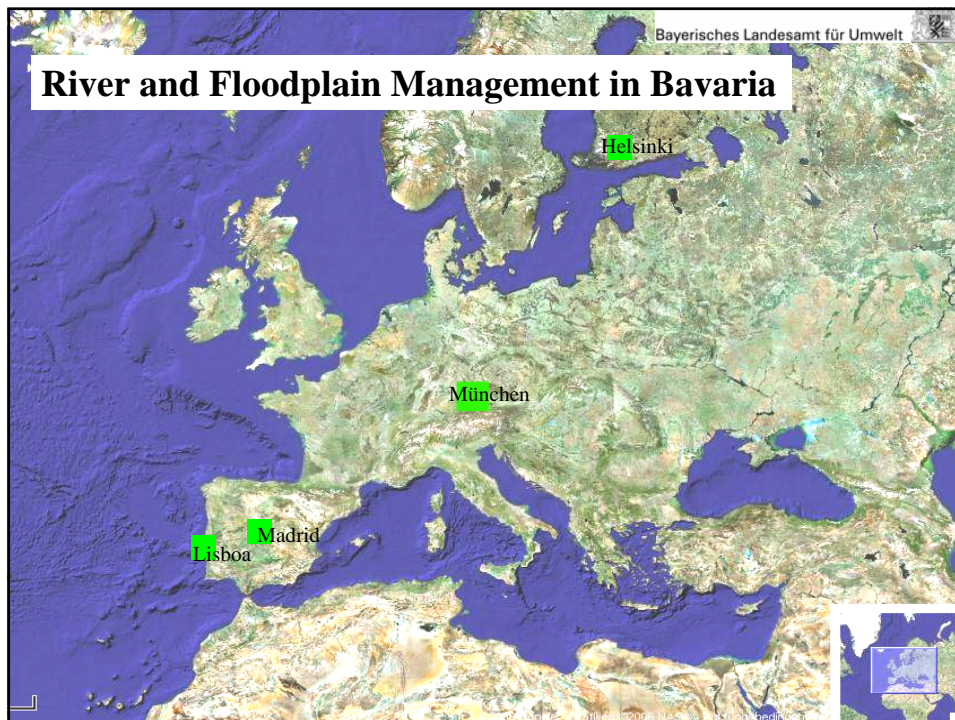
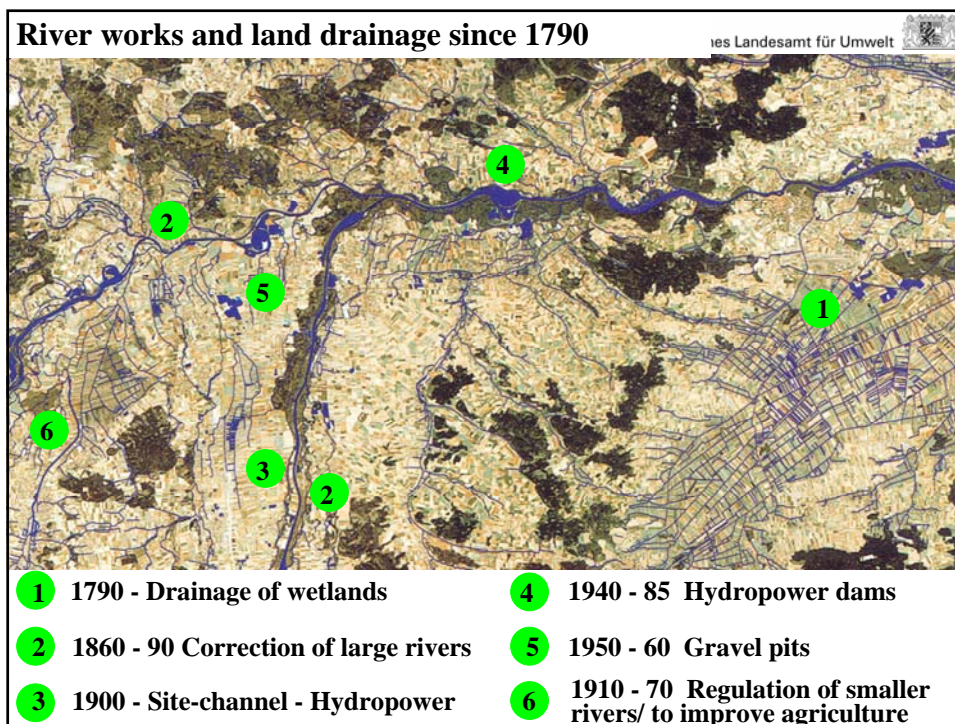
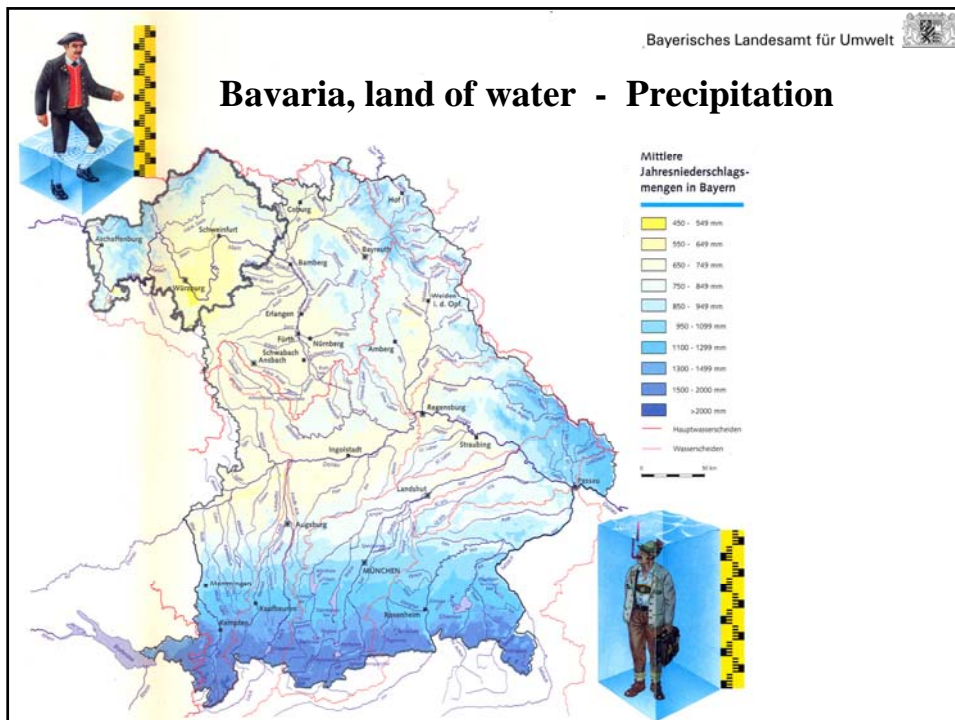


**River Restoration  
International Symposium  
Madrid 19<sup>th</sup>-21<sup>st</sup> of September 2006**

**River Restoration in Germany**  
Walter Binder  
Bayerisches Landesamt für Umwelt

- 1 Bavaria, land of water**
- 2 River construction, land drainage, 19<sup>th</sup> and 20<sup>th</sup> century**
- 3 Guideline for river management**
- 4 River management**  
in urban areas - space limited  
in open areas - space available
- 5 Flood protection, action program 2020**
- 6 Implementation of the EU Water Framework Directive and hydromorphological measures**





## Regulated rivers and streams



**Lech channalized 1860 -1890**  
**Hydropower channel 1900**

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**River channalisation and land drainage**  
**to improve agriculture 1910 - 1970**



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**Brook, straightened**  
**with weirs:**

**loss of hydromorpho-**  
**logical processes and**  
**ecological functions**

**Channalized about 1965**



**Reference condition for river restoration are:  
to keep hydromorphological processes going**

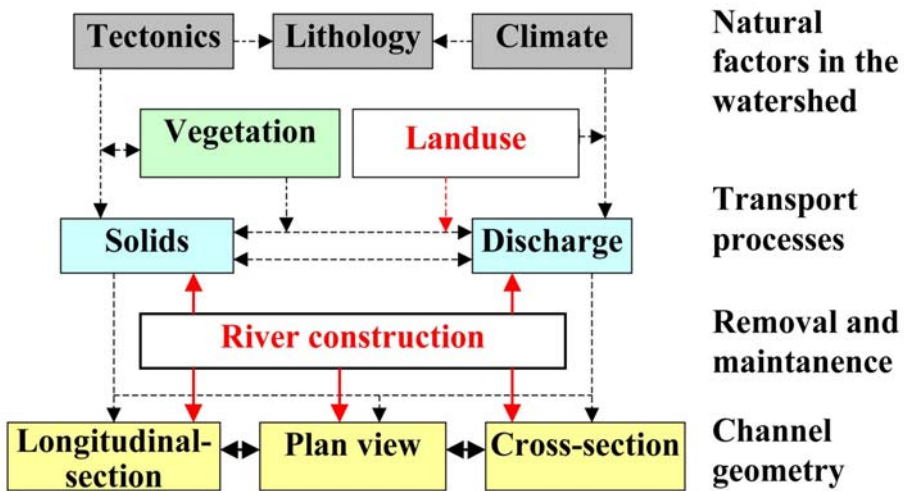


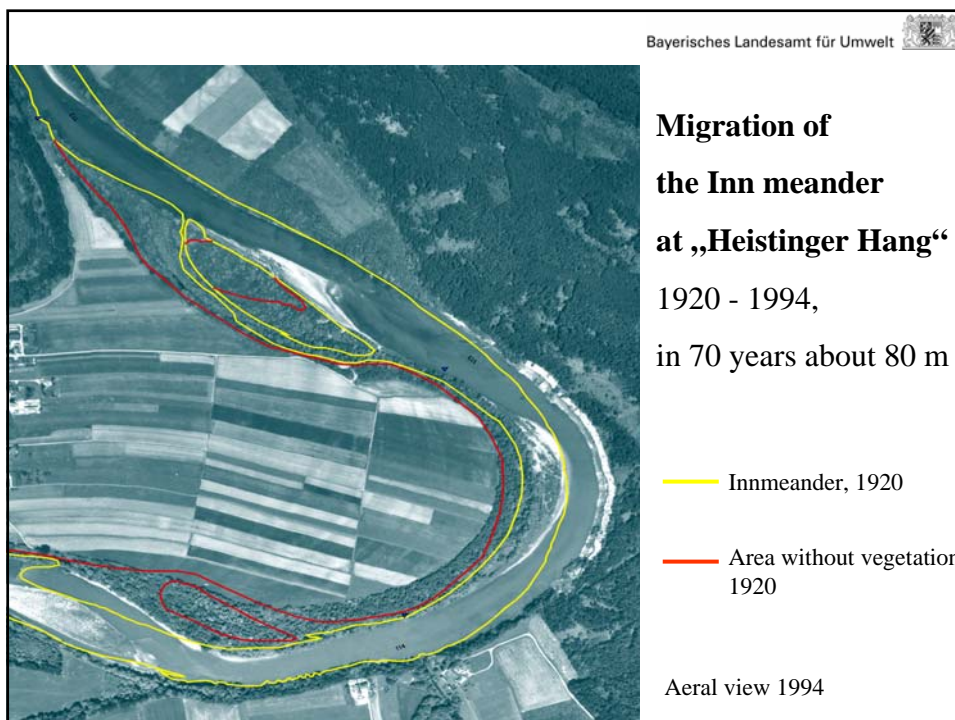
**River and floodplain are an ecological unit.**

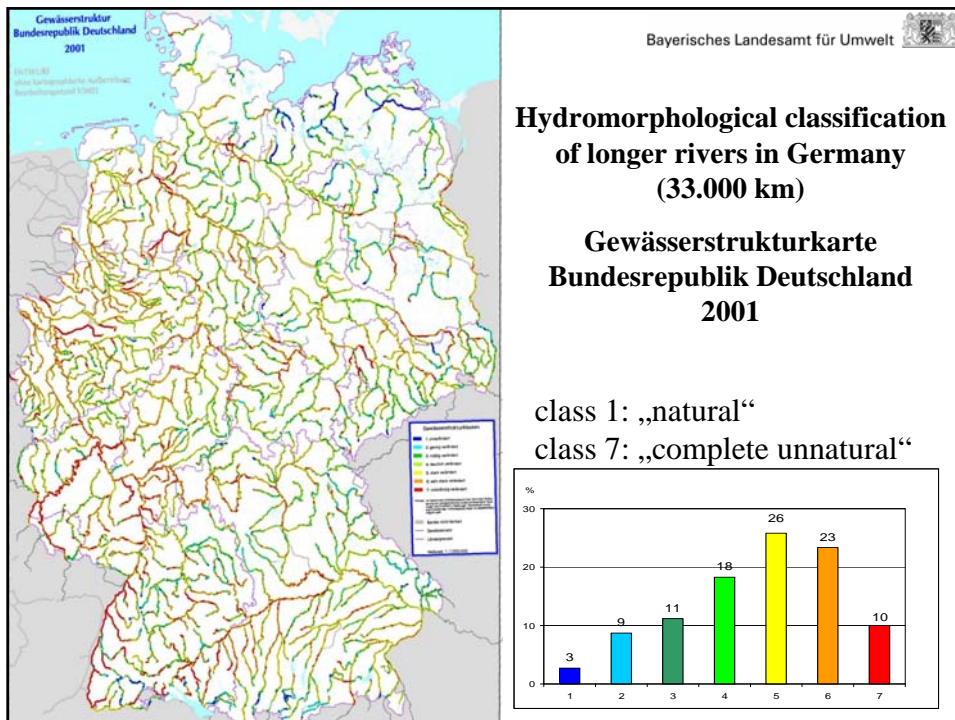
**Natural discharge, bed migration, sediment-transport, lateral - longitudinal connectivity**

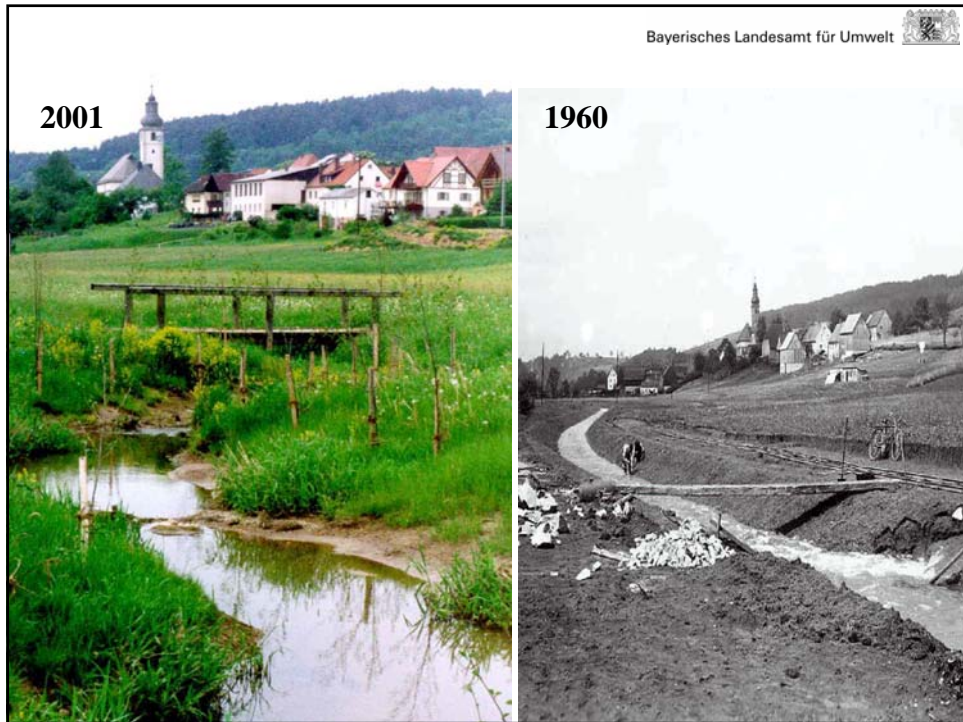
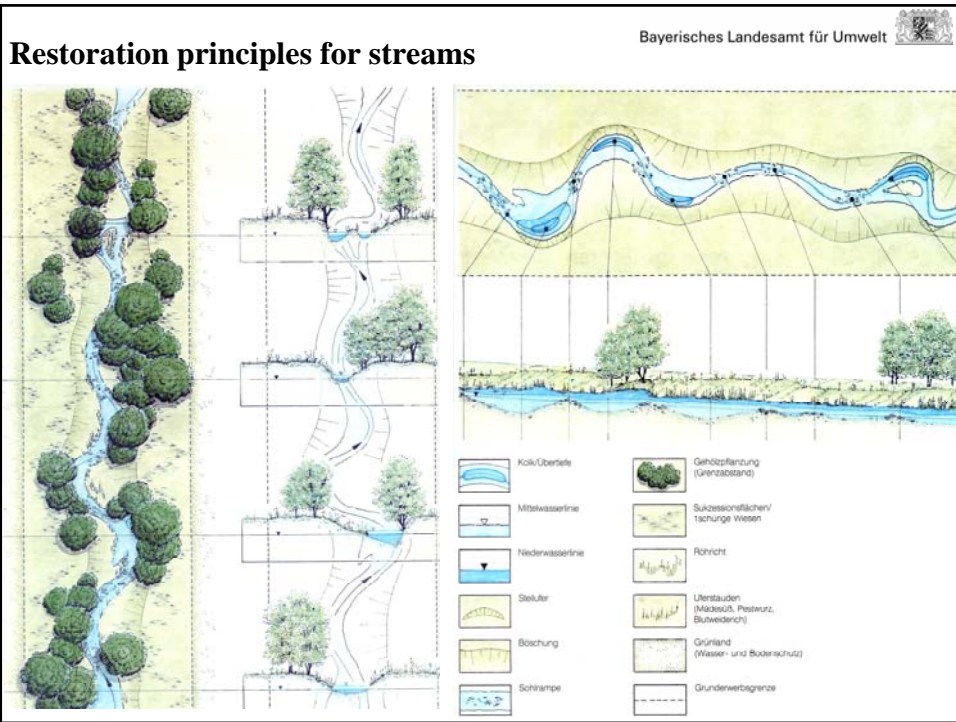


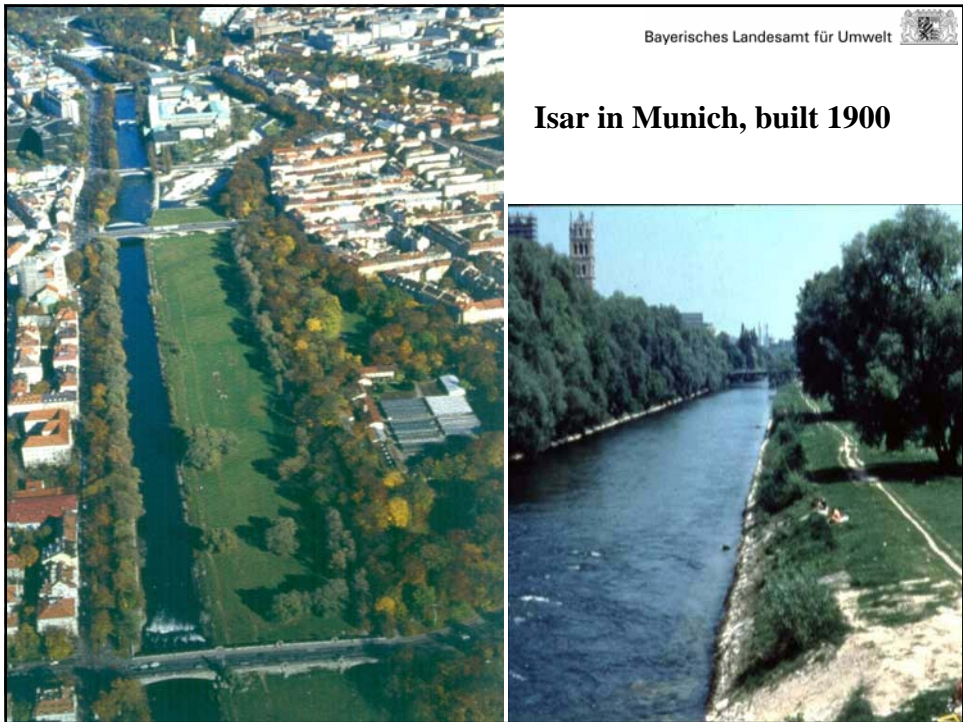
**Moderation of water courses by water works and its influence on the hydromorphological process**












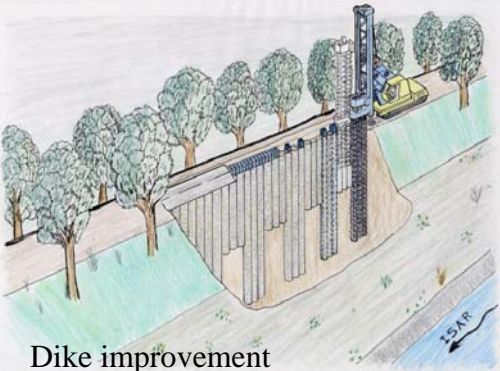




**Leitbild:**  
Flaucher in München

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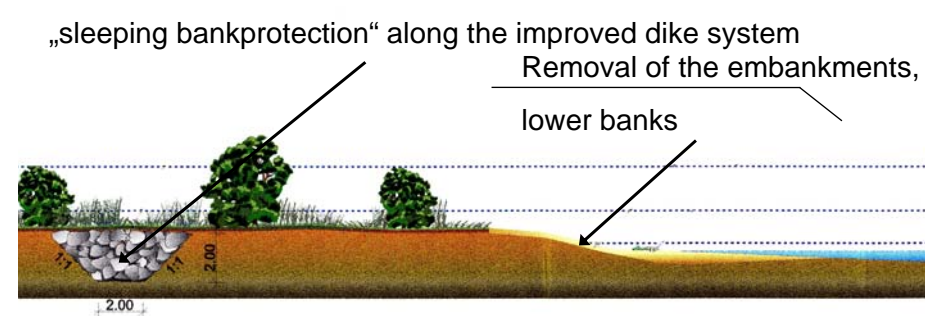
### Restoration of the Isar in Munich



Dike improvement

„sleeping bankprotection“ along the improved dike system

Removal of the embankments,  
lower banks





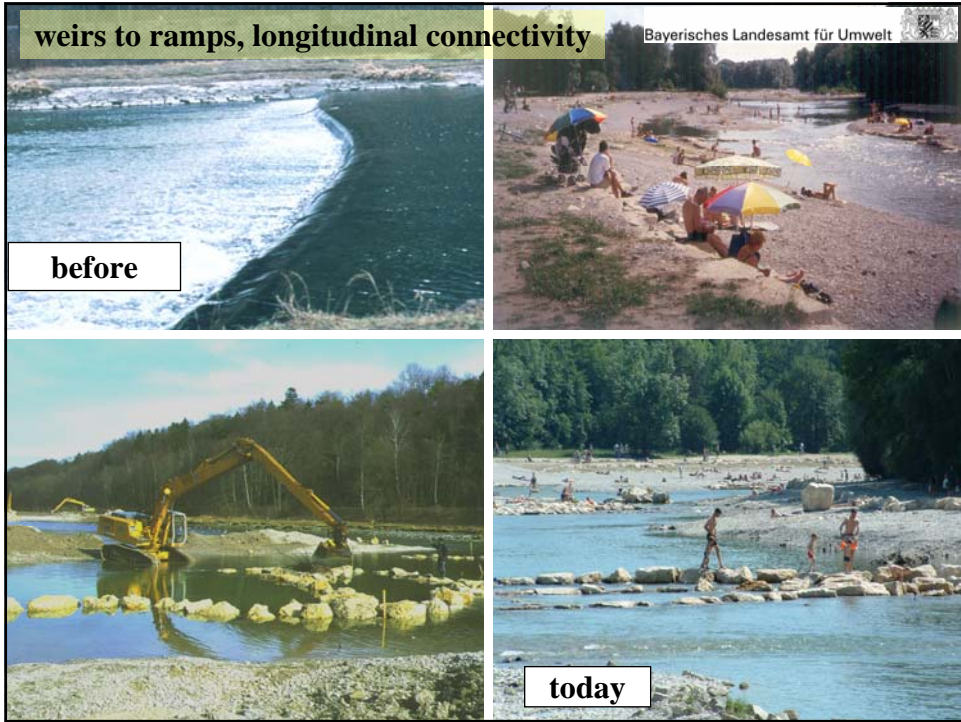
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**before**

**today**

**View  
to river Isar  
from the  
„Großhesseloher  
- Bridge“  
before and after  
the restoration  
project was done**



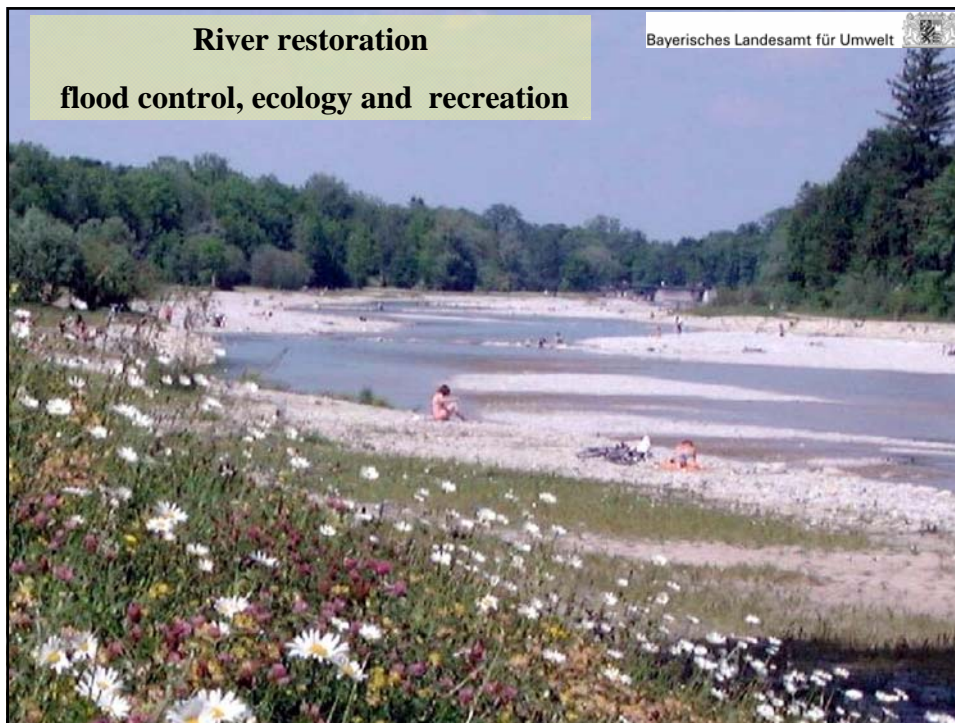
**weirs to ramps, longitudinal connectivity**

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**before**

**today**



Bayerisches Landesamt für Umwelt 

**Costs of Isar-Plan 28 mio. €**

**45 % city of Munich**

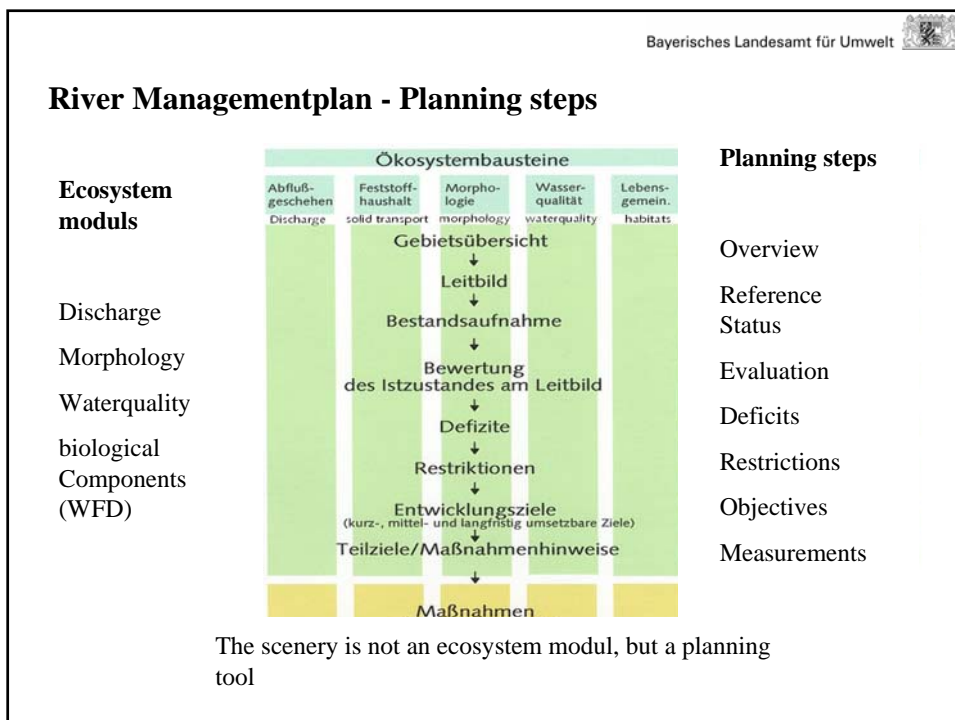
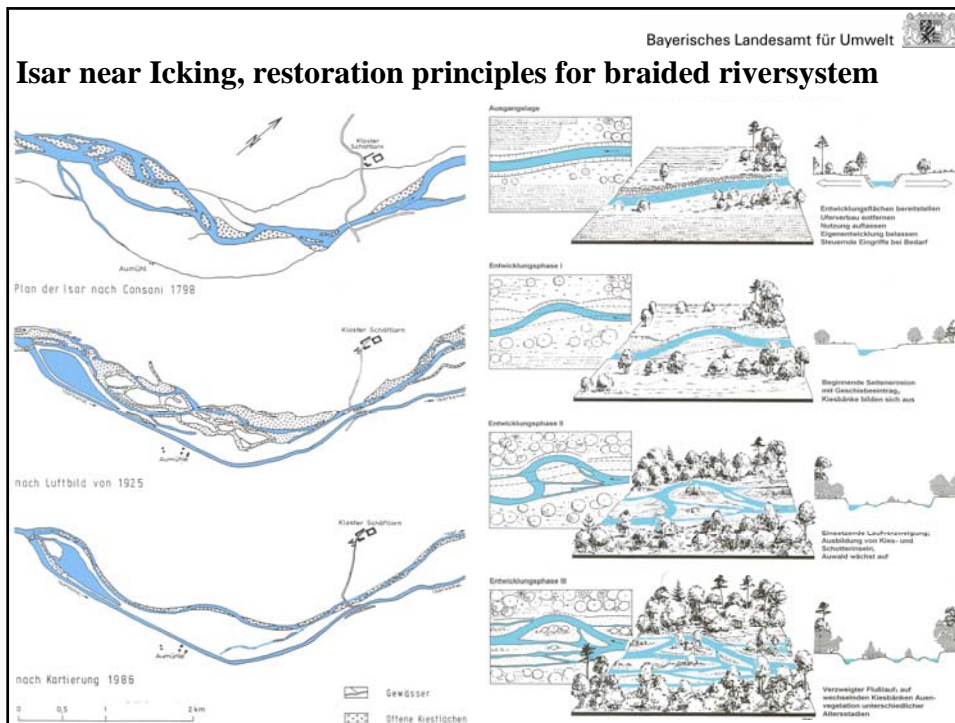
**55 % state of Bavaria (co-financed by EU)**

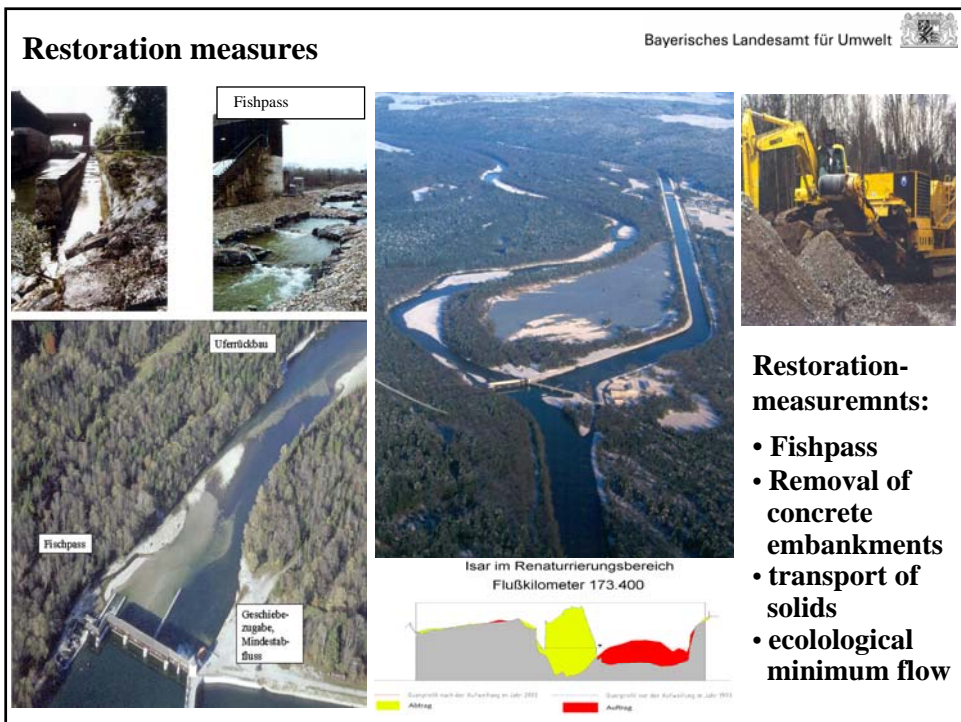
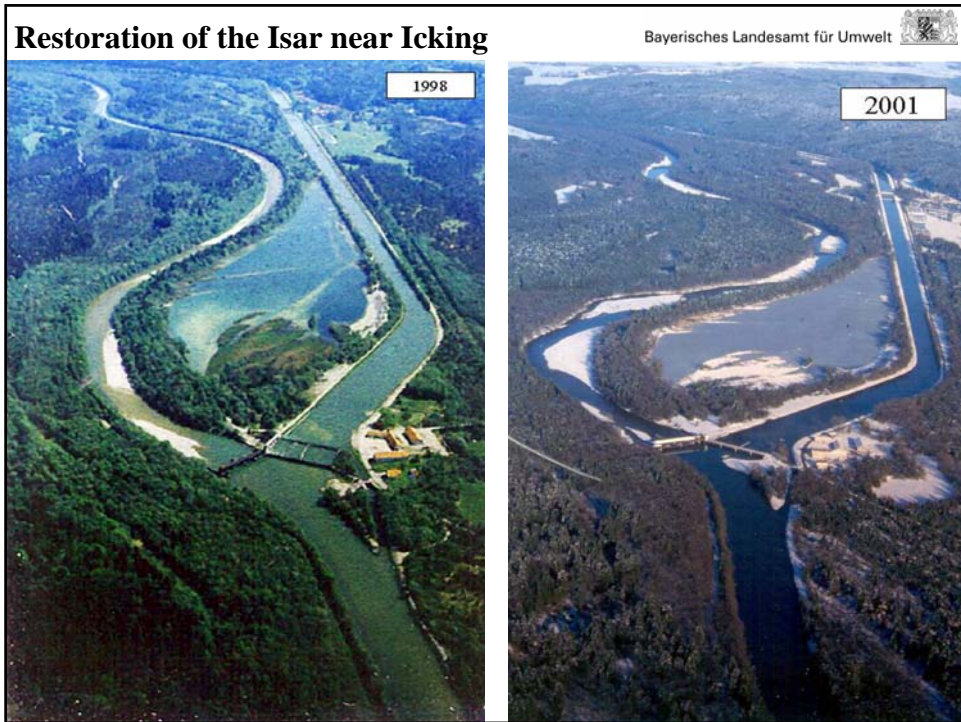
**start of the planning 1995**

**start of the construction 2000**

**2006 about 80% completed**

**2008 Project finished**



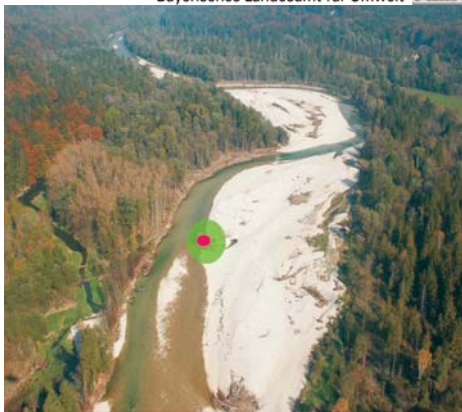


# Restoration process 1999 - 2006

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Isar 1999

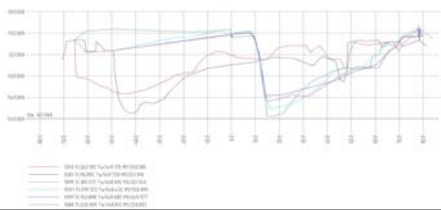


Standort des Strommastes im Gewässerbett der Isar



Isar 2002

Isar im Jahr 2005 auf Höhe des Wasserkraftwerkes Mühlthal



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## Restoration Project Isar at Mühlthal about 12 km

**1997 expiring of Hydropower concession (given 1927), new concession with ecological enhancements (from 1988 to 2018), based on a river management concept started 1995:**

**minimum flow raised from 5 to 15 m<sup>3</sup>/s, construction of a functional fish-pass, extraction of bank fixation, improvement of sediment transport**

**start of pilot project 1999**

**restoration project 2000 - 2002**

**costs (paid by the hydropower-company): 3 mio. € for bank extraction, length about 7 km, 200.000 € for fish-pass, 130.000 € for information trail**

**land for extension of the river bed: owned by the state**



## Example Ems

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Ems-Verlauf bei Einem um 1841 (dunkelblau) und um 1998 (hellblau).



Die Ems in Norddeutschland ist 371 km lang; sie entspringt bei Paderborn und mündet bei Emden in die Nordsee.



Renaturierter Emsabschnitt

Seit Ende der 1980-er Jahre gibt es Auen-, Schutz- und Entwicklungsprojekte in Nordrhein-Westfalen. Mehr als 5000 ha sind unter Naturschutz gestellt worden. Beispielhaft ist das Auenprojekt Ems. Durch den Erwerb von Flächen in der Aue wurden neue Mäander angelegt, Altarme wieder angeschlossen und neue Feuchtlebensräume geschaffen.



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## Thur - Schweiz



Die Thur, Kantone Zürich und Thurgau

Renaturierung bei beengten Vorländern - 2000/2005

Im Mündungsgebiet wird derzeit ein Thur-Auenprojekt durchgeführt. Die Thur wird entfesselt und 200 ha Auwald werden ökologisch aufgewertet



**City development within floodplains causes damages and endangered people**

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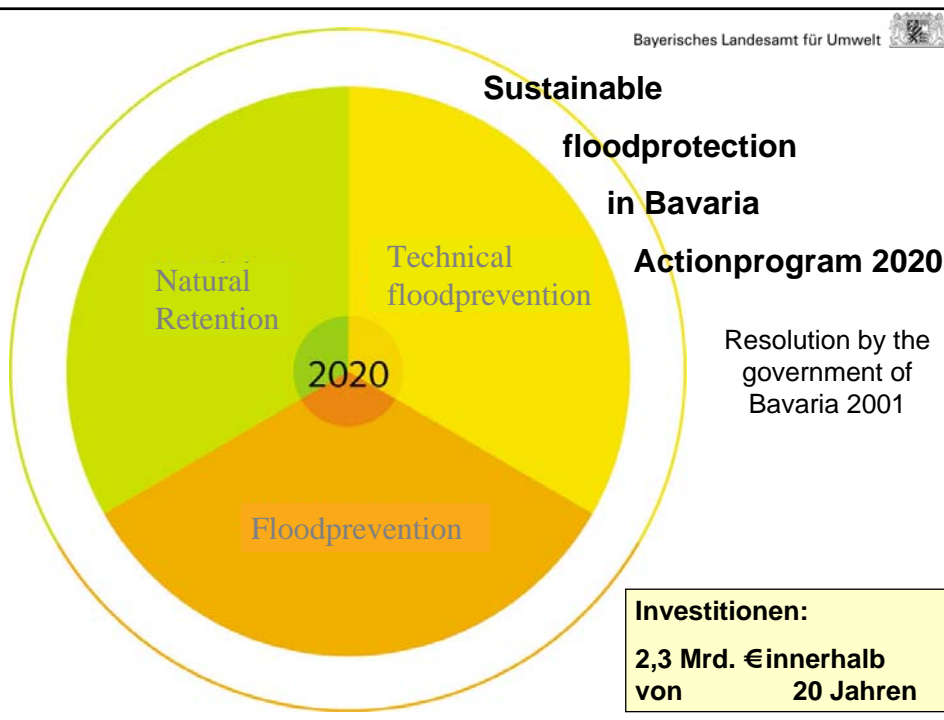
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**Sustainable  
floodprotection  
in Bavaria**

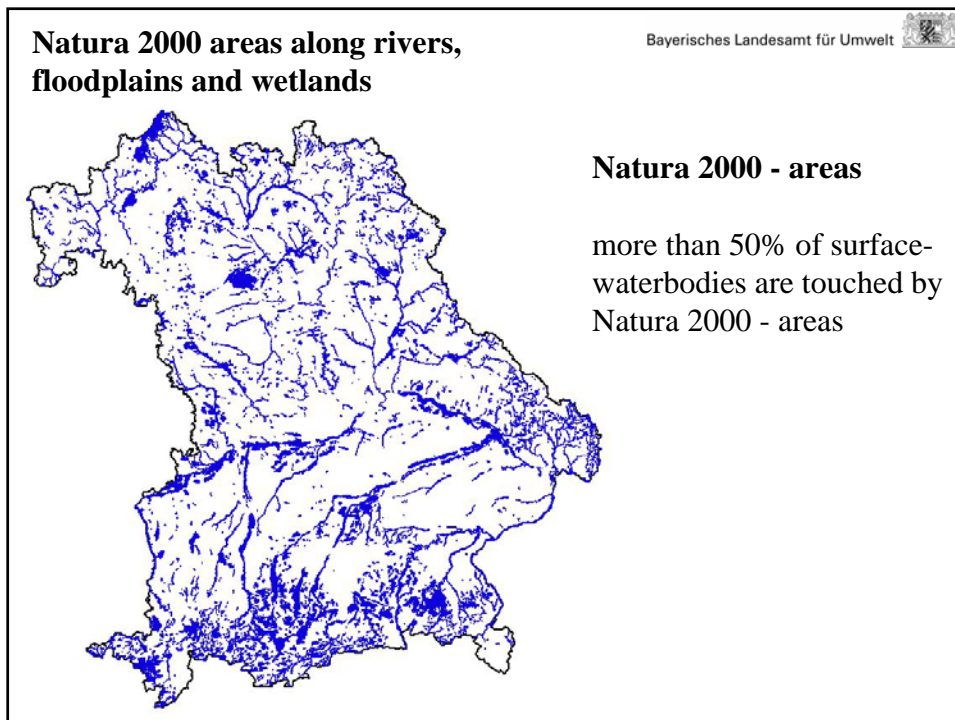
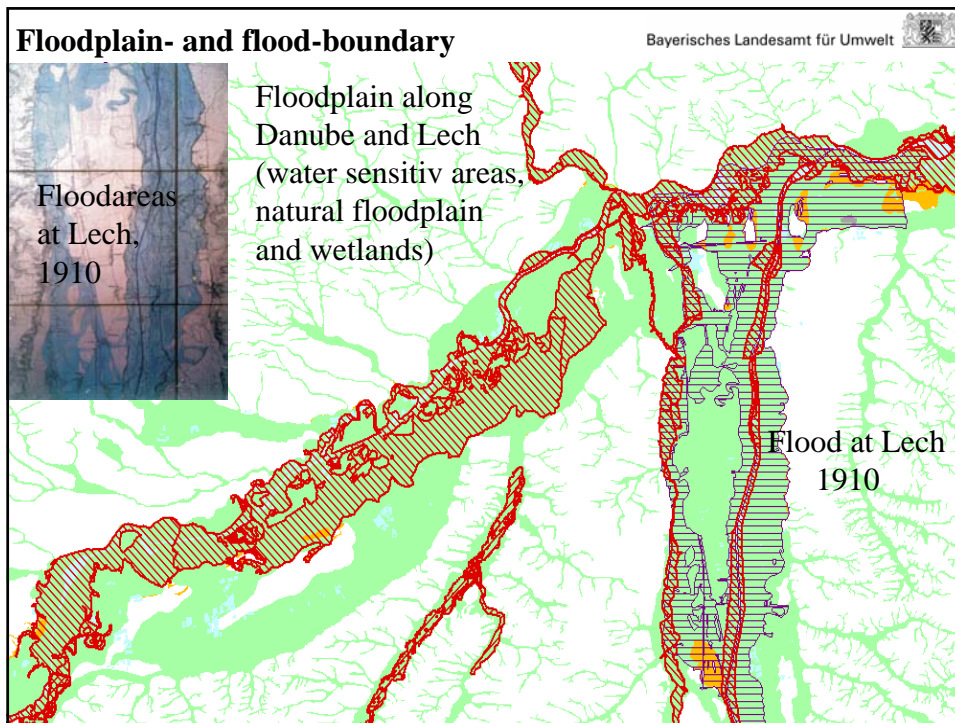
**Actionprogram 2020**

Resolution by the  
government of  
Bavaria 2001



**Investitionen:**

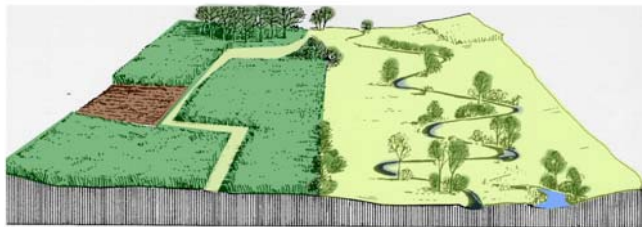
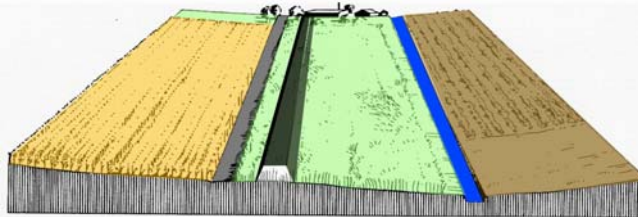
**2,3 Mrd. € innerhalb  
von 20 Jahren**



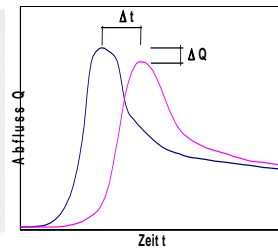


## River restoration and retention potential

Extension of banks  $\approx$  to reduce slope  
 Relocation of dykes - to increase retention, modification of land use



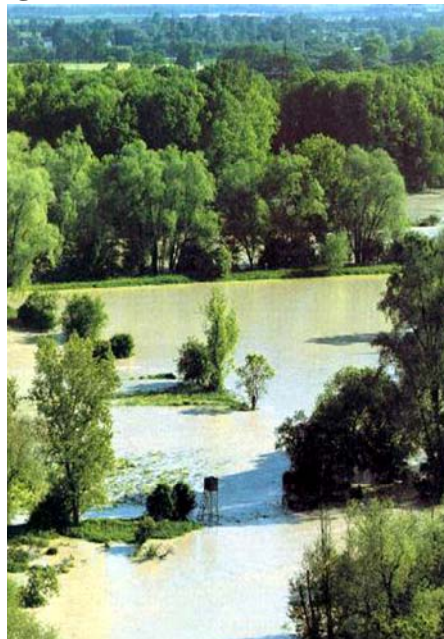
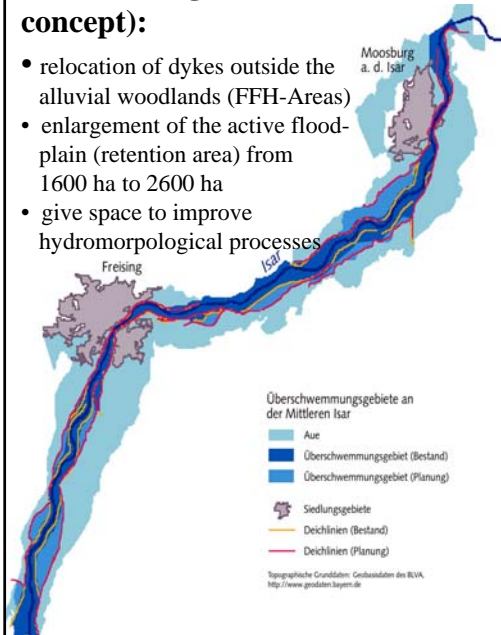
Modification of high floodpeak by Retention



## Integrated Flood Protection Projects, Isar near Freising (based on a river management concept):



- relocation of dykes outside the alluvial woodlands (FFH-Areas)
- enlargement of the active floodplain (retention area) from 1600 ha to 2600 ha
- give space to improve hydromorphological processes



**Floodplain between dykes: control of vegetation**  
**Danube near Straubing, flood 8/2005**

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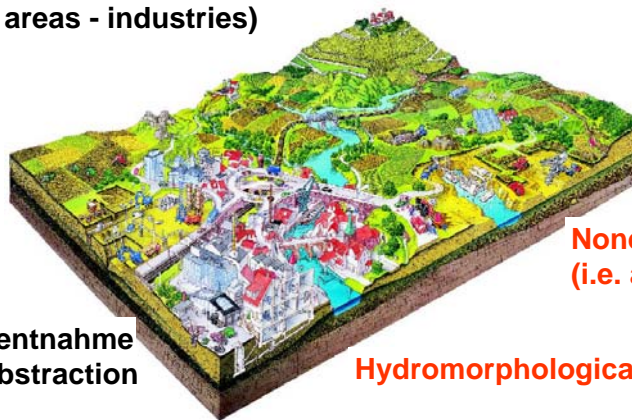
**Belastungen / Impacts - WFD**

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**Abflussregulierungen / Flow regulation**  
**(Talsperren; Querbauwerke / Barriers)**

**Punktquellen / Point sources**  
**(urban areas - industries)**



**None point sources**  
**(i.e. agriculture)**

**Wasserentnahme**  
**Water abstraction**

**Hydromorphological modifications**

**EU-WFD, result of the inventory**

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**Deficits: impacts caused by... ..interrupted connectivity**  
**...non-point sources (agriculture) (longitudinal, lateral)**



Hydropower - ecological orientated  
minimum flow

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**Hydromorphological structures**



Waterabstraction by Hydropower



Inserting gravel into the riverbed

Fishpass

1040519-10-08

## Hydromorphological structures



Naturbelassene, nicht verbauete Fließgewässer verkörpern einen Landschaftszusammenhang, der heute an der Schwelle zum Klimawandel steht.



Ufergehölze sind für die Uferstabilisierung und den Lösserhalt von Bedeutung. Sie sind auch Lebensraum für viele Arten und fördern die Selbstreinigungskraft des Gewässers.



**River neighbourhood means public participation**  
 the exchange of experiences with experts, planners, NGO's, communities and citizens





**Restoration: Planning steps**  
**Reference status – Inventory – Deficits – Objectives – Measurements**

**Objectives**  
flood control, ecology, outdoor recreation, standard of living within the city

**Planning process**  
Teamwork of experts (city, state), NGO's (e.g. „Isar-Allianz“) and public participation

**Result**  
a river for the citizens and the nature



**Objectives for river management and restoration concepts:**

- to enforce an ecological tolerable minimum flow
- to restore the ecological conditions of natural rivers, e.g. to readmit hydromorphological processes (get off bank fixation)
- to improve the longitudinal and lateral connectivity
- to enhance the habitats in the river system
- to enhance and to protect habitats
- to improve natural retention capacity, e.g. relocation of dikes
- to improve natural vegetation also in the adjacent land
- to reduce the silt freight, transported from arable land and
- to improve outdoor recreation.

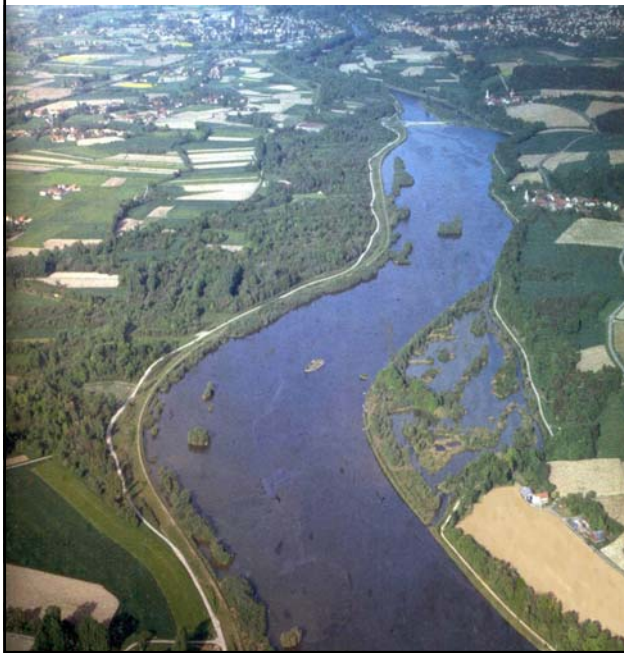
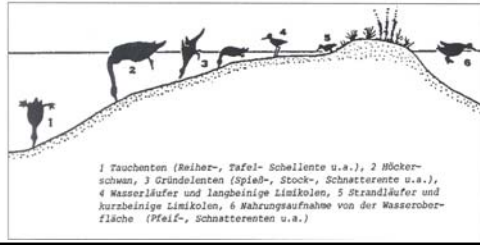
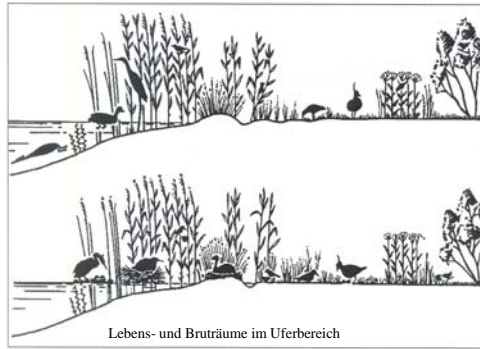
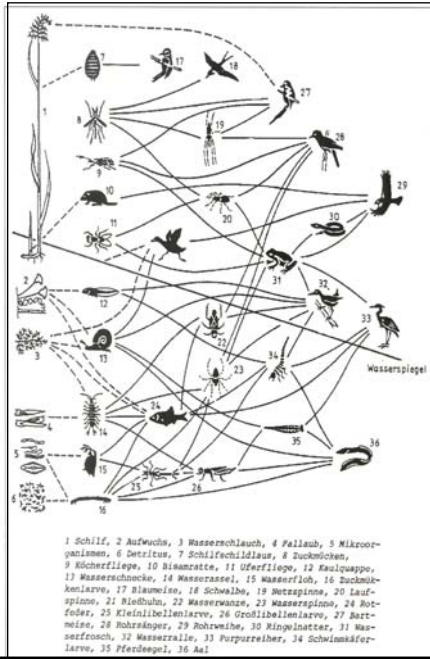


**Lech, Stufe 18**



**Inn, Stufe  
Ering -  
Braunau**

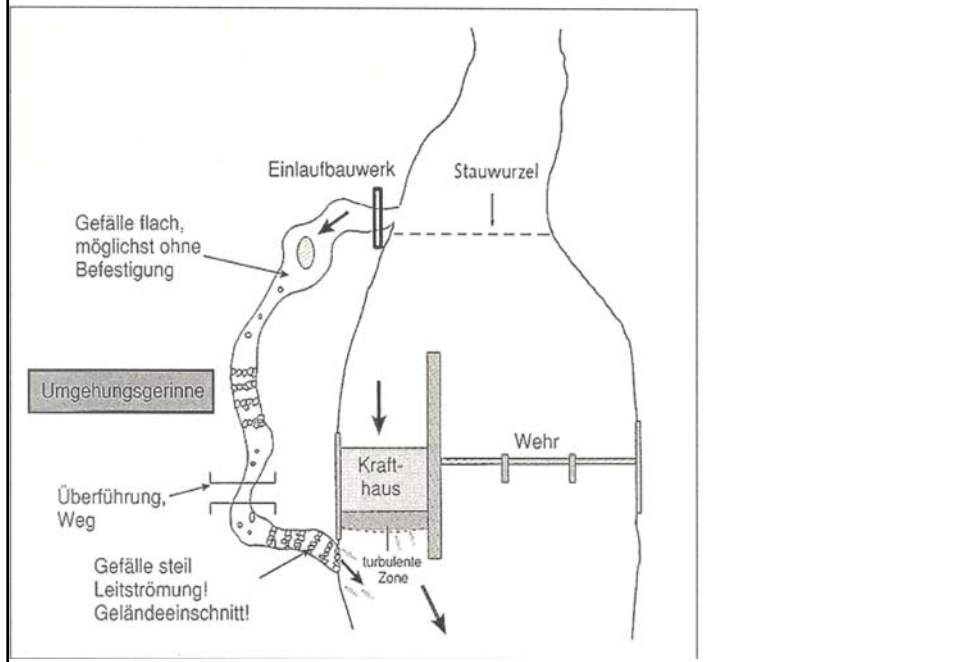




Stauraum Stützkraftstufe Landau







### Restoration principles for streams in urban areas - Designed rivers

The image illustrates restoration principles for streams in urban areas through a series of cross-section diagrams and photographs:

- Diagrams**: A 4x2 grid of cross-sections showing the transition from a technical, straight channel profile to more natural, meandering profiles with vegetation and varied channel shapes.
- Photographs**: Two photographs showing the results of restoration. The top photo shows a lush green stream with a grassy bank and trees. The bottom photo shows a stream with stone structures, a wooden walkway, and buildings in the background.

Vom technischen Regelprofil zu naturnah gestalteten Profilen  
Gestaltungsvarianten für einen Bach im Ortsbereich

