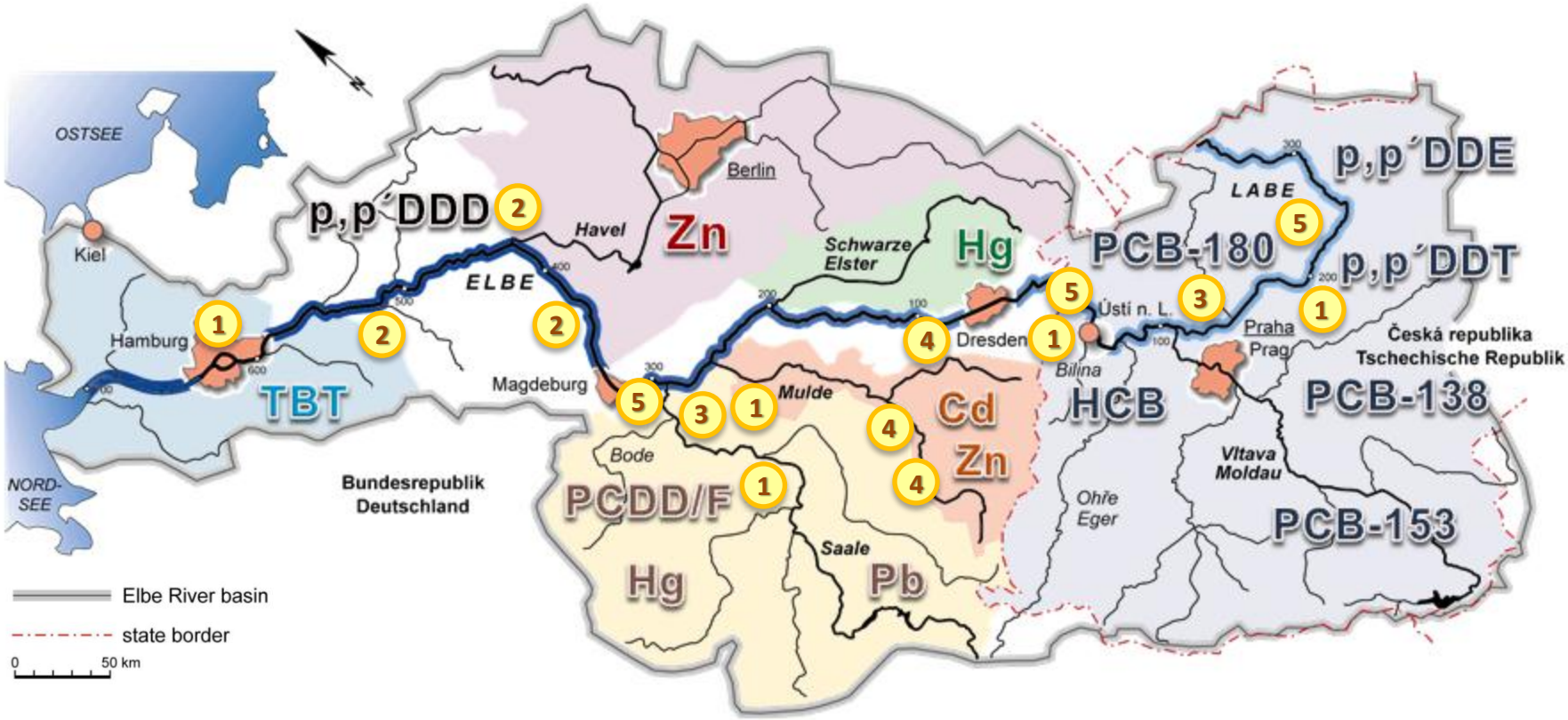
Prioritization criteria

Aspect		
Quality	**Hydromorphology**	**Navigation**
1. Quantitative significance of a source (load / potential load) 2. Number of relevant contaminants of Group 1 per source 3. Total number of relevant contaminants per source	1. Positive influence on one or both key indicators 2. Positive influence on further indicator-parameters 3. Effect potential for long river reaches 4. Orientation at areas of classes 3, 4, and 5	Inland Elbe: 1. Maintain, optimize, adapt the regulating system (free-flowing reaches) / stabilize the riverbed in the longitudinal section and river constructions (impounded reaches) 2. Relocate or add sediment 3. Dredge Tidal Elbe: 1. Reduce the contaminant import from upstream 2. Establish an adaptive dredged material management

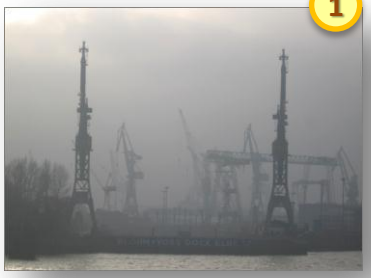
General criteria

1. Solving a problem at source or elimination of the underlying cause.
2. If the underlying cause (source) does not exist anymore, the problem should be solved possibly near to the source (“Sweeping the stairs from the top down“).
3. The recommendation has positive effect on one or both of the other aspects.
4. A single investment causes lower follow-up costs in the long run.
5. Degree of difficulty/costs of implementation.
6. Safety/uncertainty in the assessment of success, e.g. because of variability of the system.
7. The criterion for exclusion “Absence of appropriate options for solution“ is applied only in exceptional cases when the level of knowledge is very well based/substantiated.

System view – Main pollution areas



Industry 1



Side structures 2

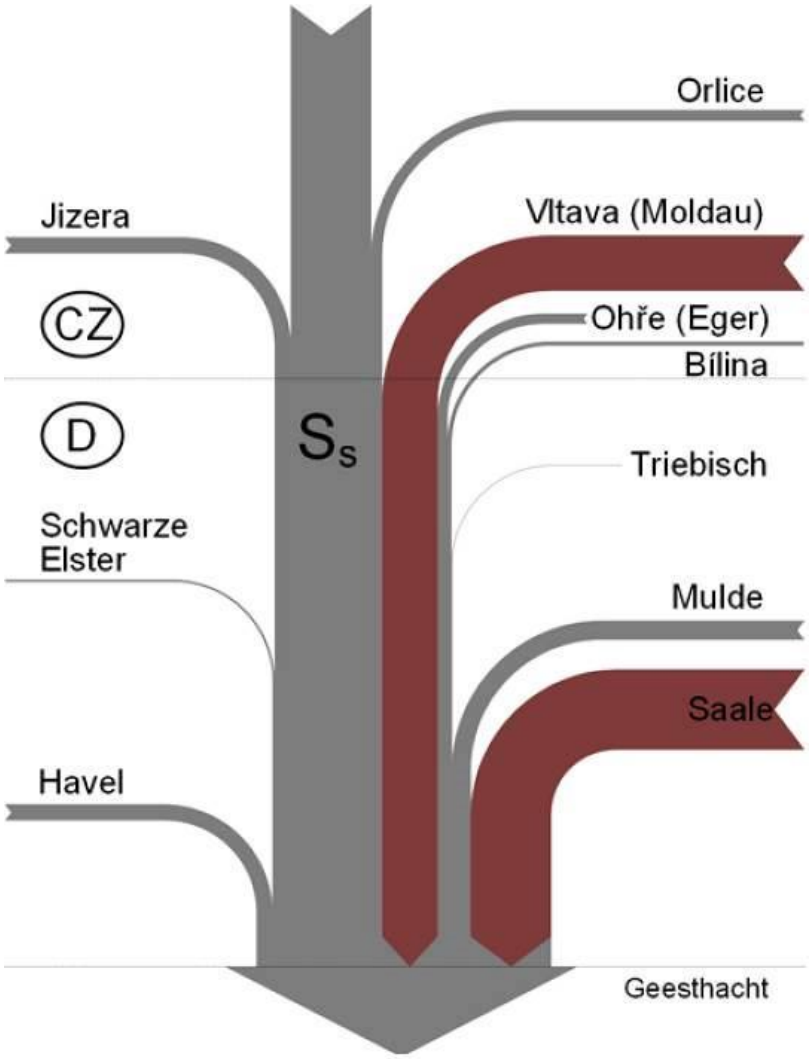
Major barrages 3

Old mining 4

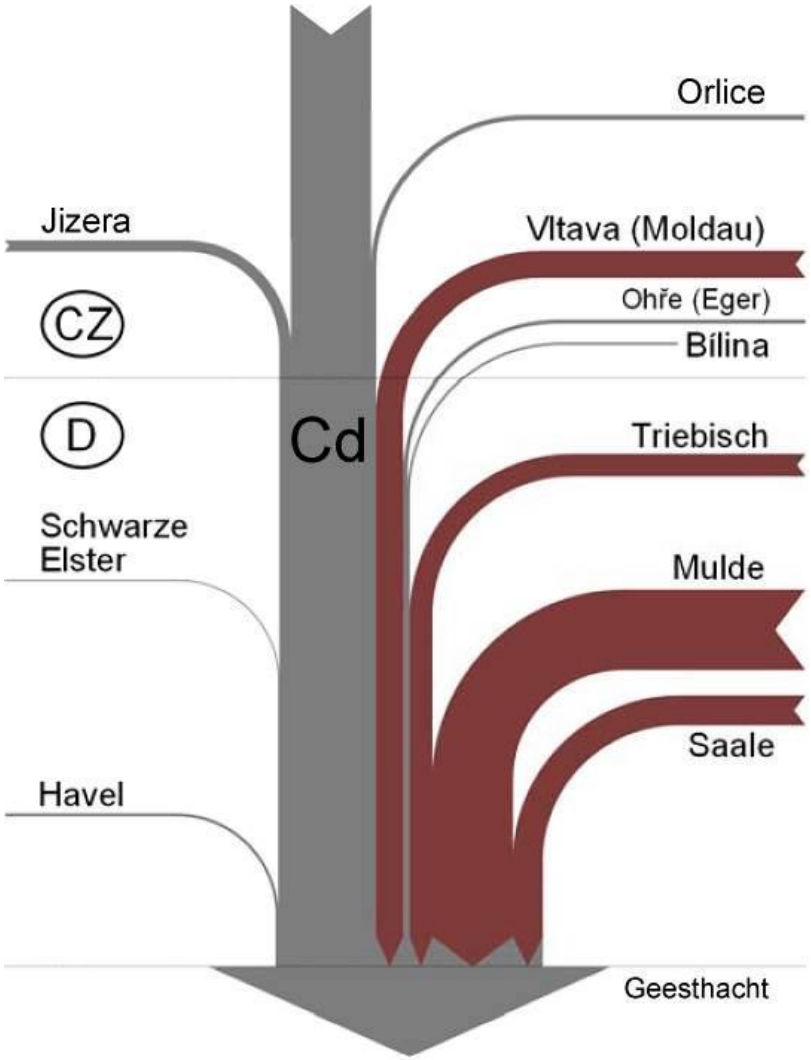
Old sites 5

source: map: RBC Elbe; 1,2,3,5: ELSA; 4: J. Kugler

System view – Material flows



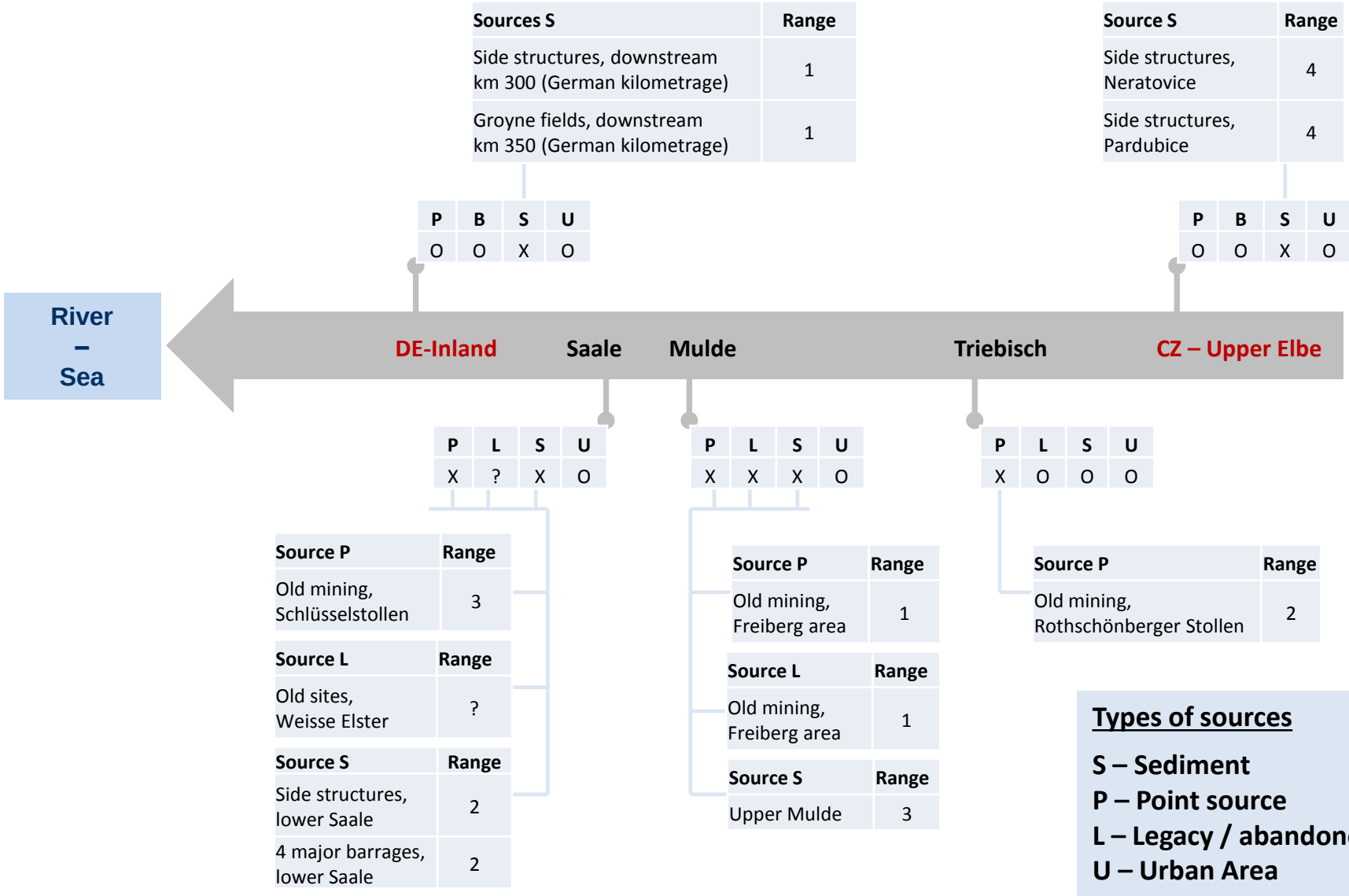
650,000 t/yr (2003-2008)



6.3 t/yr (2005)

source: Heininger et al. 2015

System view – Example priority pollutant Cd



source: Heininger et al. 2015

02 Working with the Concept

source: Icon 1 made by dreamstime; Icon 2 made by clipartLogo

Dredged material management in the Port of Hamburg

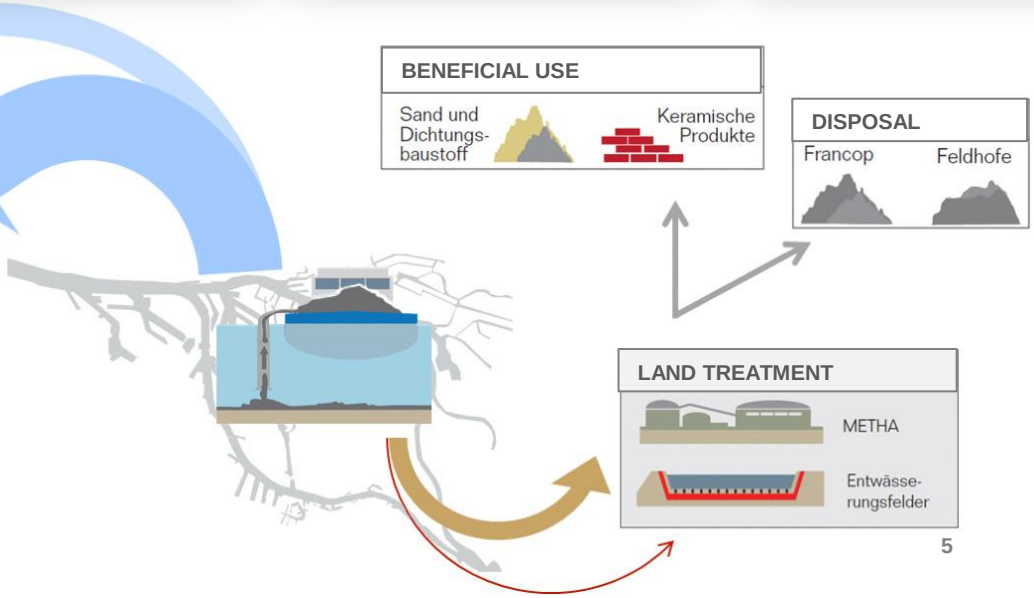

1


2


3


4

Low contamination:
Relocation into the North Sea placement
1 - 3 mio m^3/a
or relocation within
Tidal Elbe
4 - 8 mio. m^3/a



5

- **Regular river maintenance total cost: ~ 75 Mio. € per year!**
- **Land treatment: 1/5 of volume, but 3/4 of cost!**

High or specific contamination:
Land treatment & disposal
up to 1 mio m^3/a

sources: 1 & 3: ELSA; 2, 4, 5: HPA

Implementation of the Concept

Implementation in the 2nd management cycle

- Permanent consideration in the responsible bodies of ICPER / RBC Elbe
- Report every 2 years on implementation
  - Questionnaire
- International workshop series (CZ/DE)
- Methodological progress
  - Development of tools for efficiency control (e.g. aspect quality: Sediment quality index)

Progress report 2017

Knowledge

- ELSA Project: case studies and financial support

- Stakeholder involvement

Monitoring

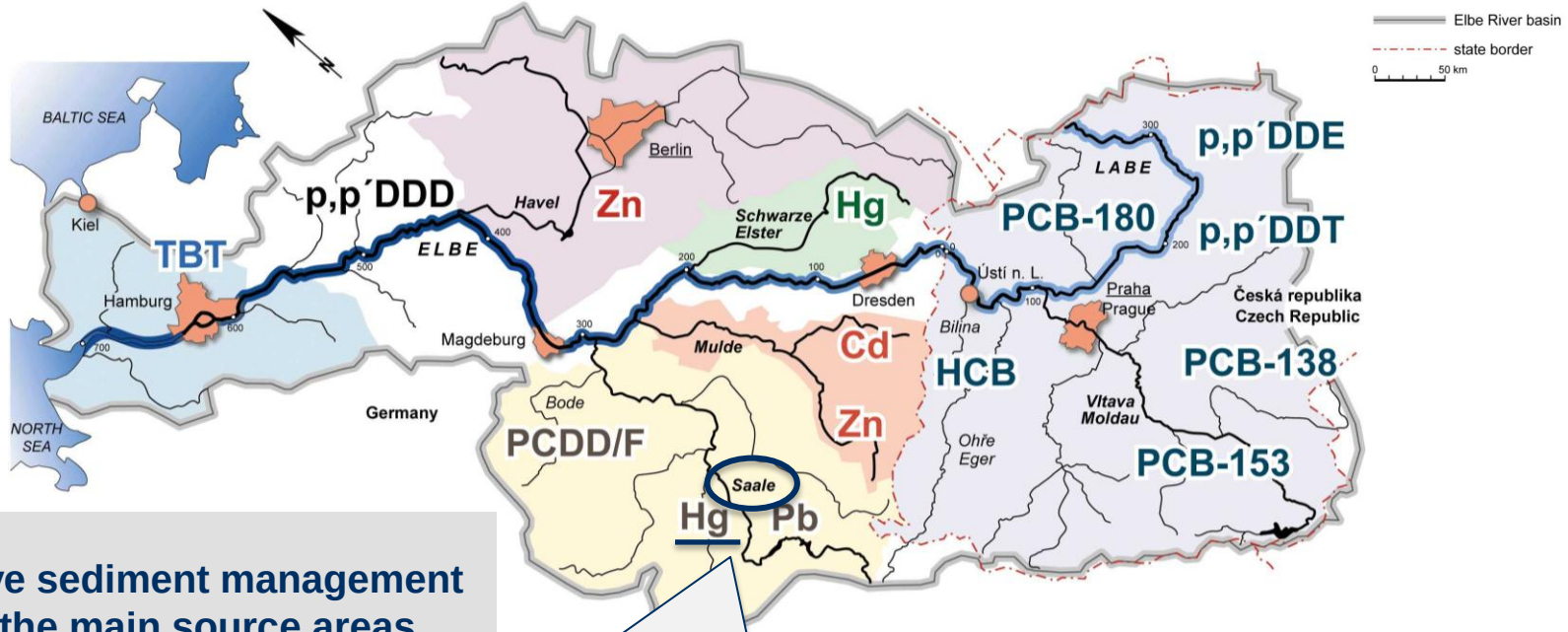
- Extreme event monitoring:
  flood and low water, extreme pollution situations (e.g. accidents)

Practical status

- Improvement of sediment continuity
- Removal of old contaminated sediments

sources: 1: HAW (Heise); 2: HPA, 3: UFZ (Künzelmann); 4: HU (Blohm); 5: ELSA; 6: Tauw

Practice – Removal of old sediments “The Mühlgraben-Case”



- **Qualitative sediment management in one of the main source areas**

Relevant tributary “Saale”:

- Due to its long industrial and mining history, the Saale catchment has a high relevance for the pollutant situation in the Elbe river

sources: Map: RBC Elbe/ELSA; 1: GoogleMaps

Practice – The example “Mühlgraben”

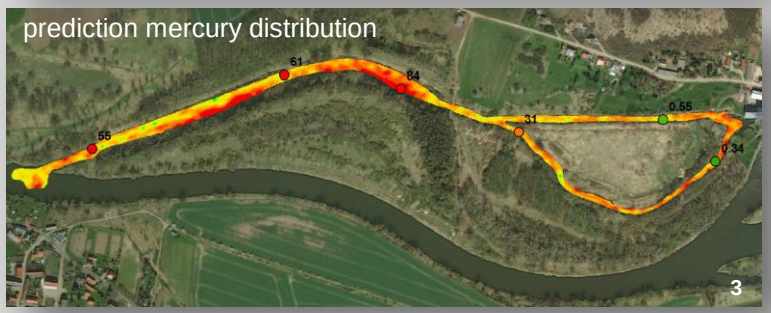
- **Action: Removal of old contaminated sediments from “Mühlgraben”**

Approach:

- Detailed characterization of the sediment inventory in terms of quantity and contamination
- Evaluation of the relevance of the secondary structure for the main stream
- Realization as measure of the regional management plan (2nd /3rd cycle)

Tauw

Radiometry_countrate
total counts
High
Low



Mercury predicted
mg/kg
0.00 - 0.15
0.16 - 1.00
1.01 - 2.00
2.01 - 5.00
5.01 - 10.00
10.01 - 20.00
20.01 - 30.00
30.01 - 40.00
40.01 - 50.00
>50

sources: 1: GoogleMaps; 2 & 3: Tauw

WFD & sediment management – a perfect match?

WFD – The River Basin Concept

- **Holistic approach:**
  Protection and sustainable management of all surface and groundwater, including transitional and coastal waters

- Covering **all pressures and impacts**

- Water management at **river basin level**

- **River Basin Management Plans:** basic instrument to implement WFD

Review of the implementation status – Challenges & needs

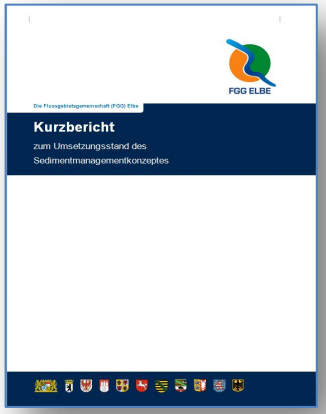
- **Challenges:** What does complicate the implementation?

Complexity of the system …	Principle of proportionality in management planning	Lack of (basin-wide accepted) socio-economic approaches
Detailed risk analyses and expensive feasibility studies	High, unevenly distributed costs …	Lack of clear political commitment … Insufficient consultation and cooperation

- **Needs:** What do we need to encourage implementation?
  "Be well informed – Manage adaptively – Take a participatory approach"

System knowledge	Reduce the responsibility ripple	Prioritization & efficient combination of measures
Comprehensive stakeholder involvement in decision-making	Solidarity approach „river basin bugdet"	WFD and beyond: Political impulse „pro sediment"

Review of implementation status – Two perspectives



Short Review of the implementation progress by the RBC Elbe, 2018

- Confirmation of the concept as transnational basis and decision support for the determination of measures in the frame of the second WFD management cycle (2016 - 2021).

- However, the implementation remains challenging. Notwithstanding the sediment management concept provides a good conceptual basis, the step towards concrete measures has proven too big.

Reese & Köck, 2018

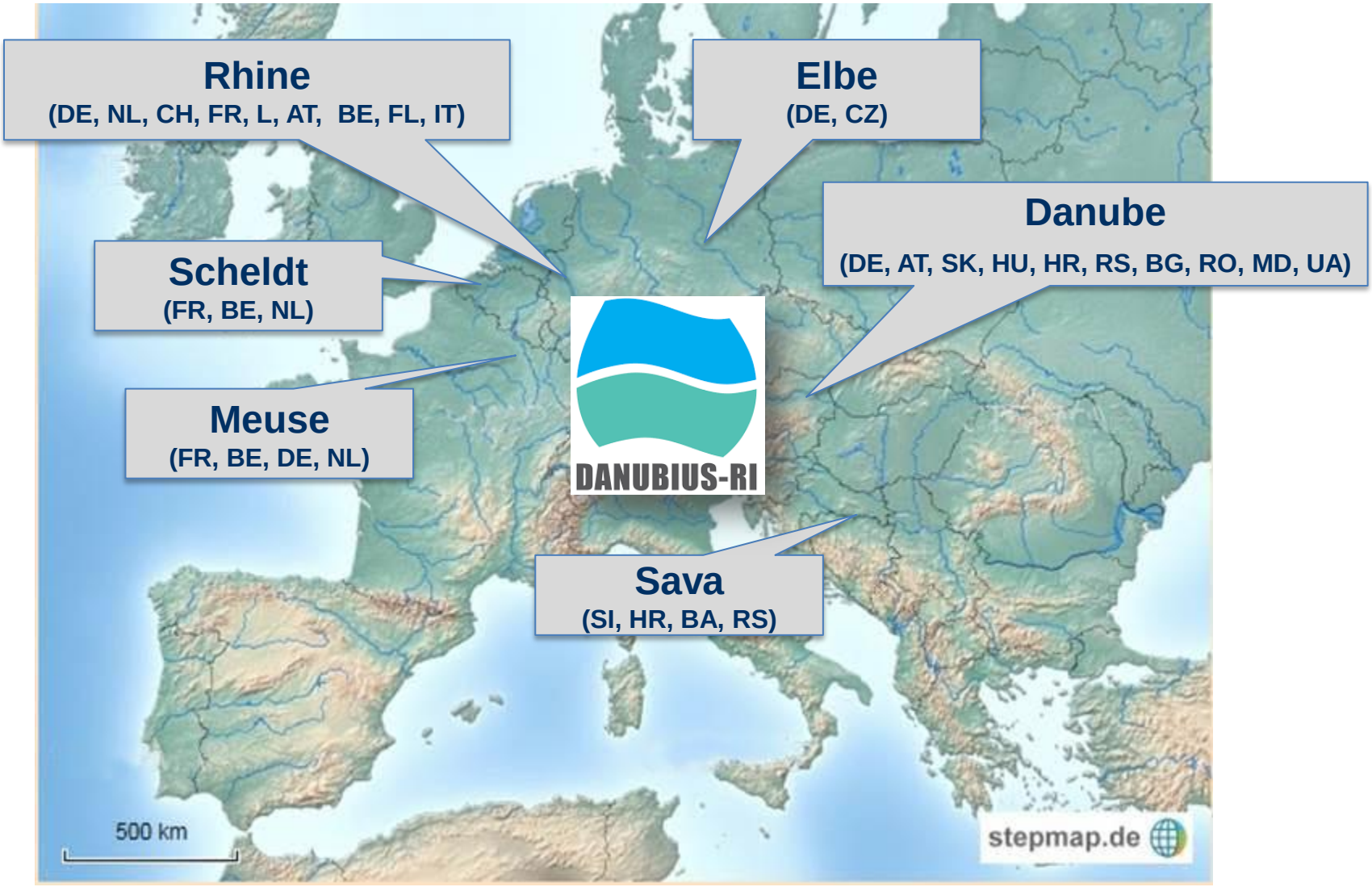
Legal analysis of political and administration relationships with a special view on contaminated sediments and WFD

- Yes! The Sediment Management Concept meets the spirit of the WFD. RBC Elbe and ICPER are with it on the right way to an integrated, river basin-wide management.

- By contrast, the recent management plan and program of measures (2016-2021) partly fail in meeting the required river basin wide coordination. The plan/program refer to the concept in principle but do not transfer its spirit into adequate management actions.

- In Germany, obtaining the required level of cooperation between the different Federal States and between the Federal Government and the States remains difficult. As a consequence often management decisions are taken just from a single State or the federal point of view, sometimes with considerable problem shifts in the river basin.

Sediment management in Europe



source: Stepmap

Thank you!

Peter Heininger

HZG - Centre for Materials and Coastal Research

peter.heininger@hzg.de

Ilka Carls

Ministry of Environment and Energy

ilka.carls@bue.hamburg.de