

A tiered approach to develop indicator systems for biodiversity conservation

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Outline



- Remarks on the terms „monitoring“ and „indicator“
- Tiered development of biodiversity indicator sets
- Examples of biodiversity indicator sets
- Conclusions

Definition: Monitoring

Monitoring comprises

- empirical records (observations, counts and measurements) of selected elements of communities, habitats and landscapes
- in regular long-term spatiotemporal sequences
- which are designed to achieve with standardized scientific methods
- reliable results on the state and changes of these elements and
- which are directed to nature conservation and environmental protection objectives.

after Stöcker (1981) and Sukopp & Weddelling (2007)



Definition: Indicators (1)

Indicators in environmental sciences and nature conservation

- summarize empirical data from monitoring programmes
- in order to depict driving forces, pressures, states, impacts or societal responses related to biodiversity
- in an easily understandable manner.
- Indicator results can be used to control the achievement of previously agreed conservation objectives and should provide policy advice.



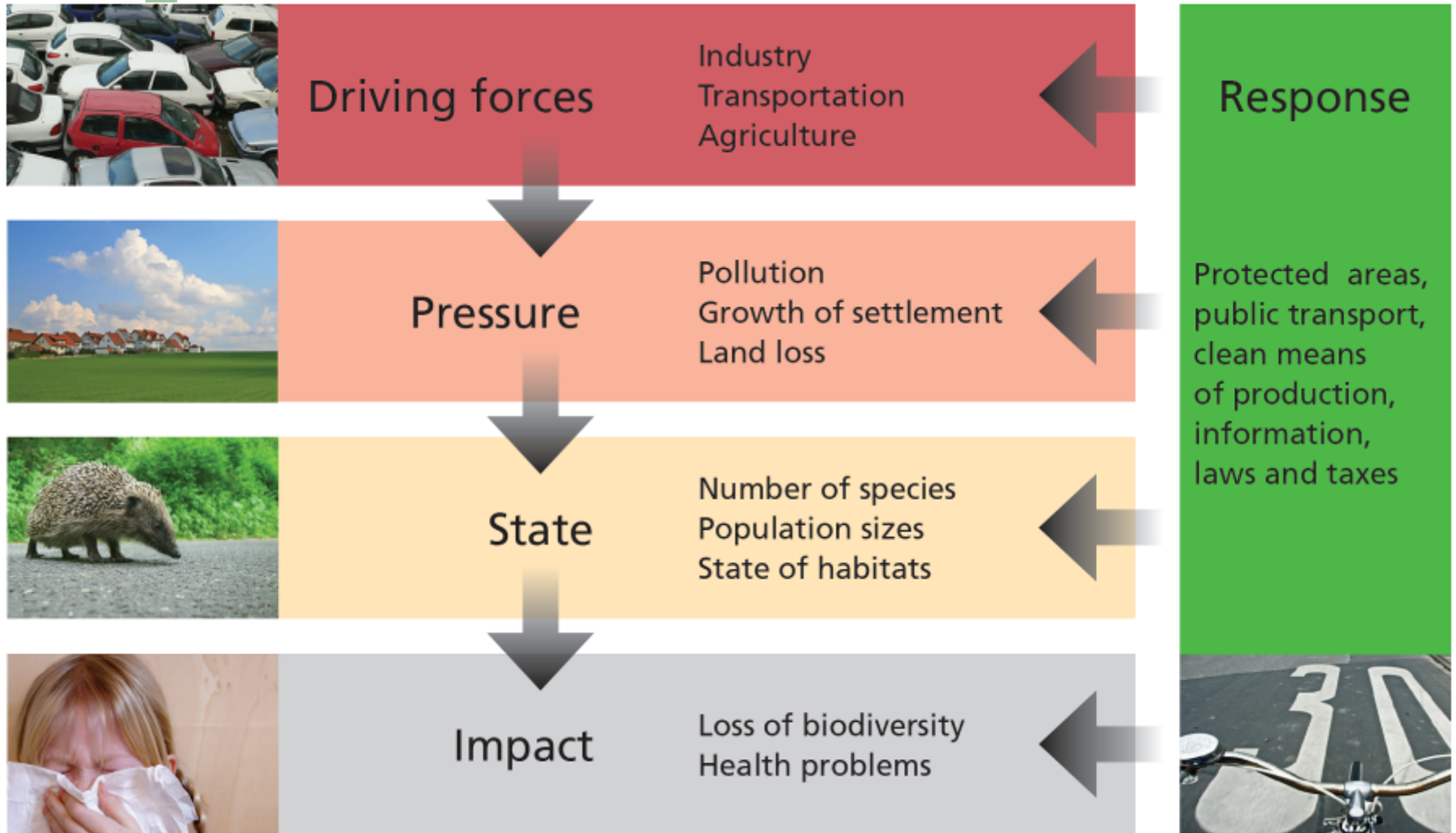
Definition: Indicators (2)

In a more strict and traditional scientific context, an **indicator** is

- a surrogate for an issue which cannot be recorded directly.
- This requires a proof of evidence how the indicandum (the issue to be indicated) and the indicans (the issue to be recorded instead) are in fact related to each other.
- The proof of evidence should be shown quantitatively, possibly by employing statistical methods.



Classification of biodiversity indicators: The DPSIR model



Classification of biodiversity indicators: The DPSIR model



- **Driving Forces:** Driving force indicators point at general developments of mankind which cause pressures on biodiversity.
- **Pressure:** Pressure indicators express which concrete negative factors act on biodiversity.
- **State:** State indicators outline the status of certain components of biodiversity.
- **Impact:** Impact indicators highlight certain changes in biodiversity which can be ascribed to known adverse factors.
- **Response:** Response indicators measure the means by which politics and society respond to changes in biodiversity.

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Definition: Monitoring (2)

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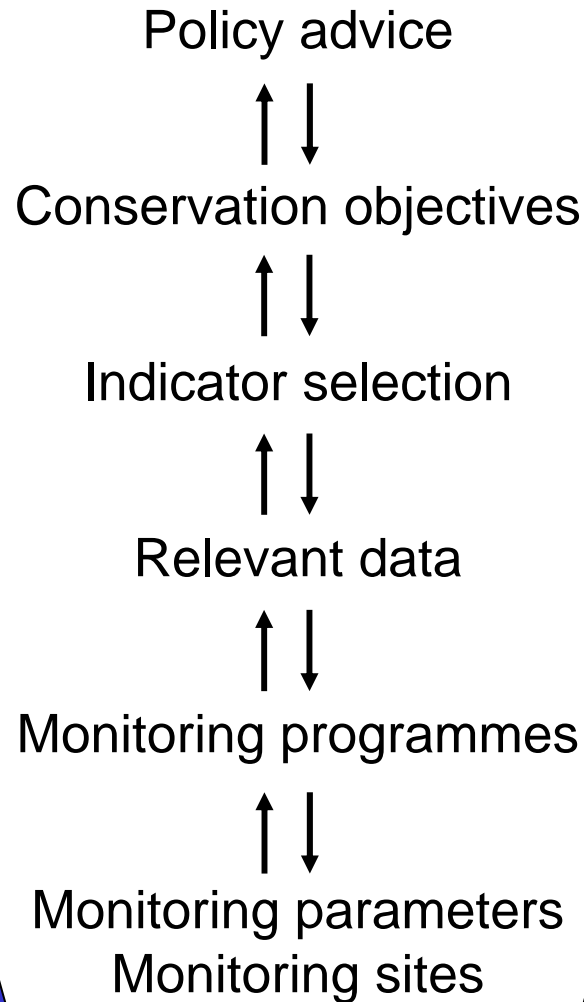
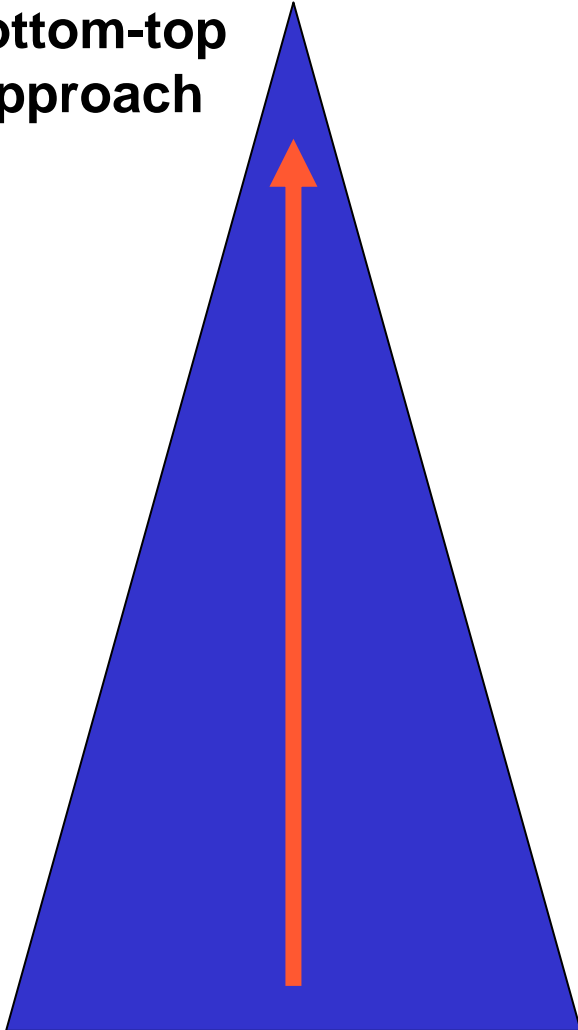
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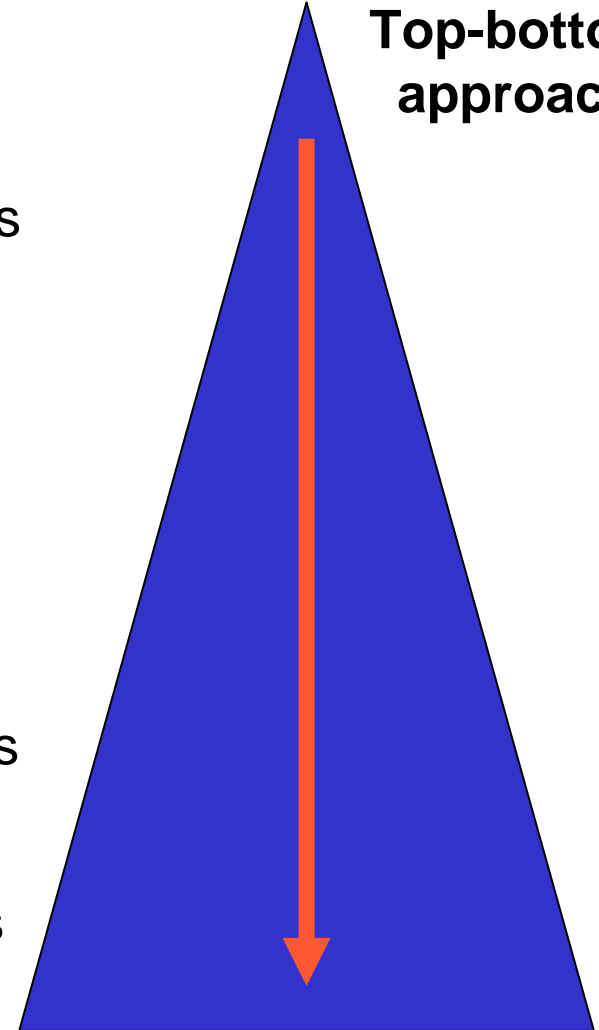


Tiered approach to develop indicator systems

**Bottom-top
approach**



**Top-bottom
approach**




The top-bottom approach

- (1) Top goal: Conservation of biodiversity
- (2) Specified goals: e.g. conservation of certain species, certain habitats
- (3) Development of indicators providing relevant information on the specified conservation goals
- (4) Development of monitoring programmes designed to collect relevant information
- (5) Implementation of monitoring in the field at the necessary number of sites



The bottom-top approach

- 
- (5) Already existing monitoring schemes in the field
 - (4) Provision of some sort of information – relevant or not?
 - (3) Development of indicators based on the available information – sufficient or not?
 - (2) Attribution of indicators to certain goals
 - (1) Compilation of several indicators to a broader set of indicators

Does such an indicator set provide a comprehensive picture of biodiversity conservation?

SEBI 2010 Indicator Set

Sreamlining European Biodiversity Indicators by **2010**

- How can we respond to the challenge of biodiversity loss?
- 1995: endorsement of the Pan-European Biological and Landscape Diversity Strategy
- 1998: adoption of the European Community Biodiversity Conservation Strategy
- 2001: four biodiversity action plans (natural resources, agriculture, fisheries, development)
- 2003: Kiev Resolution on Biodiversity by pan-European environment ministers (halt the loss of biodiversity by 2010)
- 2005-2007: first phase of SEBI 2010 project resulting in a proposal for a first set of indicators



SEBI 2010 Indicator Set

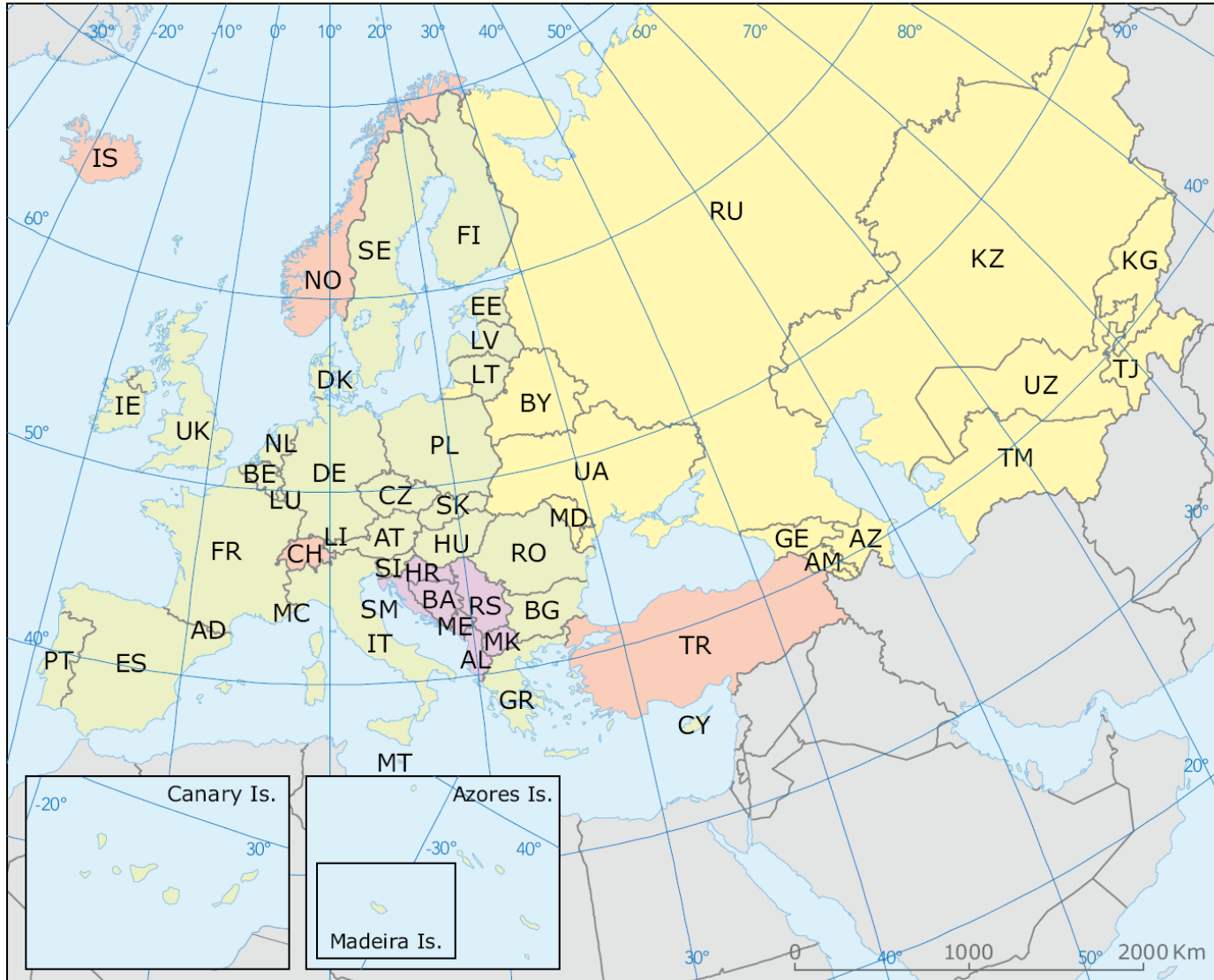
EEA Technical report | No 11/2007

Halting the loss of biodiversity by 2010:
proposal for a first set of indicators to monitor progress in Europe

ISSN 1725-2237

- With the report No 11 of 2007 EEA provided an initial set of biodiversity indicators available at EU and pan-European levels
- On-going work: further development of indicators, implementation of agreed regular indicator reports

SEBI 2010 Indicator Set



Countries in the Pan-European region, EEA members and EU-27

- EU-27
- EEA outside EU-27
- EEA collaborating countries
- Pan-European countries outside EU and EEA

SEBI 2010 Indicator Set

Focal area	EU and PEBLDS headline <i>(italics indicate changes from CBD headlines)</i>	Proposed indicators
Status and trends of the components of biological diversity	Trends in the abundance and distribution of selected species	1 Abundance and distribution of selected species
	<i>Change in status of threatened and/or protected species</i>	2 Red List Index for European species 3 Species of European interest
	Trends in extent of selected biomes, ecosystems and habitats	4 Ecosystem coverage 5 Habitats of European interest
		6 Livestock genetic diversity
	Coverage of protected areas	7 Nationally designated protected areas 8 Sites designated under the EU Habitats and Birds Directives

SEBI 2010 Indicator Set

Focal area	EU and PEBLDS headline <i>(italics indicate changes from CBD headlines)</i>	Proposed indicators
Threats to biodiversity	Nitrogen deposition	9 Critical load exceedance for nitrogen
	Trends in invasive alien species	10 Invasive alien species in Europe
Ecosystem integrity and ecosystem goods and services	<i>Impact of climate change on biodiversity</i>	11 Occurrence of temperature-sensitive species
	Marine Trophic Index	12 Marine Trophic Index of European seas
	Connectivity/fragmentation of ecosystems	13 Fragmentation of natural and semi-natural areas
		14 Fragmentation of river systems
	Water quality in <i>aquatic</i> ecosystems	15 Nutrients in transitional, coastal and marine waters
		16 Freshwater quality

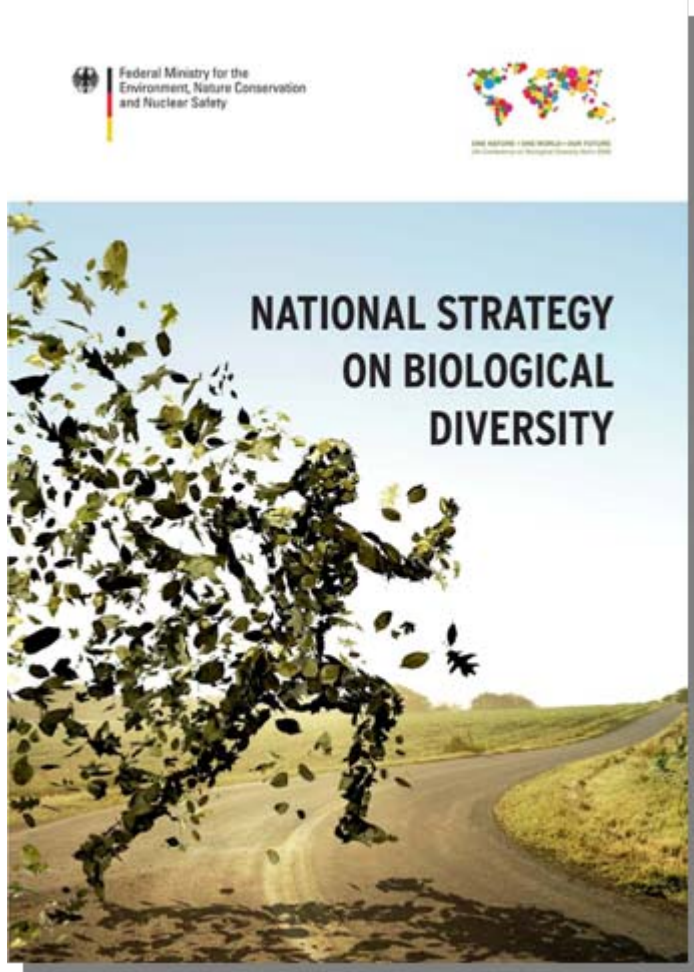
SEBI 2010 Indicator Set

Focal area	EU and PEBLDS headline <i>(italics indicate changes from CBD headlines)</i>	Proposed indicators
Sustainable use	Area of forest, agricultural, fishery and aquaculture ecosystems under sustainable management	17 Forest: growing stock, increment and fellings
		18 Forest: deadwood
		19 Agriculture: nitrogen balance
		20 Agriculture: area under management practices potentially supporting biodiversity
		21 Fisheries: European commercial fish stocks
		22 Aquaculture: effluent water quality from finfish farms
	Ecological Footprint of European countries	23 Ecological Footprint of European countries
Status of access and benefits sharing	<i>Percentage of European patent applications for inventions based on genetic resources</i>	24 Patent applications based on genetic resources
Status of resource transfers and use	<i>Funding to biodiversity (Note: PEBLDS also added 'PEBLDS public and private sources')</i>	25 Financing biodiversity management
Public opinion	<i>Public awareness and participation</i>	26 Public awareness

Proposed indicators	Existing indicator sets that contain this indicator
1 Abundance and distribution of selected species	SDI ⁽⁹⁾ (Common Bird Index)
2 Red List Index for European species	SDI (under development)
7 Nationally designated protected areas	EEA Core Set of Indicators (008 Designated areas)
8 Sites designated under the EU Habitats and Birds Directives	EEA Core Set of Indicators (008 Designated areas)
	SDI (Sufficiency of Member States proposals for protected sites under the EU habitats directive – title may change depending on outcome of current discussions)
9 Critical load exceedance for nitrogen	EMEP
	SDI (under development)
13 Fragmentation of natural and semi-natural areas	To be developed for SDI
15 Nutrients in transitional, coastal and marine waters	EEA Core Set of Indicators (021 Nutrients in transitional, coastal and marine waters)
16 Freshwater quality	EEA Core Set of Indicators (019 Oxygen consuming substances in rivers and 020 Nutrients in freshwater)
	SDI (Concentration of organic matter as biogeochemical demand of rivers)
17 Forest: growing stock, increment and fellings	MCPFE
	SDI
18 Forest: deadwood	MCPFE
	To be developed for SDI
19 Agriculture: nitrogen balance	IRENA
	To be developed for SDI
20 Agriculture: area under management practices potentially supporting biodiversity (High nature value farmland area; Area under organic farming; Area under biodiversity supportive agri-environment schemes)	IRENA (area under organic farming)
	SDI (Area under agri-environmental commitments; Area under organic farming)
21 Fisheries: European commercial fish stocks	EEA Core Set of Indicators (032 Status of marine fish stocks)
	SDI (Fish catches from stocks outside safe biological limits)
22 Aquaculture: effluent water quality from finfish farms	EEA Core Set of Indicators (033 Aquaculture production)

EEA (2007)

National Strategy on Biological Diversity



- Endorsement in November 2007
- About 330 environmental quality targets and action objectives
- Quantification of targets and objectives
- Deadlines
- About 430 specific measures

National Strategy on Biological Diversity

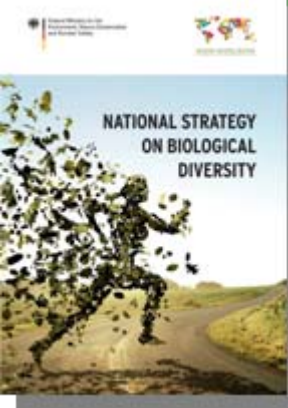
Examples for mid-term objectives:

Until 2015

- The proportion of agricultural land with high conservation value has increased by at least 10 % compared with 2005.

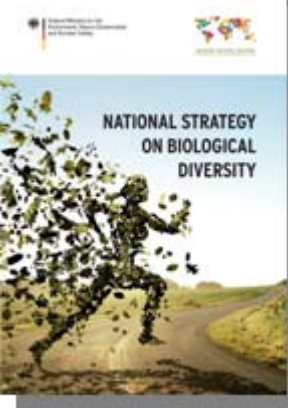
Until 2020

- For most of the species on the Red List the threat situation will have improved by one level.
- Woodland with natural development accounts for 5 % of the wooded area.



The Indicator Set of the National Strategy on Biological Diversity

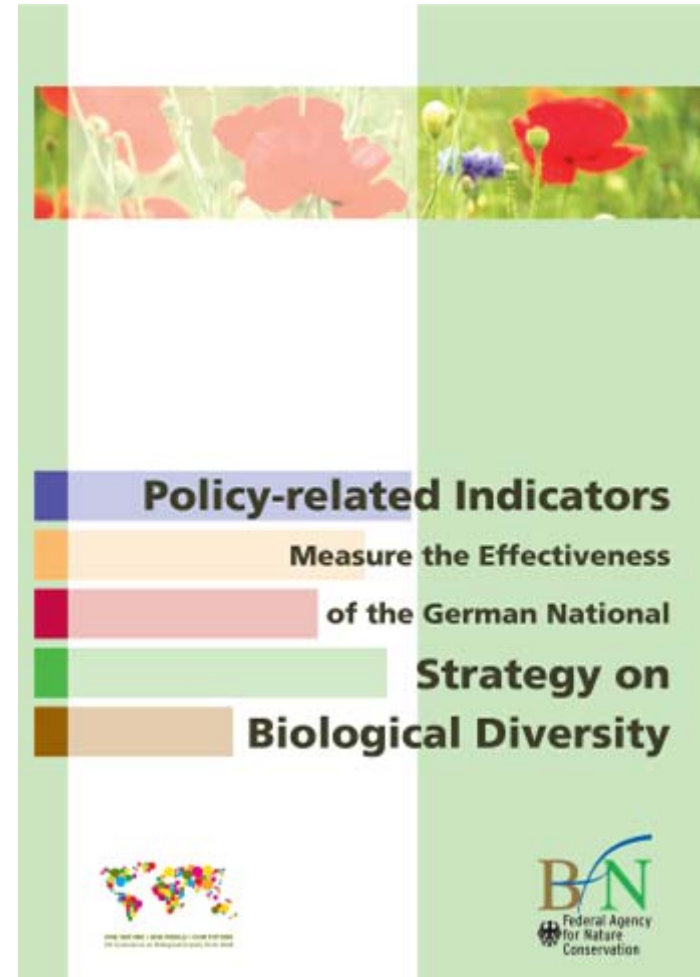
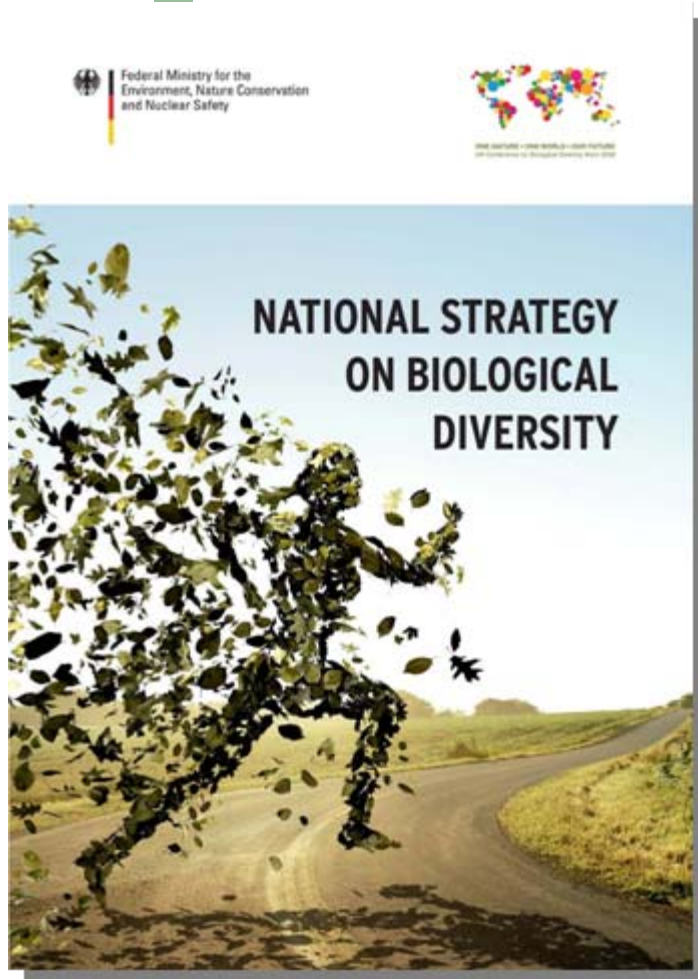
- A set of currently **19 indicators** has been selected to estimate how successfully the strategy objectives will be met in the future.
- Performance reviews should take place at regular intervals.
- Implementation of measures and achievement of targets will be reviewed in a summarizing manner.
- The German government will present a report on the current situation for every legislative period (i.e. every 4 years).



The Indicator Set of the National Strategy on Biological Diversity

Indicators Used in the National Strategy		DPSIR statement	Also used in
1	Sustainability indicator for species diversity	State	NHS, KIS, LIKI
2	Endangered species	Impact	KIS
3	Conservation status of Habitats Directive habitat types and species	State	LIKI (planned)
4	Number of non-native fauna and flora species in Germany	Pressure	KIS
5	Size of strictly protected areas	Response	KIS, LIKI
6	Natura 2000 area designations	Response	KIS, LIKI
7	Land use: Increase in the amount of land used for human settlements and the transport infrastructure	Pressure	NHS, KIS, LIKI
8	Dissection of the landscape	Pressure	KIS, LIKI
9	Urban sprawl	Pressure	–
10	Agro-environmental subsidy (subsidised area)	Response	KIS
11	Organic farmland as a proportion of total agricultural land	Response	NHS, KIS, LIKI
12	Proportion of certified forest land in Germany	Response	KIS
13	Nitrogen surplus (overall balance sheet)	Pressure	NHS, KIS, LIKI
14	Genetic engineering in agriculture	Pressure/ Response	LIKI (planned)
15	Water quality – Proportion of waterbodies with at least water quality grade II	Impact	LIKI
16	Marine Trophic Index	Pressure	CBD
17	Populations of selected commercial marine species	Impact	–
18	Flowering season of indicator plants	Impact	KIS
19	Significance of environmental policy goals and tasks	Response	–

Information Material



The Indicator Set of the National Strategy on Biological Diversity

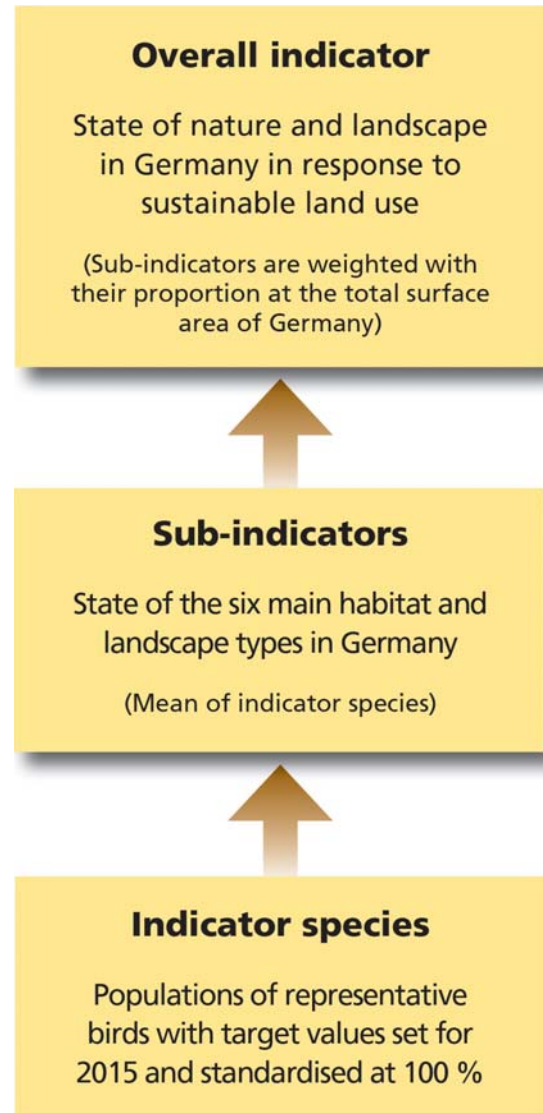
Standards and requirements for indicators:

- High quality monitoring programmes for accurate data
- Policy-related issues for a successful conservation of biodiversity
- Clear commonly understandable message
- Quantitative future targets
- Regular updates of data
- Communication towards the public and decision makers

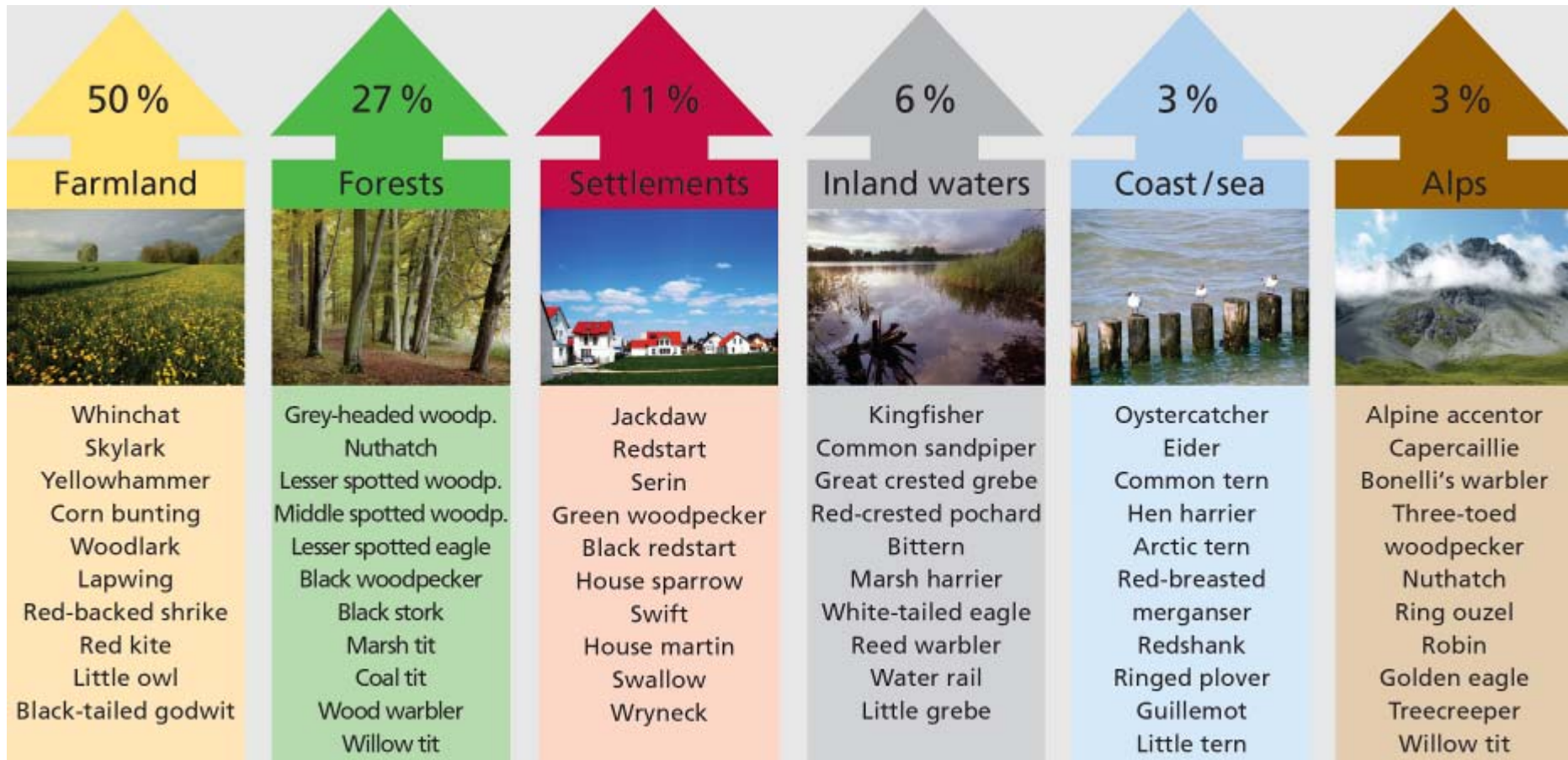


Example: Sustainability Indicator for Species Diversity

- Based on population trends of 59 representative bird species
- Flagship indicator of nature conservation
- Reflects the sustainability of land use as an essential prerequisite for the conservation of species diversity



Example: Sustainability Indicator for Species Diversity



Example: Sustainability Indicator for Species Diversity

Trend over the last 10 years: ———

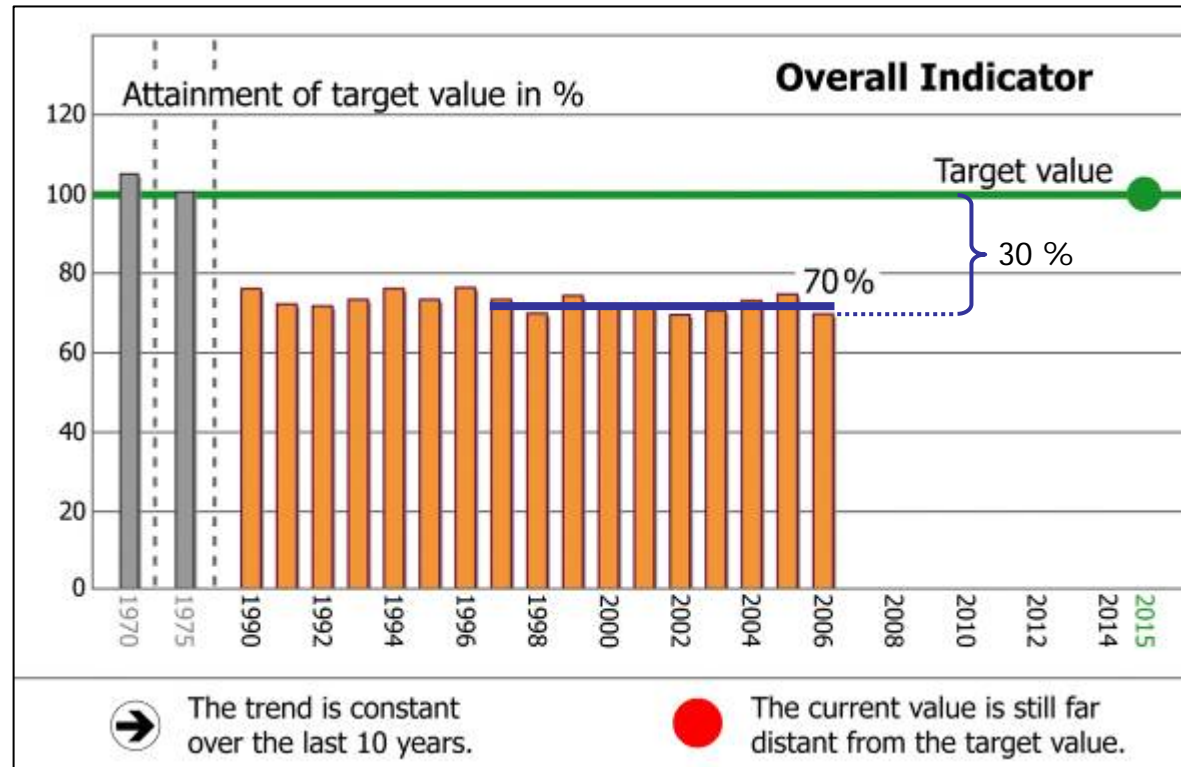
r_s = Rank correlation coefficient after Spearman

p = Level of significance

Arrow: ↗ Increasing
(r_s positive, $p \leq 0,1$)

Arrow: → Constant
(r_s any value, $p > 0,1$)

Arrow: ↘ Decreasing
(r_s negative, $p \leq 0,1$)



Attainment of target value (distance between last value and target value): }

Current value is close to or at the target (value ≥ 90 %, green dot ●)

Current value is still distant from the target (value < 90 % und ≥ 80 %, yellow dot ●)

Current value is still far distant from the target (value < 80 %, red dot ●)

Conclusions

- Indicators depict driving forces, pressures, states, impacts or societal responses related to biodiversity in an easily understandable manner.
- Indicators refer to quality objectives for the future condition of biodiversity.
- Indicators allow to review the implementation of measures and the achievement of nature conservation objectives.
- Indicators help decision makers in environmental policy.
- Indicator systems can be developed in a tiered bottom-top approach or in a tiered top-bottom approach. For practical reasons, we usually find a mixture of both.



Thanks for your attention!

Ulrich Sukopp
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