



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Swiss Confederation

Federal Department of the Environment,  
Transport, Energy and Communications DETEC

**Federal Office for the Environment FOEN**  
Division Risk Prevention

# **ProtectBio – effect of protection forests on natural hazards due to gravity**

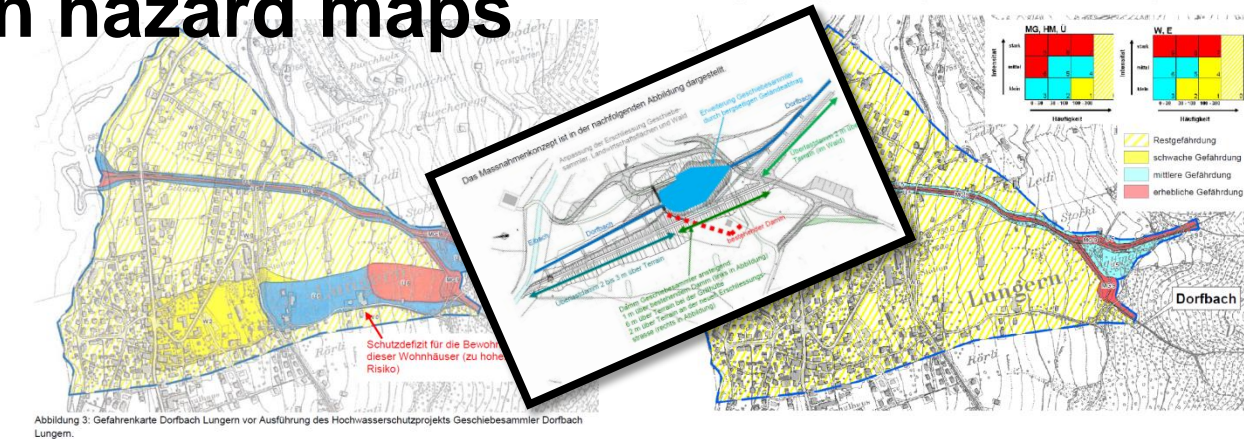
3rd European forest week – Silva 2015

Engelberg 4 november 2015



# Why a new method?

## Integration of protection works and forest in hazard maps



- Existing protection works are considered in hazard maps, hazard maps has to be updated when new protection works are built ► PROTECT
- Protection forests: Qualitative consideration based on expert knowledge → no systematic integration of protection forest



# Why a new method?



## PLANAT strategy 2004

### Paradigm change

«from defence against hazards to a integrated risk management»



# Why a new method?

## Integrated means:

- all important natural processes
- all stakeholders
- all possible risks
- every kind of possible measures
- ...

## Every kind of possible measures:

- ▶ in order to take every possible measure into account, a comparable assessment of the effectiveness of different measures is mandatory.



# ProtectBio

## Aims of ProtectBio

1. Assess the effects of biological protection measures in such a way that they can be compared to the effect of technical measures with the same objectives.
2. Evaluate if the principles for technical protection measures as defined in the guideline PROTECT can be applied for protection forests.
3. Development of a method to evaluate the relevance of biologic protection measure
4. Quantify the impact of biologic protection measures



## PROTECT Bio: Project Workflow

Part 1: Definition of the aims. Verifying if the principles of PROTECT can be applied to biological measures. Development of methods to prove if biological measures have an impact, if this measures can be quantified...

1. Part 2: Verifying and further development of the principles introduced in part 1 on the basis of five case studies.
2. Part 3: Syntheses of the findings.



## Nature of protection forests

1. Protection is only one of the functions of a forest
2. Impact depends on natural cycles
3. Large-scaled effect
4. Negative and positive interactions between forests and hazard processes
5. Protection forest can partially/temporarily be destroyed by natural hazards
6. Sustainability is of high importance



# ProtectBio

## Applicability of the 9 principles

PROTECT	Protection forest	Remarks
Effect quantifiable	✓ - ✗	<i>Depending on process</i>
Uncertainties	?	<i>Same difficulties for tech. works</i>
Scenarios	✓	<i>Risk to fail for intense events</i>
Delimitation of system	✓	
Permanent availability	✓	<i>Risk of large scale damage in protection forest is small</i>
Surveillance and maintenance	✓	<i>responsibility of forest service</i>
Temporary measures	(✓)	<i>E.g. lying logs</i>
Planned measures	(✓)	<i>Only for reforestation</i>
Time	✓	<i>Ensured by applying NaiS</i>





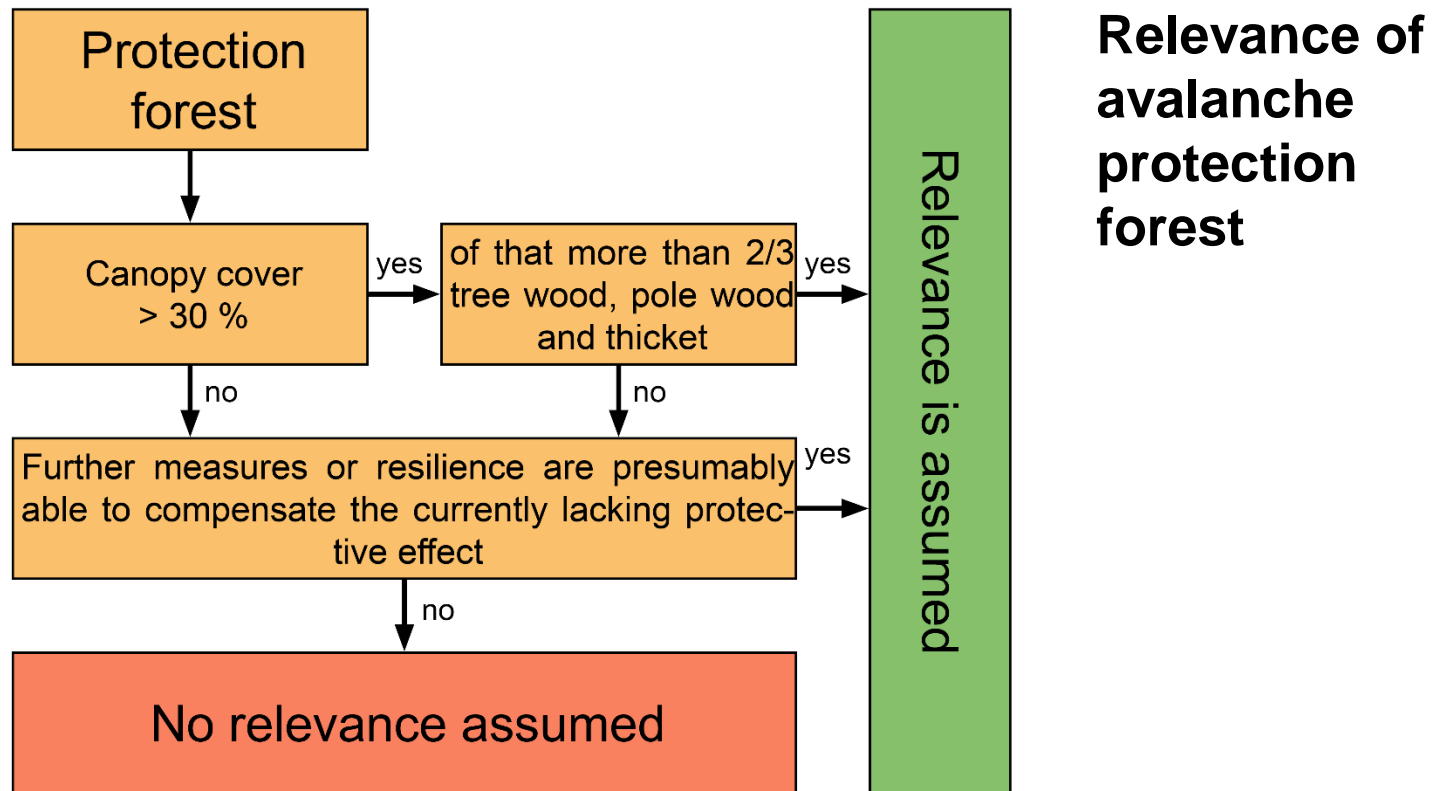
## Limits of applicability

- **At current state, the quantifiability of the forests' protection function is not given for big mass movements (ice- and rock-avalanches), medium and deep seated landslides and floods.**
- The return period of relevant damages in protection forest (storm, insects, forest fire) with an intensity that decrease the protective effect significantly for longer periods exceeds 50 years. Nevertheless, permanent availability has to be assessed in the individual case.



# ProtectBio: Rapid assessement

Is a protective effect expected?





# ProtectBio: Evaluation of measures

**Structural safety** ist the ability to resist an impact







# ProtectBio: Evaluation of measures

**Serviceability** ist the capacity of a forest to guarantee its protective function







# ProtectBio: Evaluation of measures

**Durability** means that the structural safety and the serviceability are ensured for at least 50 years





# ProtectBio: Evaluation of measures

## Reliability against rockfall

Structural safety?

- Basal area
- dbh, number of trees per area
- Size of stones
- Tree species

Serviceability

- minimal length of forested slope
- gaps or gullies in the forest

Durability?

- Regeneration
- Hazards (Storm, Insects ...)

Potential for forestal intervention or further measures?

- Improve of permanent availability by forestal intervention
- Improve bearing capacity by lying logs or piles of branches



# ProtectBio: Evaluation of measures

## Reliability of forest for different natural hazards

Main Process	Reliability of Forest	
	Possible	Quantifiability
Avalanches	✓	✓
Rockfall	✓ - ✗	✓ - ✗
Flood	✓	✗
Debris flow	✓ - ✗	✓ - ✗
Landslide	✓ - ✗	✓ - ✗





# ProtectBio: Evaluation of effects

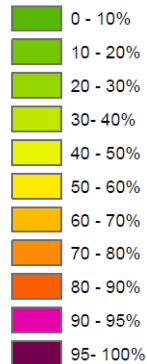
## Effect on reduction of rockfall frequency

Current forest

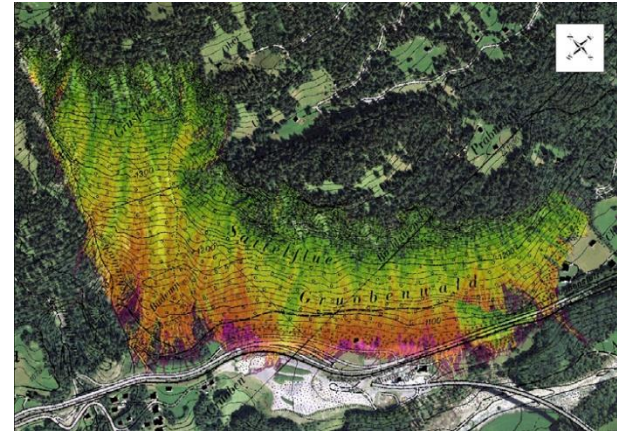
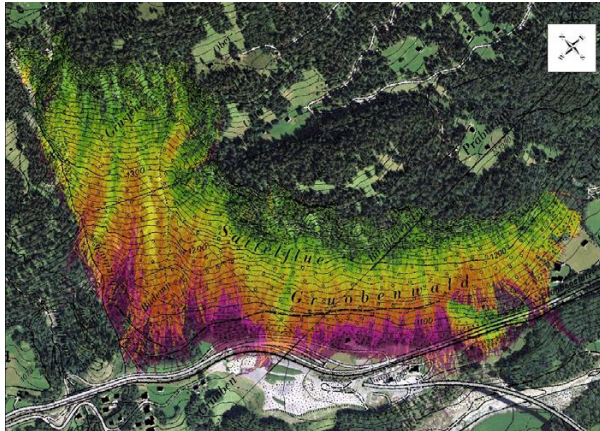
Tended forest (-30%)

### Legende

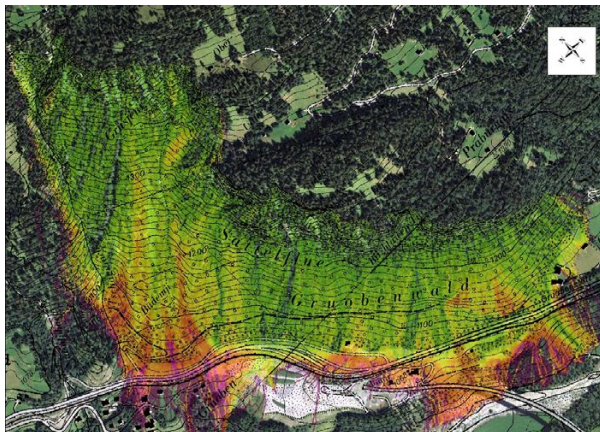
Reduktion der  
Durchgangsfrequenz  
durch Wald



0.4 m<sup>3</sup>



1.3 m<sup>3</sup>

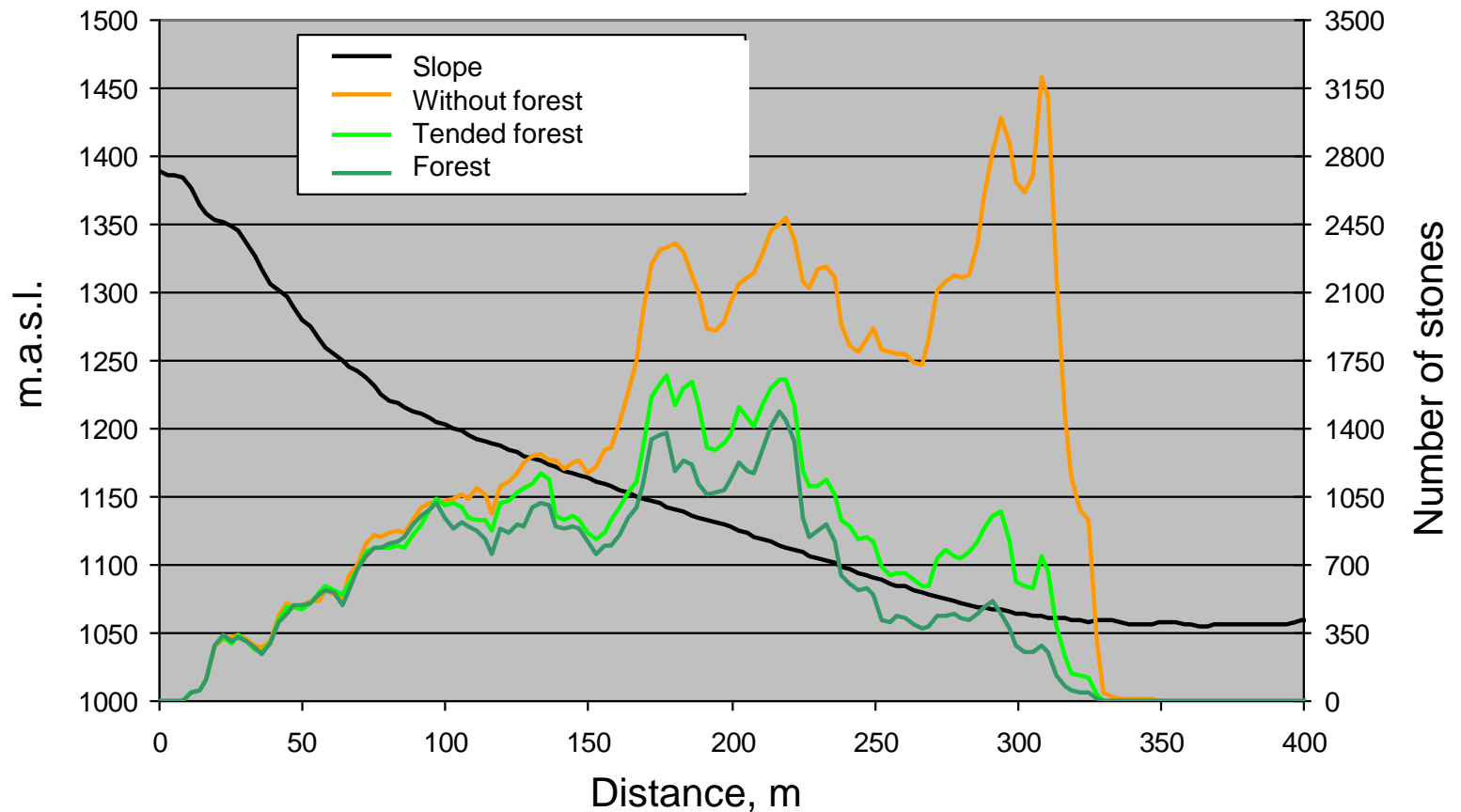






# ProtectBio: Evaluation of effects

## Effect on reduction of rockfall frequency





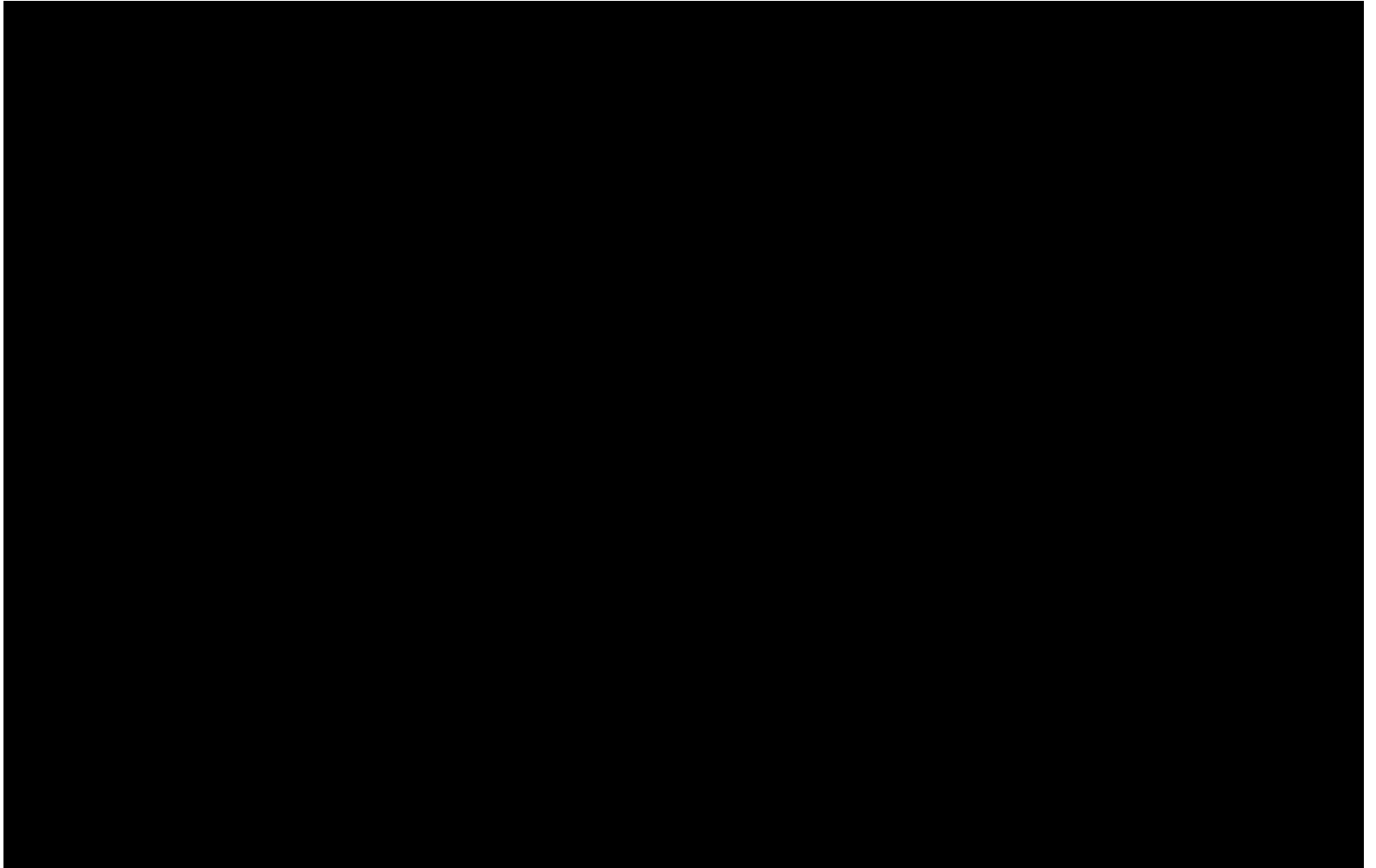
# ProtectBio: Applicability

Hazard Process	PROTECT-Bio applicable?
Avelanches	++
Rockfall	+++
Landslides	+ (important improvements expected in near future)
Flood	--



# ProtectBio: Conclusions

- The procedure for assessing the effect of technical protection measures can be applied to biological measures
- The concept is useful to assess the contribution of a specific stand to hazard protection
- ProtectBio is not suitable for a surface covering application (time- and money consuming / further research is needed).
- Report is available online  
<http://www.planat.ch/de/infomaterial-detailansicht/datum/2014/11/25/protect-bio/> (only in German), a fullpaper in the framework of the Interpretvent will be published 2016 in English.





# Why a new method?

## Hazard Maps in Switzerland: Review

- **1951:** First attempt to create hazard maps as a result of several snow avalanches (98 dead people)
- **1965:** First legal foundations for the production of hazard maps (Federal superintendence on forestry police)
- **1979:** Federal law on spatial planning laid stress on the importance of considering natural hazards for planning.
- **1991:** Federal laws on water construction and forestry oblige all Swiss cantons to create hazard maps for their municipalities.
- **2014:** Most of the Swiss cantons complete hazard zone mapping.





# PROTECT

- **PLANAT 2008: „PROTECT“:** Evaluation of the effect of protection measures (technical measures). **9 Principles** how and on what condition protection works are considered in hazard maps.

PROTECT	Remarks
Effect quantifiable	<i>Protection measures must have a quantifiable effect on the process</i>
Uncertainties	<i>Uncertainties of hazard assessment &lt; effect of protection measures</i>
Scenarios	<i>Evaluation of the effect for different scenarios (high/medium/low probability)</i>
Delimitation of system	<i>Evaluation of a single element and the whole system</i>
Permanent availability	<i>Availability given for at least 50 years</i>
Surveillance and maintenance	<i>must be guaranteed by an organisation</i>
Temporary measures	<i>are not taken into account</i>
Planned measures	<i>only after official building inspection</i>
Time	<i>Periodic inspection of hazard and protection measures</i>



# PROTECT

## 4 step procedure

1	Rapid assessement
2	Evaluation of measures
3	Evaluation of effects
4	Recommendations for spatial planning



# ProtectBio

Aim of case studies: (i) to verify the principles of PROTECT Bio on the basis of real objects, (ii) to complete the principles and (iii) to ensure that PROTECT Bio can be applied to real objects.

Five case studies for different natural hazards and situations:

- Avalanches
- Landslide
- Debris flow
- Flood
- Rockfall

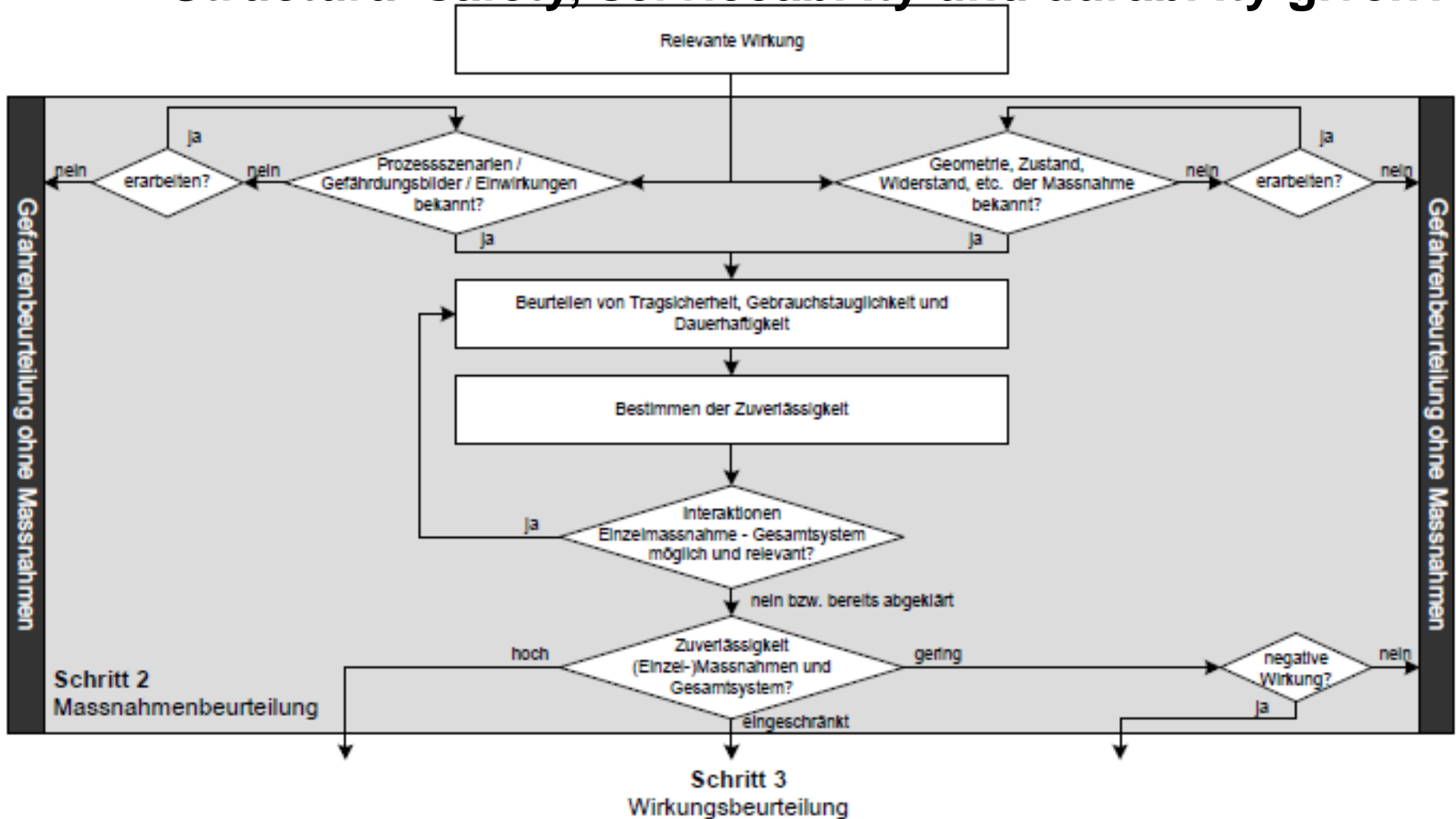






# ProtectBio: Evaluation of measures

## Structural safety, serviceability und durability given?





# ProtectBio: Evaluation of effects

**The evaluation of effects** quantifies the impact of the protection measures to the hazard process

