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# net risk work

## NET RISK WORK project outcomes: The Risk Assessment Matrix

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## Risk Dimensions

### Background:

The **Sendai Framework for Disaster Risk Reduction** highlights that: *“Policies and practices for disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment.*”





# Risk Assessment Matrix



## Risk Dimensions

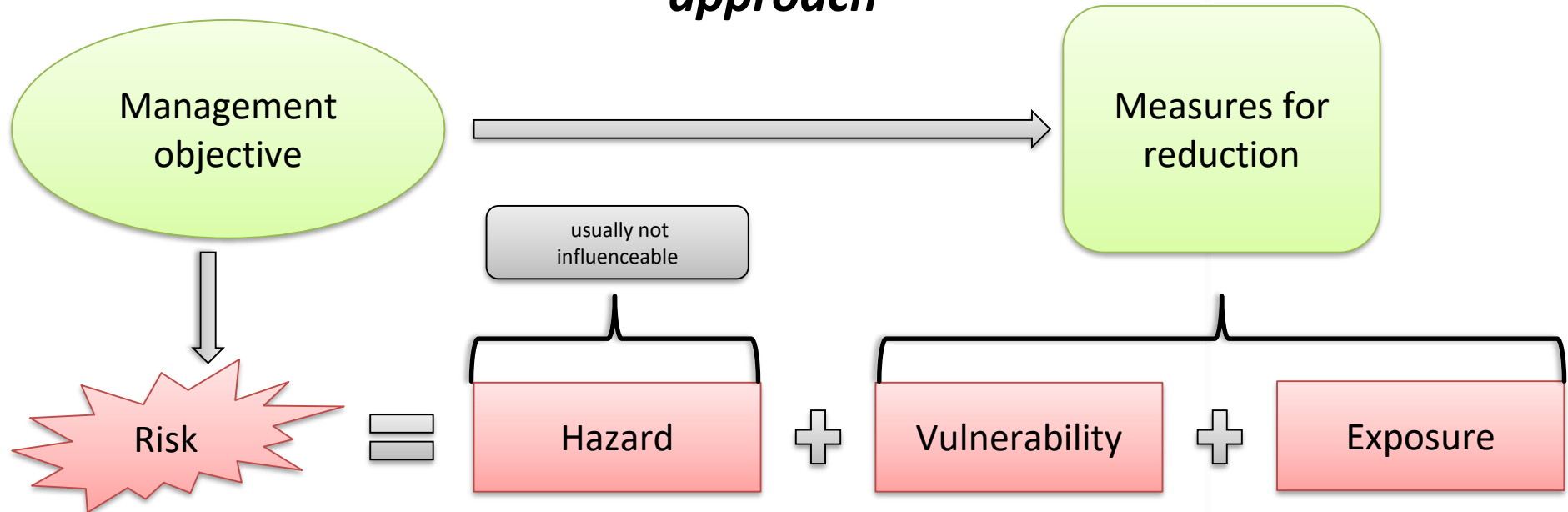
### Definitions:

- **Exposure** refers to the *inventory of elements in an area in which hazard events may occur* (Cardona, 1990; UNISDR, 2004, 2009b). Hence, if population and economic resources were not located in (exposed to) potentially dangerous settings, no problem of disaster risk would exist. While the literature and common usage often mistakenly conflate exposure and vulnerability, they are distinct. Exposure is a necessary, but not sufficient, determinant of risk. It is possible to be exposed but not vulnerable (for example by living in a floodplain but having sufficient means to modify building structure and behavior to mitigate potential loss). However, to be vulnerable to an extreme event, it is necessary to also be exposed. (SREX, 2012)
- **Vulnerability** refers to the *propensity of exposed elements* such as human beings, their livelihoods, and assets *to suffer adverse effects when impacted by hazard events*. Vulnerability is related to predisposition, susceptibilities, fragilities, weaknesses, deficiencies, or lack of capacities that favor adverse effects on the exposed elements. (SREX, 2012)



Relations between risk, its elements and management objectives

## *“Goal-oriented risk management approach”*





# Risk Assessment Matrix

## Objectives of the Risk Assessment Matrix

### *Why?*

- Analyze different forest risks (wildfire, storms, avalanches, and floods)
- Detect present and potential interactions between these hazards
- Identify factors and measures that have influence on vulnerability and exposure

### *How?*

- Harmonized risk assessment methodology
- Risk comparability thanks to abstract level
- Goal-oriented risk management approach

### *What?*

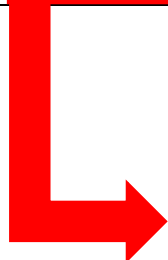
- Systematic single risk assessments conducted for each forest risk
- Subsequent risk interaction assessment, based on results of single risk assessment
- Identification of new types of risk and understanding of interlinked risk relations

# Risk Assessment Matrix

## Single Risk Assessment

Management objective:				
Hazard	Storm	Fire	Flood	Avalanche
Impact on Vulnerability	Natural influence	Natural influence	Natural influence	Natural influence
	Human influence	Human influence	Human influence	Human influence
Impact on Exposure	Natural influence	Natural influence	Natural influence	Natural influence
	Human influence	Human influence	Human influence	Human influence

Single risk  
assessment  
overview



General Information

Impact on Vulnerability

Impact on Exposure

# Risk Assessment Matrix

## The Single Risk Assessment Sheet I

### General Information

Author	<i>(Name and institution)</i>
Management Objective	Category of management objective: <b>Please choose</b>
	Please specify: <i>(e.g. expected outcome / yield, desired state / function of forest )</i>
Hazard type	Hazard analyzed: <b>Please choose</b>
	Please specify: <i>(e.g. intensity of impact, areal extent, duration of impact, probability of occurrence, predictability of the event)</i>
Area of applicability	Please describe regional limitations etc. <i>(e.g. geographic region, climate zone, socio-cultural context)</i>

Selecting the category of management objective is necessary to apply the goal-oriented risk assessment approach.

Select a hazard type. It determines the general impact on the forest ecosystem.

### Impact on Vulnerability

Natural Influence	Description	Effect on vulnerability
Please name	Please describe	choose...
		choose...
		choose...
		choose...


**Vulnerability:**  
“... propensity of exposed elements [...] to suffer adverse effects [...]” (SREX 2012).

**Natural Influence:**  
factors influenced by the natural context and cannot be influenced by humans

# Risk Assessment Matrix

## The Single Risk Assessment Sheet II

*Human Influence:*  
Human measures that actively alter vulnerability.

Human Influence	Description	Effect on vulnerability	 1
Please name	Please describe	choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>


Choose if a factor increases or decreases vulnerability. It can also be “unknown”.

*Exposure:* “... inventory of elements in an area in which hazard events may occur.” (SREX 2012).

### Impact on Exposure

Natural Influence	Description	Effect on Exposure
Please name	Please describe	choose...
		choose...
		choose...
		choose...

Elements vary largely by the set management objective.

Human Influence	Description	Effect on Exposure	 2
Please name	Please describe	choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>

The check box indicates if a measure/activity can be found in the [“Tools and best practices on risk planning and management for fire, storms, floods and avalanches”](#)





# Risk Assessment Matrix

## Example: Single Risk Assessment


### Example:

Management  
objective:  
"Income"

Hazard:  
"Storm"


### Impact on Vulnerability

Natural Influence	Description	Effect on vulnerability
Water logged soil	Trees are not able to build deep roots	Increase

Human Influence	Description	Effect on vulnerability	
Thinning activities	Selective thinning to increase mechanical stability of single trees	Decrease	<input type="checkbox"/>
Tree species composition	Adaption of the tree species composition according to the <i>tree species suitability maps</i>	Decrease	<input checked="" type="checkbox"/>

### Impact on Exposure

Natural Influence	Description	Effect on Exposure
None found	-	choose...

Human Influence	Description	Effect on Exposure	
Early harvesting	Early harvesting of vulnerable stands can save values before damage.	Decrease	<input type="checkbox"/>
Storm damage insurance	Risk transfer to insurer	Decrease	<input type="checkbox"/>

# Risk Assessment Matrix

## Risk Interaction Assessment

*Risk interaction assessment, overview from single risk to risk interaction*

Management objective:						
Hazard	Storm	Fire	Flood	Avalanche		
Impact on Vulnerability	Natural influence	Natural influence	Natural influence	Natural influence	Previous storm	
	Human influence	Human influence	Human influence	Human influence		
Impact on Exposure	Natural influence	Natural influence	Natural influence	Natural influence		
	Human influence	Human influence	Human influence	Human influence		
Hazard	Storm	Fire	Flood	Avalanche		
Impact on Vulnerability	Natural influence	Natural influence	Natural influence	Natural influence		Previous Fire
	Human influence	Human influence	Human influence	Human influence		
Impact on Exposure	Natural influence	Natural influence	Natural influence	Natural influence		
	Human influence	Human influence	Human influence	Human influence		
Hazard	Storm	Fire	Flood	Avalanche		
Impact on Vulnerability	Natural influence	Natural influence	Natural influence	Natural influence	Previous Flood	
	Human influence	Human influence	Human influence	Human influence		
Impact on Exposure	Natural influence	Natural influence	Natural influence	Natural influence		
	Human influence	Human influence	Human influence	Human influence		
Hazard	Storm	Fire	Flood	Avalanche		
Impact on Vulnerability	Natural influence	Natural influence	Natural influence	Natural influence		Previous Avalanche
	Human influence	Human influence	Human influence	Human influence		
Impact on Exposure	Natural influence	Natural influence	Natural influence	Natural influence		
	Human influence	Human influence	Human influence	Human influence		

# Risk Assessment Matrix

## The Risk Interaction Assessment Sheet II

Similar layout as  
single risk  
assessment sheet.

### General Information

Author	<i>(Name and institution)</i>
Management Objective	Category of management objective: <b>Please choose</b>
	Please specify: <i>(e.g. expected outcome / yield, desired state / function of forest )</i>
Hazard type	Hazard analyzed: <b>Please choose</b>
	Previous hazard: <b>Please choose</b>
	Please specify: <i>(e.g. intensity of impact, areal extent, duration of impact, probability of occurrence, predictability of the event)</i>
Area of applicability	Please describe regional limitations etc. <i>(e.g. geographic region, climate zone, socio-cultural context)</i>

A previous hazard is chosen. The risk interaction assessment analyses the risk prior to a following hazard.

Please copy and paste the analysis from the → **single risk assessment**


### Impact on Vulnerability

Natural Influence	Description	Effect on vulnerability
Please name	Please describe	choose...
		choose...
		choose...
		choose...

The results of the single risk assessment are copied into the risk interaction sheet.


# Risk Assessment Matrix

## The Risk Interaction Assessment Sheet II

Human Influence	Description	Effect on vulnerability	 1
Please name	Please describe	choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>

### Impact on Exposure

Natural Influence	Description	Effect on Exposure
Please name	Please describe	choose...
		choose...
		choose...
		choose...

Human Influence	Description	Effect on Exposure	 2
Please name	Please describe	choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>
		choose...	<input type="checkbox"/>



# Risk Assessment Matrix

## Example: Risk Interaction Assessment

### Example:

Management objective: "Income"


Hazard: "Storm" after "Avalanche"

Question: What does the previous hazard change?

### General Information

#### Impact on Vulnerability


Natural Influence	Description	Effect on vulnerability
Water logged soil	Trees are not able to build deep roots	Increase
Pre-damage	Destabilization of stands through avalanche	Increase

Human Influence	Description	Effect on vulnerability	 3
Thinning activities / salvage logging	Selective thinning or salvage logging can lead to an increased or decreased stability caused by the need to remove damaged trees.	Unknown	<input type="checkbox"/>
Tree species composition	Adaption of the tree species composition according to the tree species suitability maps	Decrease	<input checked="" type="checkbox"/>

Factors related to the interaction of risks are written in red.

#### Impact on Exposure

Natural Influence	Description	Effect on Exposure
None found	-	choose...

Human Influence	Description	Effect on Exposure	 4
Early harvesting	Early harvesting of vulnerable stands can save values before damage.	Decrease	<input type="checkbox"/>
Storm damage insurance	Risk transfer to insurer	Decrease	<input type="checkbox"/>



# Risk Assessment Matrix

## Lessons learned

***Sounds complex and complicated?***

***Yes, it is an abstract exercise!***

***... but we want to:***

- ***Compare risks***
- ***Identify new types of risks***
- ***Better understand risk interactions***



# Risk Assessment Matrix

## Main challenges I

- ***Defining a „case“***  
“A delicate balance between being specific enough to be able to identify driving factors and remaining as general as possible to allow drawing common conclusions.”
- ***Goal-oriented risk management approach***  
Factors and risk management measures in the sheet, should relate to the management objective. When coming up with a factor, check in what way it is influencing the possibility to reach the set management objective.
- ***Difference and definition of „vulnerability“ and „exposure“***  
Vulnerability: tendency/propensity of exposed elements to suffer negative consequences, when impacted by a hazard event.  
Exposure: sum or inventory of exposed elements, which can be affected by a hazard.



# Risk Assessment Matrix

## Main challenges II

### *To address these challenges...*

- ***We created:***
  - A Guideline – How to Fill the Assessment Sheet
  - An annotated example for Single Risk Assessment
  - General Comments on main challenges with the matrix
- ***We updated***
  - several sections of the risk assessment matrix
- ***We reviewed***
  - 30 single risk assessments and risk interaction sheets
- ***We discussed***
  - objectives and purpose of the risk assessment matrix





# Risk Assessment Matrix

## Preliminary results of single risk assessments

- *3-4 per sheets per partner organisation*
- *Total 21 sheets*
- *Sorted by hazard and management objective*

Single Risk Assessments:					
Management objective	Hazard				
	Storm	Fire	Flood	Avalanche	Other
Income	1	-	1	-	-
Protection	1	3	2	1	-
Recreation	1	3	-	-	-
Nature conservation	1	3	-	-	-
Other	-	-	-	-	1

# Risk Assessment Matrix

## Preliminary results of risk interaction assessments I

- 2-3 per sheets per partner organisation
- Total 15 sheets
- Sorted by previous hazard, analysed hazard, and management objective

Risk Interaction Assessments:						
Hazard	Storm	Fire	Flood	Avalanche	Other	
Income	1	-	-	1	-	Previous storm
Protection	-	-	-	-	-	
Recreation	-	1	-	-	-	
Nature conservation	-	1	-	-	-	
Other	-	1	-	-	-	
Hazard	Storm	Fire	Flood	Avalanche	Other	
Income	-	-	1	-	-	Previous Fire
Protection	-	-	2	1	-	
Recreation	-	2	-	-	-	
Nature conservation	-	-	1	-	-	
Other	-	-	-	-	-	
Hazard	Storm	Fire	Flood	Avalanche	Other	
Income	-	-	-	-	-	Previous Flood
Protection	-	1	-	-	-	
Recreation	-	1	-	-	-	
Nature conservation	-	-	-	-	-	
Other	-	-	-	-	-	

# Risk Assessment Matrix

## Preliminary results of risk interaction assessments II

- *2-3 per sheets per partner organisation*
- *Total 15 sheets*
- *Sorted by previous hazard, analysed hazard, and management objective*

Risk Interaction Assessments:						
Hazard	Storm	Fire	Flood	Avalanche	Other	
Income	-	-	-	-	-	Previous Avalanche
Protection	-	-	-	-	-	
Recreation	-	-	-	-	-	
Nature conservation	-	-	-	-	-	
Other	-	-	-	-	-	
Hazard	Storm	Fire	Flood	Avalanche	Other	
Income	-	-	-	-	-	Previous Other
Protection	-	-	-	-	-	
Recreation	-	-	-	-	-	
Nature conservation	-	1	-	-	-	
Other	-	-	-	-	-	



# Risk Assessment Matrix

## Outlook

### ***Value and purpose of the results***

- ***A collection of influencing factors:***
  - What are the main risk drivers
  - What factors are multi-risk related
- ***A comparison of management objectives***
  - Which factors are drivers in different management objectives
  - *Do different management objectives stand in conflict to each other regarding risk*
- ***Building a database***
  - Based on a growing number of information, a database of factors and drivers can be obtained
- ***Open to others***
  - The method and sheets are open for other experts to add their experience



# Risk Assessment Matrix



## Discussion

- **Guiding questions:**
- Do you have experience with interaction of two risks?
  - Share your story/example!
- Do you know other approaches to assess interaction of risks?
  - Share your story/example!



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