

How much impact on plant populations is tolerable? An approach to determine thresholds for significant detrimental impacts

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„Ecological damages“ through genetically modified crops

Phase I

Developing a definition and a concept

October 2004 – April 2005



Phase II

Developing an assessment scheme

August 2005 – January 2007



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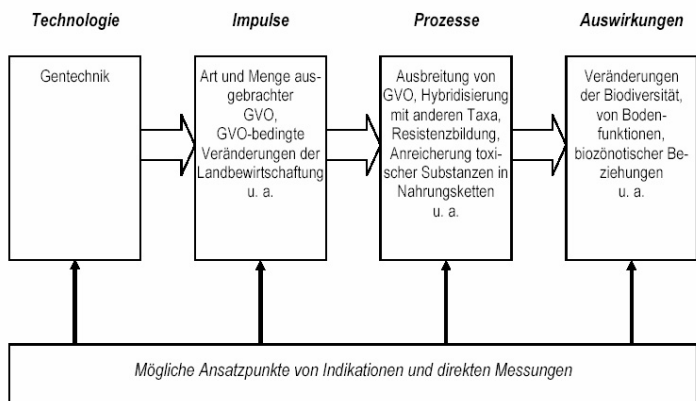
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Ingo Kowarik, Ulrich Heink und Robert Bartz

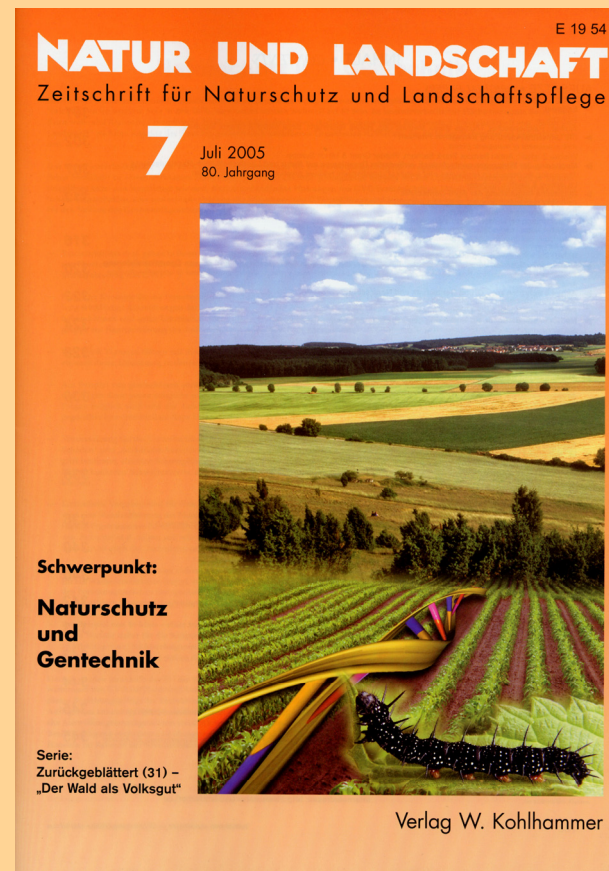
**„Ökologische Schäden“
in Folge der Ausbringung gentechnisch
veränderter Organismen im Freiland
– Entwicklung einer Begriffsdefinition und
eines Konzeptes zur Operationalisierung**



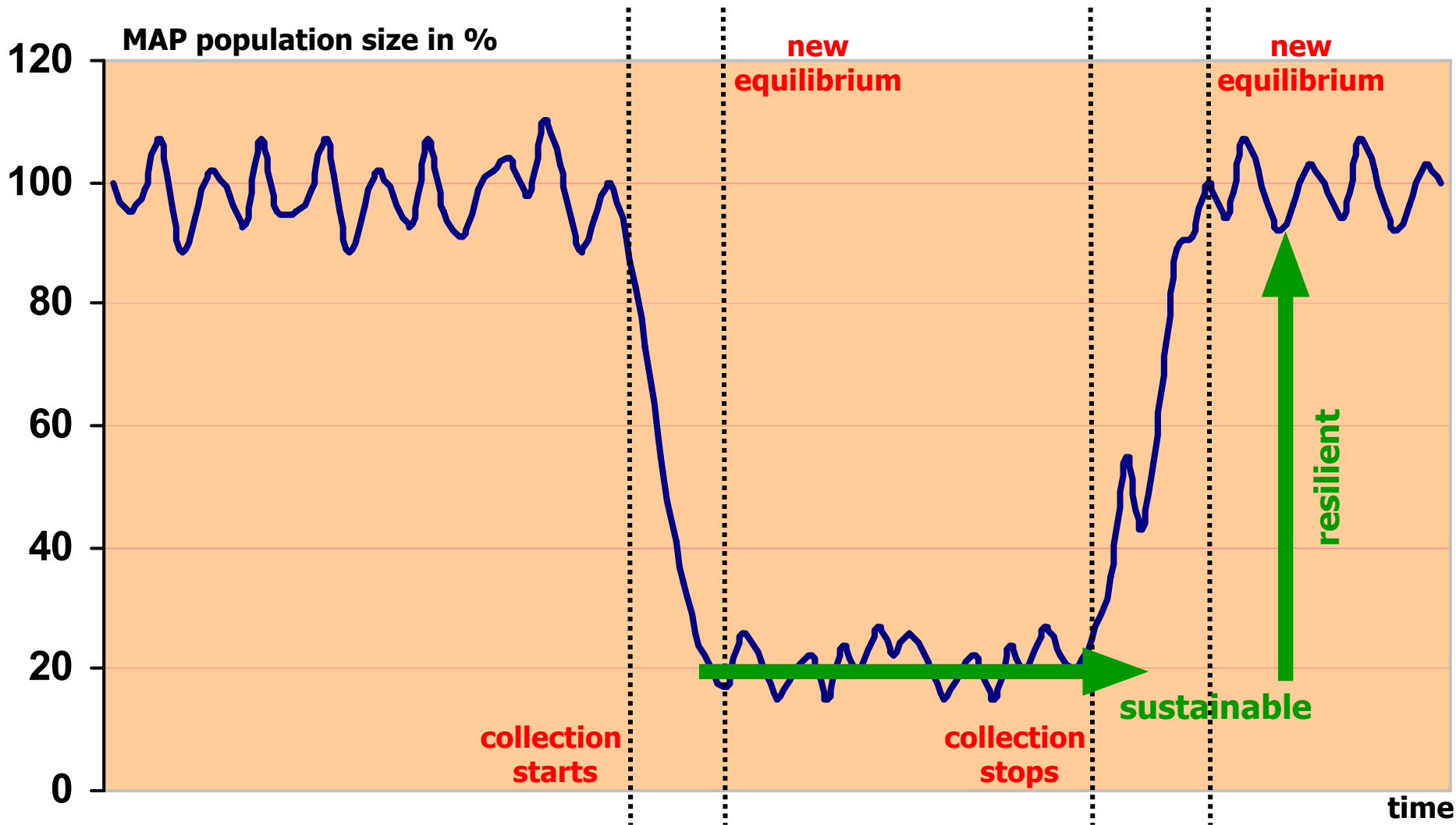
BfN-Skripten 166

2006

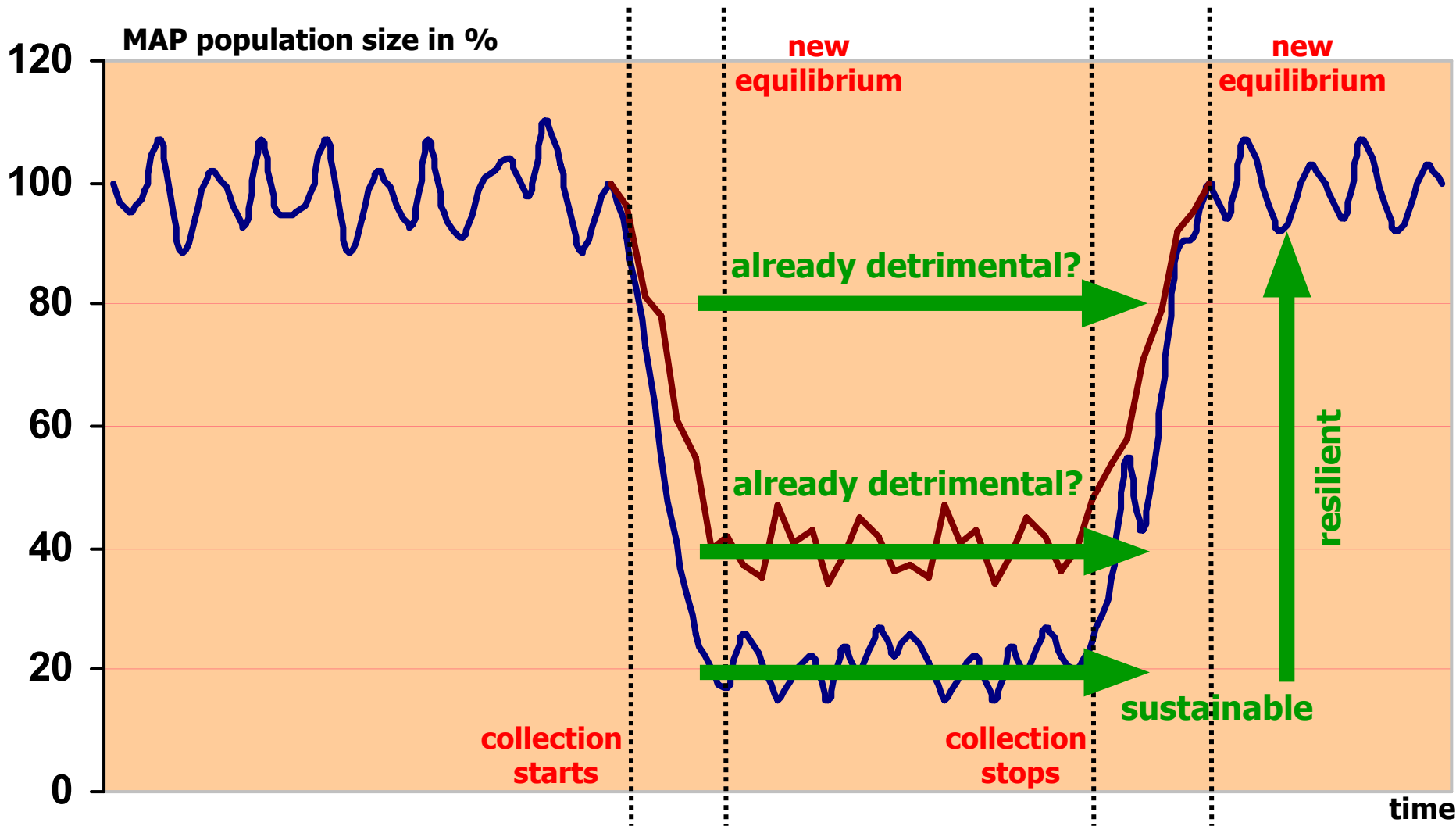
Bartz, R., Heink, U., Kowarik, I. (2005):
**Ökologische Schäden durch
Anwendungen der Agro-Gentechnik:
zum Schadensbegriff und dessen
Operationalisierung.** – Natur und
Landschaft 80 (7): 320-322.



Setting the scene ...

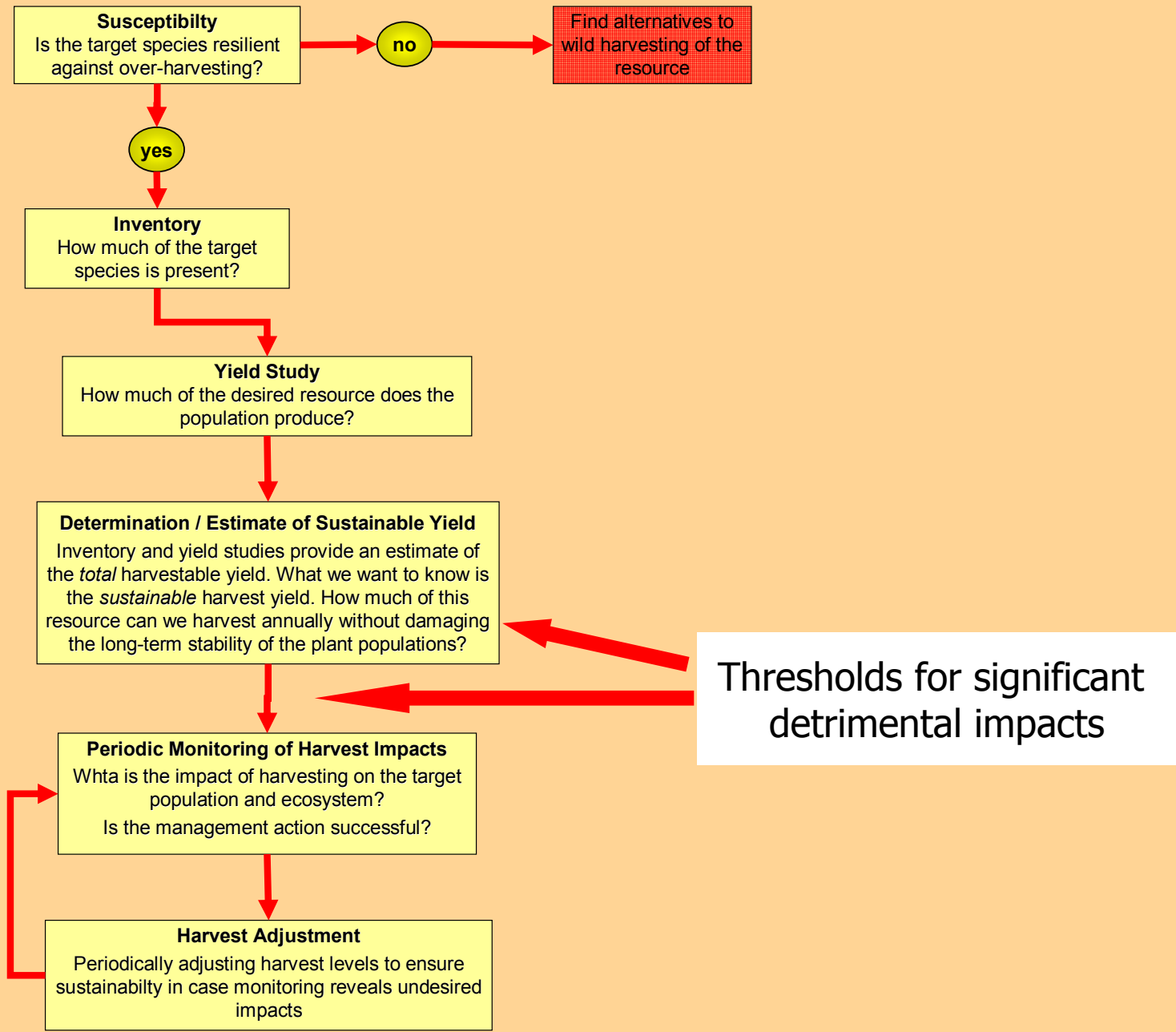


Setting the scene ...

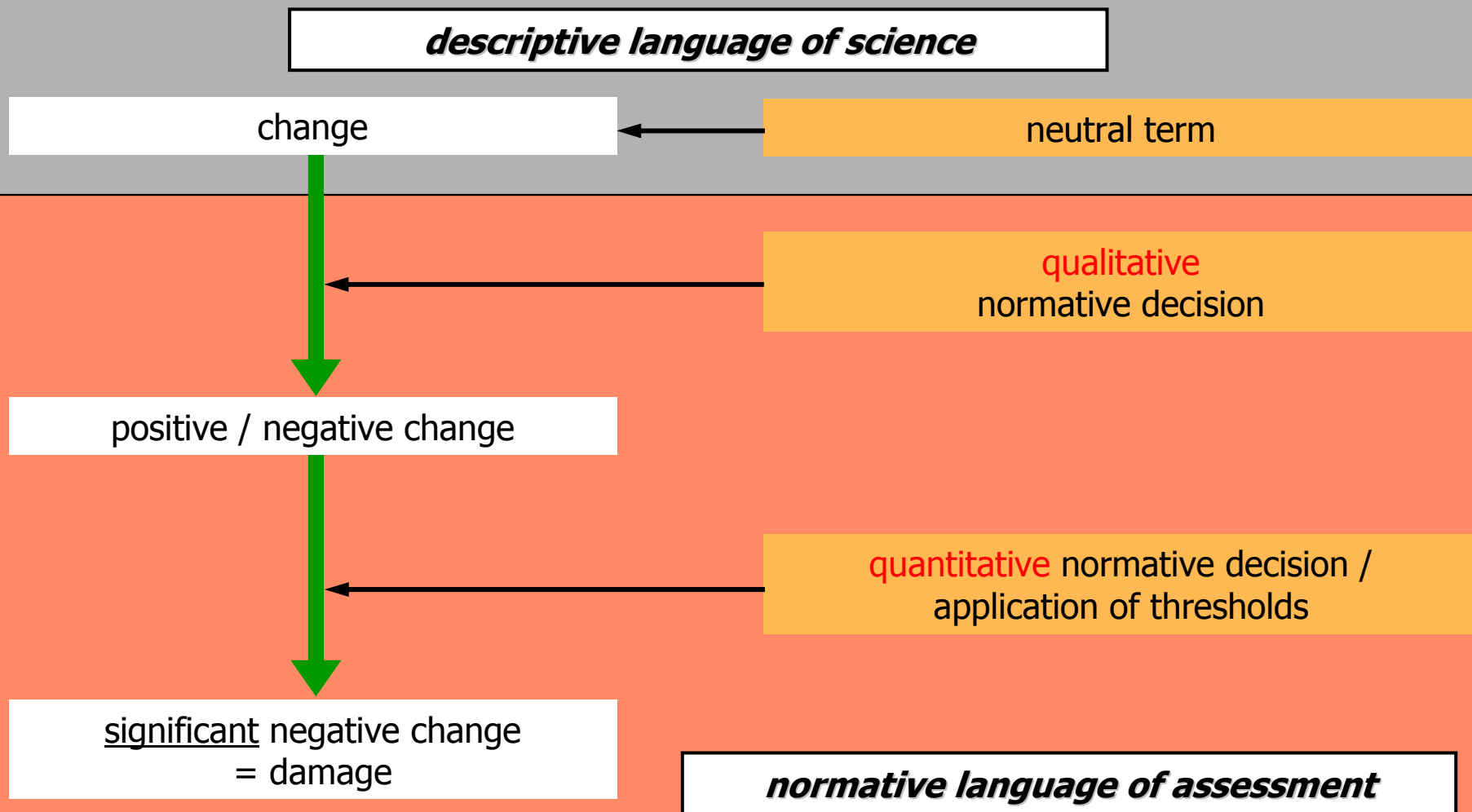


“How to ...” : A process of assessing, monitoring and adjusting the annual sustained yield

Uwe Schippmann



Some remarks on terminology or the language of assessment

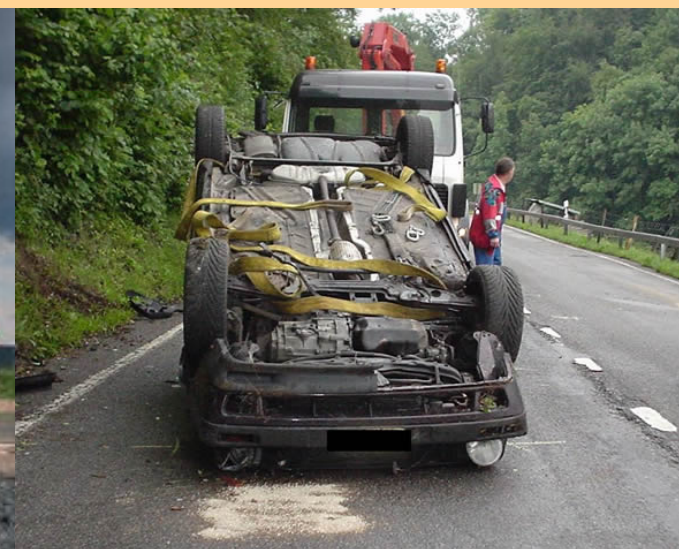


Damage – an everyday example ...

impulse

process

effect



Parameters/indicators to describe damages and preceding events

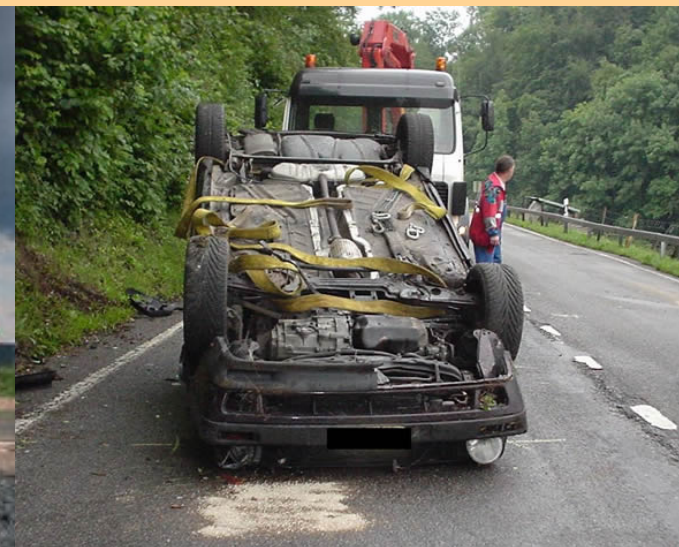
e. g. velocity, traffic
density



e. g. forces during
clash



e. g. costs to
repair the damage



Definition of environmental damage

An environmental damage caused by wild collection of MAP is a **significant direct or indirect detrimental impact** on a biotic subject of protection/regulation (animals, plants, fungi, microorganisms) or on an abiotic subject of protection/regulation (soil, water, air/climate).

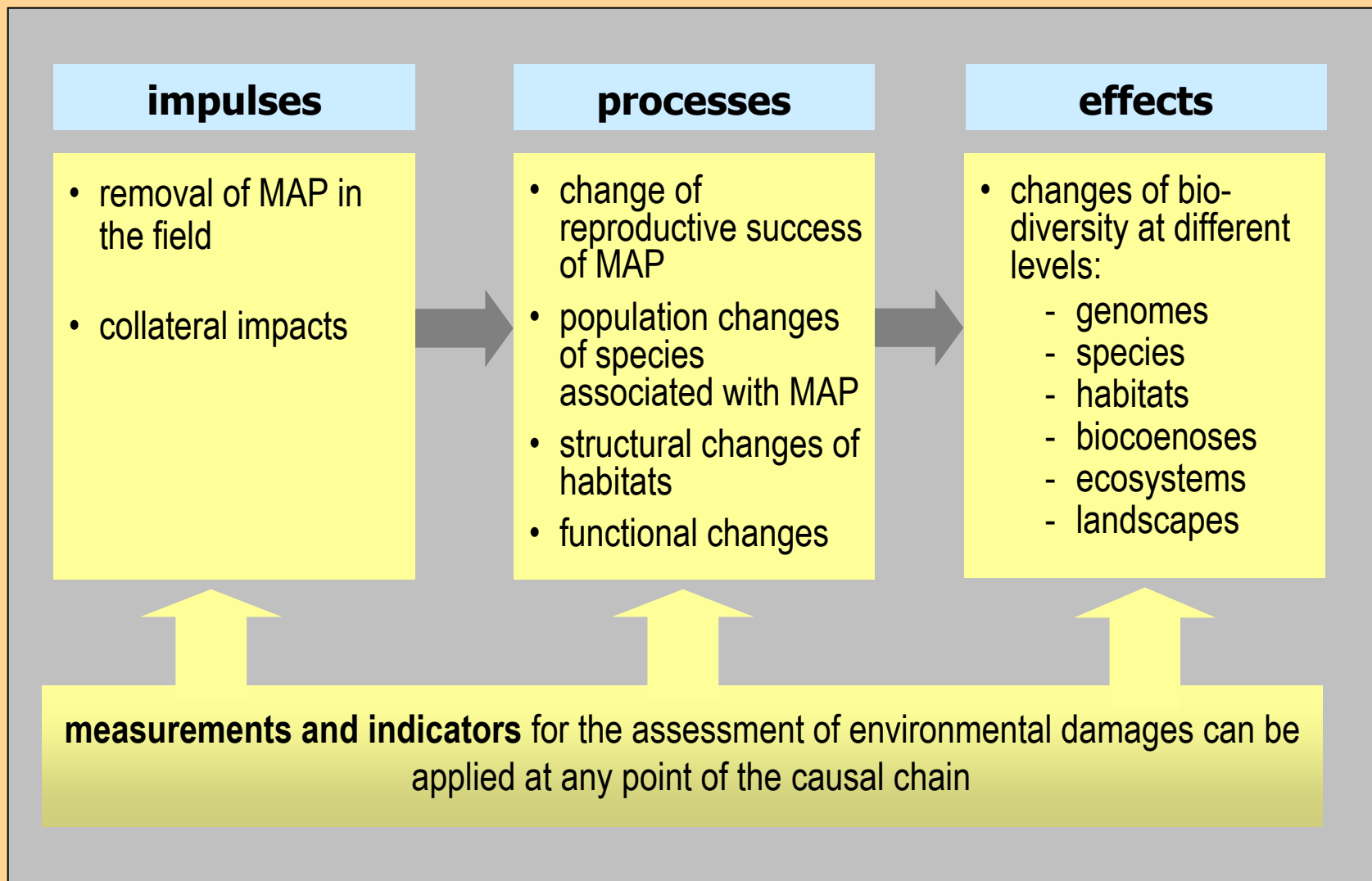
The damage may affect ...

- the subject of protection/regulation as a whole or
- any of its components or
- the functional and structural relations of the protected/regulated subject or
- the sustainable use of the protected/regulated subject including its functional and structural relations.

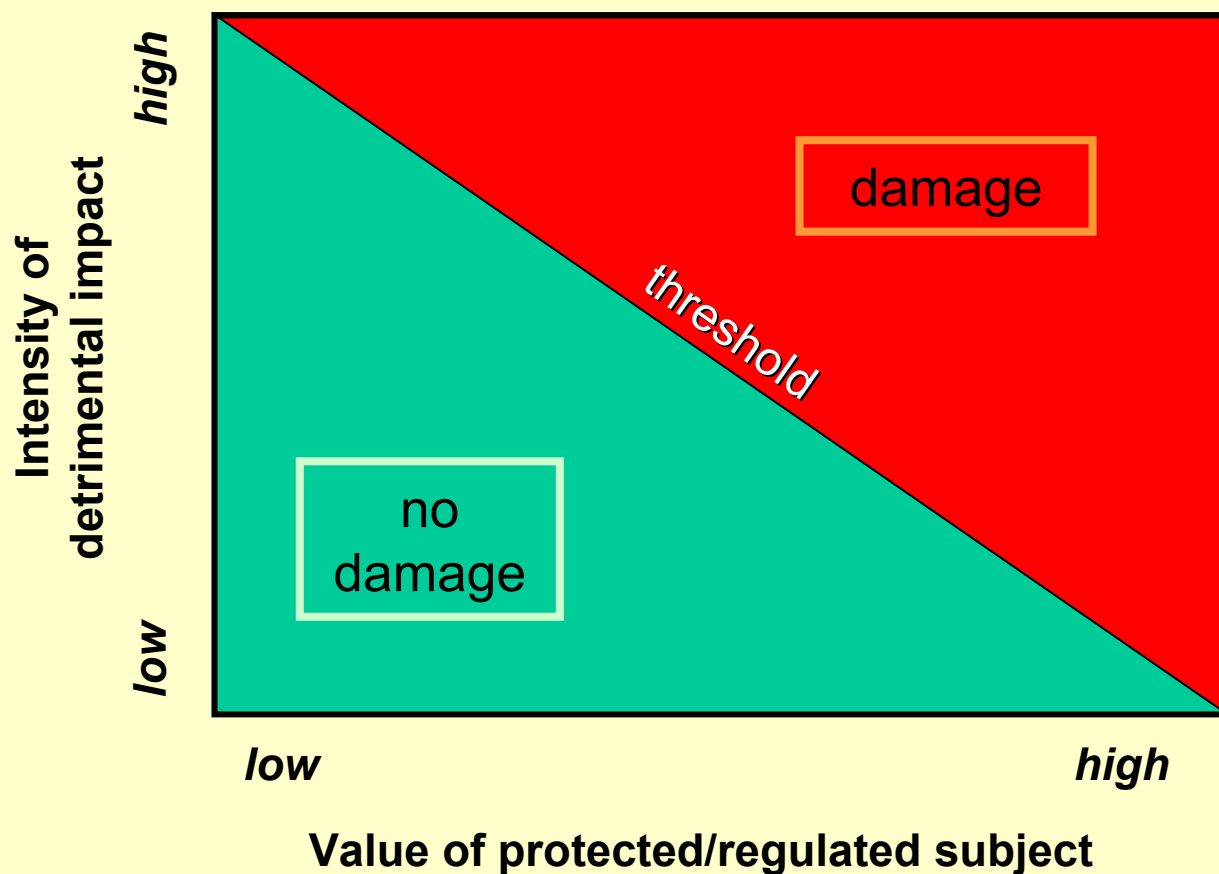
Conceptual frame ...

- Damages become apparent when we look at the protected/regulated **subjects** (⇒ definition).
- In the course of an assessment measurements and indicators **can point at ...**
 - the protected/regulated subjects,
 - preceding processes.

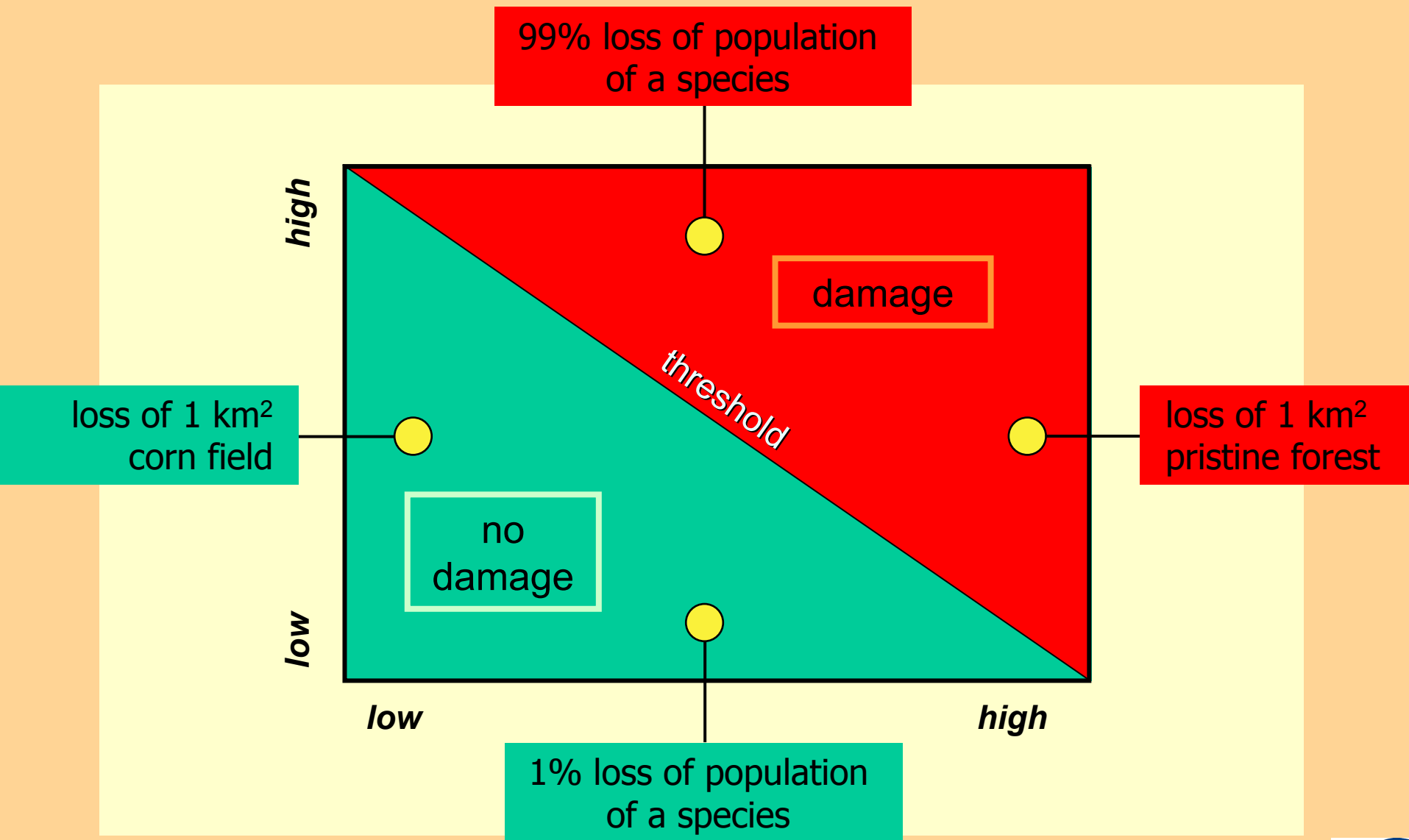
Cause effect chain of wild-collection of MAP



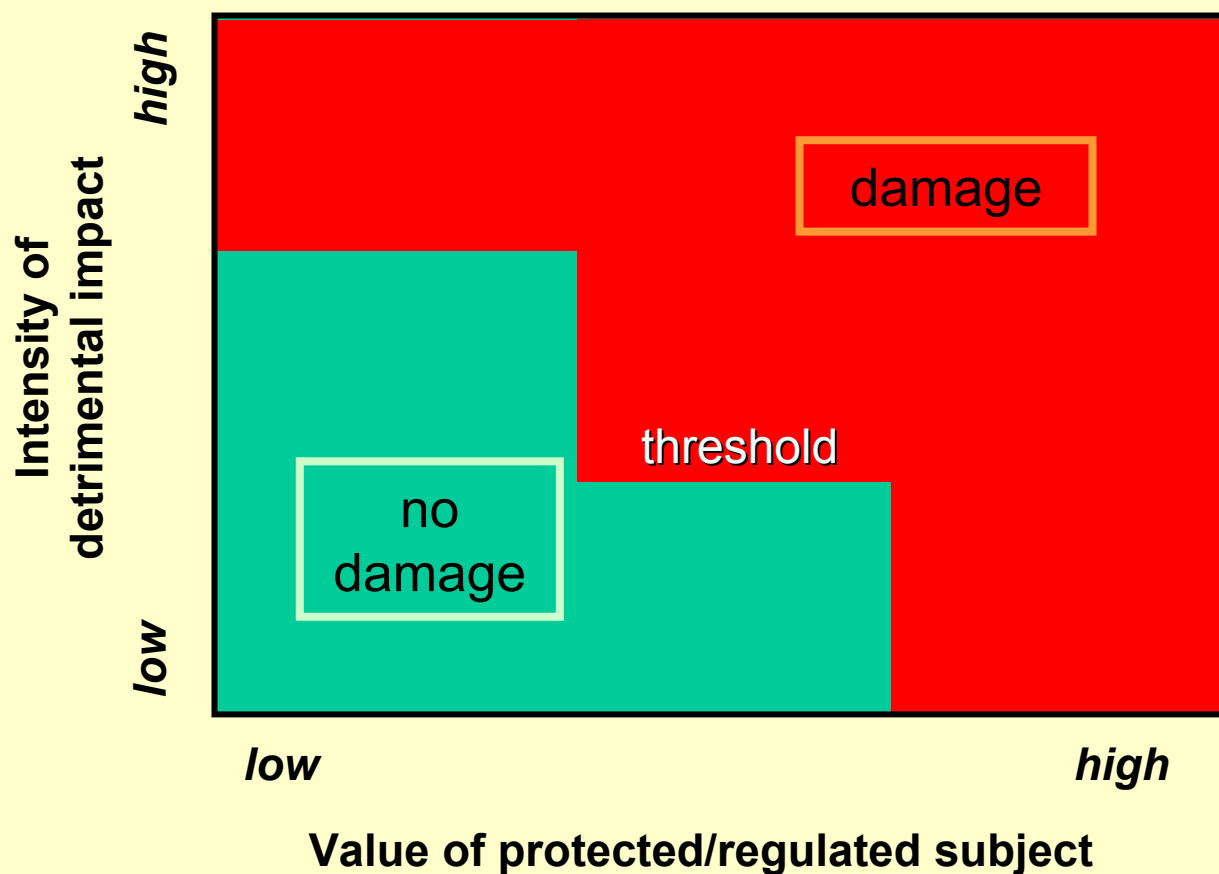
Setting the threshold for significant detrimental impacts



Setting the threshold for significant detrimental impacts



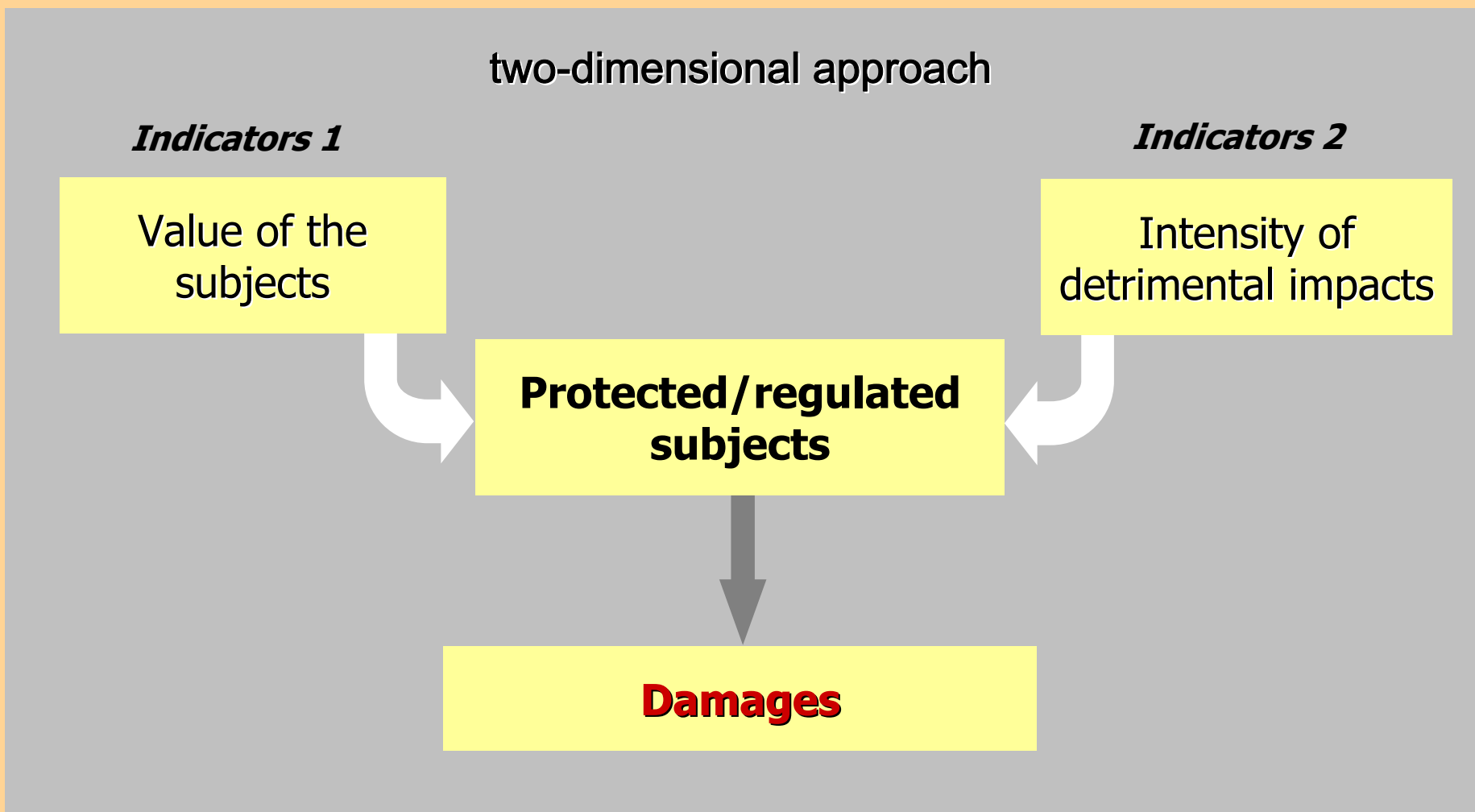
Setting the threshold for significant detrimental impacts



Examples of detrimental impacts on protected/regulated subjects

Subject	Changes		Detrimental impact
Species	Decreasing population size	⇒	Unwanted lowering of population size
	Decreasing frequency of certain genotypes	⇒	Unwanted reduction of genetic diversity
	Decreasing resources for phytophagous animals	⇒	Unwanted reduction of phytophagous animal populations
	Increasing disturbance of animals	⇒	Reduction of reproductive success of animals
Habitats	Loss of certain habitat structures	⇒	Reduction of animal populations depended on such structures
	Loss of essential abiotic habitat features	⇒	Loss of the habitat through conversion

Concept of assessing significant detrimental impacts



Criteria and indicators for the value of the protected/regulated subjects

two-dimensional approach

Indicators 1

Value of the
subjects

Indicators 2

Intensity of
detrimental impacts

Protected/regulated
subjects

Damages

Criteria and indicators for the value of the protected/regulated subjects

Rareness and endangerment

Rare and/or declining species, habitats or biocoenoses, detrimental factors known or putative

Responsibility for world-wide conservation

Importance of local / regional / national populations of a species for the world-wide conservation of this species

Closeness to (pristine) nature of habitats, biocoenoses and ecosystems

Measurement of the distance of the actual condition from the original pristine condition (historical perspective)

Importance in land use history

Importance of species, habitats, biocoenoses or ecosystems for the conservation of historical types of land use, which are today (almost) extinct

Typical composition of species and structures

Diversity and completeness of typical species and structures of a habitat

Conflict with local nature conservation goals

Local goals for the conservation of species and habitats may not be achieved, such goals are fixed e. g. in management plans, species conservation programmes, protected areas regulations

Legal protection status

Particularly protected species and habitats according to national and international law

Criteria and indicators ...

... for the value of the protected/regulated subjects

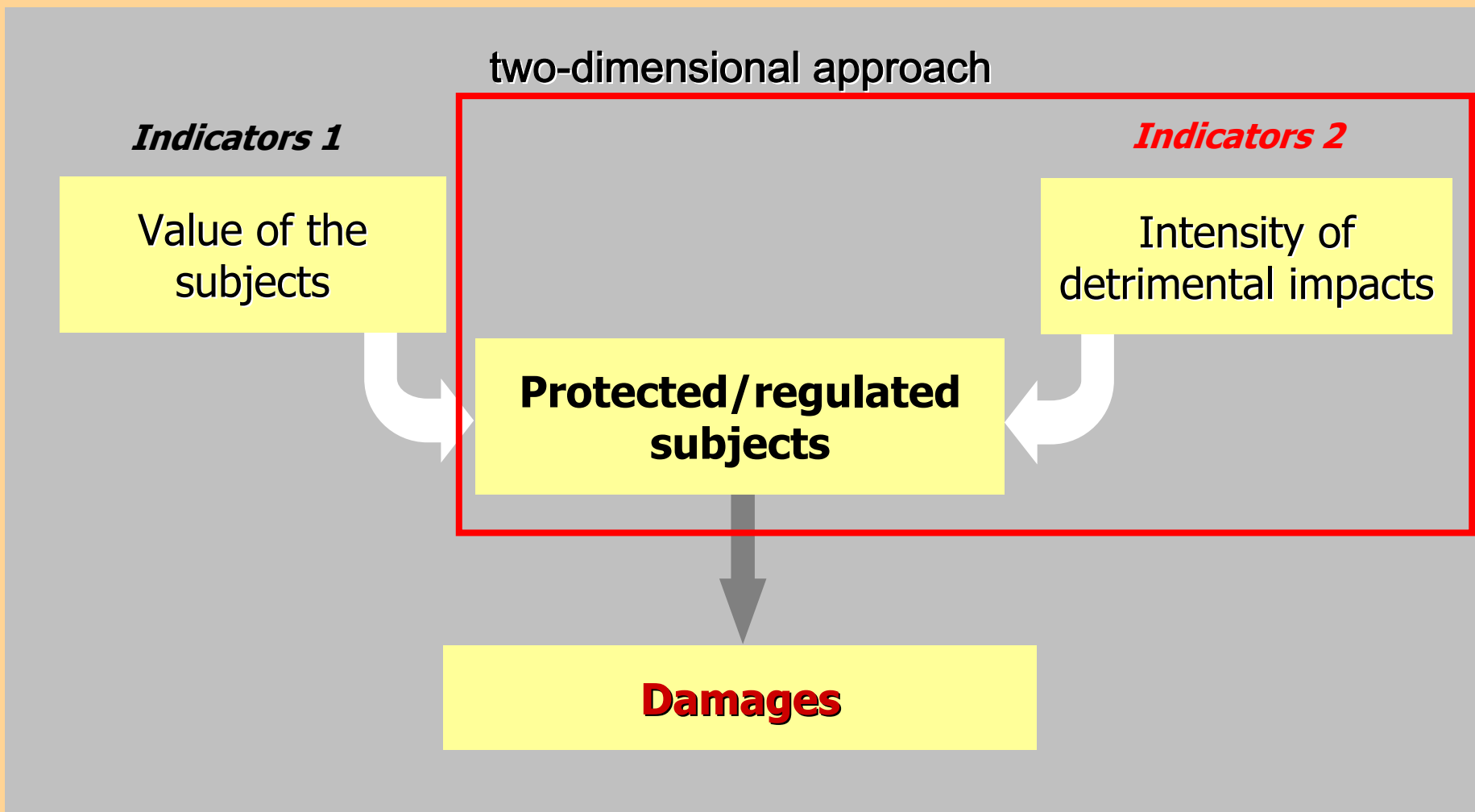
⇒ Application in prediction and monitoring

Criterion	Application	
	prospective	retrospective
Rareness and endangerment	●	●
Responsibility for world-wide conservation	●	●
Closeness to nature	●	●
Importance in land use history	(●)	(●)
Typical composition of species and structures	●	●
Conflict with local nature conservation goals	●	●
Legal protection status	●	●

Prospective: prediction; retrospective: monitoring

● = feasible, (●) = partly feasible, ○ = not feasible

Criteria and indicators for the intensity of detrimental impacts



Criteria and indicators for the intensity of detrimental impacts

Intensity and range in space and time of collection activities

e. g. frequency, period allowed for collection, collected quantities

Detrimental impacts on the target species

life history parameters (e. g. biomass of certain organs, number of flowers, fruits and seeds, size, age structure and distribution of populations, gene frequencies)

Detrimental impacts on non-target species

life history parameters describing other plant and animal species associated with the target species

Detrimental impacts on habitat structures

case-specific selection of parameters used for indication

Detrimental impacts on diversity, structures and functions of ecosystems and landscapes

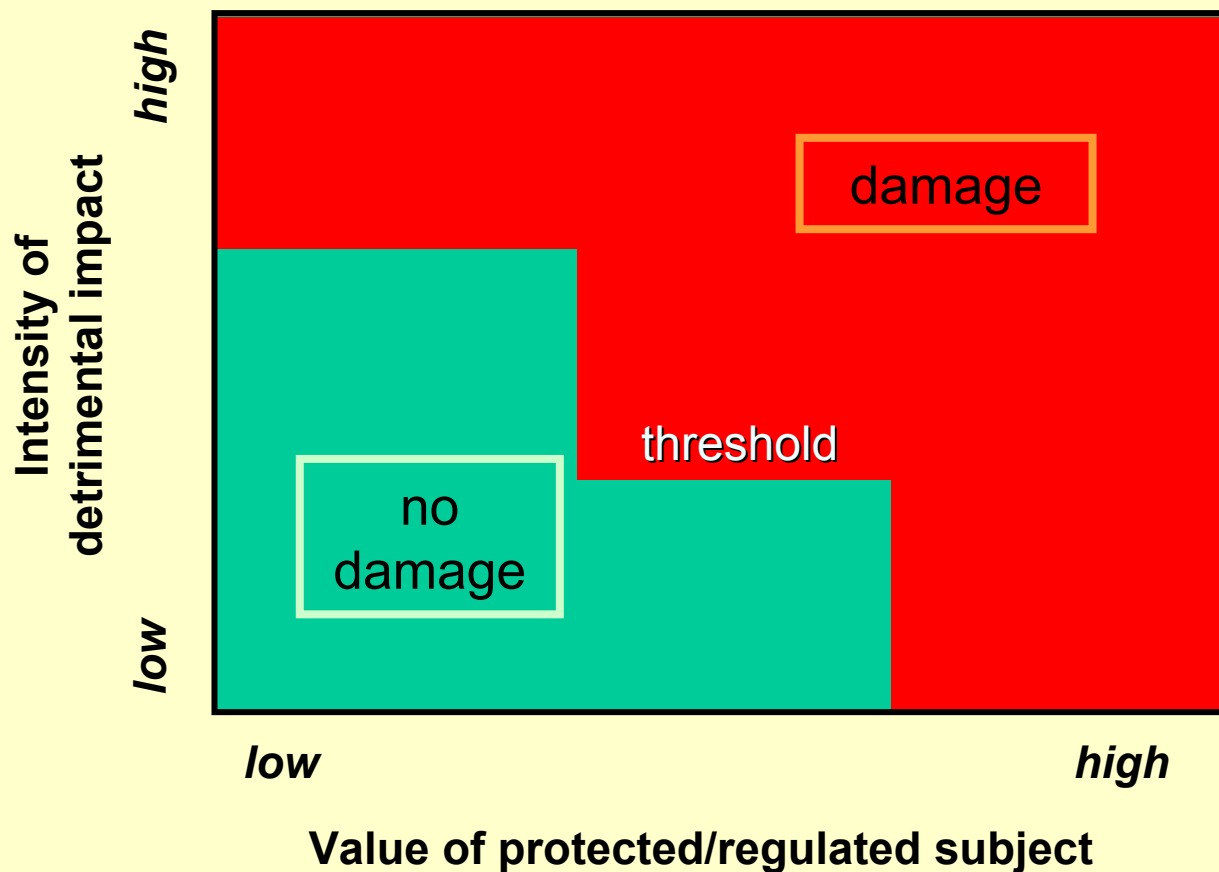
case-specific selection of parameters used for indication

...

Finalizing the procedure ...

- Fixing the thresholds according to normative conventions (usually done on a gradual scale for each indicator, e. g. from 1 to 5, threshold set at 3)
- Combining the two dimensions of the assessment (usually done in a two-dimensional matrix with weighing factors, calculation of grades leads to „steps“ in the threshold line)
- Getting a final result ⇒ damage / no damage

Setting the threshold for significant detrimental impacts



Some remarks on risk assessment ...

1. ... is performed **before** something may go wrong
2. ... is essentially based on **predictions**
3. ... is (very) **difficult** in case of complex ecosystems
4. ... provides tools to deal with **uncertainty**

Precautionary principle

Example: Local extinction of MAP caused by wild-collection		Actual effect	
		Local extinction	No local extinction
Predicted effect	Local extinction	right	false
	No local extinction	false	right

Precautionary principle

Example: Local extinction of MAP caused by wild-collection		Actual effect	
		Local extinction	No local extinction
Predicted effect	Local extinction	right	Acceptable
	No local extinction	Should be prevented	right

Conclusions

- Separate scientific descriptions from normative assessments.
- Sustainability and resilience are necessary criteria but not sufficient.
- Nature conservation values provide additional criteria.
- An environmental damage caused by wild-collection of MAP is a significant direct or indirect detrimental impact on a biotic or abiotic subject of protection/regulation.
- Expand your view from target plants to a more comprehensive picture of nature (non-target plants, ecosystems, landscapes).
- The definition of environmental damage is operated by selecting and applying various indicators (a) for the value of the protected/regulated subjects and (b) for the intensity of detrimental impacts (two-dimensional approach of environmental risk assessment).
- The final setting of thresholds is based on normative conventions.
- Learn from risk assessment and apply the precautionary principle.

Thank you for your attention!