A future task in good hands

Federal Agency for Nature Conservation

The realisation of economic valuation: Practical examples of valuation exercises

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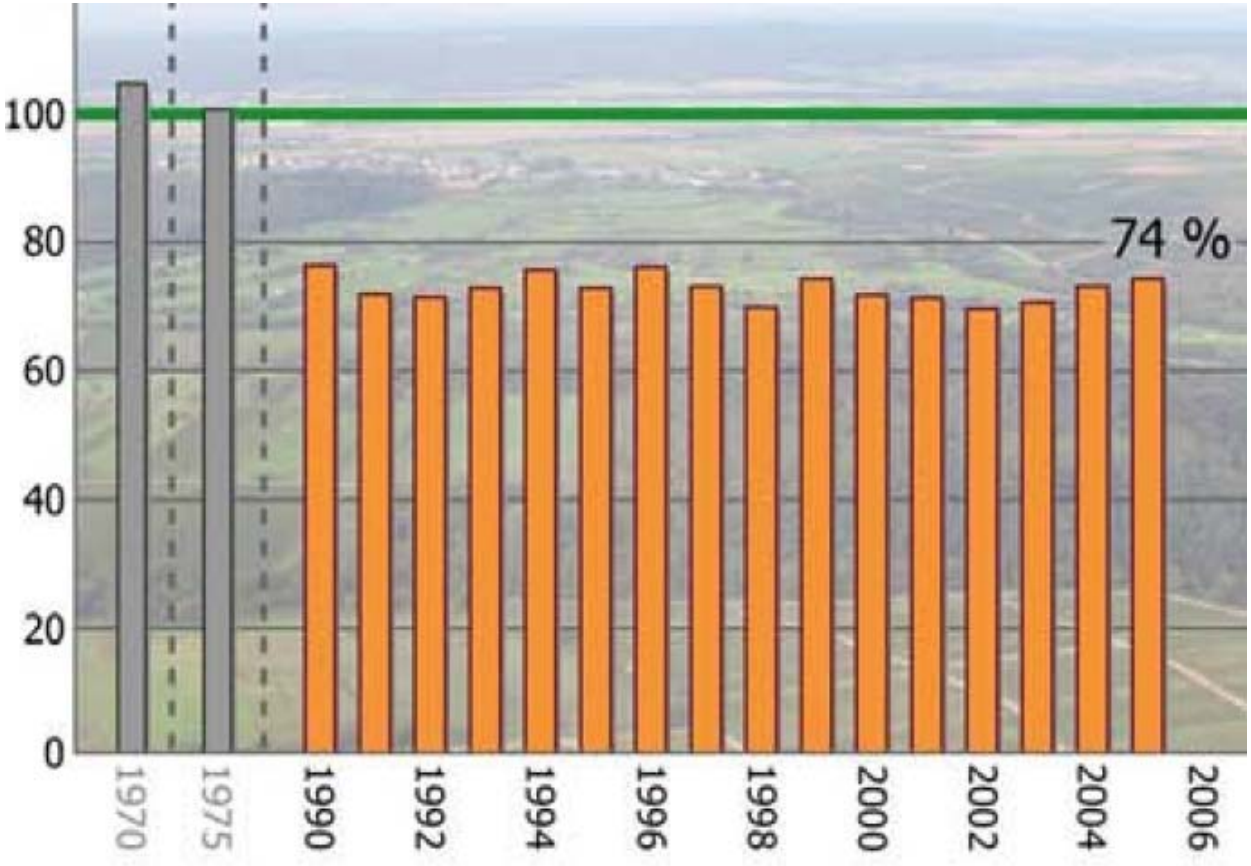
What´s the problem?
A “conservationist´s” view on economic valuation

**“Sustainability indicator for species diversity”
of the German Sustainability Strategy**

State of biodiversity:

➡ **near stability but on a rather low level**



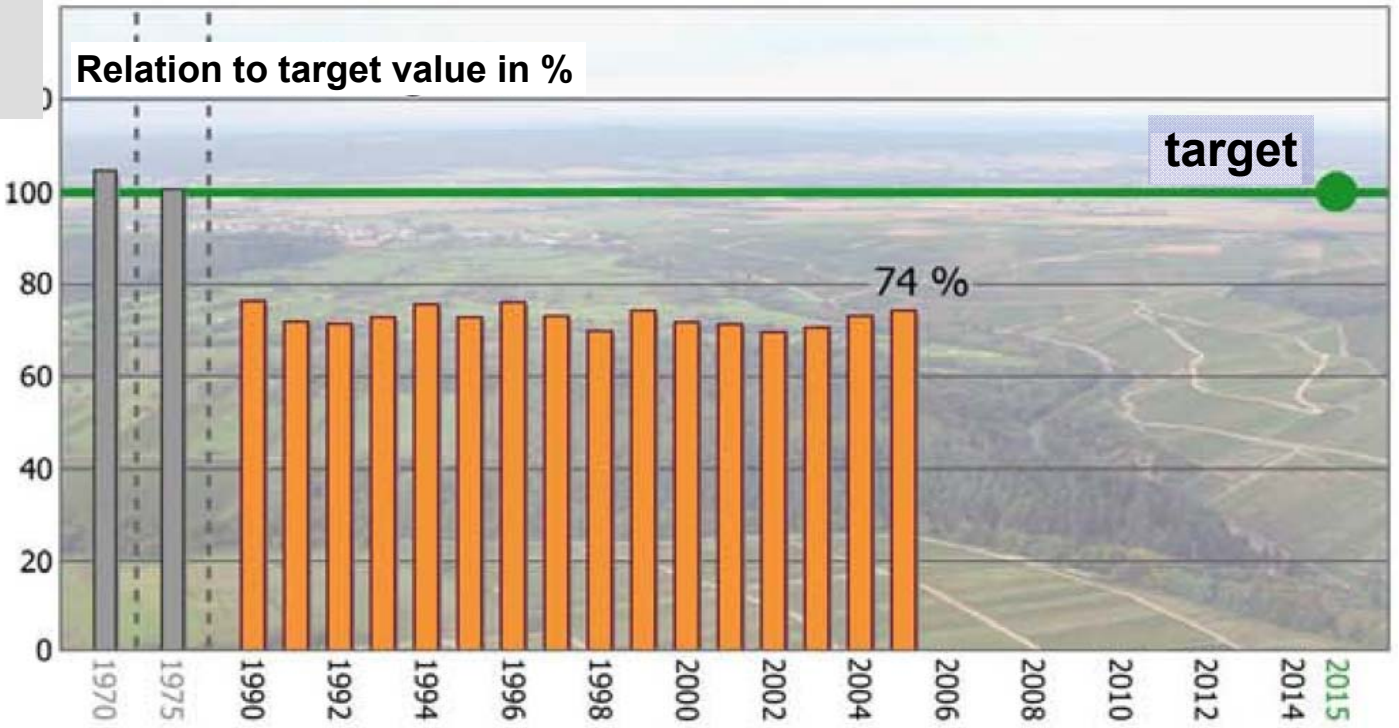
Aggregated population development of selected breeding birds

Political targets regarding biodiversity

European Göteborg Strategy:

Halt the loss of biodiversity until 2010

German National Sustainability Strategy:



What does this all have to do with money?

- **Natural vegetation of Germany is predominantly woodlands; Agricultural use has fundamentally changed wild species composition**

- **Today nearly 50% of the biodiversity of Germany depends on traditionally or less intensively used farmland, which is not economically competitive on the world market**

- **Nearly 30% of the overall expenditure for nature conservation in Germany (overall expenditure is about 1 Bio. € per year) is dedicated to farmers to apply farming practices that help to conserve species rich farming areas**

Importance of traditional and non-intensive agriculture for biodiversity

Importance of extensive land use for biodiversity in Germany			Source: Korneck et al. 1998
Biotope / land use (= traditional and extensive forms of land use)	% - share of endangered and extinct species		
	… regarding species richness of biotope (p1)	… regarding the overall number of endangered and extinct species in Germany (p2)	Ranking p1 + p2 --- 2
Vegetation of oligotrophic running and stagnant waters	83,0	4,6	43,8
Oligotrophic peatlands incl. woods on peatland	62,1	12,3	37,2
Natural and semi-natural dry grasslands	43,5	24,8	34,1
Schlammbodenvegetation	64,1	2,9	33,5
Halophyte Vegetation	45,5	4,7	25,1
Meadows and pastures on moist to wet sites	38,7	9,3	24,0
Dwarf shrub heathlands	37,8	8,3	23,1
Arable land with threatened herbaceaus vegetation communities and pioneer vegetation	31,6	9,9	20,7
Vegetation of eutrophic waters	34,1	6,8	20,5
...			

Financial needs and real expenditures for nature conservation

	Bil. € in 2000	Per household and year [4]	% of GDP
Costs / need for ressources to stop the loss of biodiversity in Germany	1.7 – 2.3	43 - 59 €	0,1
Nature Conservation expenditures [3] (fed. state, countries, communities = 0,07% of overall public spending)	0.67	17 €	0,03

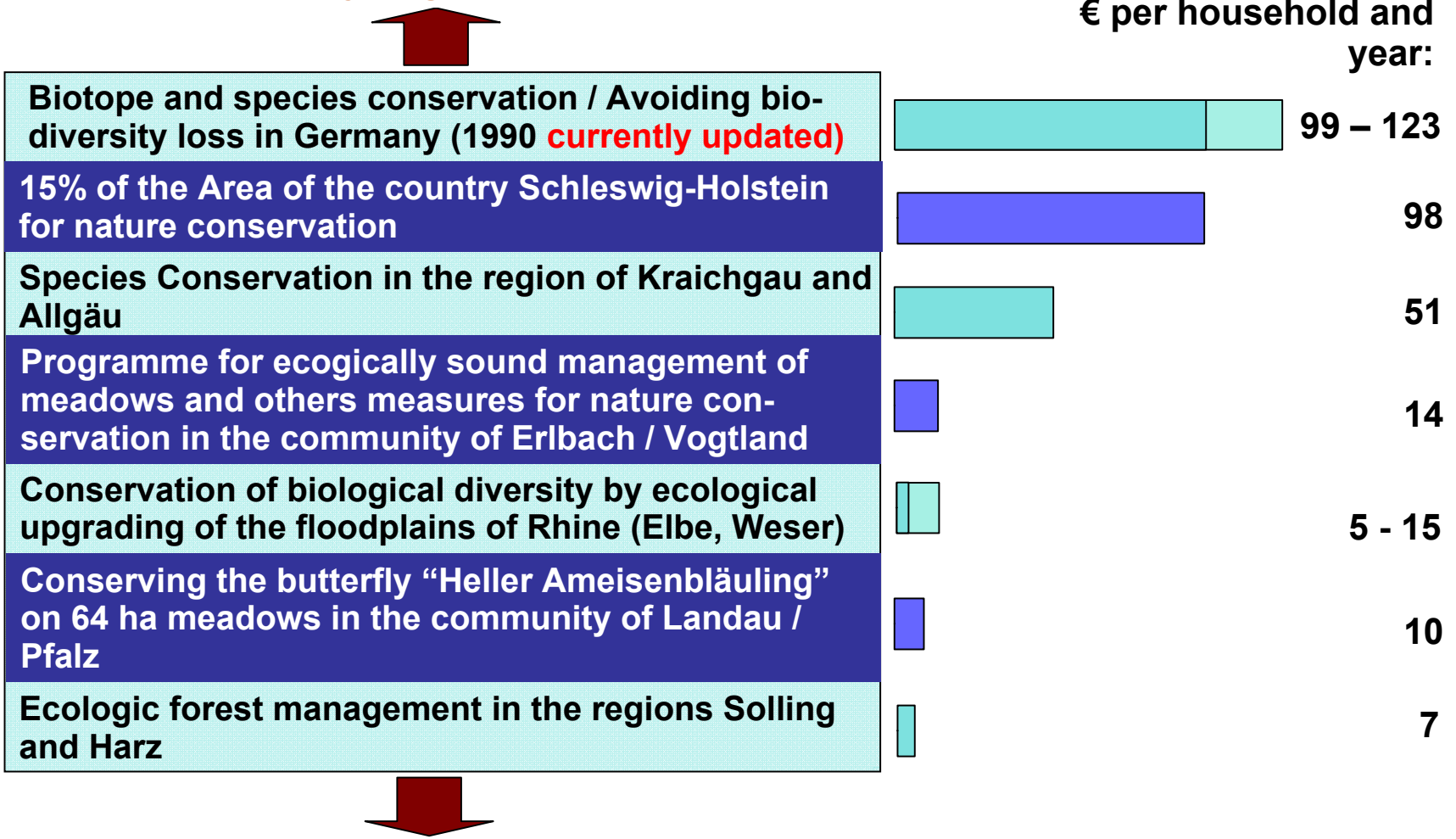
Saving biodiversity needs economic ressources!!!

Are we willing to pay or are we willing to forego for additional income resp. market goods in favour of more nature conservation???

= Is nature conservation beneficial from the point of view of welfare economics?

The answer could be so easy: Willingness to pay for nature conservation in Germany

General aims / programmes covering Germany or greater parts of it



Special aims / programmes covering smaller areas

Willingness to pay, a politically adequate argument for nature conservation?

	Bil. € in 2000	Per household and year [4]	% of GNP
Willingness to pay to stop the loss of biodiversity in Germany (1990)	3.9 – 4.8	99 - 123 €	0,21
Costs / need for ressources to stop the loss of biodiversity in Germany	1.7 – 2.3	43 - 59 €	0,1
Nature Conservation expenditures [3] (fed. state, countries, communities = 0,07% of overall public spending)	0.67	17 €	0,03

Pro

Stated willingness to pay to prevent the loss of biodiversity substantially exceeds current expenditures as well as estimated costs to conserve biodiversity in Germany

Contra

Politicians distrust of the liability of figures derived from stated preference techniques

Political steps towards (other) economic arguments for nature conservation

European Commission

Worrying that the EU-member states are going to miss the Göteborg objective to halt the loss of biodiversity until 2010 the European Commission set off a study with the aim of giving additional economic arguments to conserve biodiversity

Institute for European Environmental Policy

VALUE OF BIODIVERSITY

Documenting EU examples where biodiversity loss has led to the loss of ecosystem services

ENV.G.1/FRA/2004/0081

.....

G8 Environment Ministers Meeting
Potsdam, 15-17 March 2007
"Potsdam Initiative – Biological Diversity 2010"
(Initiated by Germany an the EU)

"In a global study we will initiate the process of analysing the global economic benefit of biological diversity, the costs of the loss of biodiversity and the failure to take protective measures versus the costs of effective conservation."

The idea of „Naturkapital Deutschland“

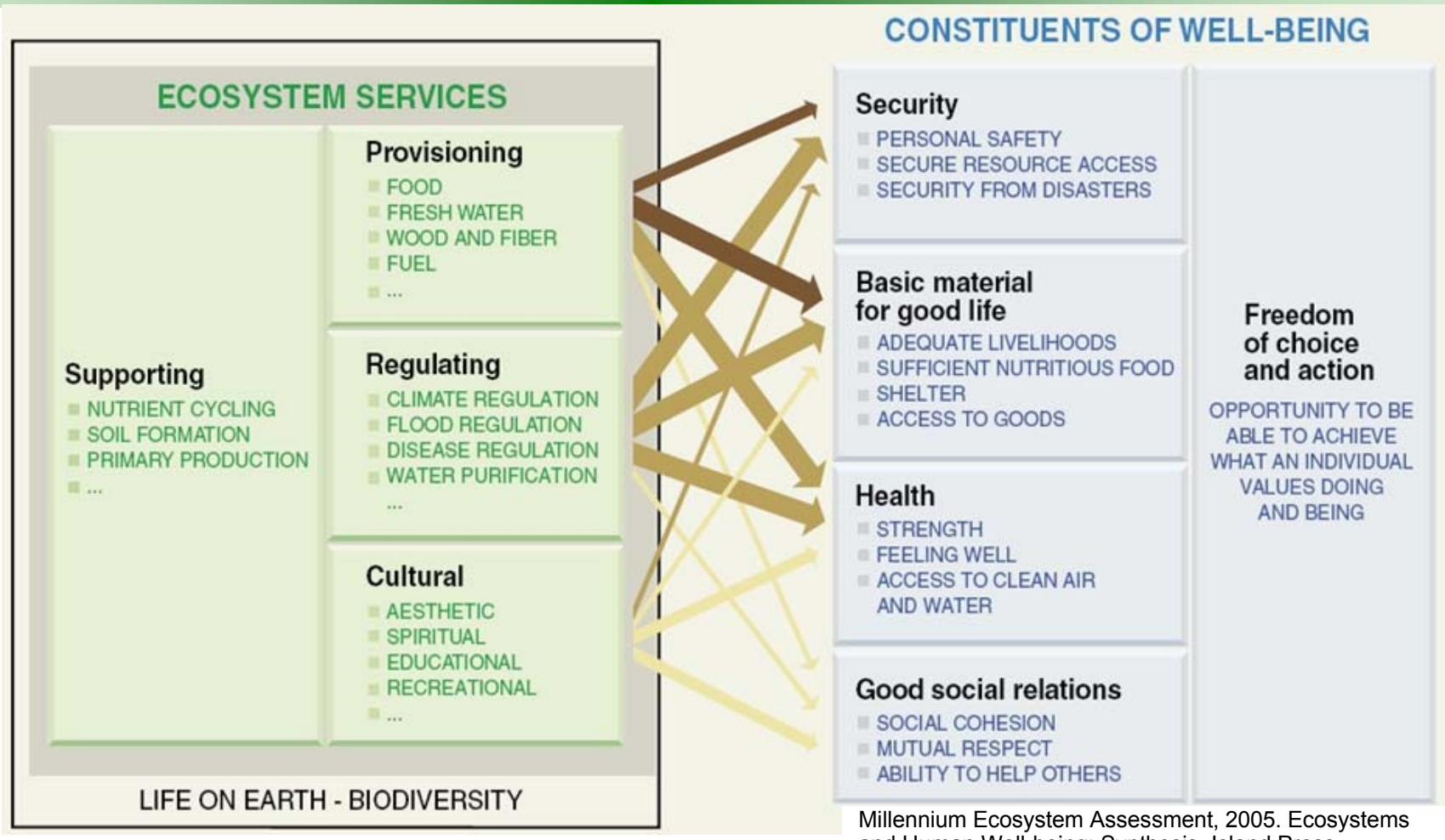
Encouraged by the TEEB-Study
(The Economics of Ecosystems and Biodiversity)

the aim is to

- ⇨ **show the benefits (ecosystem services) of nature and nature conservation**
- ⇨ **not only in qualitative and physical terms**
- ⇨ **but also – where possible and meaningful – in monetary terms**

also for the specific situation of Germany

Ecosystem Services following the Millenium Ecosystem Assessment (MA) as a new argument for biodiversity



Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC., Copyright © 2005 World Resources Institute, http://www.millenniumassessment.org/en/Synthesis.aspx

Why do conservationists deal with ecosystem services

- **Regulating and cultural services are very often correlated with high biodiversity**

  (e.g. - C-sequestration by peatlands,
  - mitigation of CO_2 emissions by peatland restoration,
  - flood-protection and water purification by natural flood plains)

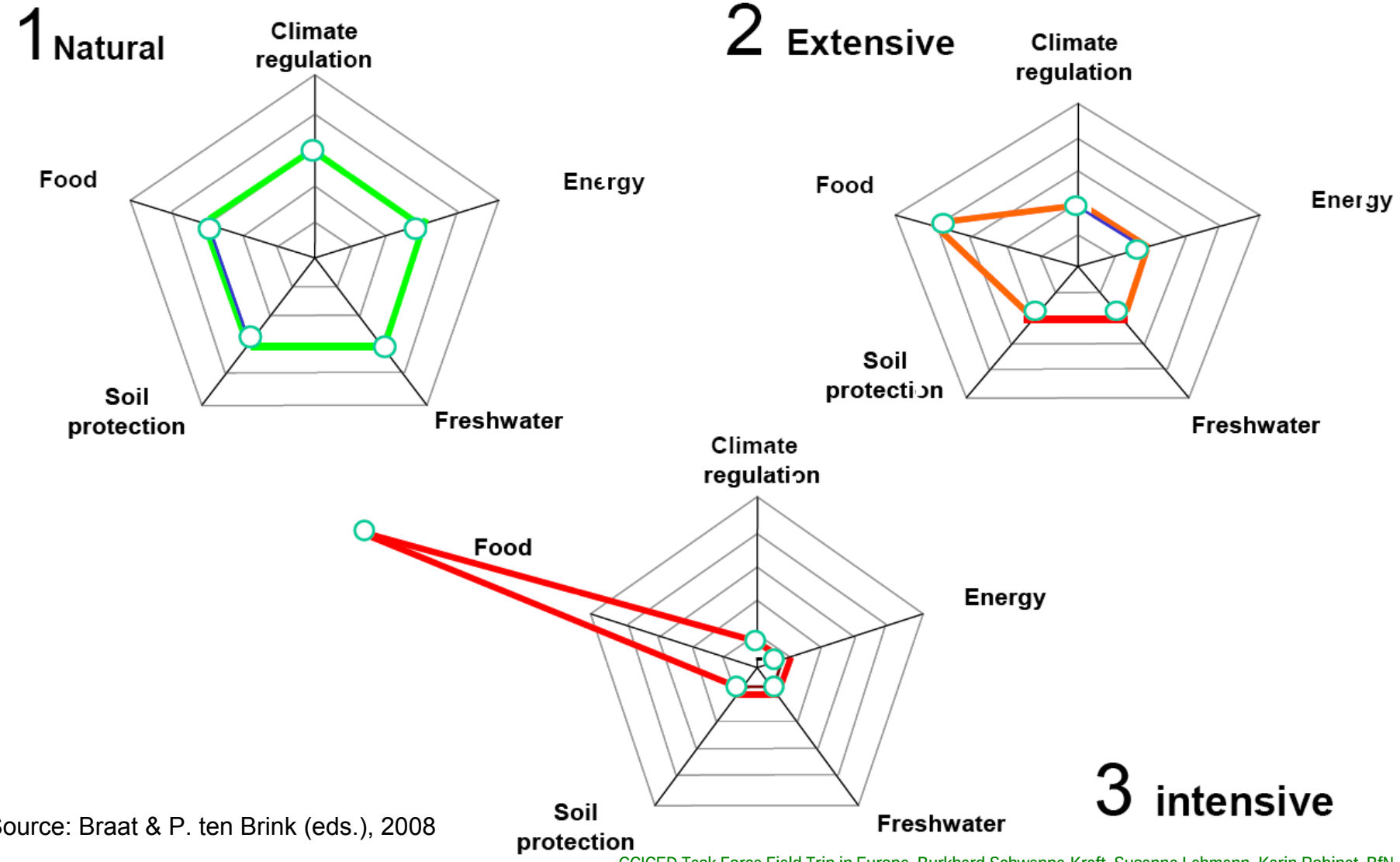
- **Furthermore there is often a conflict or trade-off between**

  (the intensive use of) provisioning services on the one hand
  (e.g. food production, biomass production for use in energy-production) and

  cultural or regulating services as well as biodiversity on the other hand

➡ **Monetary value of certain ecosystem services can often serve as an additional (economic) argument for the conservation and restoration of high-nature-value ecosystems**

Trade-off between ecosystem services and increasing intensity of land use



Source: Braat & P. ten Brink (eds.), 2008

The role of cost benefit analysis (CBA)

Cost-benefit-analysis is an instrument of welfare economics

- **(All) Costs and benefits are made comparable and valued in monetary terms:**
- **A ratio „benefit / costs“ that exceeds „1/1“ means: this project has positive effects on welfare.**

applying cost-benefit-analysis helps to value gains in provisioning services (by intensification of land use) against losses in regulating or cultural services (or the other way round)

“Total Economic Value” and “Ecosystem Services” as a basis for CBA

	Categories	Examples, explanations	Valuation methods (examples)
Components of TEV	**direct use values**	agricultural and forest products, recreation, hunting, fishing	**Market gains, production costs, travel cost method, hedonic pricing**
	indirect use values	improvement of water quality, carbon sequestration, flood prevention, pollination	**reduced damage costs, reduced avoidance costs, reduced (alternative) water purification costs**
	option value	benefit from ensuring the option for a future use	**Different stated preference methods (contingent valuation, choice analysis, ...)**
	existence value	benefit without direct or indirect use, ethical obligation to preserve	
	bequest value	benefit from preserving for future generations	

vgl.: Jürgen Meyerhoff Mitteilung 5 Ökonomische Bewertung ökologischer Leistungen (Elbe Ökologie) (Mitteilungen der BfG/Projektgruppe Elbe-Ökologie), nach Barbier 1994 fußend auf Pearce 1993, http://elise.bafg.de/?2103

economic relevance versus reliability and political acceptance of value categories and valuations methods

Components of TEV	Categories	Examples, explanations	Valuation methods (examples)
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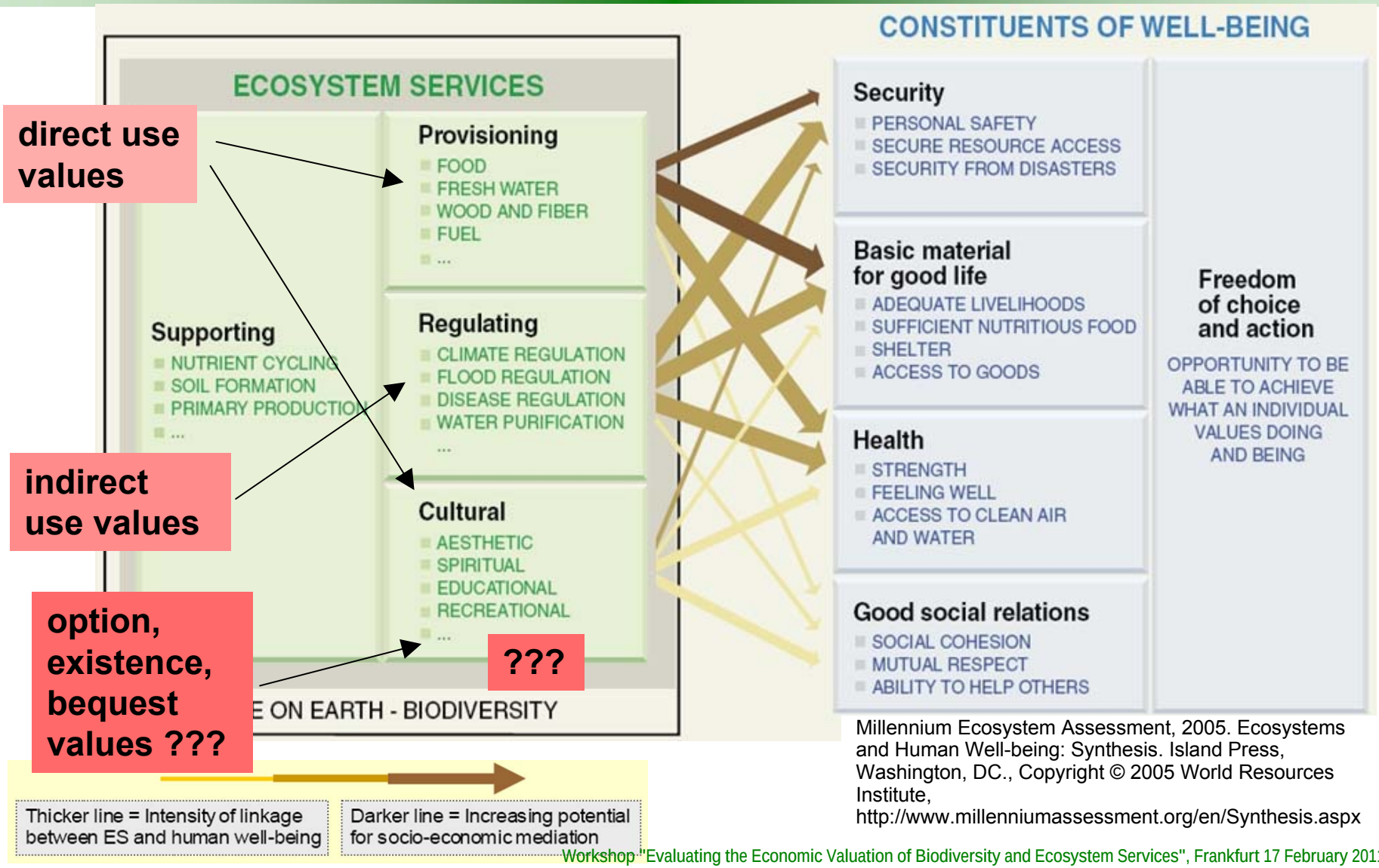
encreasing economic relevance

decreasing reliability / acceptance

vgl.: Jürgen Meyerhoff Mitteilung 5 Ökonomische Bewertung ökologischer Leistungen (Elbe Ökologie) (Mitteilungen der BfG/Projektgruppe Elbe-Ökologie), nach Barbier 1994 fußend auf Pearce 1993, http://elise.bafg.de/?2103

Ecosystem Services and non-use values



Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC., Copyright © 2005 World Resources Institute, http://www.millenniumassessment.org/en/Synthesis.aspx

Ecosystem Services in the narrow and in the broader sense

	Categories	Examples, explanations	Valuation methods (examples)
ecosystem services in the narrow sense	direct use values	agricultural and forest products, recreation, hunting, fishing	Market gains, production costs, travel cost method, hedonic pricing
	indirect use values	improvement of water quality, carbon sequestration, flood prevention, pollination	reduced damage costs, reduced avoidance costs, reduced (alternative) water purification costs
ecosystem services in the broader sense	option value	benefit from ensuring the option for a future use	Different stated preference methods (contingent valuation, choice analysis, ...)
	existence value	benefit without direct or indirect use, ethical obligation to preserve	
	bequest value	benefit from preserving for future generations	

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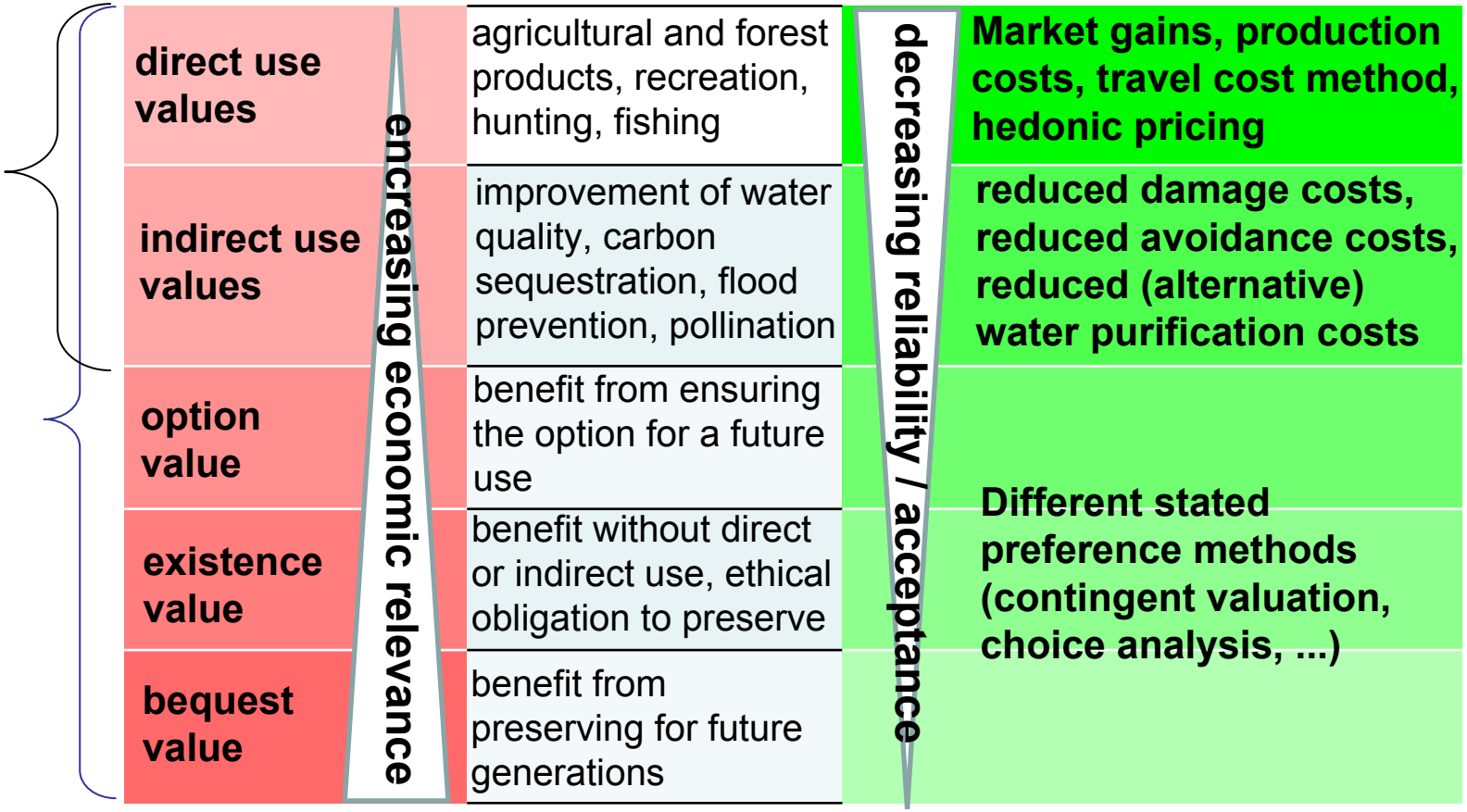
“Total Economic Value” or/and Ecosystem Services as a basis for CBA

economic arguments additional to ethical arguments

full range of welfare effects including willingness to pay for conservation without direct or indirect use



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Non market direct and indirect use values of (natural and semi-natural) ecosystems

- contribution of urban green to a sound urban climate and air quality
- importance of urban green for other aspects of urban life quality
- importance of (semi-) natural ecosystems and less intensive land uses for recreation
- contribution of less intensive farming to the protection of fresh-water
- organic farming as a sink for greenhouse gas due to humus accumulation
- natural or semi-natural forests as a carbon sink
- carbon dioxide fixation in bogs and swamps
- effect of natural floodplains on running water purification
- contribution of natural floodplains to mitigate flood damages
- effects of hedgerows, wood patches and similar biotopes on crops
- importance of (semi-) natural biotopes for hunting
- importance of (semi-) natural waterbodies for fishing
- use of waterbodies with high water quality for bathing and swimming
- retention of avalanches and land slides by forests
- gathering fruits growing especially in (semi-) natural biotopes

Non market use values – a sufficient basis to argue for biodiversity on economic grounds?

Pro

Non market use values incl. non marketed contributions to goods and services (and their production) are far more accepted as political arguments to conserve biodiversity particularly if they are elicited by revealed preferences or production cost methods.

Contra

In industrialized countries like Germany non market use values might be too small to act as the only economic argument for biodiversity

In developing countries the case should be different due to the important role of natural and semi-natural ecosystems to meet basic needs

Differences between developing and industrialized countries

importance of natural and semi-natural ecosystems
(gradings do not fit to all countries / exceptions exist)

	developing countries	industrialized countries
spread	larger share of surface	small share of surface
importance for water supply	high	low / moderate
contribution to food supply	moderate / high	no / low
importance for recreation and leisure	low/ moderate ?	high
existence values	low/ moderate ??	high

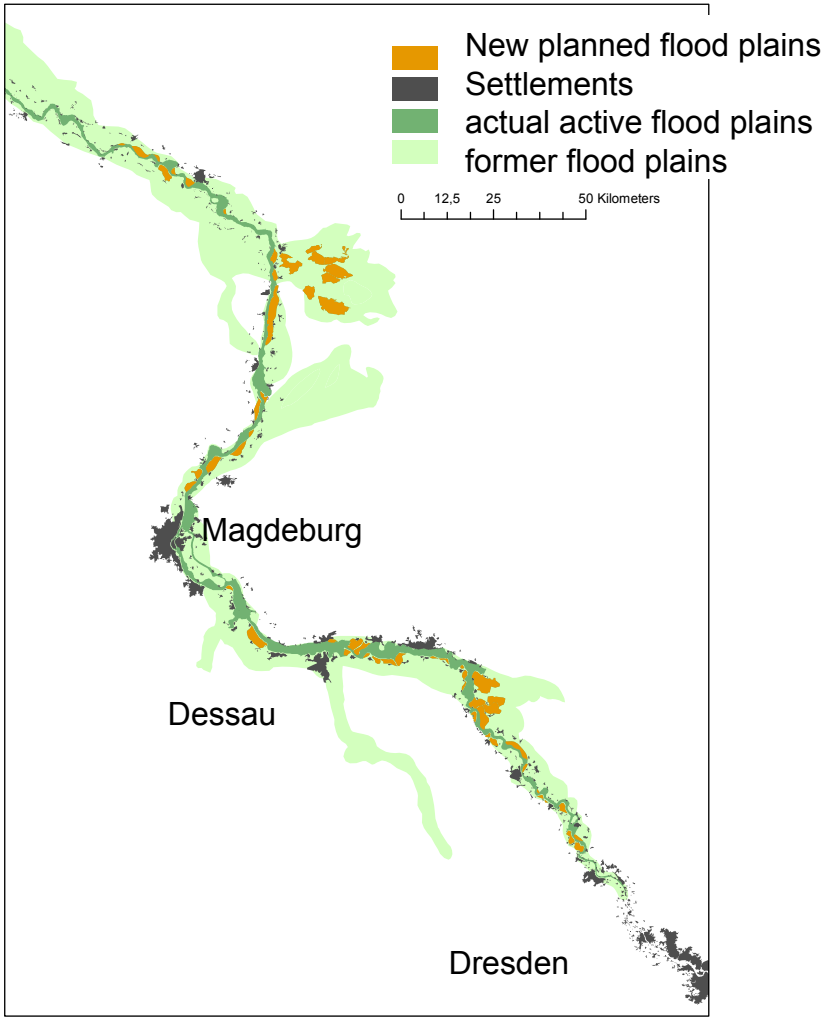
choice of adequate valuation methods should regard these differences

Case-Study: Regaining 35.000 ha natural flood plains by dike shifting along the river Elbe

Inundation 2002

Project alternative with the maximum number of redevelopments by dyke shifting

- 60 dyke "shiftings" (= usually opening the first dyke and raising the second one)
- Redevelopment of 35.000 ha active flood plains
- De-intensification of agricultural use on new flood plains

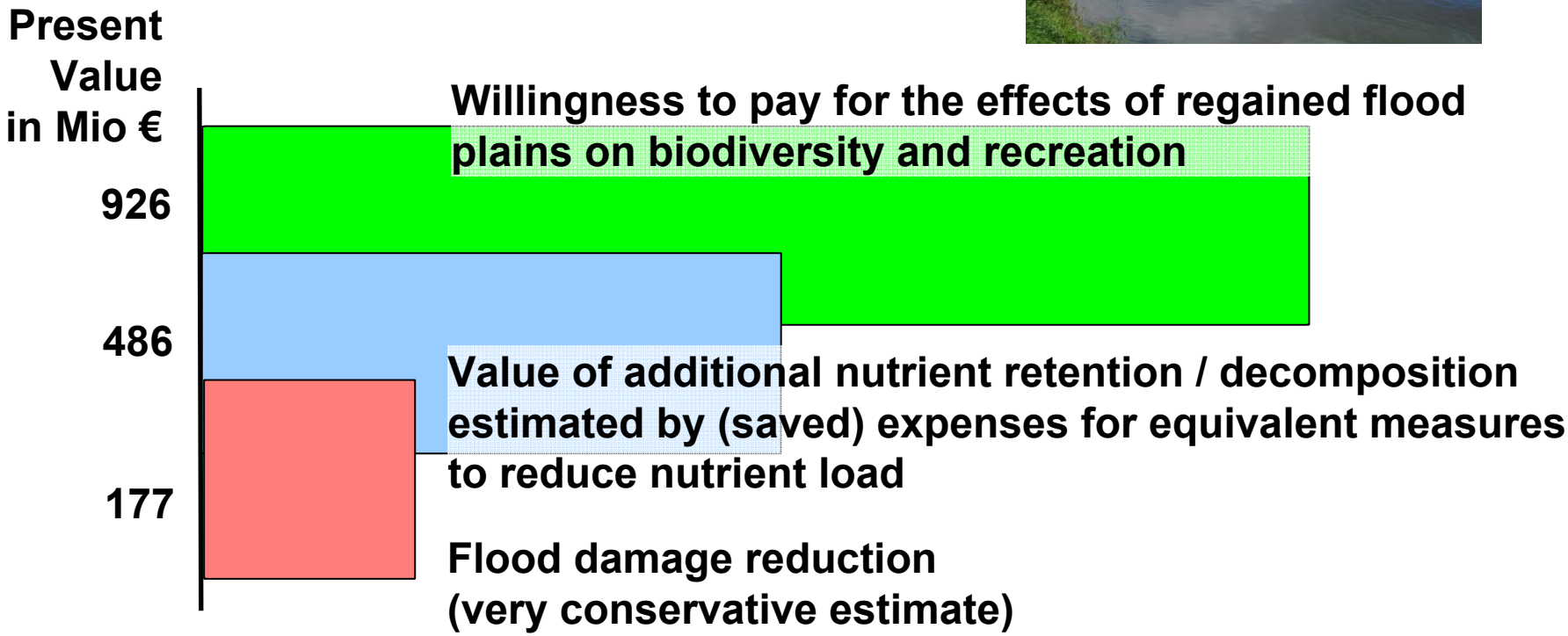


Quelle: Grossmann et al. 2010

Value of ecosystem services, recreation and existence values

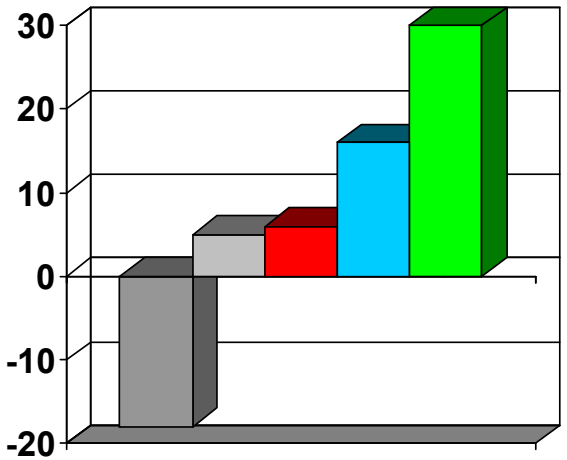
Cost-benefit-analysis of dyke-shifting and regaining natural flood plains at the river Elbe

Source: Grossmann et al. 2010



Results of the cost benefit analysis

Annual costs and benefits in Mio. €



- Investments for dike shifting, loss of agr. production
- avoided flood damage cost
- reduced cost for dike maintenance
- nitrate reduction (alternative cost appr.)
- willingness to pay for habitats and recreation value

Cost-benefit-analysis of dyke-shifting and regaining natural flood plains at the river Elbe

Source: Grossmann et al. 2010

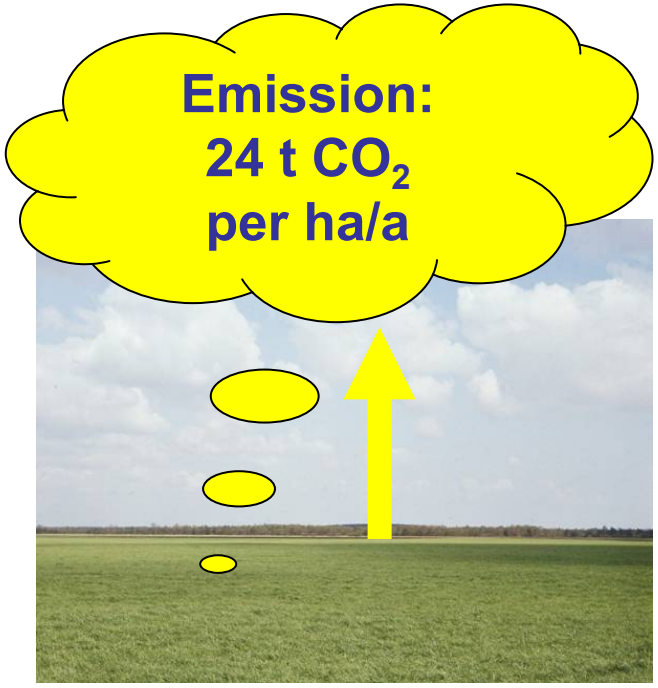
Cost benefit ratio: 1:3

incl.

- **regained ecosystem services,**
- **willingness to pay for biodiversity,**
- **lost provisioning services and**
- **project costs**

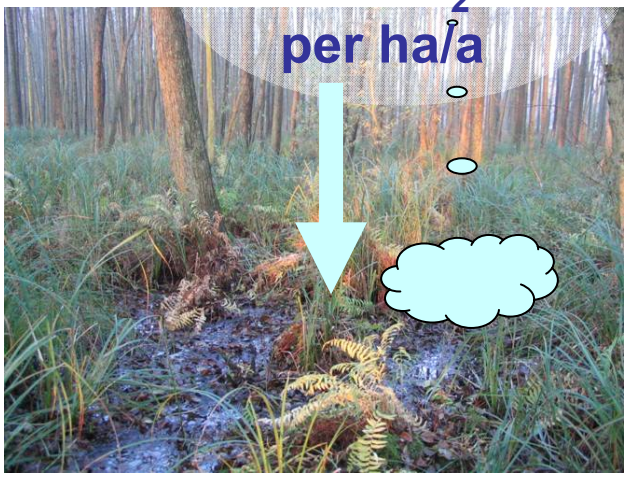
Example: Mitigation of climate gas emissions and carbon sequestration by peatland restoration

Source: Schäfer 2007, 2009



intensively used meadows and pastures on peat soil

Sequestration:
1 t CO_2
per ha/a



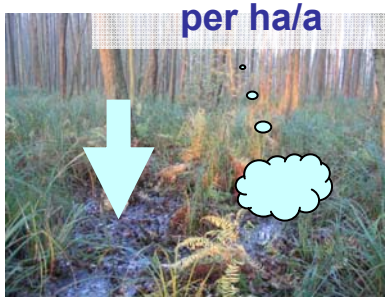
rewetted grassland with elder afforestation

Results of cost benefit analysis

Emission:
24 t CO_2
per ha/a

intensively used meadows
and pastures on peat soil

Sequestration:
1 t CO_2
per ha/a



rewetted grassland with
elder afforestation

net value of lost agricultural production

– net value of forest production

– conversion cost

= 0 – 100 € /ha

A very cheap opportunity for climate gas mitigation

Source: Schäfer 2007, 2009

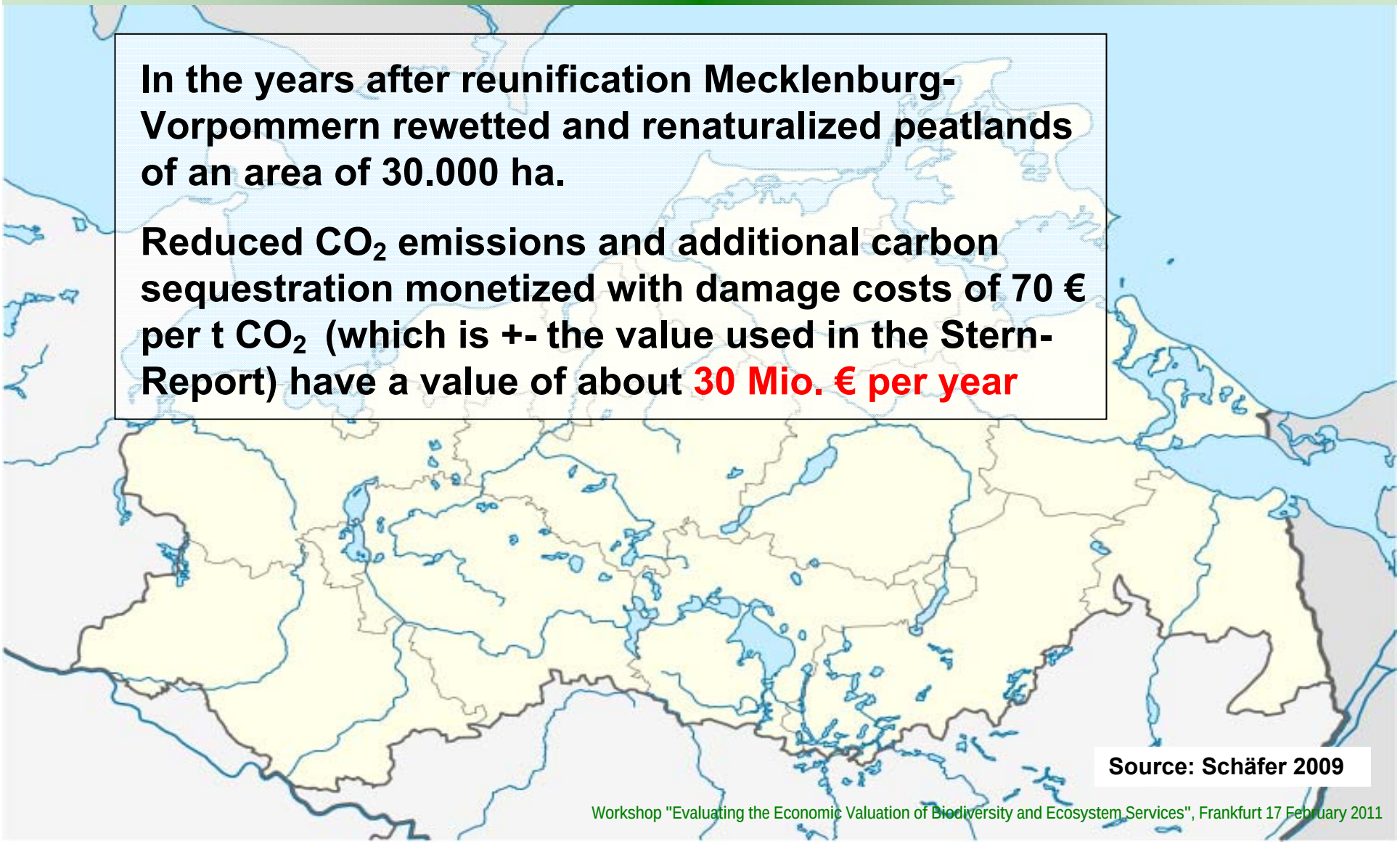
Mitigation costs per t CO_2:
= 0 – 4 €

alternative costs per t CO_2 by wind power:
= 40 €

Climate-gas-mitigation value of peatland restoration in Mecklenburg-Vorpommern

In the years after reunification Mecklenburg-Vorpommern rewetted and renaturalized peatlands of an area of 30.000 ha.

Reduced CO_2 emissions and additional carbon sequestration monetized with damage costs of 70 € per t CO_2 (which is +- the value used in the Stern-Report) have a value of about 30 Mio. € per year



Source: Schäfer 2009

Example: Ecosystem services of high-nature-value grassland (meadows and pastures)

Data basis: Representative sample of high-nature-value (HNV) grassland;
estimated area of HNV-grassland in Germany:
1.062.322 ha = 2,8% of total land cover

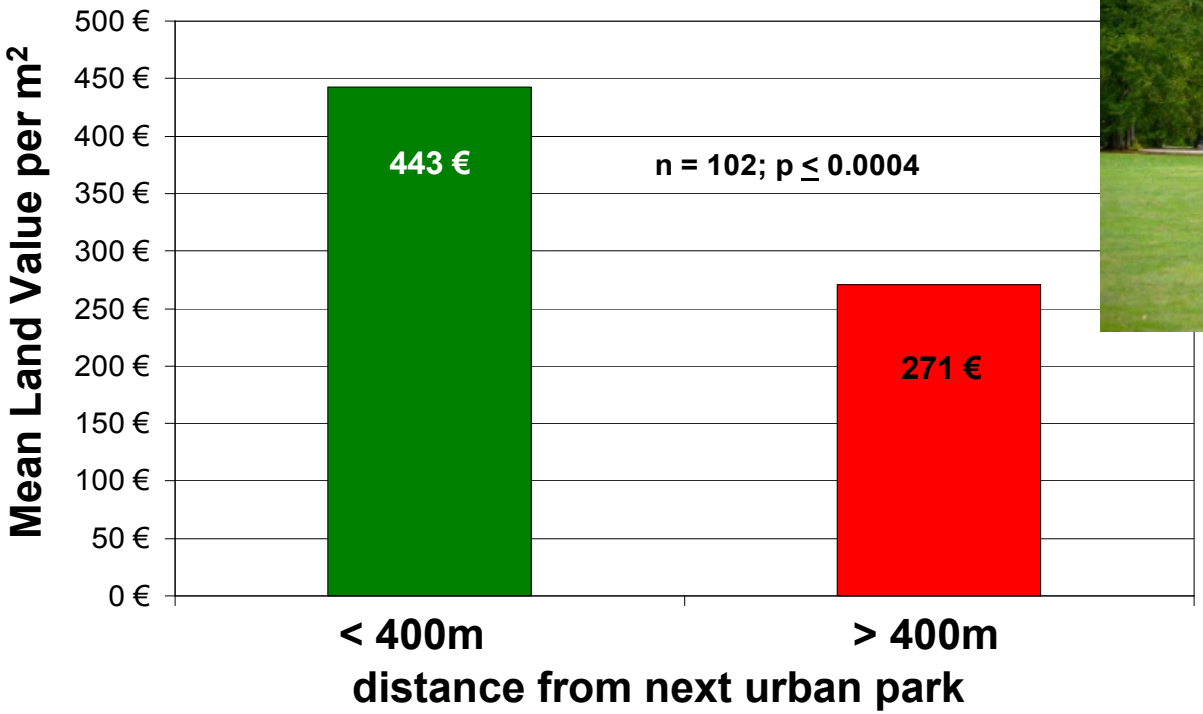
Value of ecosystem services of HNV-grassland compared with conversion to cropland

- **Production:**
  reduced market returns minus production costs: **0 – - 435 €/ha/a**
- **Carbon sequestration, climate-gas-mitigation**
  damage cost approach (70 € / t $C0_2$, +- Stern-Report) **+ 285 to + 1.541 €/ha/a**
- **Groundwater purification**
  compensation payments for reduced fertilizer input on cropland **+ 40 to + 120 €/ha/a**
  (only in groundwater catchment areas relevant for fresh water supply)
- **Nature conservation**
  downscaling of germanwide willingness to pay for nature-conservation measures on a simple ha basis **1.000 €/ha/a**

net value: 850 to 2.160 €/ha/a

Example: Welfare effects of urban green

Influence of urban green on land value

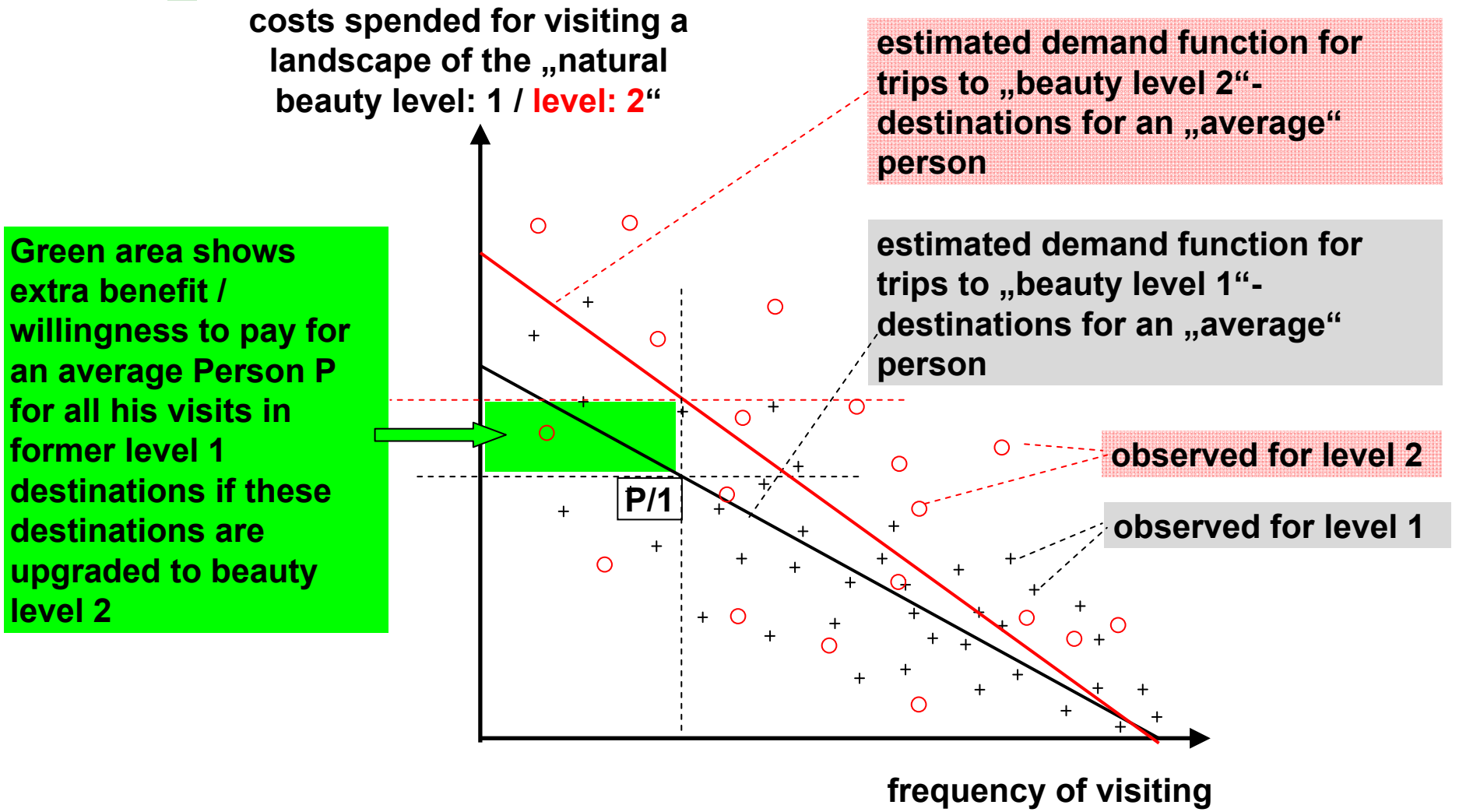


Research results from Berlin, Source: Gruehn 2006, Hoffmann, Gruehn 2010

Additional value through parks is very significant but slightly smaller than < 172 € / m^2 due to intercorrelations with other factors that have positive effects on land value.

All urban green factors contribute to 36,7 % of land value in densely populated urban areas

Example: Assessing recreation values for germany with an extended travel cost approach (still in work)

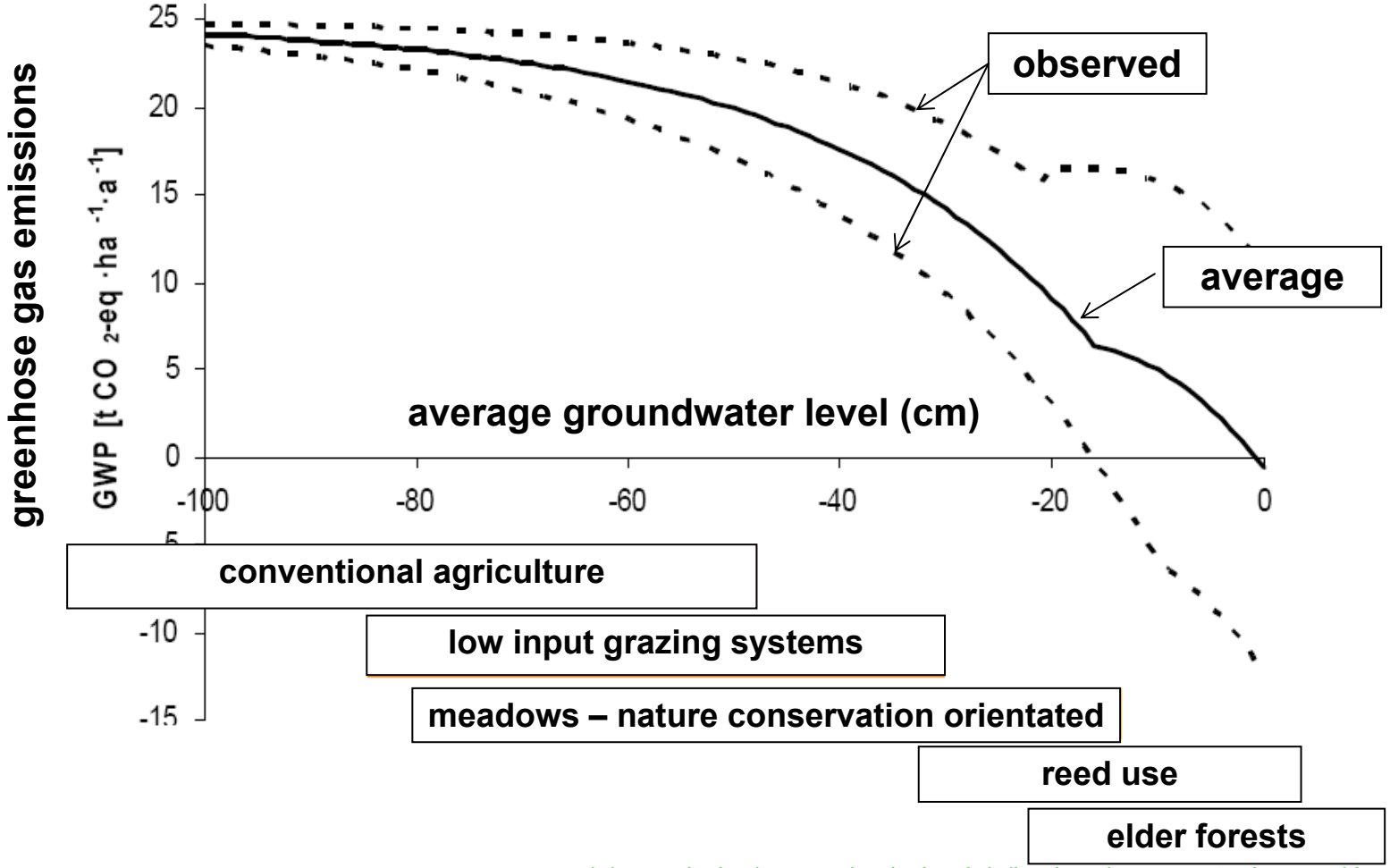


Monetary calculation
- limits -

- Only a few ESS can be estimated for different ecosystems relative easily (e.g.: carbon sequestration, existence values for species habitats)
- Other ESS are extremely hard to quantify because they depend heavily on local physical and social conditions (e.g.: flood mitigation)

Model for assessing greenhose gas emissions / carbon sequestration of different types of peatlands

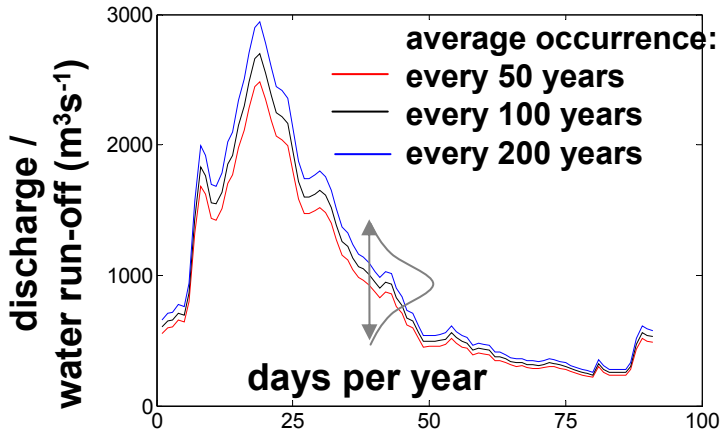
Relationship between greenhouse gas emissions, average groundwater level and land use



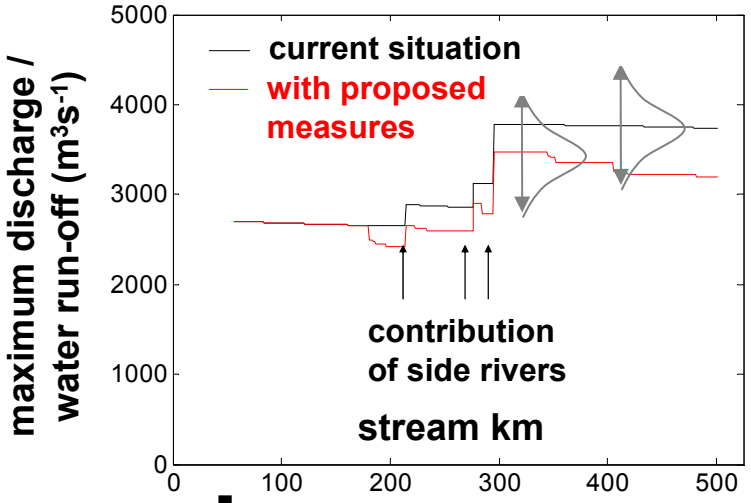
Models applied for the estimation of flood damage reduction, I

Source: Hartje, Grossmann, 2010

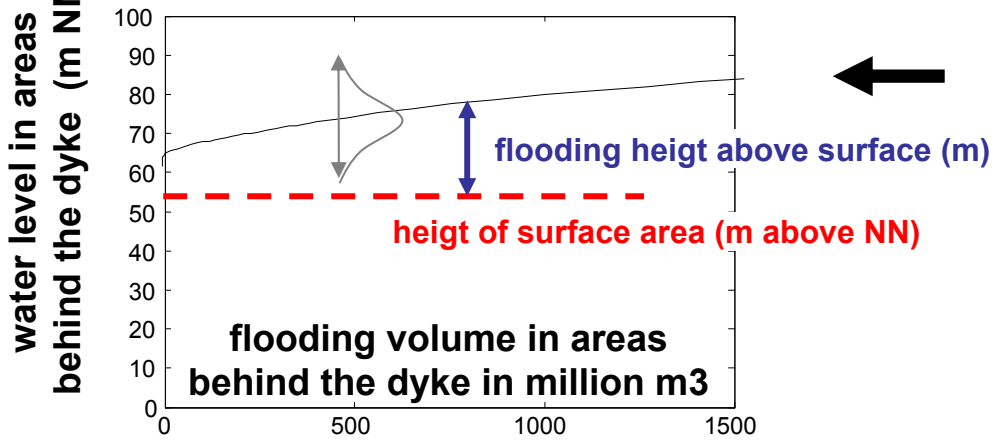
1. Statistical model of flood water incidents

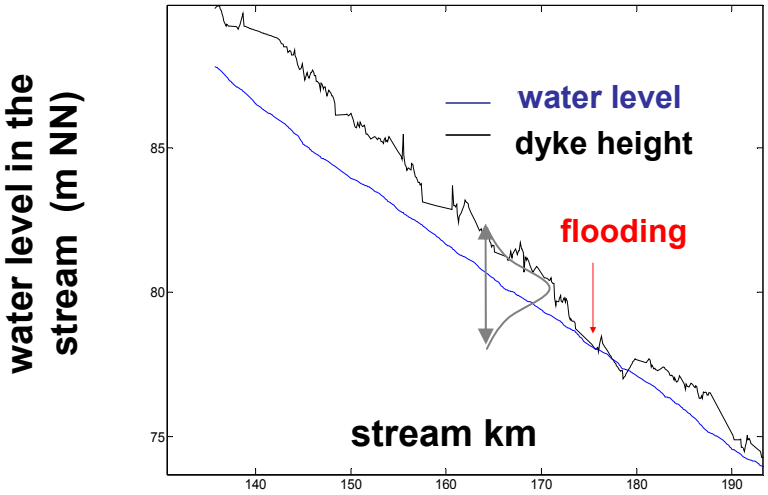


2. Flood-routing model for the river



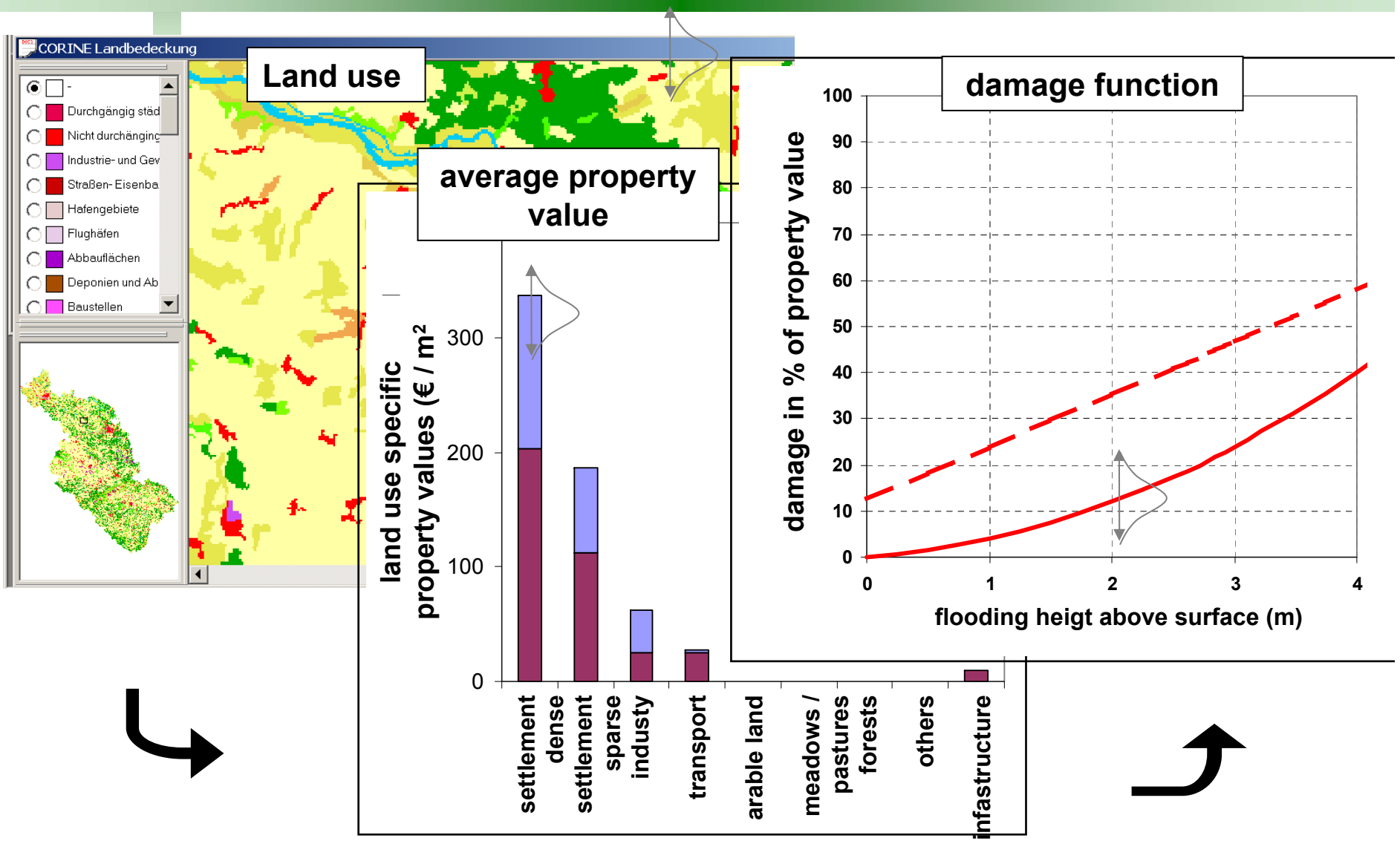
3. Inundation model / flooding model for areas behind the dykes





Models applied for the estimation of flood damage reduction, II

Source: Hartje, Grossmann, 2010



Monetary calculation
- more limits -

- Some monetary values of ESS can be heavily dependent on assumptions on discount rates (e.g. flood mitigation, climate gas mitigation)
- Important components of total economic value can only revealed with stated preference methods, which are in the public not regarded as beeing reliable enough

Monetary calculation
- chance and risks -

Chance: Often evaluating only a few aspects of the overall figure is enough to show that nature conservation counts even economically, especially if existence values are included

Risk: If stated preference methods are not accepted, only use values can be measured.

This may lead to results where benefits are only slightly higher than or even below costs

The restoration cost approach as an additional economic argument - the value of “green infrastructure” -

The rationale:

- If values based on stated preferences (e.g. willingness to pay to stop biodiversity loss) face low acceptance in the political debate
- and (potentially) more accepted use-values are not completely available or show only moderate amounts

⇒ then restoration costs (including benefit losses until ecosystem services reach full recovery) could be taken as an additional or second best approach to point out the potential economic consequences and the risks of biodiversity loss

A cost approach coping with restoration time

Methodological background:

"Habitat Equivalency Analysis" (HEA) developed in the USA to determine the extent of measures to compensate for ecosystem damages, particularly for interim losses (NOAA 1995, 2000, 2006)

"Investment Model" proposed by Schweppe-Kraft, 1996, 1998 as one Model to determine compensation fees for the German "Eingriffsregelung"

Basic Assumptions:

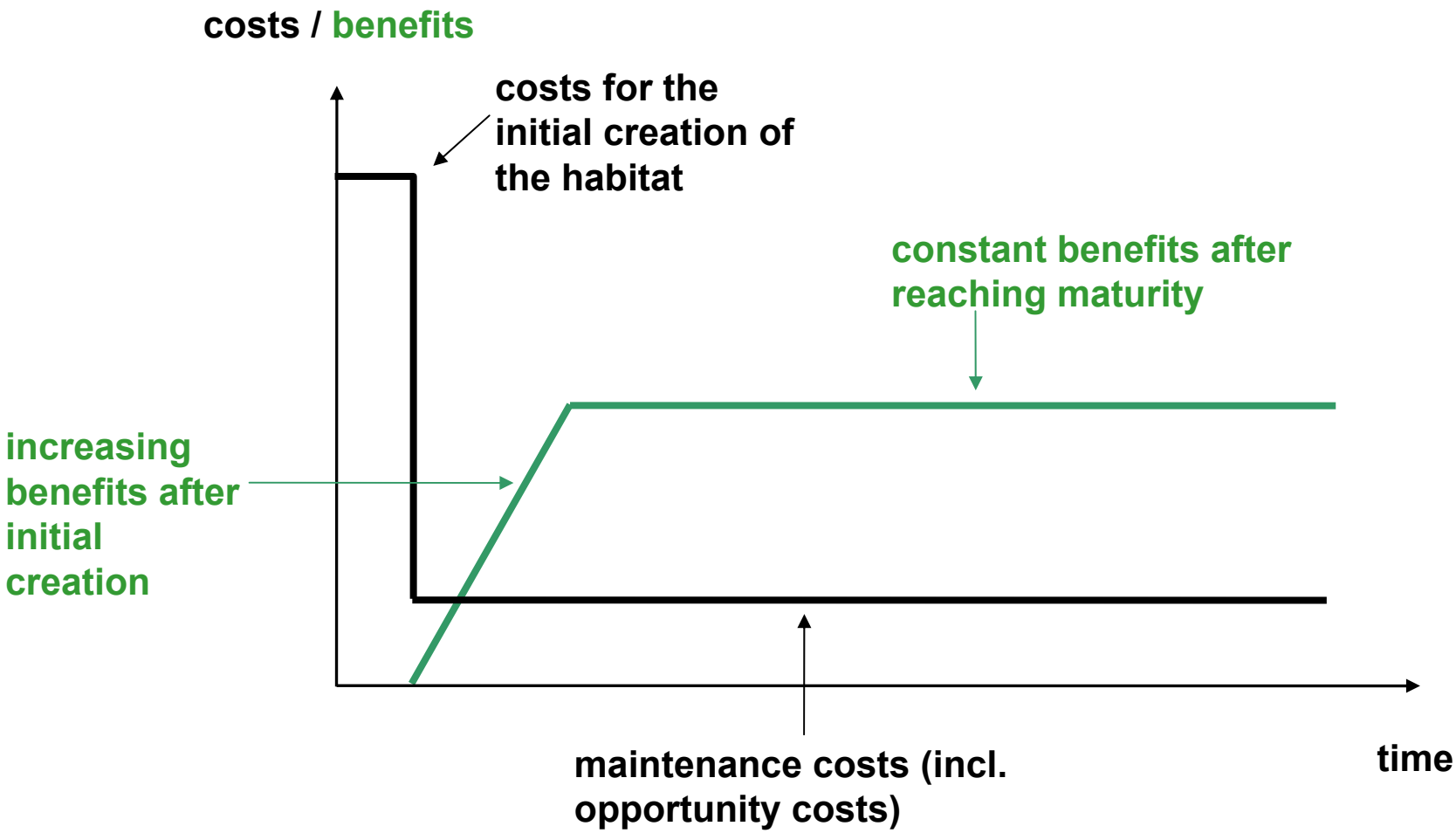
1) **Benefits of Biodiversity can be measured in annual rates and can be discounted**

2) **Normal "profitability". Nature conservation projects to develop new habitats for threatened species are (on average) at least as cost-effective (profitable on the basis of total economic value) as commercial investments.**

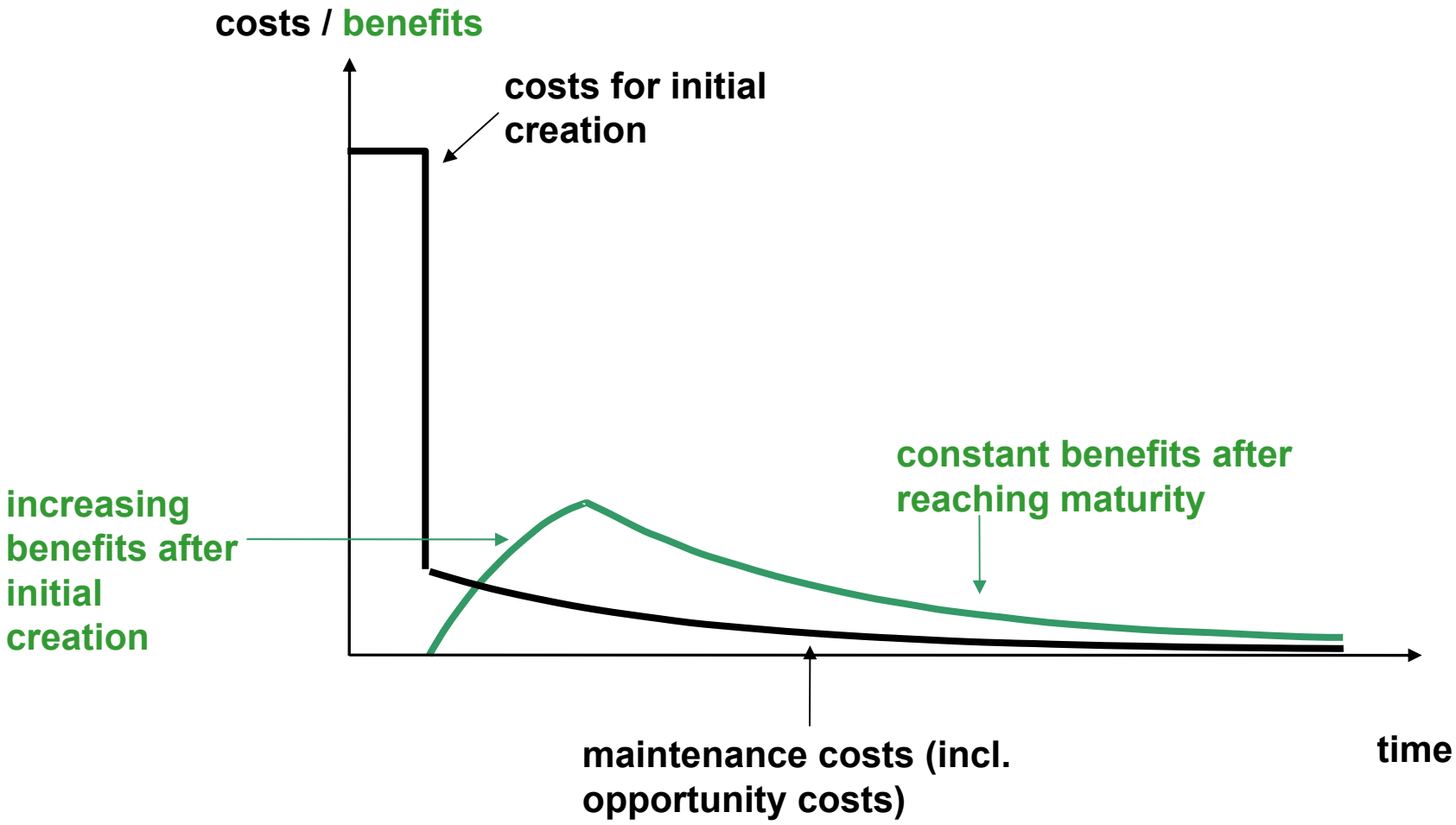
Recommended field of application:

Natural and semi-natural ecosystems that are essential for the conservation of biodiversity (in Germany: 10 to 15% of the landscape)

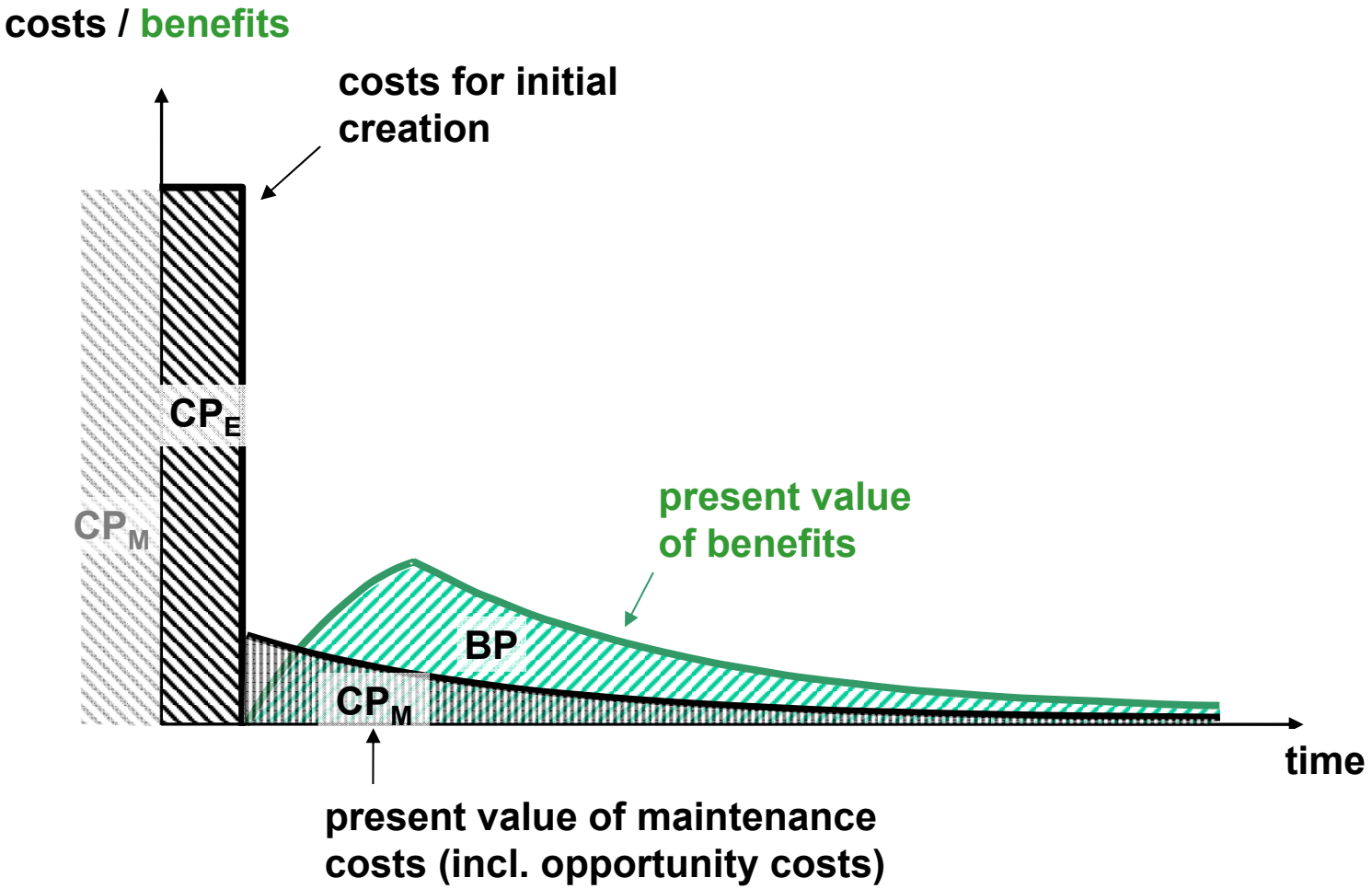
Costs and benefits of a habitat development project



Discounted costs and benefits

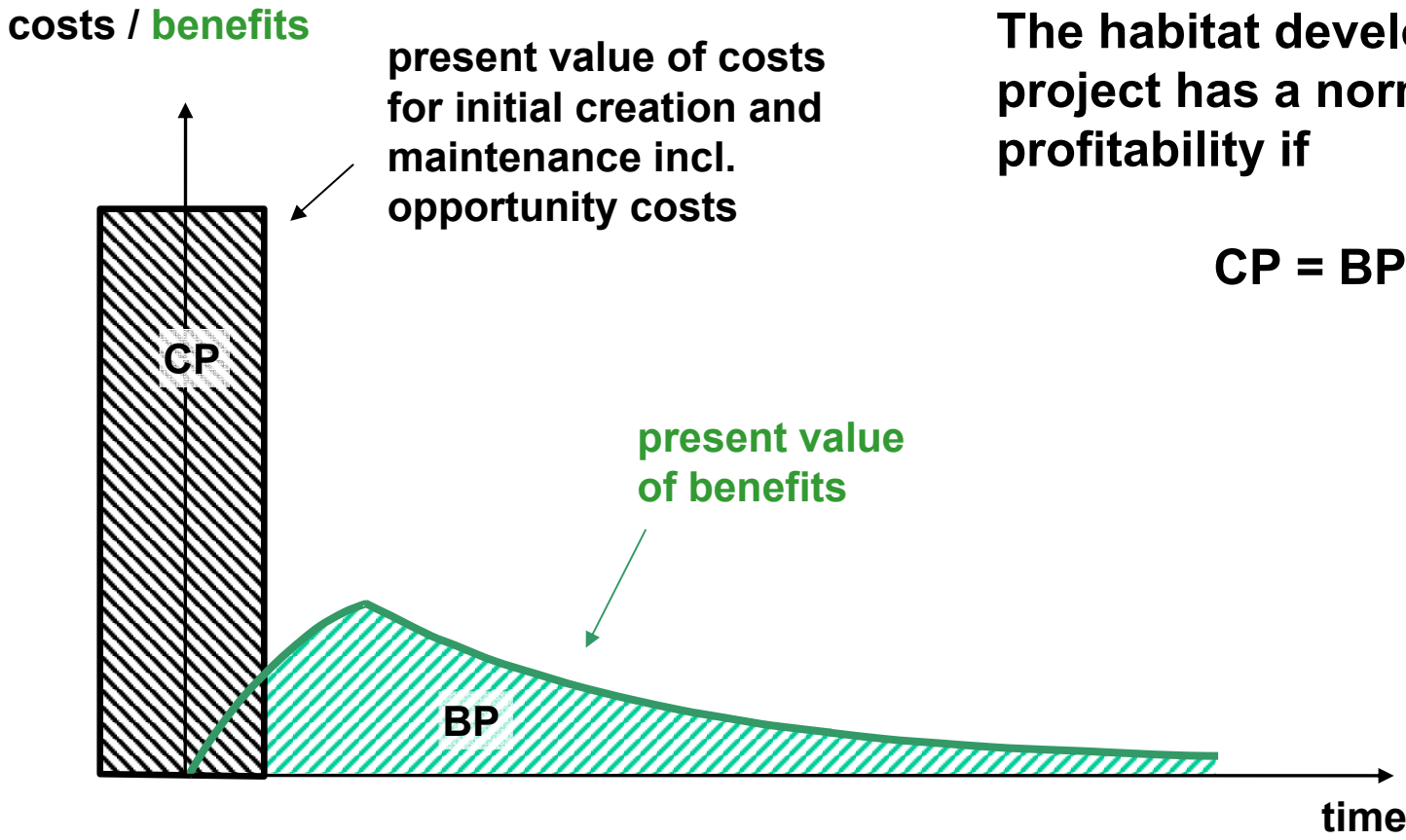


Present values



Discounted benefits of a restoration are at least as high as discounted costs

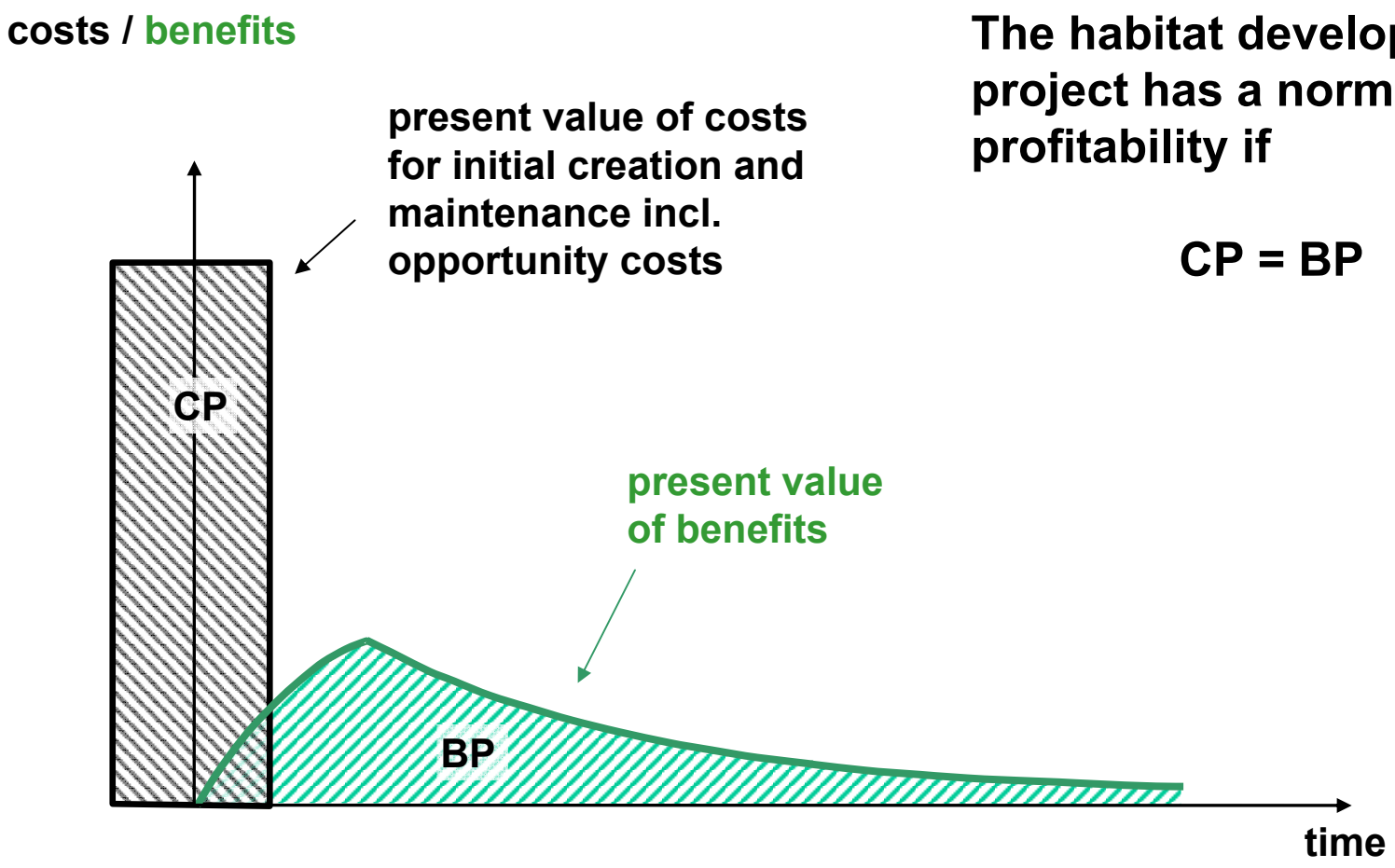
Rationale for the above assumption:
politically expressed will to stop biodiversity loss



The habitat development project has a normal profitability if

$$CP = BP$$

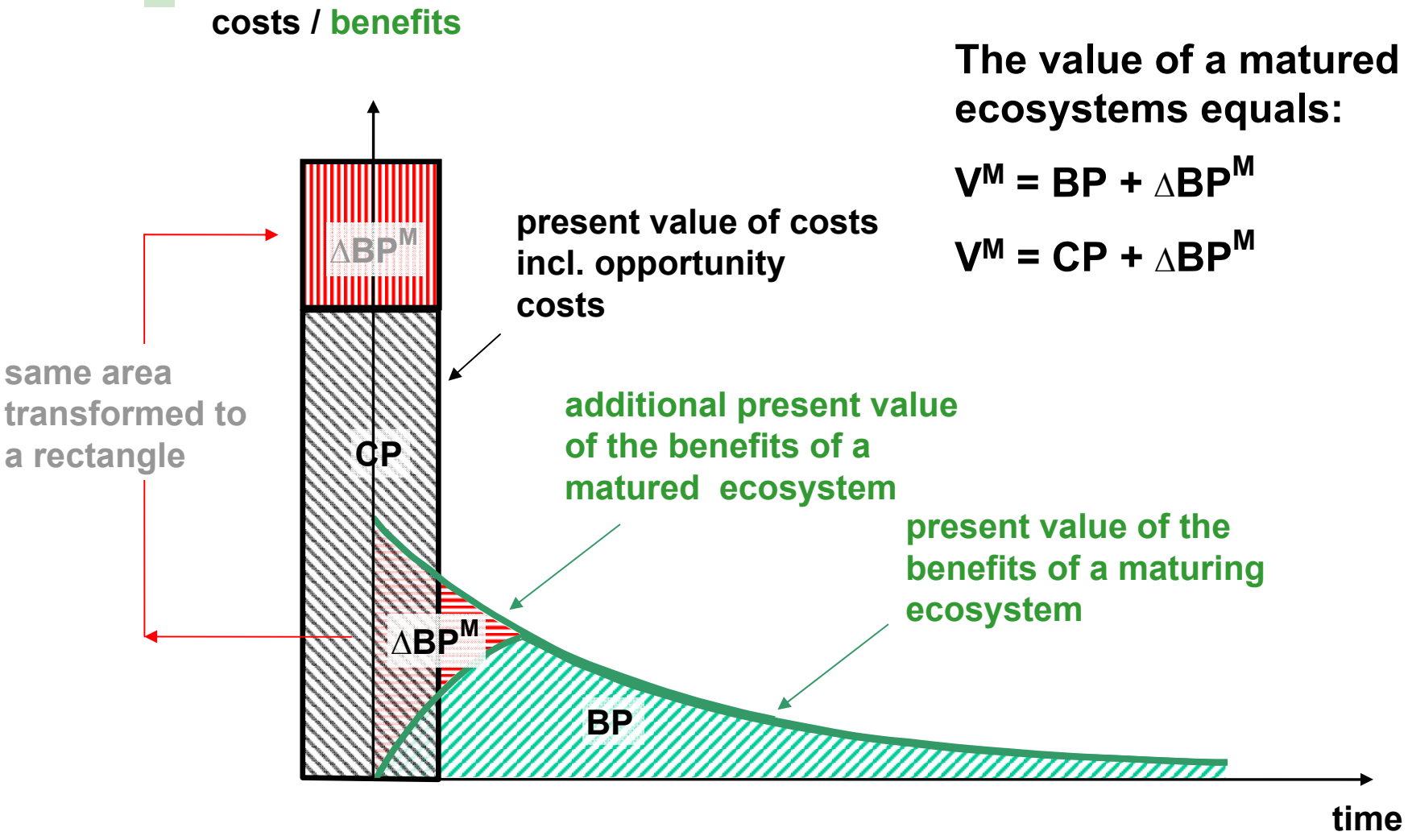
Assumption: costs = benefits (normal profitability)



The habitat development project has a normal profitability if

CP = BP

Benefits of a matured ecosystem compared with a developing one



The value of a matured ecosystems equals:

$V^M = BP + \Delta BP^M$

$V^M = CP + \Delta BP^M$

High-Nature-Value Habitat / Ecosystem	*Area (ha)*	*% of land-cover*	*Euro / m²*	*Value (Mio. €)*
Dwarf shrub heathlands	83,170	0.22	41.83	34,790.01
Natural and semi-natural dry grasslands	99,720	0.27	8.06	8,037.43
Molinea meadows	14,000	0.04	18.51	2,591.40
Riparian grasslands and tall herbaceous perennial vegetation of moist to wet sites	37,700	0.10	6.14	2,314.78
Low intensively used meadows	179,000	0.48	6.14	10,990.60
and swamps free of woodland	11,100	0.03	9.80	1,087.80
Other types of agricultural grasslands with a high species diversity	447,264	1.19	2.66	11,897.22
Arable land with threatened herbaceous vegetation communities	473,124	1.26	0.49	2,318.31
Low intensively managed vineyards	7,380	0.02	13.31	982.28
Traditionally managed orchards	350,000	0.93	9.75	34,125.00
Low intensively used ponds for fish farming	3,150	0.01	48.93	1,541.30
Copses, thickets, scrub, hedgerows and tree rows in agricultural used areas	750,000	2.00	16.28	122,100.00
Natural woods and low intensively used species-rich forests	734,438	1.96	18.44	135,430.28
Pasture woodland	31,950	0.09	20.64	6,594.48
Coppice and coppice with standard	182,813	0.49	4.47	8,171.72
Nature-like woodland edge communities	3,450	0.01	22.79	786.26
Species-rich herbaceous forest fringe communities	788	0.00	2.82	22.21
Raised bogs including less degraded restoreable forms	67,489	0.18	195.46	131,914.41
Transition mires and strongly degraded raised bogs	78,498	0.21	127.42	100,022.52
Nature-like running and standing surface waters	246,675	0.66	48.93	120,698.08
Total	3,555,033	**9.48**		**736,416.07**

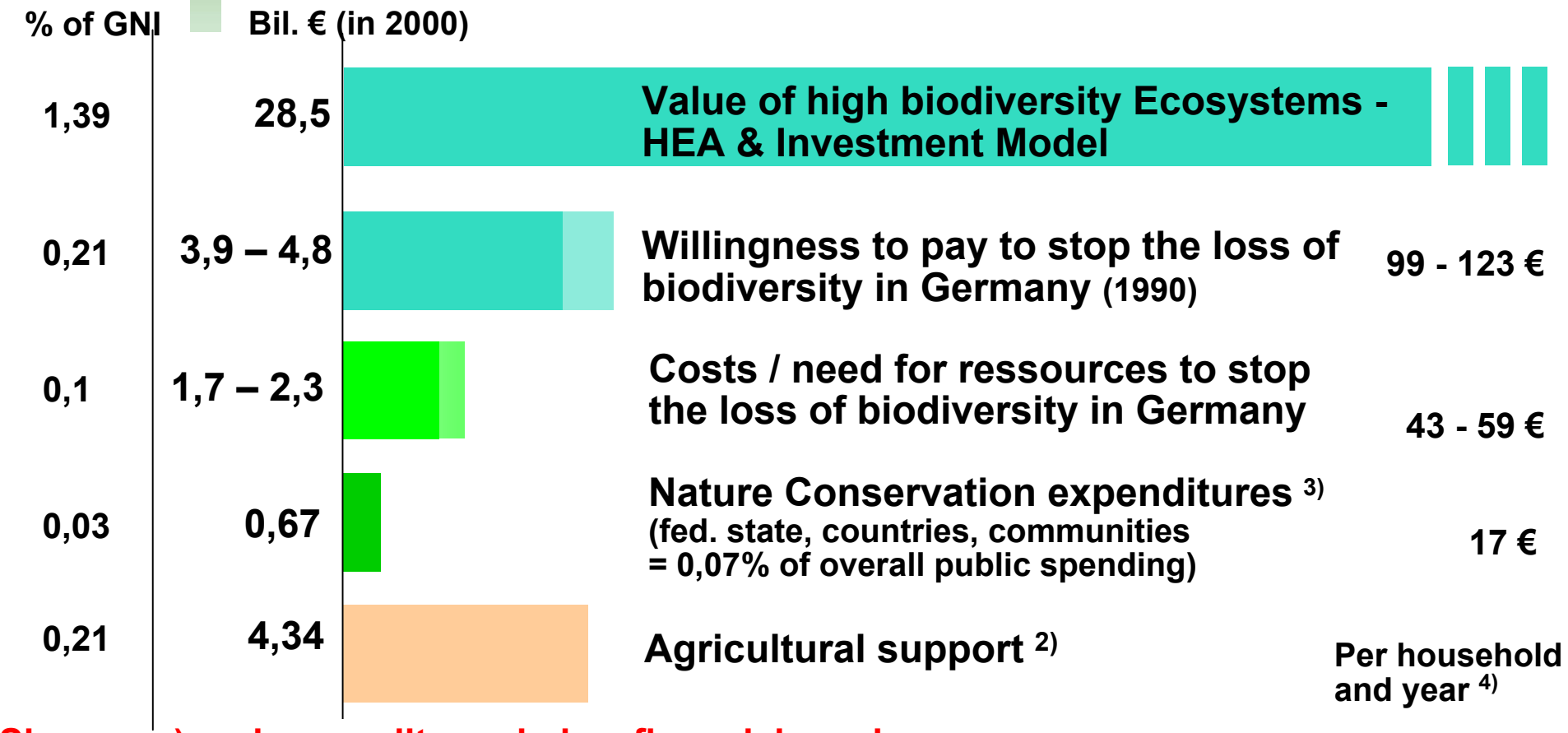
„Capital stock“ of high-nature-value ecosystems in Germany

Valuation Basis:
Restoration costs and restoration time

Method:
Habitat Equivalency Analysis

Result:
80% of the value of Germany´s productive capital / equipment

What can these informations help for?



Show that:

a) real expenditures below financial needs
b) willingness to conserve higher than conservation costs
c) willingness to conserve below restoration costs
d) high risk of irreversible negative effects on biodiversity and human welfare

Literature

Grossmann, M.; Hartje, V. und Meyerhoff, J. (2010): Ökonomische Bewertung naturverträglicher Hochwasservorsorge an der Elbe. Naturschutz und Biologische Vielfalt, Heft 89, Bundesamt für Naturschutz, Bonn.

Schäfer, A. (2009): Moore und Euros. Die vergessenen Millionen. Archiv für Forstwesen und Landschaftsökologie, Bd. 43, Heft 4, S. 156-160

Barthelmes, A.; Joosten, H.; Kaffke, A.; Koska, I.; Schäfer, A.; Schröder, J. und Succow, M. (2005): Erlenaufforstung auf wiedervernässten Niedermooren. Institut für dauerhaft umweltgerechte Entwicklung von Landschaften der Erde. 68 S., Greifswald.

Dehnhardt, A. (2002): Der ökonomische Wert der Elbe als Nährstoffsenke: Die indirekte Bewertung ökologischer Leistungen. In: Dehnhardt, A. & Meyerhoff, J. (Hrsg.): Nachhaltige Entwicklung der Stromlandschaft Elbe. Nutzen und Kosten der Wiedergewinnung und Renaturierung von Überschwemmungsauen. Vauk: Kiel.

A future task in good hands

Federal Agency for Nature Conservation

Many thanks for your kind attention

Dr. Burkhard Schweppe-Kraft

Unit I 2.1: Legal Affairs, Economics and Ecologically Sound Regional Development

Additional informations

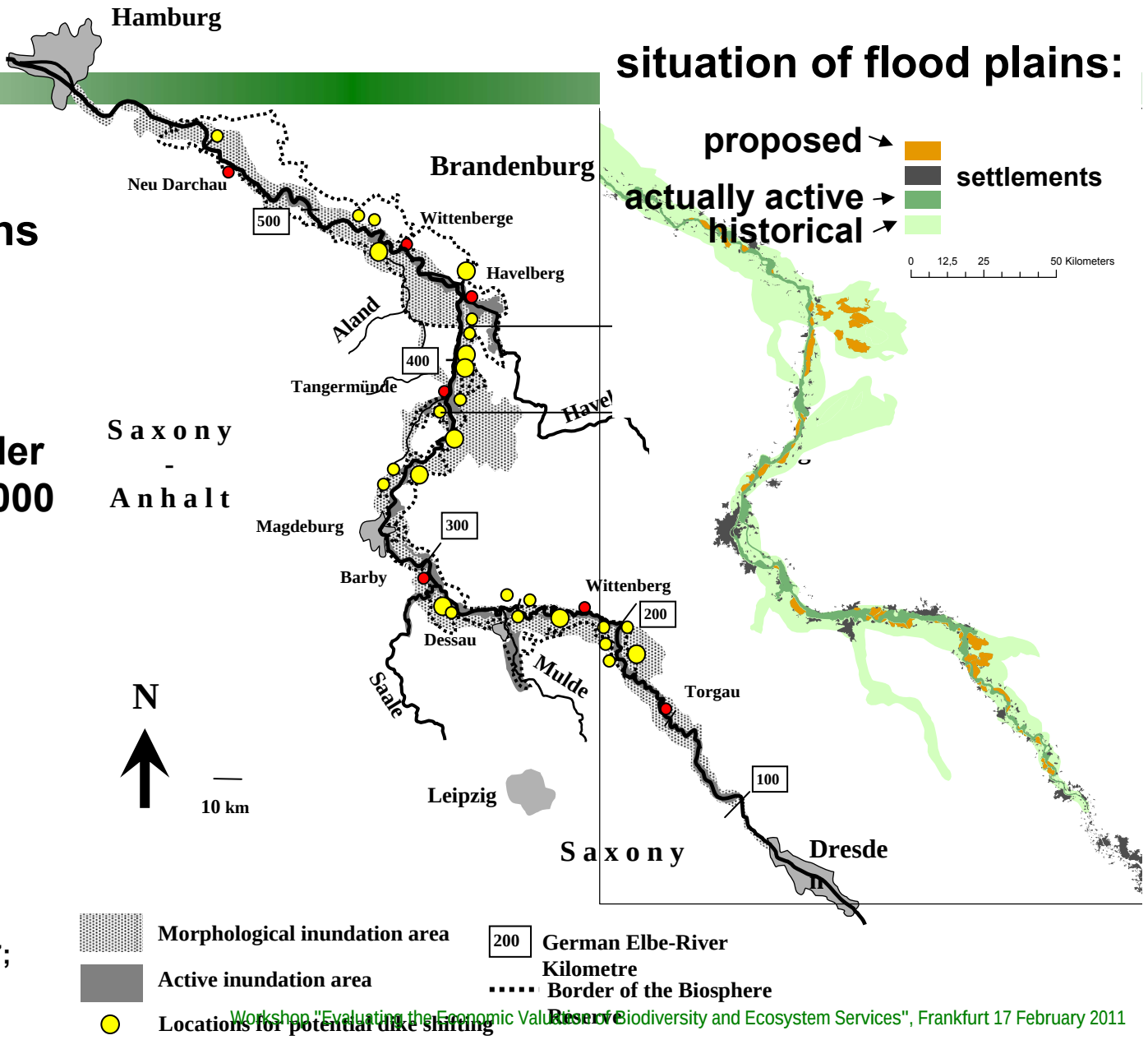
An additional ongoing study: Cost-benefit-analysis of land use-scenarios for Germany

Costs and benefits:	Land use scenarios:			
	Status Quo	Intensified land use for food and energy-biomass production	Reaching the goals of the national biodiversity strategy	focus on synergies between nature-conservation and climate gas mitigation
Production	monetary valuation: differences between prices and prod.costs			
Restoration and management	monetary valuation: restoration and management costs			
Nature Conservation	monetary valuation on the basis of choice analysis for willingness to pay for different nature-conservation programmes			
Recreation	monetary valuation on the basis of revealed preferences for nature-related day trips (demand curve estimation on the relation between costs, frequency of trips and landscape features of the destination)			
Climate-gas mitigation	partly monetary / partly semi-quantitative ++ + o – – –			
Other ecosystem services	semi-quantitative ++ + o – – –			

Details: Dyke shifting along the river Elbe

Management actions along the Elbe:

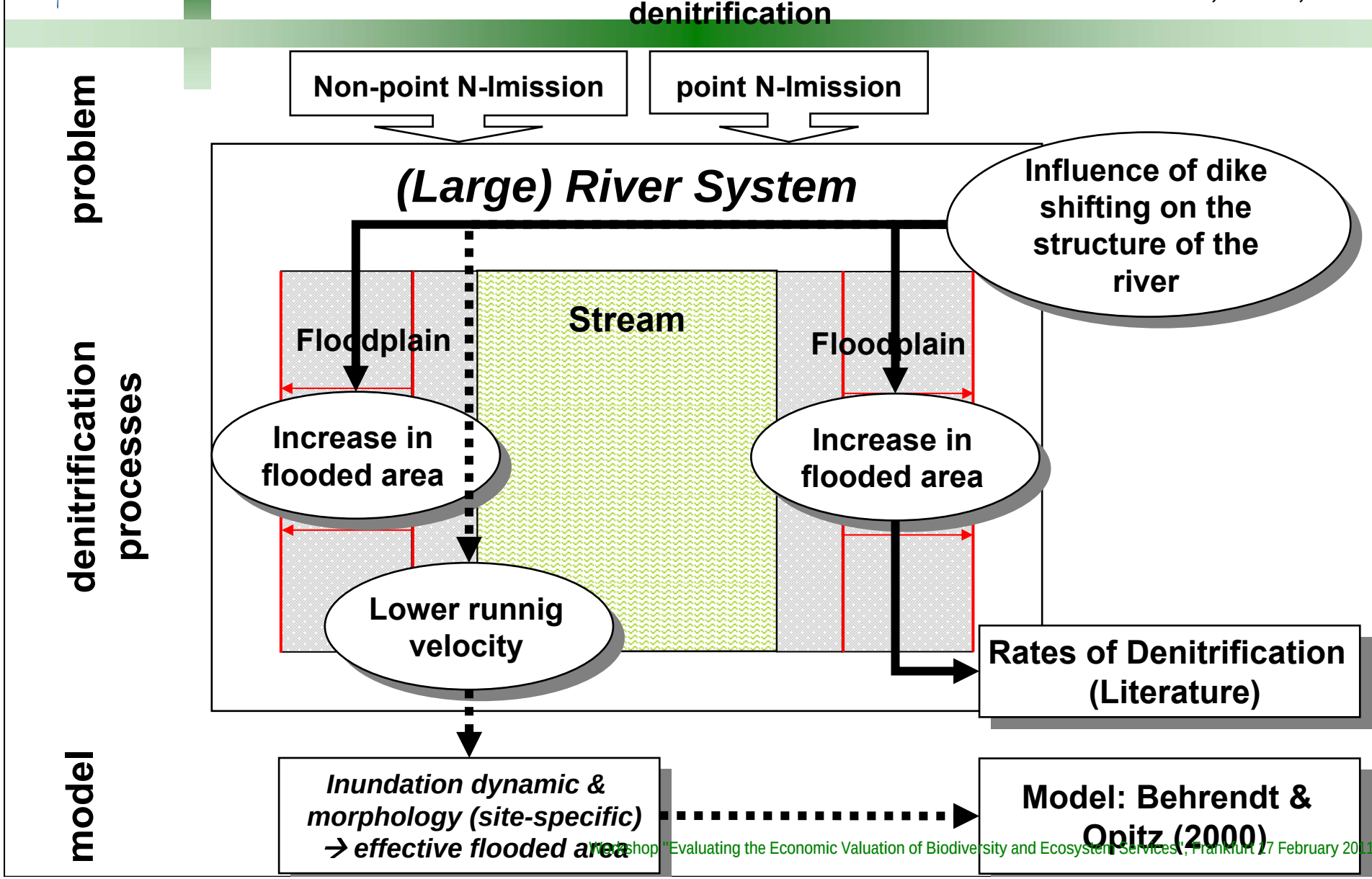
- Dike shifting in order to regain up to 15,000 ha of flood plains
- Extensification of agriculture on new and existing flood plains (up to 40,000 ha)



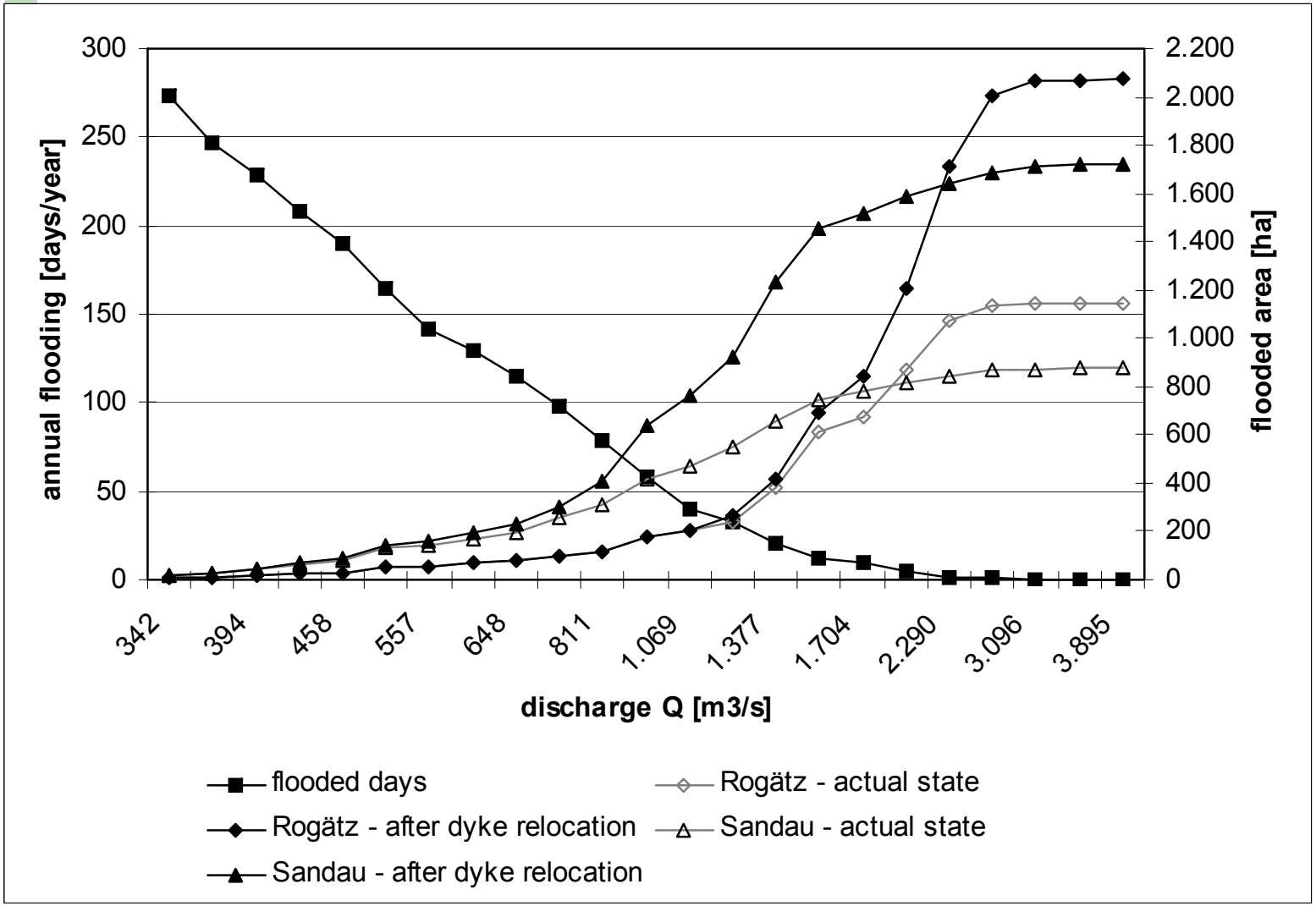
Source: Dehnhardt, Bräuer, 2007; Hartje, Grossmann, Meyerhoff, 2010)

Details: Elbe-study, models applied

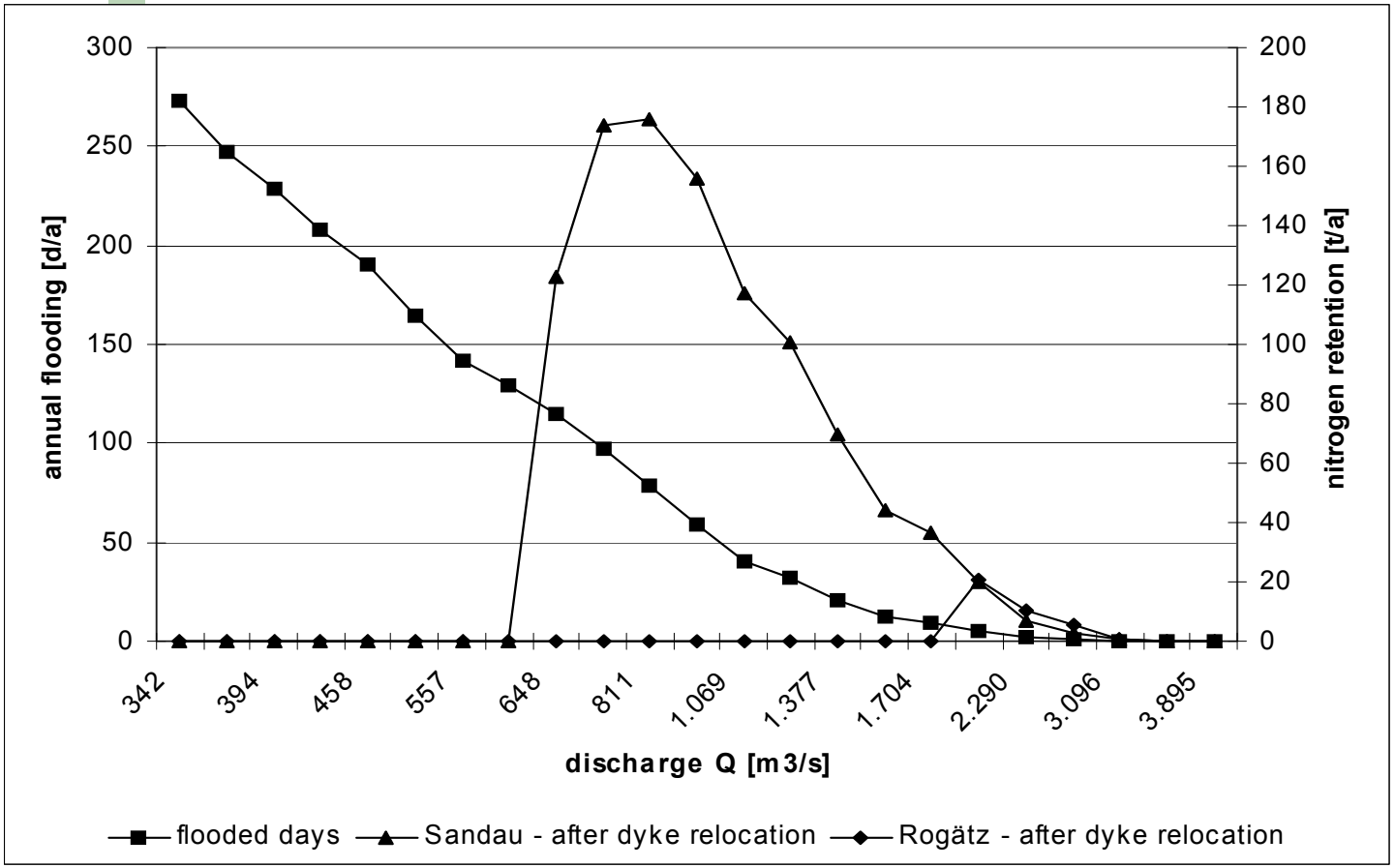
Source: Dehnhardt, Bräuer, 2007



Details: Elbe – flooded area with and without at Rogätz and Sandau



Details: Elbe – denitrification at Sandau and Rogätz – problems for benefit transfer



Annual nitrogen retention for relocation sites Sandau & Rogätz – depending on the annual inundation days and the specific discharge

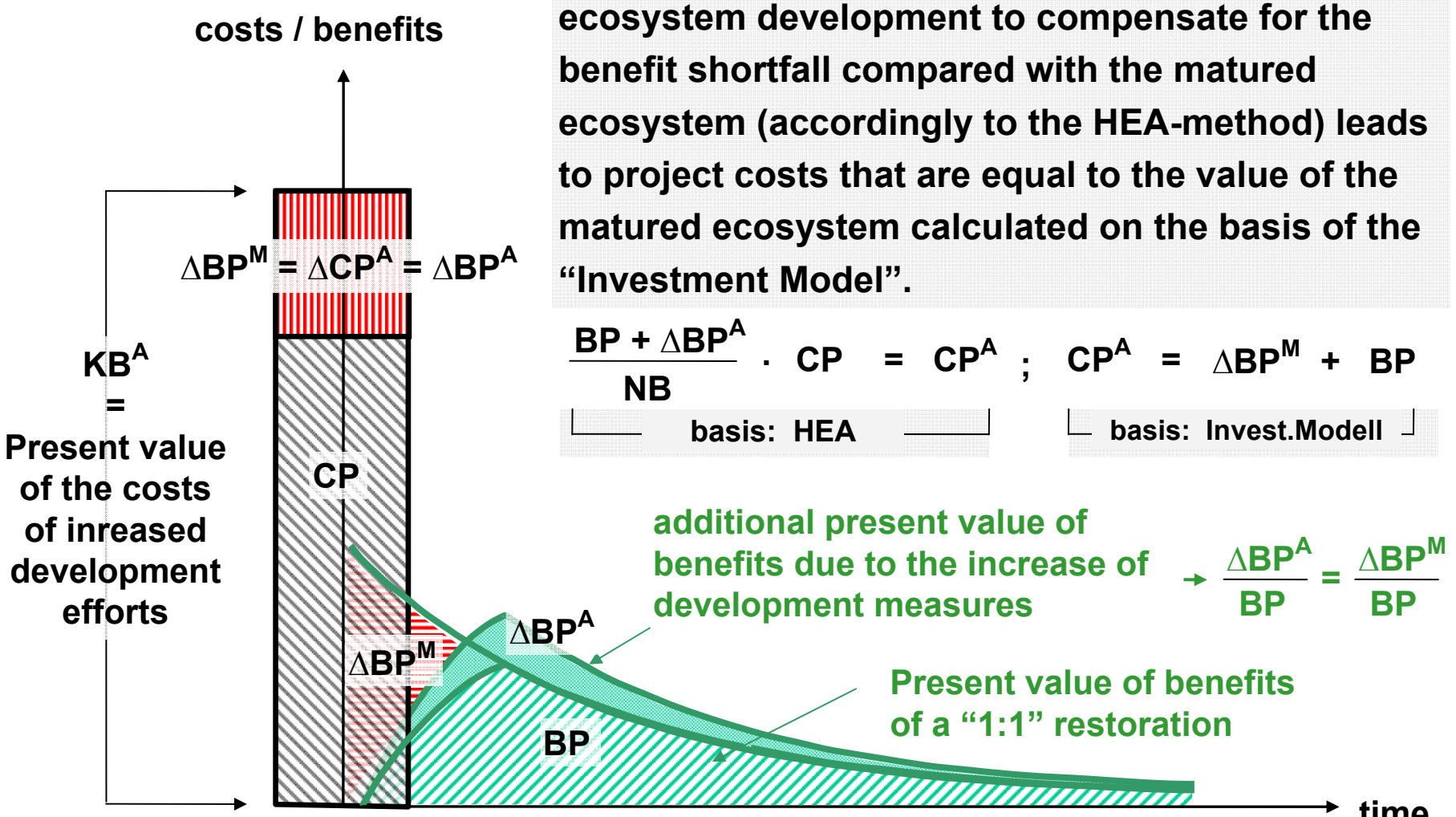
High variability of the effects → difficult to scale up for the 15,000 ha in total

Equivaleny of "Investment Modell" and HEA

A proportional increase in the amount/area of ecosystem development to compensate for the benefit shortfall compared with the matured ecosystem (accordingly to the HEA-method) leads to project costs that are equal to the value of the matured ecosystem calculated on the basis of the "Investment Model".

$$\frac{BP + \Delta BP^A}{NB} \cdot CP = CP^A \quad ; \quad CP^A = \Delta BP^M + BP$$

basis: HEA — basis: Invest.Modell



Recommendations

Many kinds of projects that offer the chance to combine nature conservation with other targets, like

- **climate gas mitigation and adaption to climate change,**
- **renewable energy,**
- **clean water supply,**
- **regional development,**

are planned on a <u>local or regional</u> level

National policy should provide regions with

⇨ **best practice examples,**

⇨ **methods to assess economic benefits,**

⇨ **funds to pay for supra-regional benefits like climate-gas-mitigation, downstream flood prevention or improved water supply**

Capital Values of Ecosystems Calculated on Restoration Costs and Periods

High Nature Habitats / Ecosystems (about 10% of German landcover)	Area	% of German landcover	Euro / ha	Value (Mio. €)
Natural and semi-natural dry grasslands	99,720	0.27	8.06	8,037.43
Molinea meadows	14,000	0.04	18.51	2,591.40
Riparian grasslands and tall herbaceous perennial vegetation of moist to wet sites	37,700	0.10	6.14	2,314.78
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Other types of agricultural grasslands v species diversity	447,264	1.19	2.66	11,897.22
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Raised bogs including less degraded restoreable forms	67,489	0.18	195.46	131,914.41
Nature-like running and standing surface waters	246,675	0.66	489.93	120,698.08
Total	**3,555,033**	**9.48**		**736,416.07**

80% of the value of Germany´s productive technical equipment (933.88 Bio.€)

Value of (semi-) natural ecosystems in D calculated with the HEA / Investment Model approach

High variety of restoration costs and length of restoration period for the same type of ecosystem. Substantial reductions possible by changing cost assumptions.

	Present value Bio. €	Annual value Bio. €
(Semi-) natural ecosystems (3,5 Bio. ha, 9,5% of the terrestrial surface of Germany) calculated with the HEA / Investment Model	712,5	28,5
Willingness to pay to prevent biodiversity loss + use values of (semi-) natural ecosystems		3,9 – 4,8 ? 2,0 ?
Costs to prevent biodiversity loss in D		1,7 – 2,3
Federal State and "Länder" expenses for nature conservation [1)]		0,67
Agricultural support [1)]		4,34

1) Figures from 2000