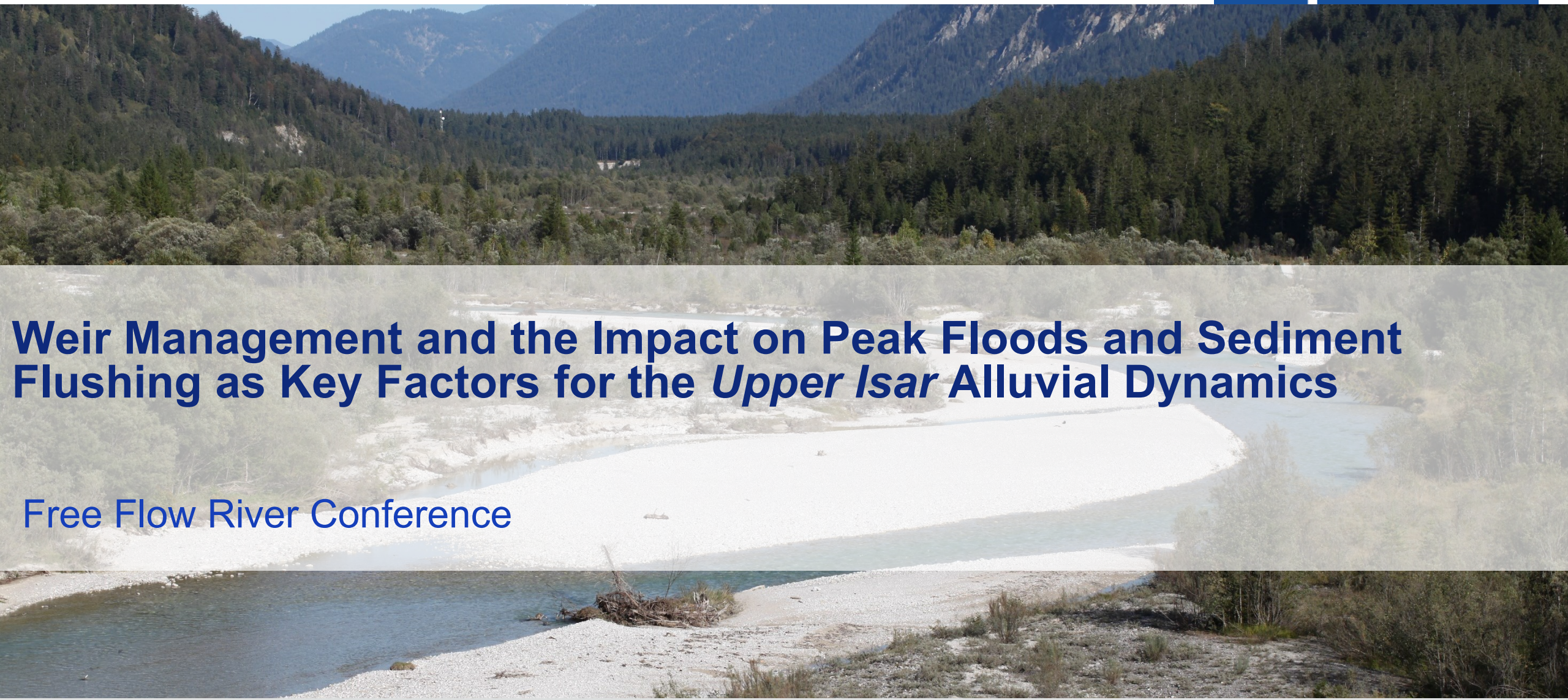
iup Institut für Umweltplanung

Leibniz Universität Hannover



Weir Management and the Impact on Peak Floods and Sediment Flushing as Key Factors for the *Upper Isar* Alluvial Dynamics

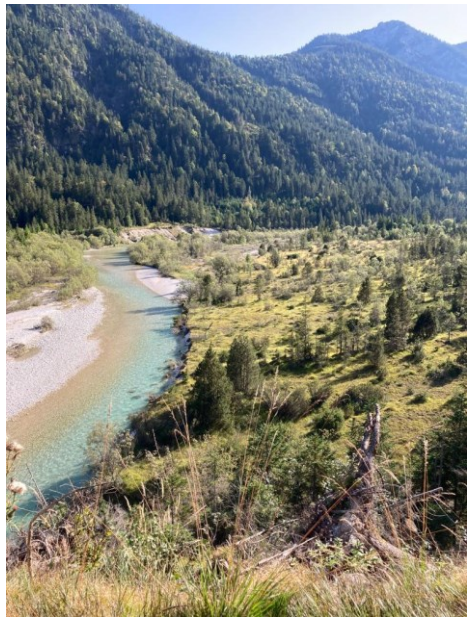
Free Flow River Conference

Carmen Rethschulte | Institute of Environmental Planning – Working Group: Nature Conservation and Landscape Ecology | Leibniz University Hannover

The *Upper Isar*

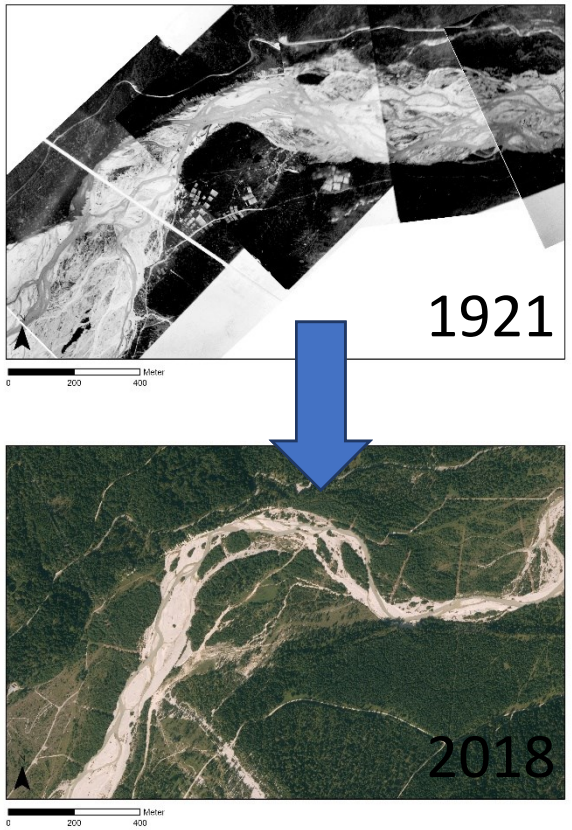
- Germany‘s (Bavaria) last near-natural wild river
- biodiversity hotspot with outstanding nature conservation significance
- Nature conservation area, NATURA 2000 area


(Zieger, o.J.: www))



Anthropogenic Interventions & Hydropower Generation

- construction and commissioning of Walchensee power station (storage plant), since 1924 abstraction of Isar water at “Krün Weir”
- total water abstraction until 1990
- since 1990 a residual water flow is permitted (summer: min. 4,8 m³/s, winter: min. 3 m³/s)
- regular gravel/sediment extraction behind Krün Weir for flood protection

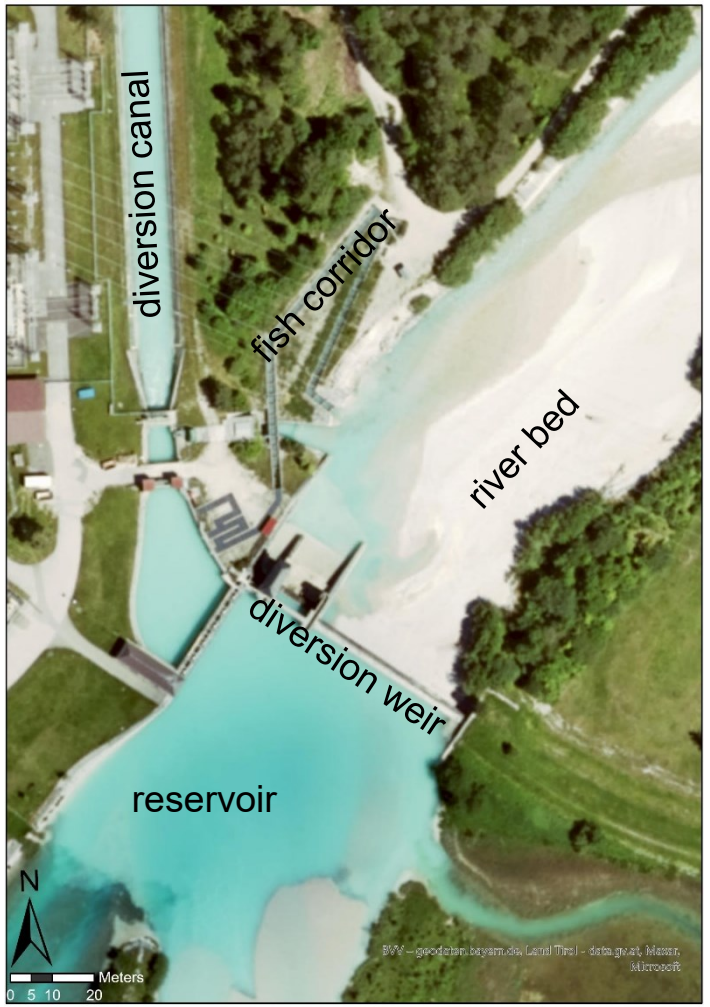


(aerial photos: Bayer. Landesvermessungsamt & WWA Weilheim)

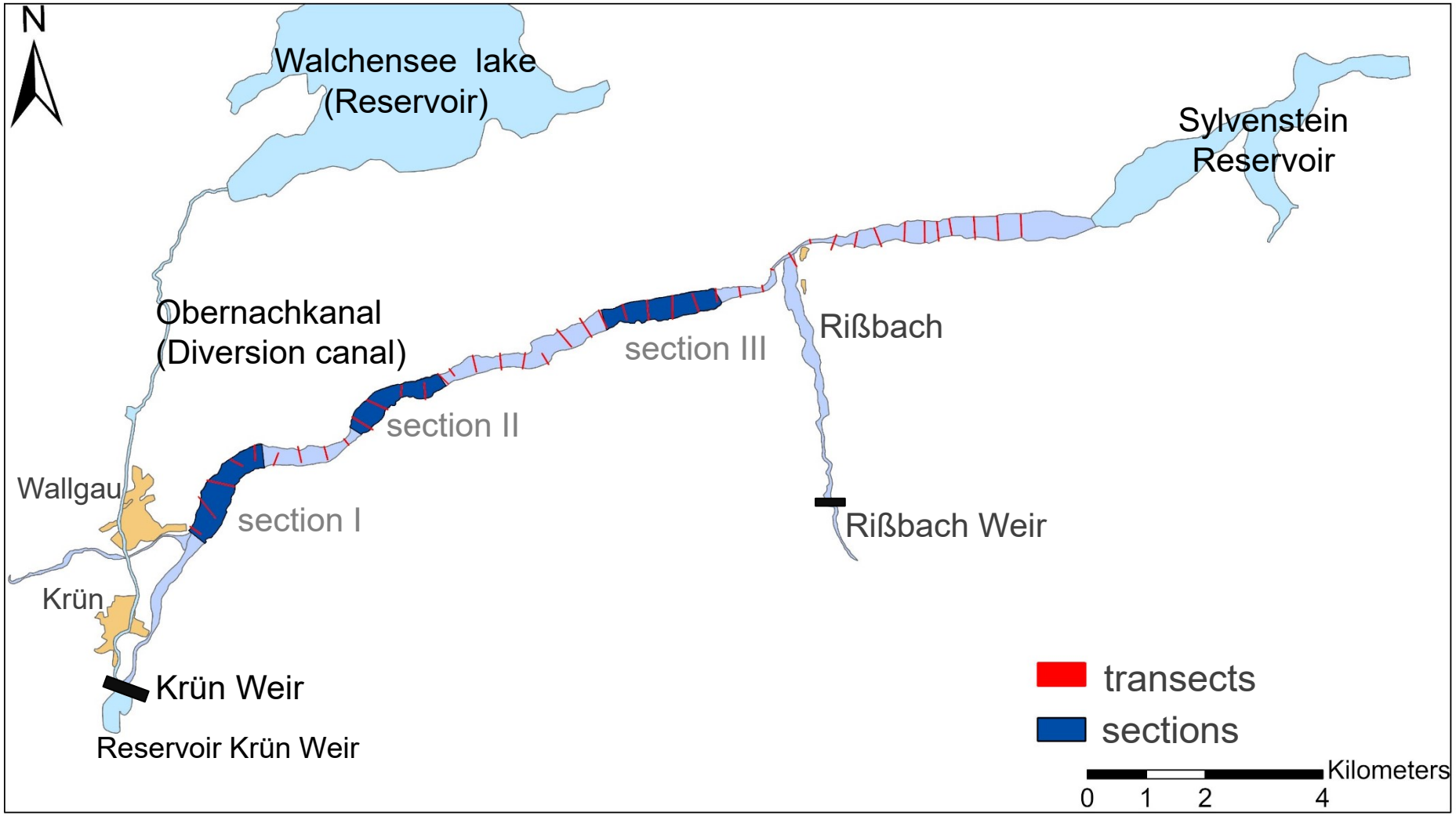
Intervention of geomorphological basis, bedload and water regime

➢ natural floodplain dynamics is being affected

Part of the Walchensee system: „Krün Weir“



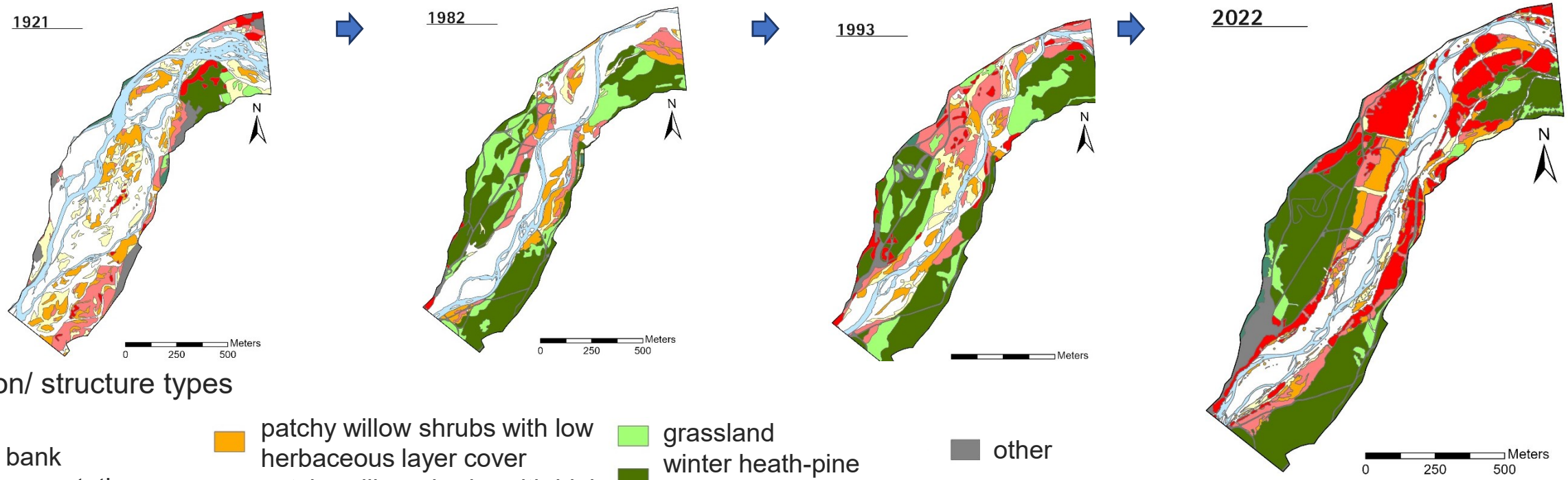
The Walchensee system



Problem: Development of the floodplain and alluvial vegetation

1. Period: natural discharge
2. Period: water abstraction (Start 1924)
3. Period: water abstraction with residual flow (since 1990) (summer: 4,8 m³/s, winter: 3 m³/s)

section I



vegetation/ structure types

- water
- gravel bank
- pioneer vegetation
- patchy willow shrubs with low herbaceous layer cover
- patchy willow shrubs with high herbaceous layer cover
- dense willow shrubs
- grassland
- winter heath-pine forest
- forest
- other

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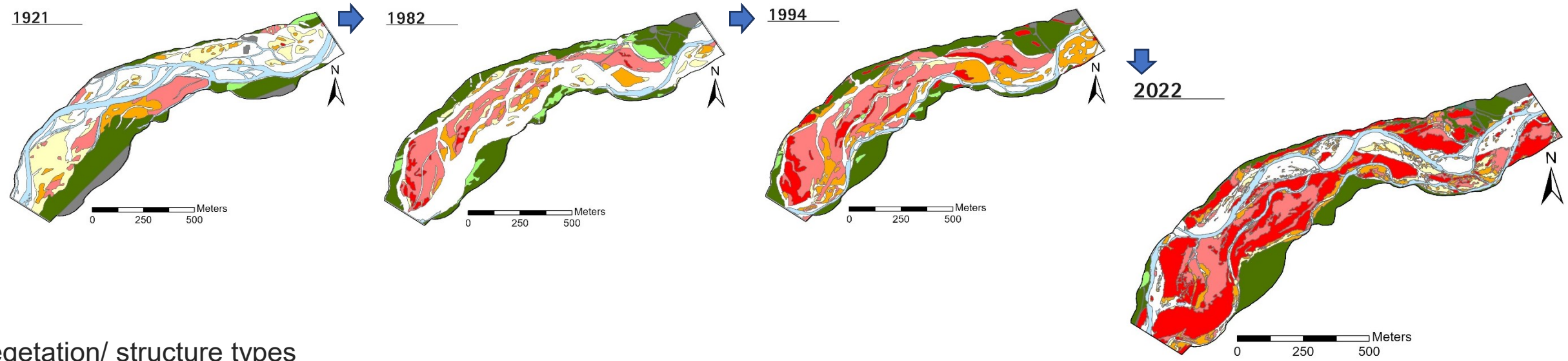
section II



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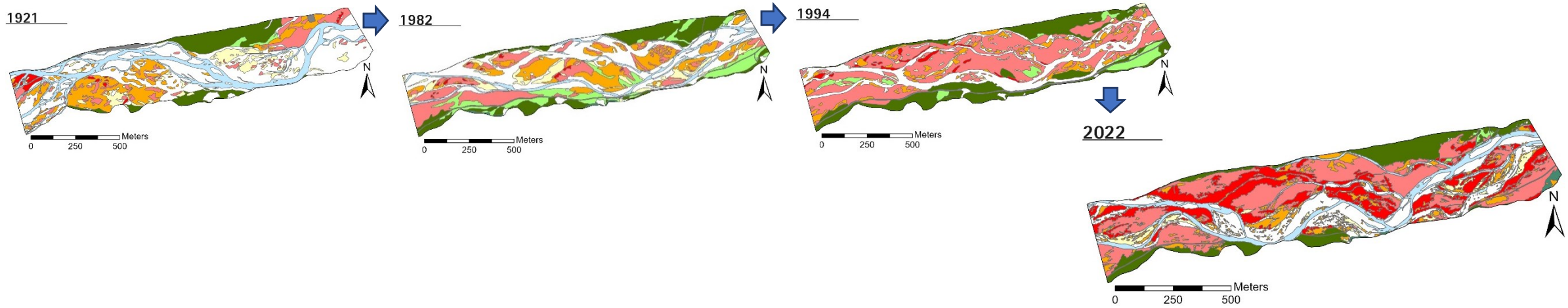
section III



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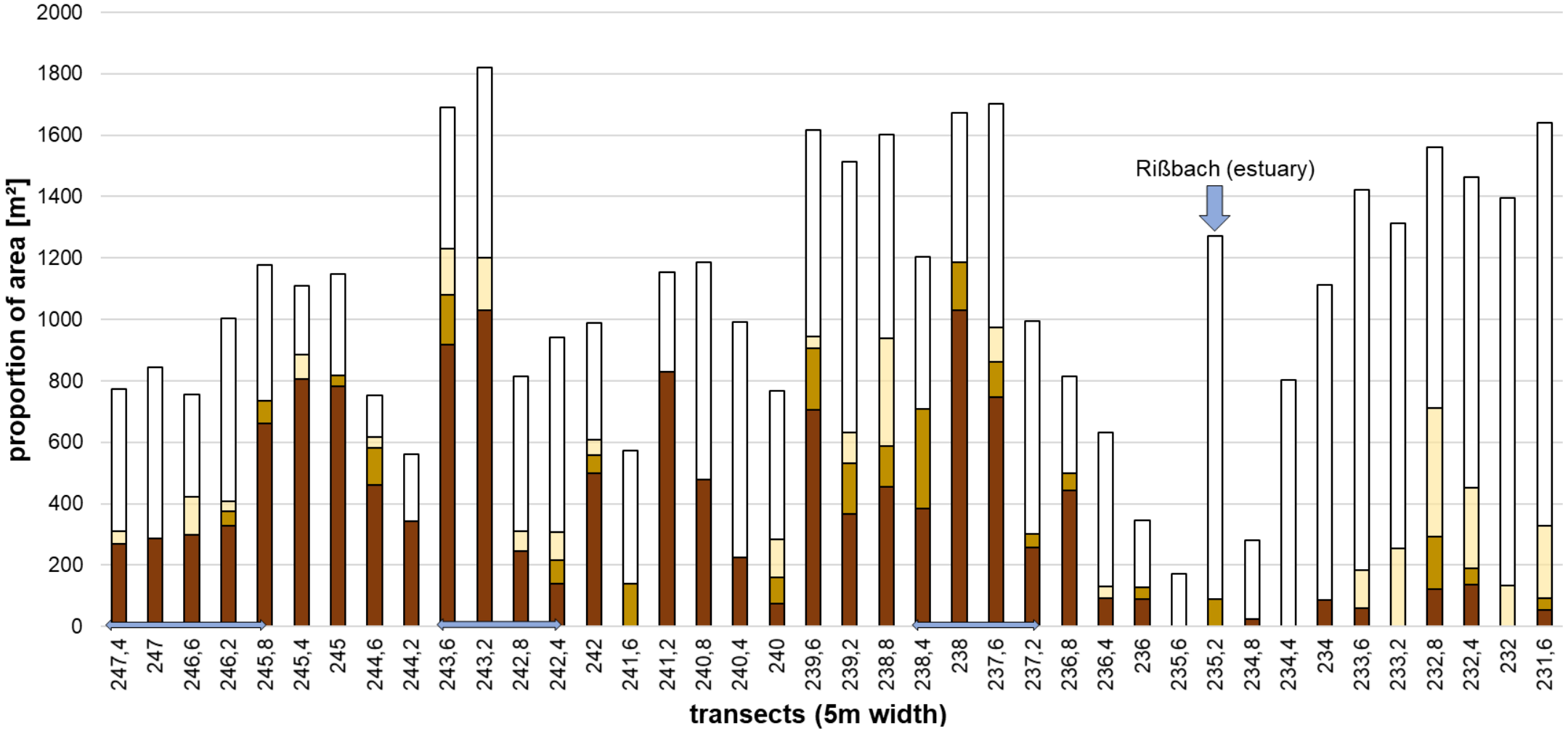
Problem: Silt deposits



Problem & Objective

- Problematic developments continue to this day

- Affects above all the valuable habitat types and species, like habitat types 3220, 3230 and 3240

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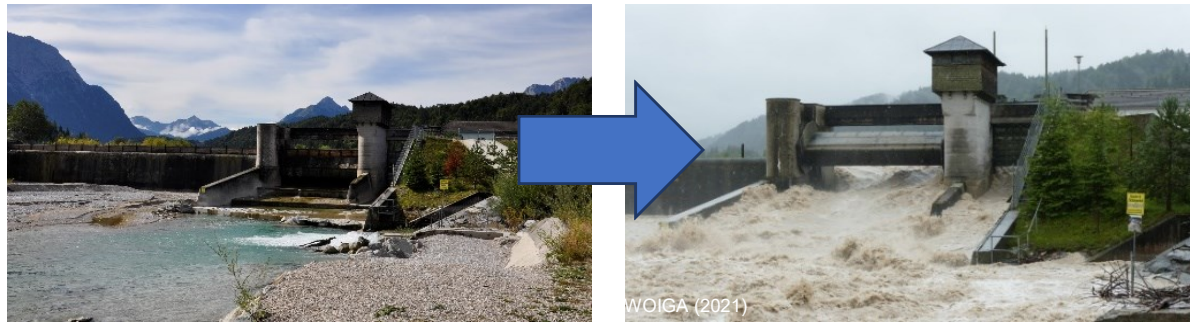
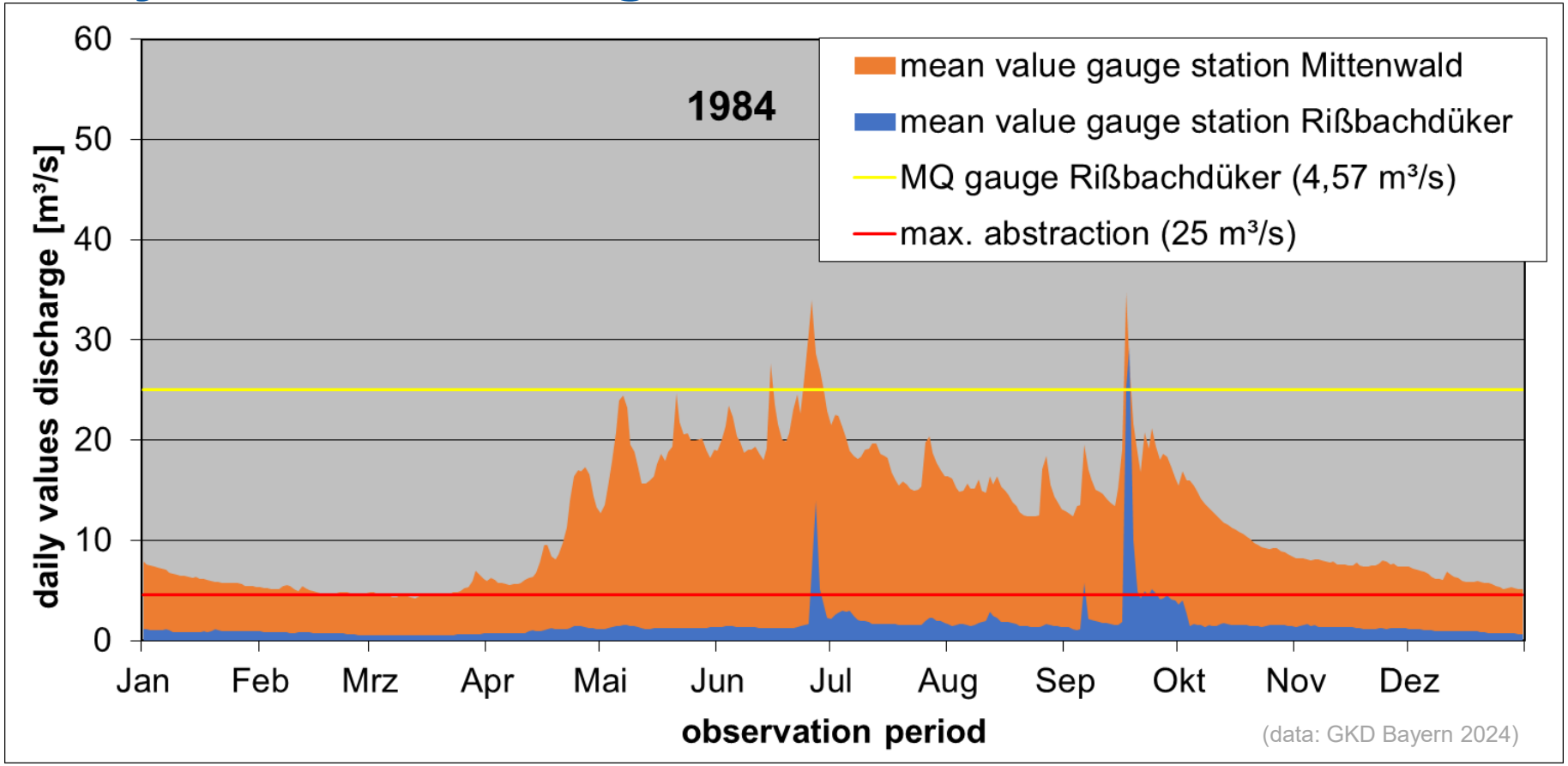


key factor = floodplain dynamic

- Affects above all the valuable habitat types and species, like habitat types 3220, 3230 and 3240

(How) can the floodplain dynamics be improved by changing the weir operation of the Krün weir?

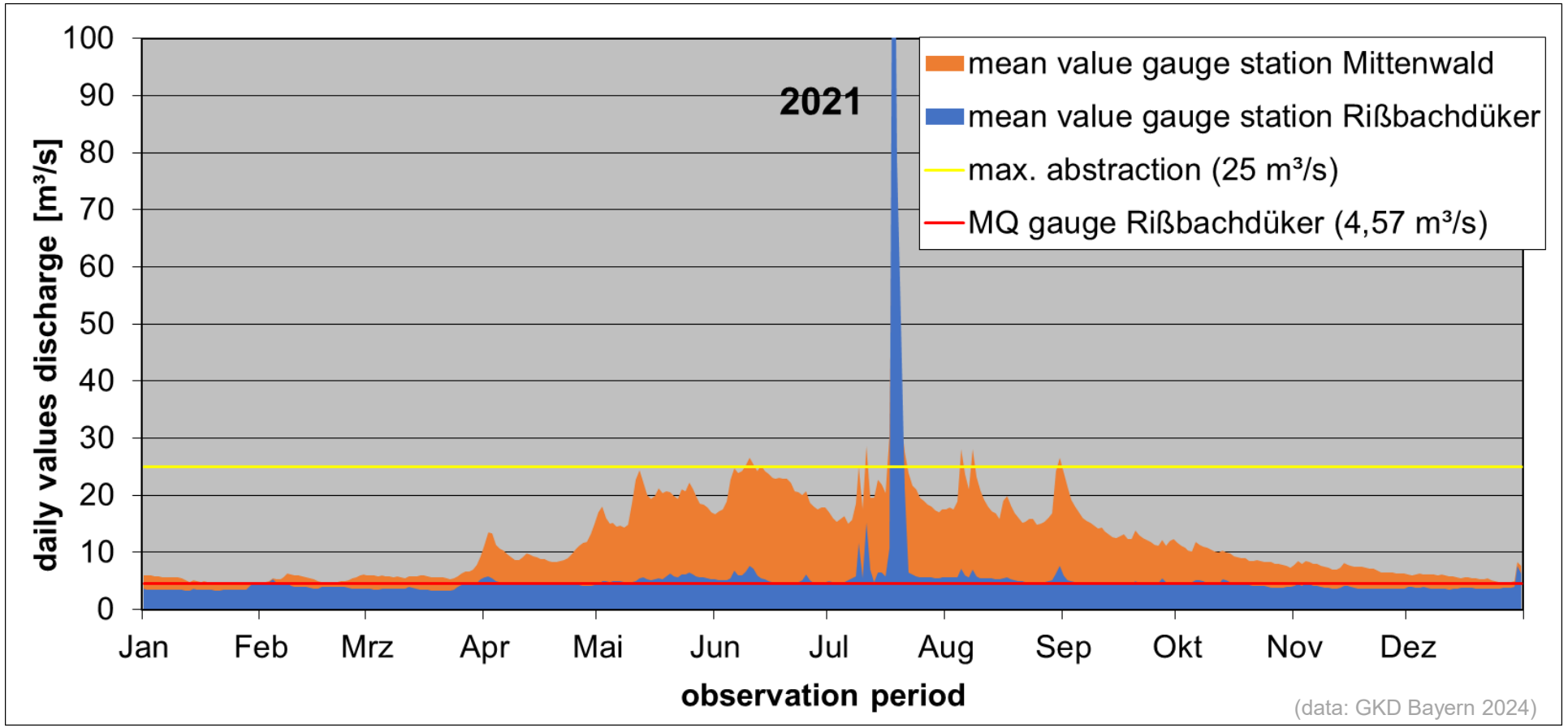
Key factor discharge: before residual flow



- priority: max. water abstraction

➢ reservoir flushing, if discharge > max. water abstraction or risk of sediment entering in diversion canal

Key factor discharge: with residual flow



- priority 1: residual water flow
- priority 2: max. water abstraction

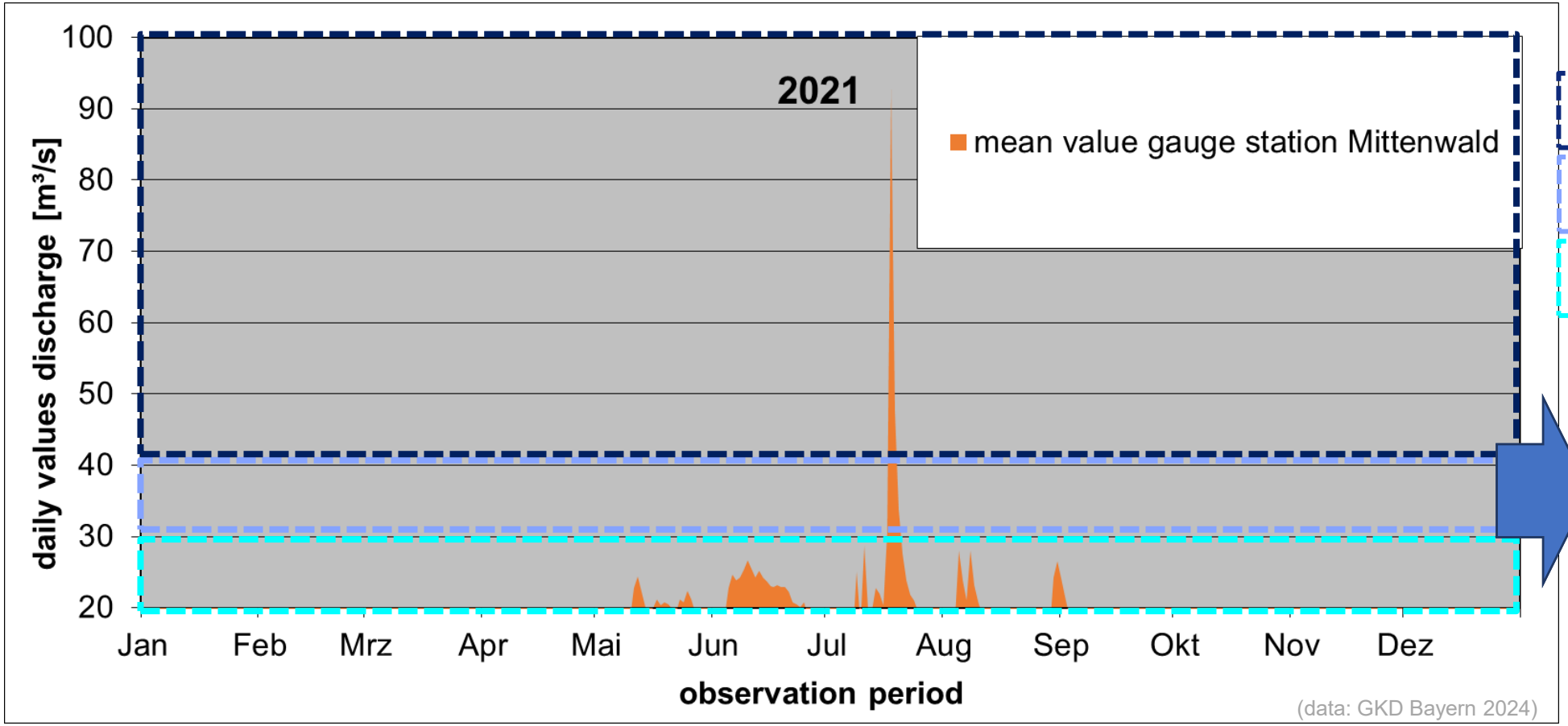
➢ reservoir flushing, if discharge > sum of residual water flow + max. water abstraction or risk of sediment entering in diversion canal

Analysis of the potential to promote the discharge regime

- Classification of the discharge according to 4 levels of impact:
  - Class 1: Q = < 20 m³/s
  - Class 2: Q = 20 - < 30 m³/s
  - Class 3: Q = 30 - < 40 m³/s
  - Class 4: Q = ≥ 40 m³/s

bankfull, bedload-transporting, bedforming

Analysis of the potential to promote the discharge regime



class 4

class 3

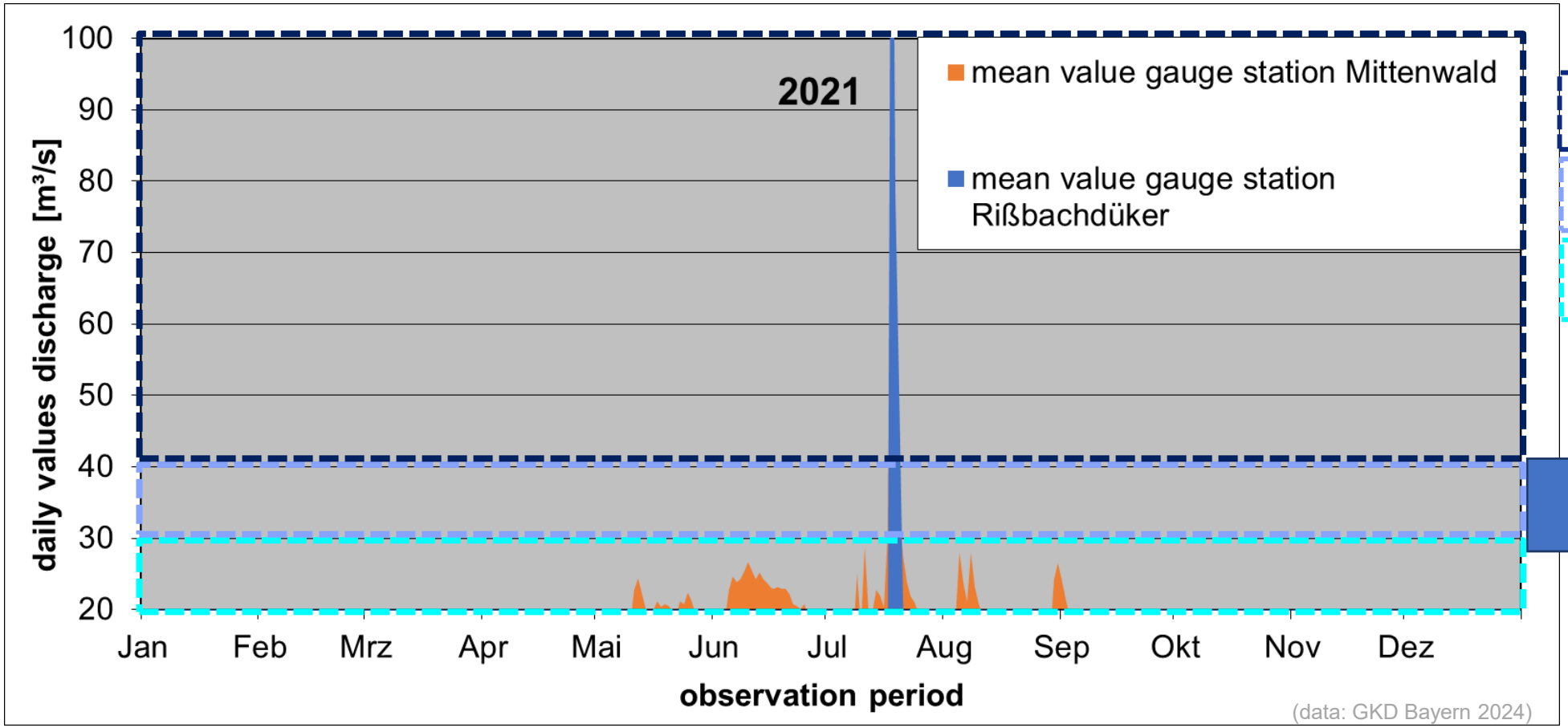
class 2

56 days with the potential for bed-forming discharge

(Q > 20 m³/s)

(gauge station: Mittenwald)

Analysis of the potential to promote the discharge regime



class 4

class 3

class 2

Only 4 days with Q > 20 m³/s at gauge station „Rißbachdüker“

Analysis of the potential to promote the discharge regime

Discharge gauge station Mittenwald	Days of the year 2021 [%]
< 20 m³/s	84,7 %
20 - < 30 m³/s	14,3 %
30 - < 40 m³/s	0,5 %
≥ 40 m³/s	0,5 %

Discharge gauge station Mittenwald	Days 1970-2023 [%]
< 20 m³/s	86,2 %
20 - < 30 m³/s	11,0 %
30 - < 40 m³/s	2,2 %
≥ 40 m³/s	0,6 %

Potential bedforming discharges =
Potential to promote discharge dynamics

Potential of discharge regime

- The aim must be to increase bedload and discharge dynamics

- We need changes to the weir operation at Krün weir:
  - Change from priority „max. discharge volume walchensee abstraction“ and „operational flushing“

Allow all bedforming discharge to flow freely!

Conclusion

- continuing operation as before = loss of habitat for valuable species
- fundamental problems need to be addressed: more bedload and transportable runoff
- reservoir flushing not for operational reasons, replaced by a free flow of all bed forming discharges
- limit values must be determined by numerical sediment transport modeling

➢ Dynamic habitats require dynamism!

Thank you for your attention!