A holistic view about future water management strategies in the Danube region

More than policies

D E G G E N D O R F – U N I V E R S I T Y O F A P P L I E D S C I E N C E S – W a t e r a n d E n v i r o n e m e n t

Dorner W., Spachinger K., Schrenk C., Schürer C., Metzka R.

Flood 2005

Loisach - Ortschaft Eschenlohe

[Quelle: StMUGV 2005]

Overtopping of dikes

Deichversagen

[Quelle: StMUGV 2005]

Dam failure

9 m Dammhöhe
50.000 m³
9 km² Einzugsgebiet

Dammversagen 2002 - Glashütte

[Quelle: LfW 2005]

Dam failure

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50.000 m³
9 km² Einzugsgebiet

Dammversagen 2002 - Glashütte

[Quelle: LfW 2005]

Dam failure

Dammversagen 2002 - Glashütte

9 m Dammhöhe
50.000 m³
9 km² Einzugsgebiet

Flood disasters 1990 - 2004

Tab.2 Die teuersten Überschwemmungskatastrophen* seit 1990 weltweit
(nicht inflationsbereinigte Originalwerte)

Rang	Jahr	hauptsächlich betroffene(s) Gebiet(e)	Schäden (in Mio. US$) volkswirtschaftlich
1	1998	China (Jangtse, Songhua)	30 700
2	1996	China (Jangtse, Gelber Fluss, Huaihe)	24 000
3	2002	Süd-, Mittel-, Osteuropa (Elbe, Donau)	21 200
4	1993	USA (Mississippi)	21 000
5	1995	Korea	15 000
6	1991	China (Huaihe, Taihu-See)	13 600
7	1993	China	11 000
8	2004	11 Länder am Indischen Ozean (Tsunami)	10 000
9	1994	Italien (Südalpen)	9 300
10	1993	Indien, Bangladesch, Nepal	8 500
	2000	Italien, Schweiz (Südalpen)	8 500
12	2002	China	8 200
13	1999	China	8 000
14	2003	China	7 890
15	1994	China	7 800
	2004	China	7 800
17	1995	China	6 720
18	2001	USA (Texas, tropischer Sturm Allison)	6 000
19	1997	Osteuropa (Oder)	5 900
20	1998	Mittelamerika (Hurrikan Mitch)	5 500

Flood disasters 1990 - 2004

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12	2002	China	8 200
13	1999	China	8 000
14	2003	China	7 890
15	1994	China	78
	2004	China	78
17	1995	China	67
18	2001	USA (Texas, tropischer Sturm Allison)	6 000
19	1997	Osteuropa (Oder)	5 900
20	1998	Mittelamerika (Hurrikan Mitch)	5 500

5.900

Flood disasters 1990 - 2004

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Rang	Jahr	hauptsächlich betroffene(s) Gebiet(e)	Schäden in Mio. US$
1	1998	China (Jangtse, Songhua)	30...
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21.200

[Quellen: MunichRe 2005]

Three pilar strategy

Natural detention	Technical flood protection	Further prevention
➢ **durch Boden und Bewuchs** ➢ **in der Fläche** ➢ **im Gewässer und Aue**	➢ **Schutz-bauwerke** ➢ **Gewässer-ausbau** ➢ **Flutmulden** ➢ **Hoch-wasser-rückhalte-becken**	➢ **Flächen-vorsorge** ➢ **Bauvor-sorge** ➢ **Verhaltensvorsorge** ➢ **Risiko-vorsorge**

Drei-Säulenstrategie zum Hochwasserschutz

Natural detention
- ➢ **durch Boden und Bewuchs**
- ➢ **in der Fläche**
- ➢ **im Gewässer und Aue**

Technical flood protection
- ➢ **Schutz-bauwerke**
- ➢ **Gewäs...**
- ➢ **...mulden**
- ➢ **Hoch-wasser-rückhalte-becken**

Further prevention
- ➢ **...hen-vorsorge**
- ➢ **Bauvor-sorge**
- ➢ **Verhaltensvorsorge**
- ➢ **Risiko-vorsorge**

Fixed protection level HQ 100
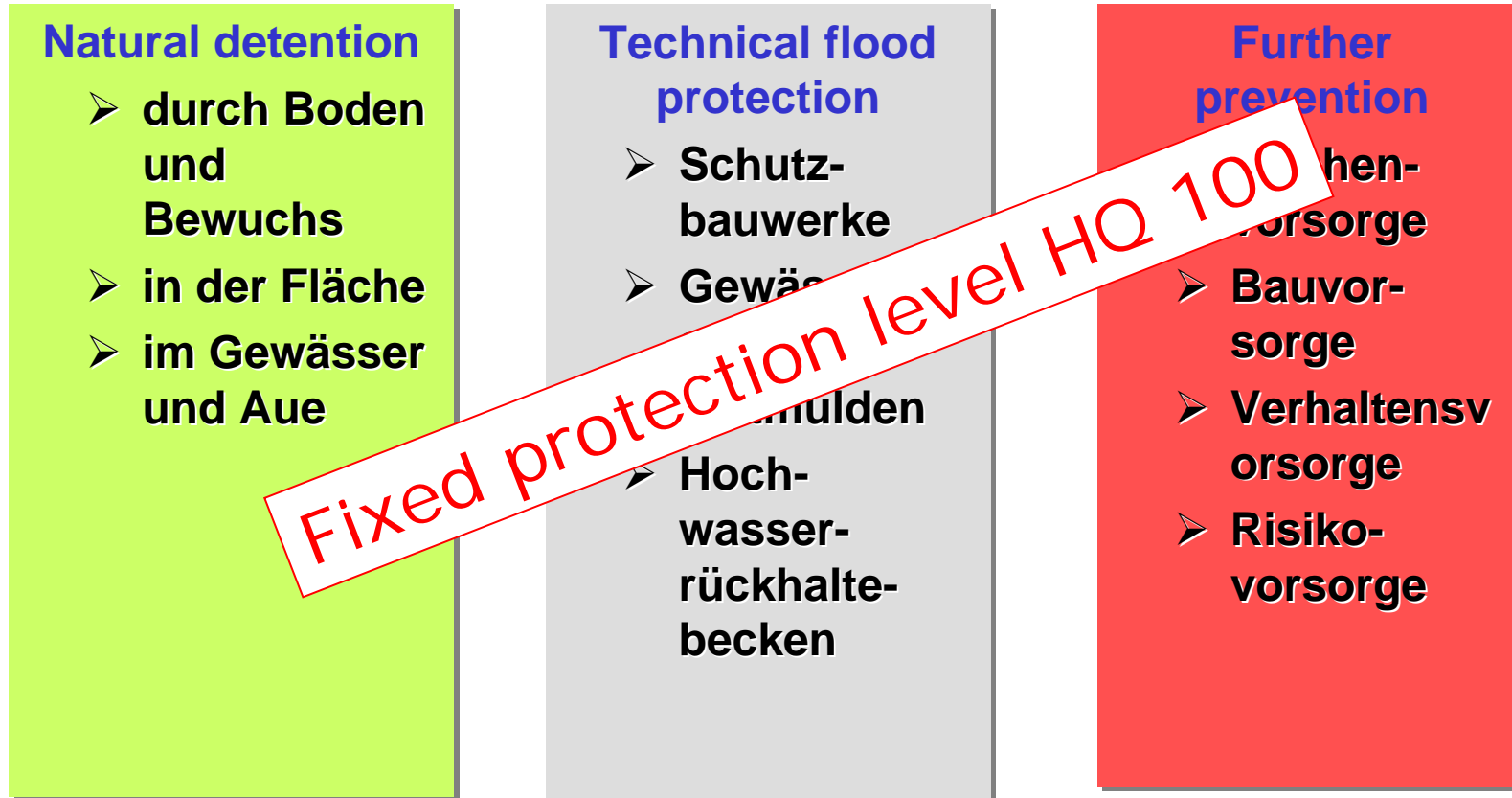
Risk equation

Flood risk

| danger | vulnerability |

Use intensification

1820   Heute

Use intensification

1820

Heute
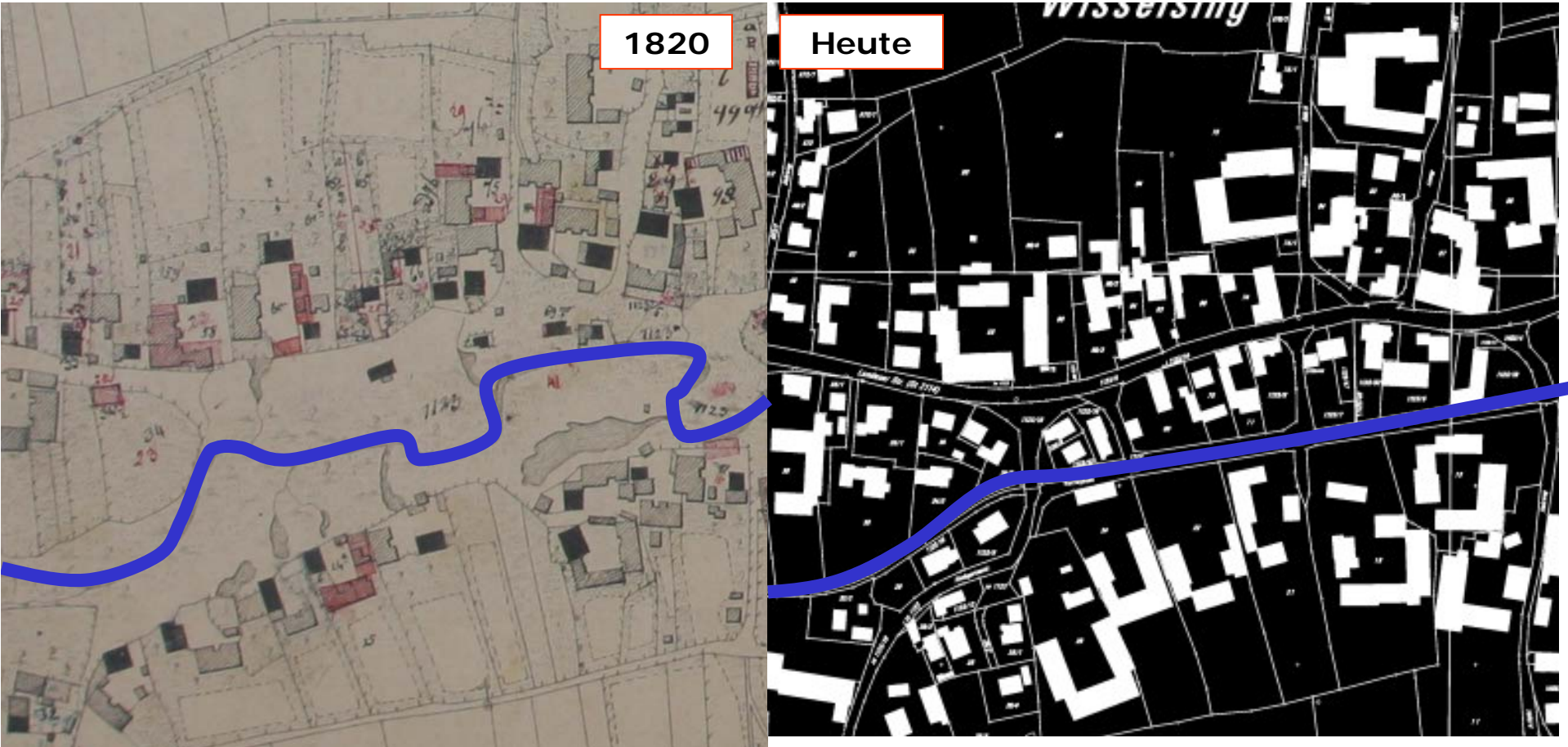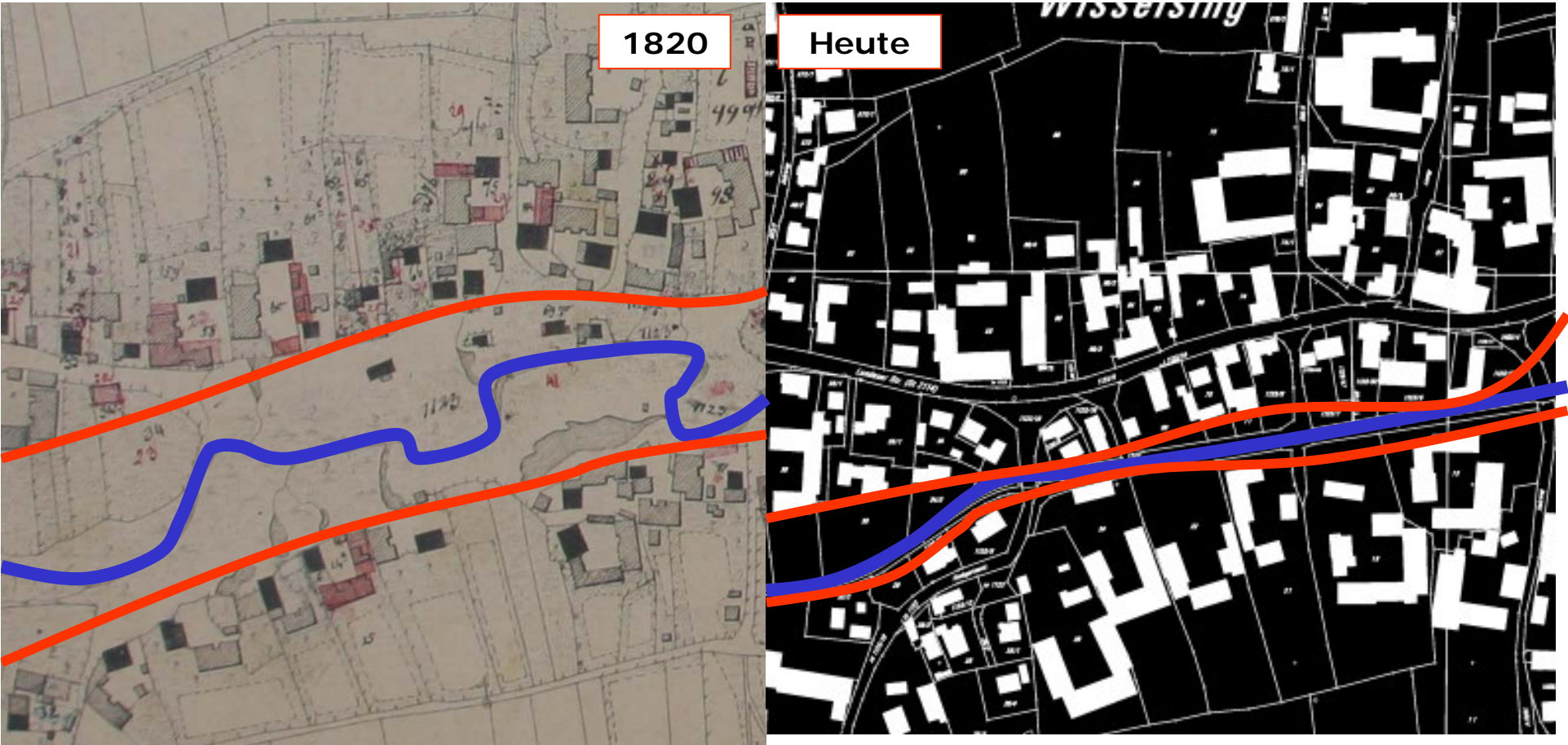
Use intensification

- Irrigation vs. hydro power

- Hydro power vs. fishery

- Fishery vs. habitat protection

- Habitat protection vs. agriculture

- Agriculture vs. urban development

- Food production vs. renewable energies

Demographic change

Zunahme in %

(dark red)	über 40
(red-orange)	30,1 bis 40,0
(orange)	20,1 bis 30,0
(light orange)	15,1 bis 20,0
(pale orange)	10,1 bis 15,0
(yellow)	5,1 bis 10,0
(pale yellow)	0,1 bis 5,0

Abnahme in %

(pale blue)	0 bis 5,0
(light blue)	5,1 bis 10,0
(blue)	10,1 bis 15,0
(dark blue)	15,1 bis 20,0
(darkest blue)	20,1 bis 30,0
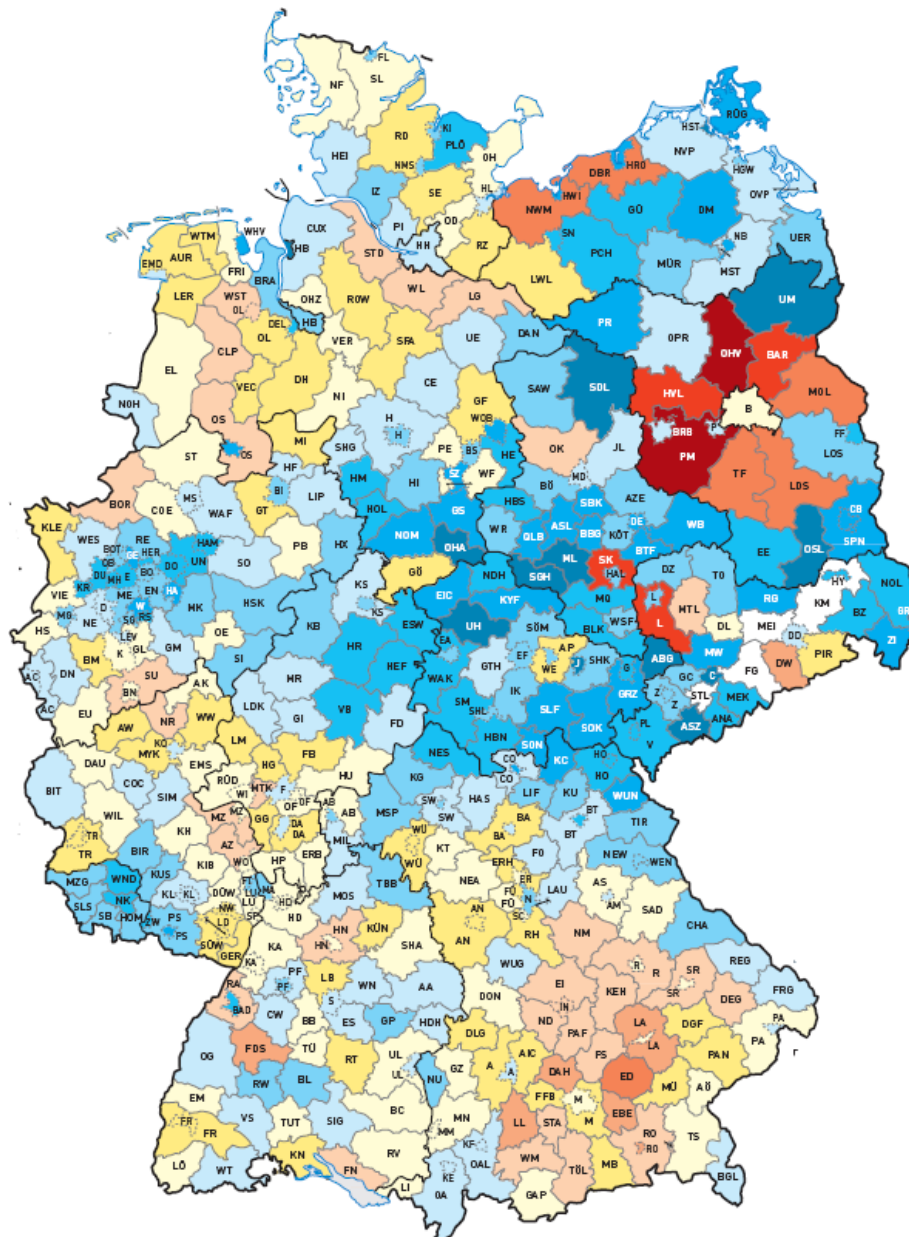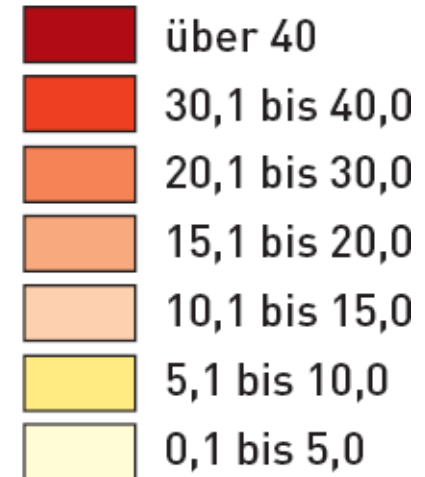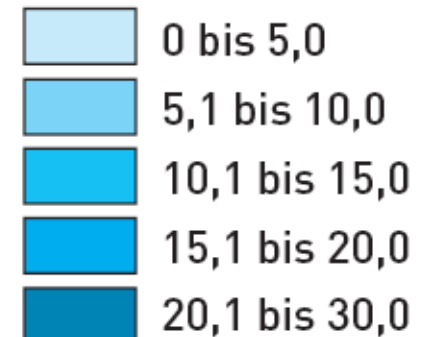
GEO Atlas Demographie 2005

Demographic change

- **Concentration of population**
  - Land use intensification
  - Increased flood risk

- **Thinning of areas**
  - Overdimensioned infrastructure
  - Sewage flushes in stormwater sewers
  - More chemicals for water supply

Climate change

Niederschlagstrend in mm

-20–0	0–20
-40–(-20)	20–40
-60–(-40)	40–60
-80–(-60)	60–80
-100–(-80)	80–100
<-100	100–120
	120–140
	>140
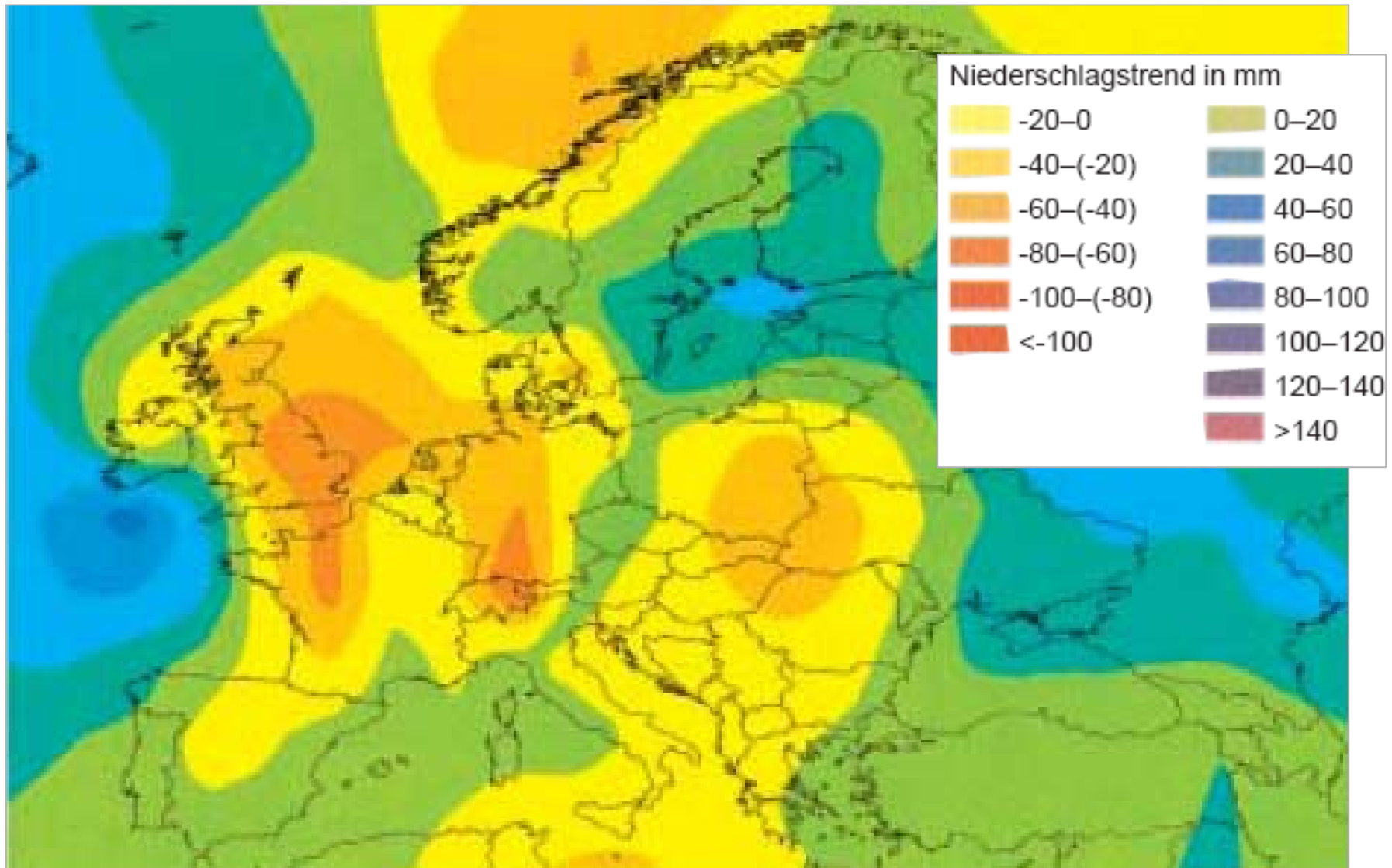
[Rapp & Schönwiese 1995]

Climate change

- Concentration of precipitation in autumn an spring

- Higher temperatures in summer (evaporation)

- Loss of glaciers and winter snow as reservoirs

➢ More and bigger floods

➢ Less water

➢ Less stored water

Four threats for water management

- ## Climate change
  - ➢ Water consumption (Fresh water, irrigation,)
  - ➢ Energy production (hydro and thermal power)

- ## Demographic change
  - ➢ Destruction planning and engineering
  - ➢ Re-engineering

- ## Use intensification and rivalry
  - ➢ Water Framework Directive
  - ➢ Flood risk management directive

Four threats for water management

- Climate change
  - Water consumption
  - Energy production
- Demographic change
  - Destruction planning and engineering
  - Re-engineering
- Use intensification and rivalry
  - Water Framework Directive
  - Flood risk management directive

Water as an interdisciplinary issue

Multi-purpose/criteria projects

Integrated policies

The hydrological cycle

Niederschlag

Verdunstung

Mulden

Versickerung

Oberflächenabfluss

Grundwasser
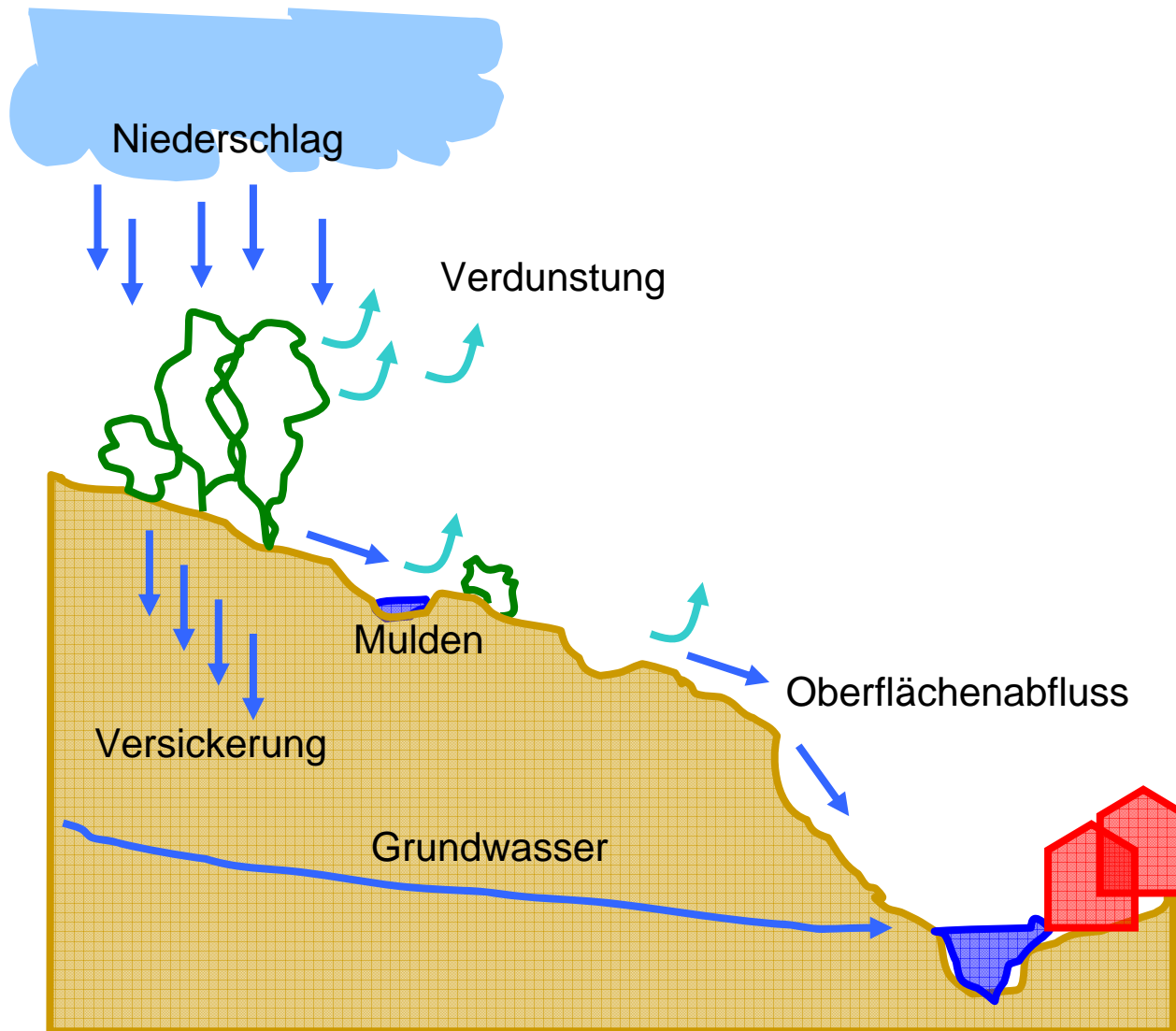
Responsible Use of Soil
and Land and Regional
Development

Risk Management

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Risk man.

Natural hazards

Risk man.

Increase of damage
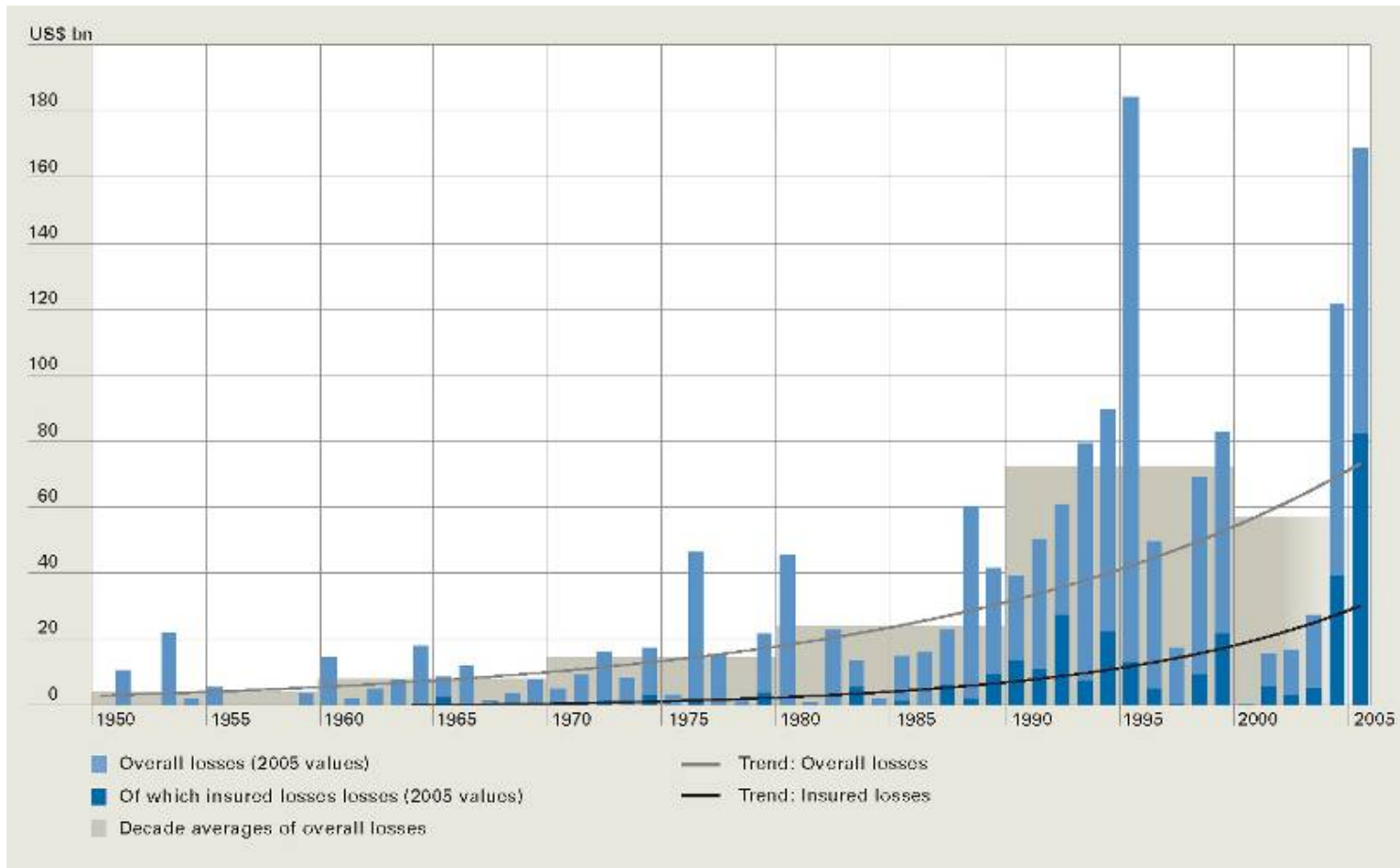
Risk man.

Risk?

- Economical term

- It's something about probability

- Extended by the factor of potential damage

- Flood risk:
  „Imponderability of the technical and/or economical flood protection"

Risk as an equation

$$R_{i,j} = f\left(p_{Si},\ A_{Oj},\ v_{Oj,\ Si},\ p_{Oj,\ Si}\right)$$

$R_{i,\ j}$ = risk

p_{Si} = probability of scenario i

A_{Oj} = value at risk of object j

$v_{Oj,\ Si}$ = vulnerability of object j, dependent on scenario i

$p_{Oj,\ Si}$ = probability of exposure of object j to scenario i

Risk man.

$R = p * s$

p = probability
s = potential damage

Risk term applied to natural disasters

- Expected loss (human loss, casualities, damaged property, interruption of economical activities) caused by a probable occurence of damage in a certain area in a certain time period.
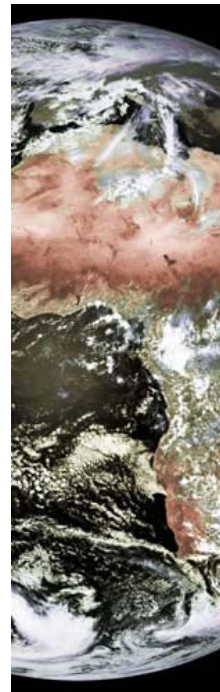
Risk man.

Risk management processes

- Identification

- Analysis

- Quantification

- Operation

Risk man.

Risk management processes

- **Identification**
  - Is there a risk?
  - What kind of risk?

- Analysis

- Quantification

- Operation

Risk man.

Risk management processes

- Identification

- **Analysis**
  - What is the reason?
  - Why is there a risk?
  - What are the possible effects?

- Quantification

- Operation

Risk management processes

- Identification

- Analysis

- **Quantification**
    - Quantification of damage
    - Quantification of impact
    - …

- Operation

Risk management processes

- Identification

- Analysis

- Quantification

- **Operation**
  - Avoid Risk
  - Prevent
  - Protect
  - Shift on
  - Accept

Risk man.

Flood events

- Identification

- Analysis

- Quantification

- Operation

Floodriskmanagement and Vulnerability

by the example Vils and Rott / Bavaria

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GEO-INF 1
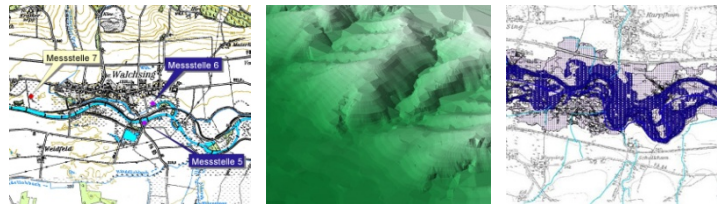
Consequences of the Flood

- **threat by the flood**
  - inundated villages and cities
  - destruction of buildings and agricultural areas
  - entry of sediments

- **destruction of infrastructure**
  - economic looses
  - traffic are handicapped

Project Area

- ## river Vils and Rott
  - Vils 1448 km^2
  - Rott 1200 km^2
  - very varied water

- ## urban sector
  - Geisenhausen
  - Eichendorf
  - Pocking
  - Ruhstorf an der Rott
  - Pfarrkirchen
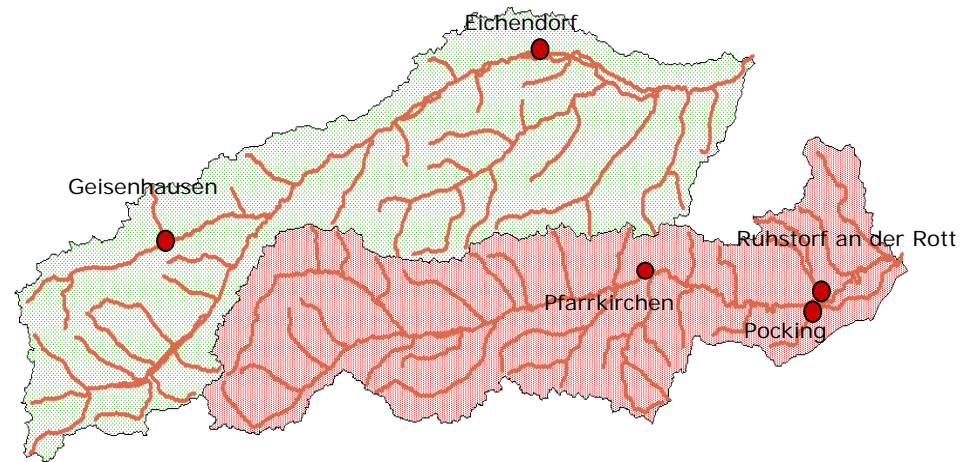
09.03.2007

Project Area

- **urban sector**
  - Geisenhausen
  - Eichendorf
  - Pocking und Ruhstorf an der Rott
  - Pfarrkirchen

Project Area

- ## rural sector
  - Rott downstream Pfarrkirchen

Pfarrkirchen
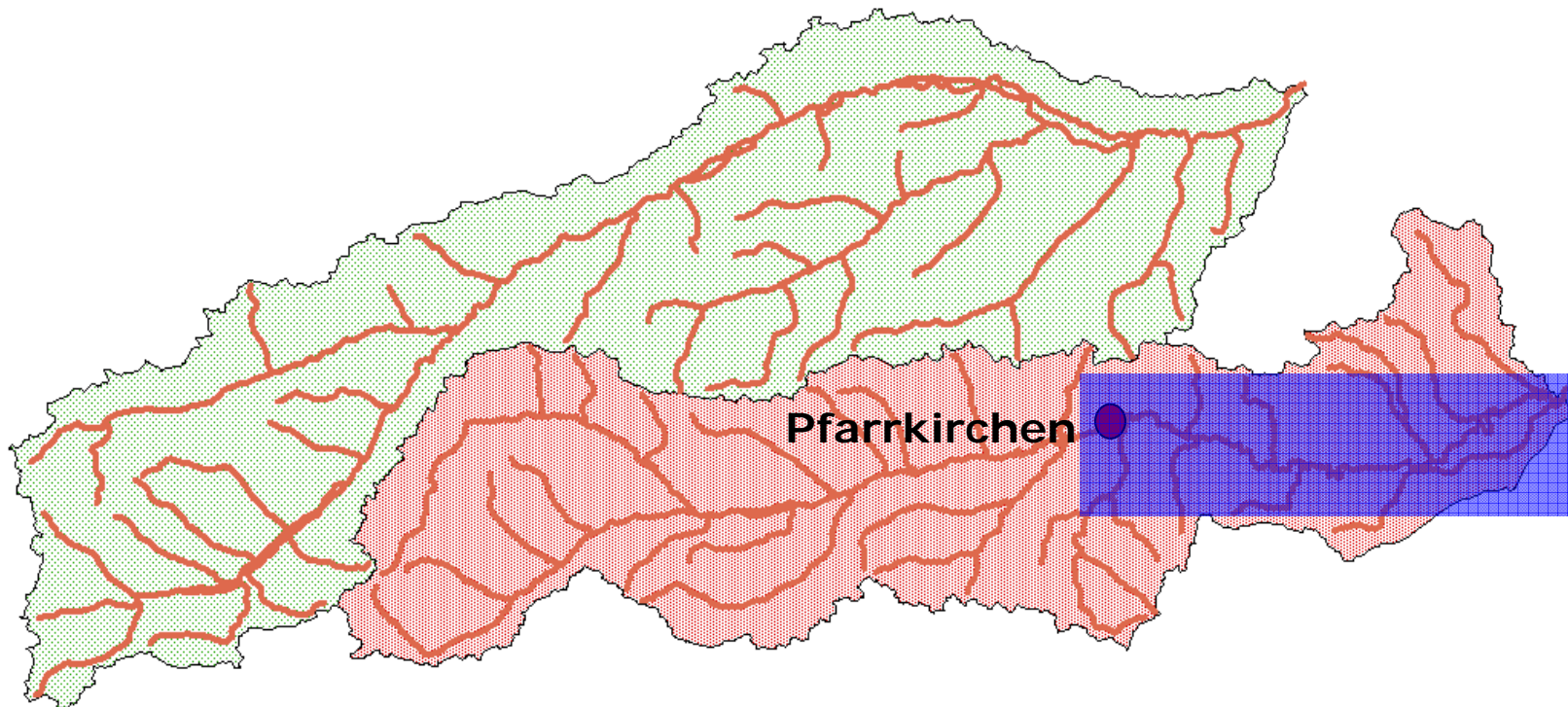
09.03.2007

- GIS
  - built-up areas
  - settlements
  - industrial parks

- hydraulic calculation

- analysis of vulnerability and damage potential
  - gross domestic product
  - gross national product
  - rate of working population and inhabitant

→**Financial Damage of the Flood**

Damages

- **direct damages**
  - tangible
  - in-tangible

- **indirect damages**
  - tangible
  - in-tangible

Risk Maps

- Event probability
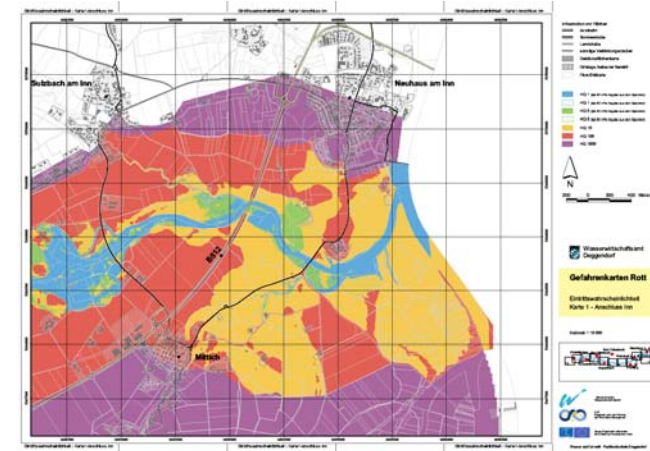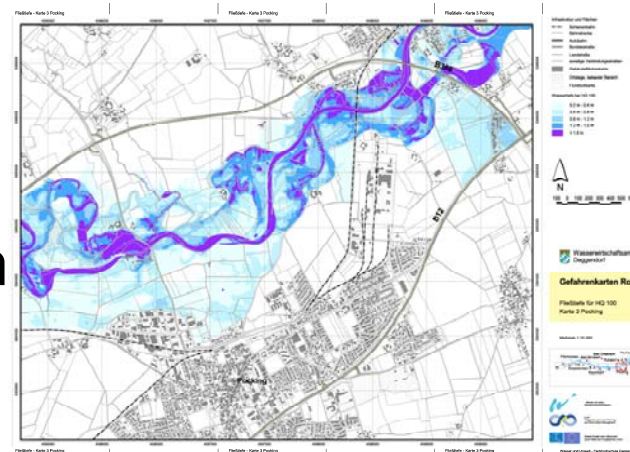
- water depth
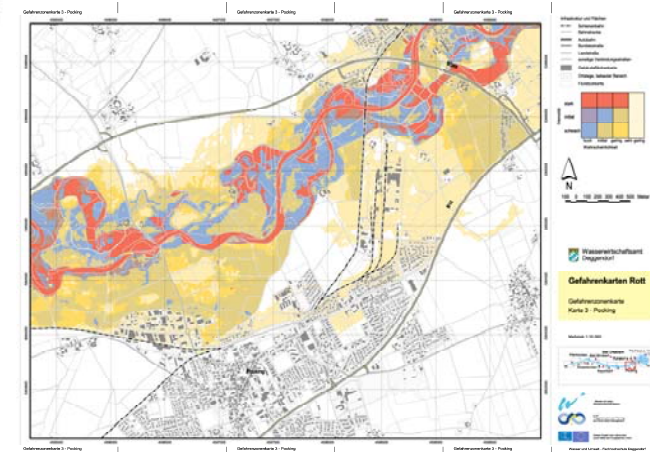
- danger zone

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Event Probability

Water depth

Danger zone
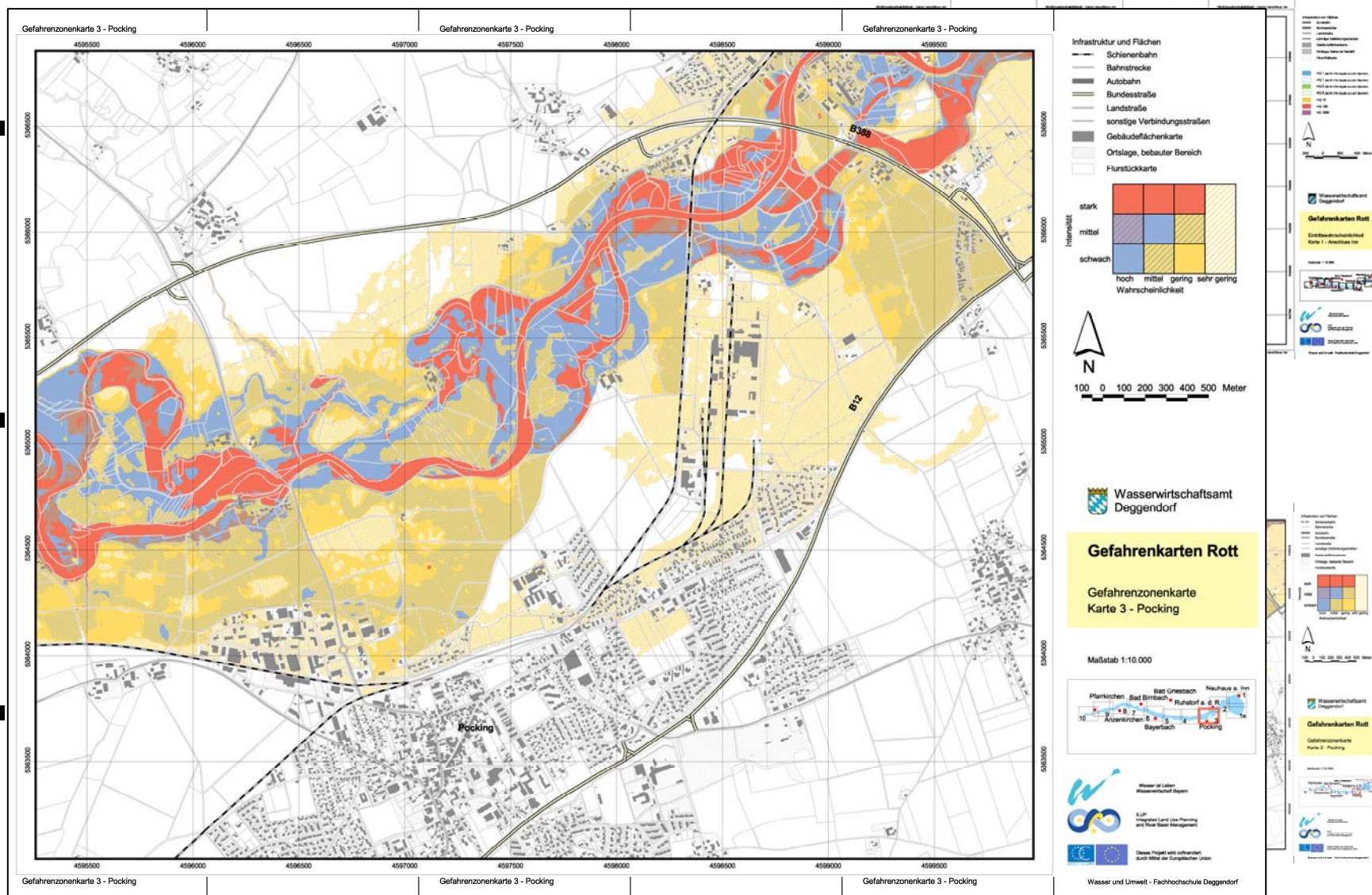
Flood Risk Management

- ## 4 steps

  - Identify
    - What kind of risk?

  - Analysis
    - What kind of area exist

  - Quantify
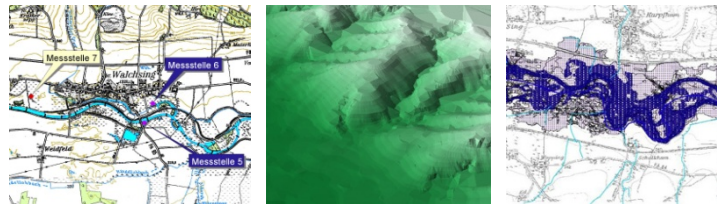   - What can we do?

  - Act
    - Koordination
    - Acting

09.03.2007

Thanks for your attention!

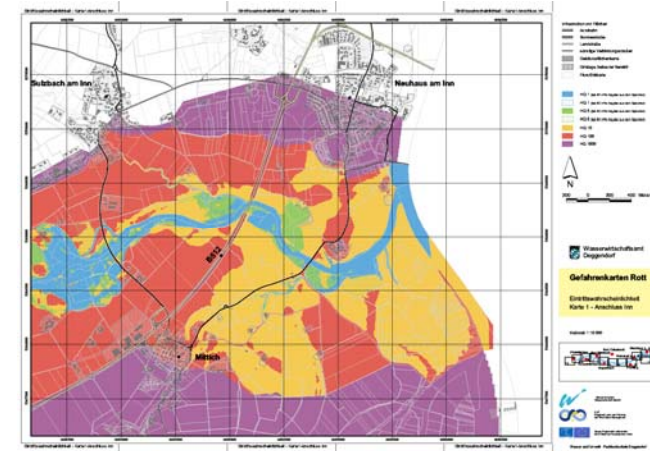# Floodriskmanagement and Vulnerability

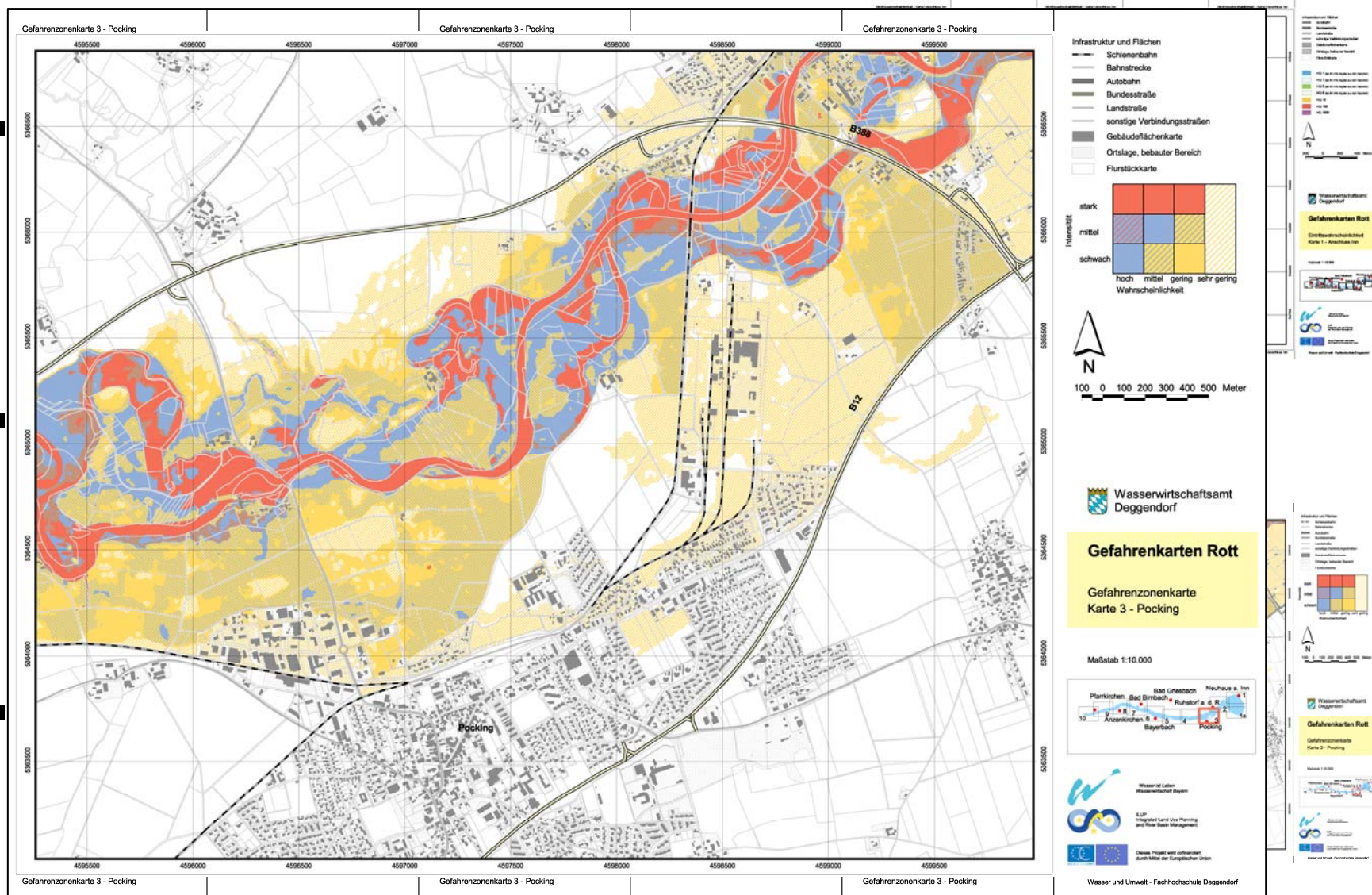## by the example Vils and Rott / Bavaria

Risk Maps

- **event risk**

- **water depth**
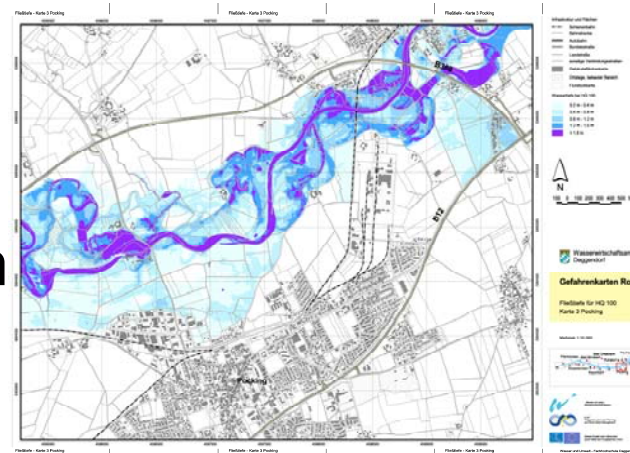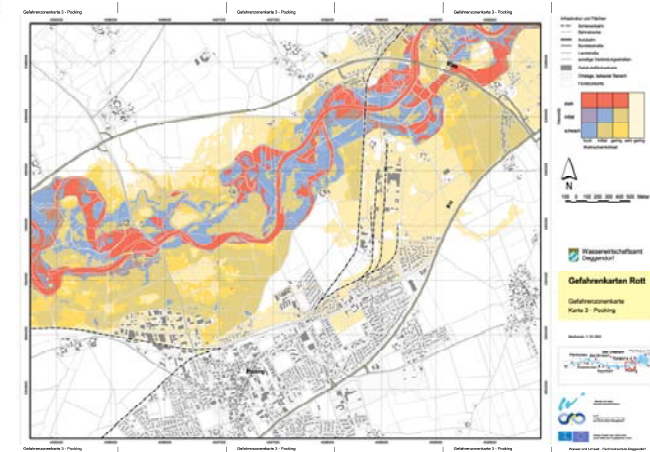
- **danger zone**

09.09.03.2007

Event risk

Water depth

Danger zone

- 4 steps

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    - What kind of area exist?
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    - What can we do?
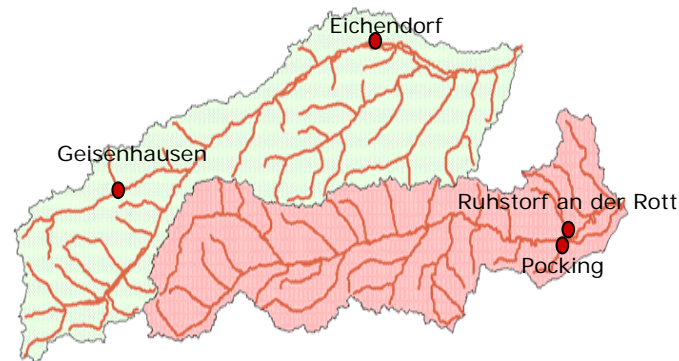 - Act
    - Koordination
    - Acting

Problems result of the flood

- **threat by the flood**
  - inundated villages and cities
  - destruction of buildings and agricultural areas
  - entry of sediments

- **destruction of infrastructure**
  - economic looses
  - traffic are handicapped

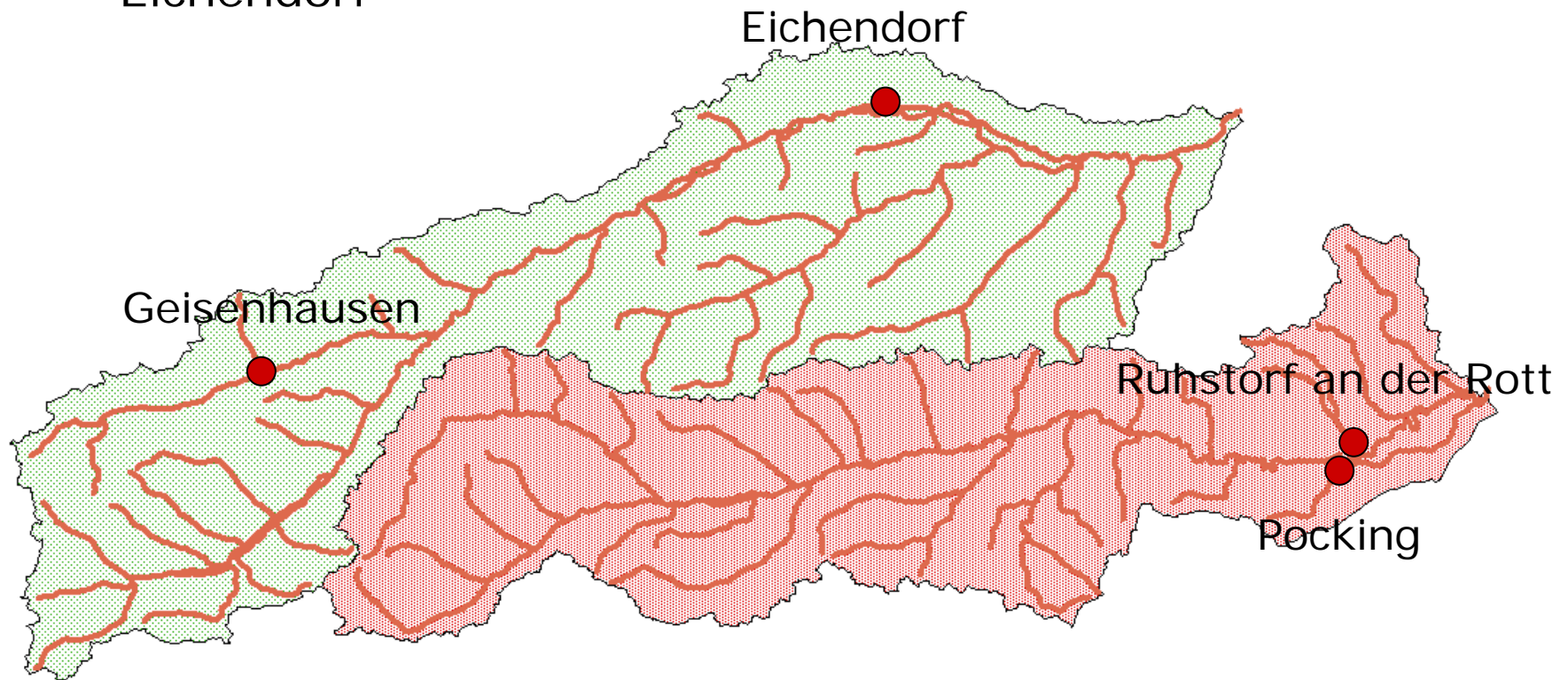09.09.03.2007

Project area

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  - Rott 1200 km^2
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- ## urban sector
  - Geisenhausen
  - Eichendorf
  - Pocking
  - Ruhstorf an der Rott

Eichendorf

Geisenhausen

Ruhstorf an der Rott

Pocking

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Project area

- **urban sector**
  - Geisenhausen
  - Eichendorf

Eichendorf

Geisenhausen

Ruhstorf an der Rott

Pocking

09.03.2007

Ergebnisse der Projekte

ILUP
Integrated Land Use Planning and River Basin Management

Ein Projekt des Bayerischen Staastministeriums für Umwelt, Gesundheit und Verbraucherschutz

cofinanziert mit Mitteln der Europäischen Union Interreg IIIB CADSES

RISKCATCH
6. Forschungsrahmenprogramm der EU – ERANET Crue

cofinanziert mit Mitteln der Europäischen Union 6. Forschungsrahmenprogramm

Finanziert mit Mitteln des Bundesministeriums für Bildung und Forschung

Fotos: Ralf Gerard

Filmausschnitte: ILUP – Der Film
Fakultät Elektro- und Medientechnik

Animationen Roland Krinner
und Videoschnitt Fakultät Elektro- und Medientechnik

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Geodaten Bayern, googleEarth, sowie ILUP-Teilprojekten

In Kooperation mit

Lebensministerium
Österreich

Wasserwirtschaftsverwaltung

Ekotoxa
Tschechische Republik

Povodi Moravi
Tschech. Wasserwirtschaftsverwaltung

Eduvizig Györ
Ungarische Wasserwirtschaftsverwaltung

Universität für Bodenkultur Wien

Technische Universität Compiegne

Hochschule für angewandte Wissenschaften
Fachhochschule Deggendorf

WASSER UND UMWELT

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