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## **RISK AND DISASTER MANAGEMENT IN NATURAL HAZARDS AS FLOODS, DEBRIS FLOWS, LANDSLIDES, ROCKFALL AND AVALANCHES IN AUSTRIA**

## **RISIKO- UND KATASTROPHENMANAGEMENT FÜR DIE NATURGEFAHREN HOCHWASSER, MUREN, RUTSCHUNGEN, STEINSCHLAG UND LAWINEN IN ÖSTERREICH**

by

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### **ABSTRACT**

**Keywords:** risk and disaster mangagment, natural hazards, legal basis, torrent and avalanche control, risk- and disaster management circle

To control natural hazards is a national task of paramount importance for the authorities in charge in the alpine countries. In order to ensure a maximum level of safety integrated and sustainable acting strategies and concepts are necessary. Natural hazards can only be encountered successfully by integrated risk and disaster management.

In Austria competencies in Risk and Disaster Management (RDM) are based on special acts and distributed hierarchically among the state, the federal states and the municipalities according to the Austrian constitution.

A risk and disaster management circle as a systemic and integral model, which combines risk assessment, prevention, disaster management and regeneration, is used in order to protect against natural hazards by a proper and efficient participatory approach.

The Forest Engineering Service for Torrent and Avalanche Control in Austria is one of the actors in RDM and applies an adapted system for analysing and assessing risks, deriving protection concepts against natural hazards, realises and maintains them.

A new technical directive for planning and financial support of protection measures based on the Austrian federal water constructions financing act was worked out recently. By means of this directive regional surveys, the prioritization of projects and general planning were introduced to this risk management circle.

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The paper gives a survey of the well approved and new instruments and their benefits in a risk management circle and shows the Austrian approach to an integrated risk and disaster management as an effective and self-contained system.

## ZUSAMMENFASSUNG

**Keywords:** Risiko- und Katastrophenmanagement, Naturgefahren, gesetzliche Grundlage, Wildbach- und Lawinenverbauung, Kreislauf des Risiko- und Katastrophenmanagements

Der Schutz vor Naturgefahren ist ein nationales Ziel von übergeordneter Bedeutung für die zuständigen Behörden in den Alpenländern. Um ein höchstmögliches Niveau an Sicherheit zu garantieren, sind integrale und nachhaltige Strategien und Konzepte erforderlich. Naturgefahren kann nur durch ein integrales Risiko- und Katastrophenmanagement erfolgreich begegnet werden.

In Österreich sind die Kompetenzen im Risiko- und Katastrophenmanagement durch spezielle Gesetze geregelt und hierarchisch entsprechend der Verfassung zwischen dem Bund, den Ländern und Gemeinde aufgeteilt.

Ein Risiko- und Katastrophenmanagement-Kreislauf, ein systematisches und integrales Modell, welches die Risikobeurteilung, die Prävention vor Naturgefahren, das Katastrophenmanagement und die Regeneration (Wiederaufbau) nach Katastrophen mit einschließt, wird für die Gestaltung eines angepassten und effizienten Partizipationsprozesses im Schutz vor Naturgefahren eingesetzt.

Der Forsttechnische Dienst für Wildbach- und Lawinenverbauung, einer der Akteure im Risiko- und Katastrophenmanagement, setzt ein integrales Präventionssystem ein, welches die Analyse und Beurteilung von Risiko, die Ableitung von Schutzkonzepten gegen Naturgefahren, deren Umsetzung und Unterhaltung einschließt.

Neue Technische Richtlinien als Grundlage für die Planung und Förderung von Schutzmaßnahmen, basierend auf dem österreichischen Wasserbautenförderungsgesetz 1985 wurden vor kurzem ausgearbeitet. Mit diesen Richtlinien sollen Regionalstudien, die Priorisierung von Projekten und die generelle Maßnahmenplanung im Schutz vor Naturgefahren implementiert werden.

Der Beitrag gibt einen Überblick über die bewehrten und neuen Instrumente und deren Nutzen im Risiko- und Katastrophenmanagement und zeigt den österreichischen Zugang als effektives und selbsttragendes System.

## Organisation of Risk and Disaster Management (RDM) in Austria

In alpine countries risk and disaster management in natural hazards is a national task of paramount importance for authorities in charge. In order to ensure a maximum level of safety the application of integral and sustainable acting strategies and concepts is necessary.

In Austria competencies in risk and disaster management are hierarchically distributed among the state, the federal provinces and the municipalities (communities) according to the Austrian constitution.

**Risk and disaster management** (RDM) is based on federal law (legal acts by the state and federal provinces) and ordinances as well as regional and local guidances and regulations. See below a survey of the most important regulations for RDM concerning hazards by torrents, avalanches and erosion in Austria:

Legislation	
National Level	<ul style="list-style-type: none"> <li>• Water Act</li> <li>• Forest Act</li> <li>• Torrent Control Act</li> <li>• Water Construction Financing Act</li> <li>• Disaster Relief Fund Act</li> <li>• Ordinance on Hazard Mapping</li> <li>• Guidelines on Hazard Mapping</li> <li>• Technical Directive for Torrent and Avalanche Control</li> <li>• Directive for Cost- Benefit- Analysis on Torrent and Avalanche Control Measures</li> </ul>
Regional Level (federal province)	<ul style="list-style-type: none"> <li>• Civil Protection Acts</li> <li>• Areal Planning Regulations</li> <li>• Building trade Acts</li> </ul>
Local Level (municipalities and communities)	<ul style="list-style-type: none"> <li>• Hazard Maps on Torrent and Avalanche Control</li> <li>• Area planning scheme</li> <li>• Local development concepts</li> <li>• Development scheme</li> <li>• Planning and building permissions</li> <li>• Alarm and action plans for catastrophes</li> </ul>

Fig. 1: Regulations in Austria concerning risk and disaster management are based on.

Abb. 1: Regelungen für das Risiko- und Katastrophenmanagement in Österreich

Based on these regulations the Ministry for Agriculture, Forestry, Environment and Water Management is in charge for the strategic steering concerning preventive measures in RDM. The Federal Forest Engineering Service in Torrent and Avalanche Control and the Technical District Offices of the Provincial Governments (Water Engineering, Building Trade and Road Construction) work together for RDM on regional level in cooperation with municipalities on local level.

Besides Research Entities like the Institute for Forest and Mountain Risk Engineering (BOKU Vienna), the Federal Forest Research Institute (BFW), the Austrian Geological Survey (GBA) and many more collaborate closely with the civil protection authorities.

## Organisation of Risk and Disaster Management in Austria concerning protection from floods, torrents, avalanches and erosion.

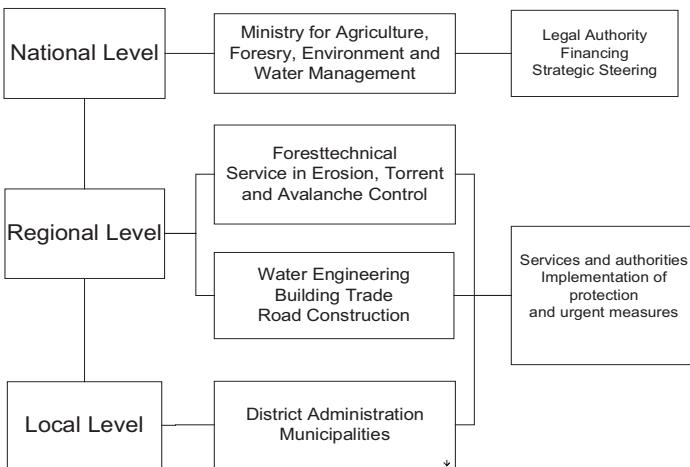


Fig. 2: Organisation of Risk and Disaster Management in Austria concerning the protection from floods, torrents, avalanches and erosion.

Abb. 2: Die Organisation des Risiko- und Katastrophenmanagements für den Schutz vor Hochwässern, Wildbächen, Lawinen und Erosion.

The Ministry for Agriculture, Forestry, Environment and Water Management and the Ministry of Innovation and Transport are the legal authorities and responsible for the financing of protection measures on the national level.

On the level of the federal states the board of the government is in charge of the concerns interior affairs (civil protection and disaster protection), building trade, forestry and land-use planning. The belonging regional and local tasks are executed by the board of the district administration and by the municipalities

The boards of the federal state governments operates alarm headquarters (which co-ordinate the alarms and operations with the local task forces in case of disaster) and avalanche alarm headquarters and is in charge of the supra-regional steering of operations and the training of rescue operations. The board of the district administration carries out the steering of regional operations, closings and evacuations (in accordance to the decisions of the local avalanche commissions).

The mayor of the community is in charge of local security affairs and head of the avalanche commission. Task forces involved in the rescue operations in case of disaster are the federal army, the fire brigades, several rescue organisations, the dog rescue organisation, the helicopter rescue service and the alpine rescue organisation.

In case of catastrophes the rescue systems in Austria worked quite well in the past. For an integral and foresighted management of risks due to natural hazards nevertheless new forms of co-operation between the authorities, public and private institutions and the citizens have to be developed, in order to overcome the limits of political and legal competencies or restrictions.

The public and political acceptance for new strategies and concepts in disaster prevention is often supported by major „key events“, such as catastrophic floods, avalanches or mass-movements. In the last years the Republic of Austria was hit by a series of severe natural disasters, the Avalanche Disaster of Galtür in February 1999, The big landslide of Rindberg/Sebratsgfäll (Vorarlberg) in Spring 1999 or the severe Flood Disaster in the Northern Parts of Austria between the 15<sup>th</sup> July and 14<sup>th</sup> August 2002.

The experiences of these events lead to a further development of the protection system in Austria towards a modern integrated and comprehensive risk management.

## **THE RISK AND DISASTER MANAGEMENT CIRCLE AS AN SYSTEMIC AND INTEGRAL MODEL**

The risk management circle is a systemic model developed in order to meet the risks with a defined system in the best possible way, which takes into consideration safety-technical, scientific and social-political claims. Integrated safety planning related to natural disasters is based on different levels: risk assessment, prevention, disaster management and regeneration.

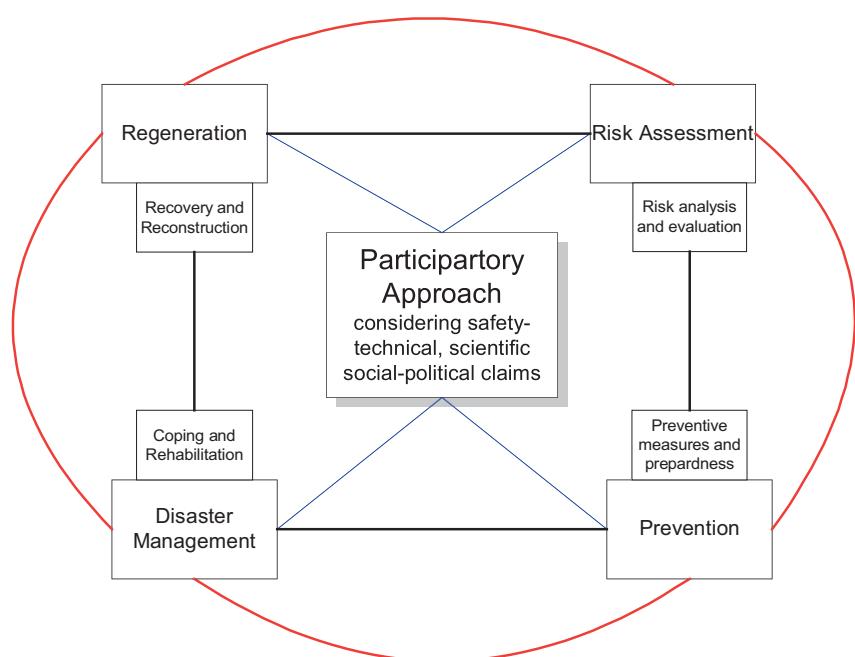


Fig. 3: Dynamic circle of a systemic and integral RDM model.

Abb. 3: Dynamischer Kreislauf eines systematischen und integralen Risiko- und Katastrophenmanagement Modells.

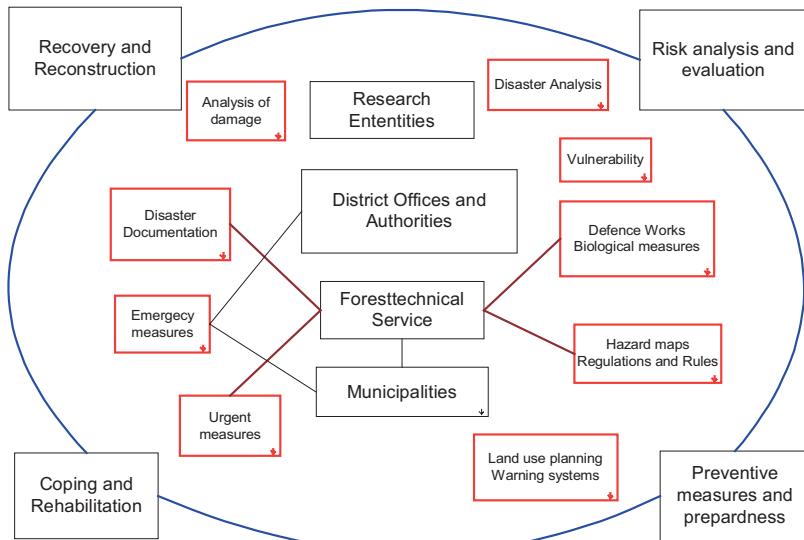


Fig. 4: Different tasks of the main actors in Risk and Disaster Management in Austria

Abb. 4: Verschiedene Aufgaben der Akteure im Risiko- und Katastrophenmanagement in Österreich.

## PROTECTION MEASURES AGAINST NATURAL HAZARDS

The operation and interaction of national, regional and local authorities enclose following measures in RDM.

	<b>Passive Measures</b>	<b>Active Measures</b>
<b>Permanent Measures</b>	Hazard-zone map Regulations and Rules	Defence works
<b>Temporary Measures</b>	Warning Systems Evacuation Closings	Urgent measures

The goal is to optimise risks and costs by a combination of active and passive measures with permanent and temporary effects.

## THE RISK MANAGEMENT SYSTEM OF THE FOREST ENGINEERING SERVICE OF AUSTRIA

The Forest Engineering Service of Torrent and Avalanche Control (WLV) exercises the function regarding the protection of the people, their habitat and settlement-area against the natural hazards of torrents, avalanches and erosion (caused by rock-fall, landslides, debris-flow and fine-sediment erosion).

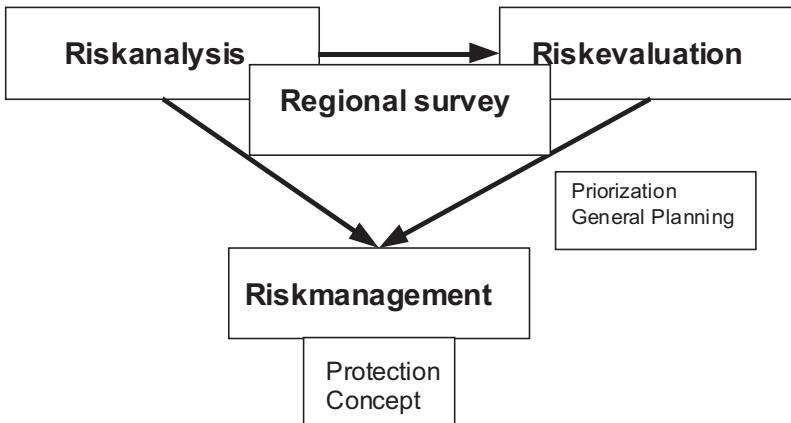


Fig. 5: Integral Risk management circle of the Forest Engineering Service of Austria; Regional Survey, Priorization and General Planning as instruments of the new technical directive for planning and financial support of protection measures

Abb. 5: Integrales Risikomanagement System des Forsttechnische Dienstes für Wildbach- und Lawinenverbauung; Regionalstudien, Priorisierung von Schutzmaßnahmen, generelle Planung als neue Instrumente der Technischen Richtlinien für Wildbach- und Lawinenverbauung (Planung und Förderung von Schutzmaßnahmen)

Risk analysis is a systemic method developed in order to characterise and if possible quantify a risk according to the probability of occurrence (frequency) and the extent of the effects. Based on the results of risk analysis and taking into account the advantages and disadvantages it is decided, which risks are acceptable or have to be accepted (risk assessment). Of paramount importance are the questions, how much risk on the one hand is accepted in general by society or is tolerable for the single citizen affected by natural hazards and on the other hand how much safety can be afforded by the state, the provinces and the beneficiaries. Risk management finally is a systemic concept, which is based on the use of measures and methods with the aim to reach the target safety and to adapt the safety planning to the constantly changing circumstances.

## WELL APPROVED INSTRUMENTS OF RISK MANAGEMENT IN AUSTRIA

**Hazard-zone maps** of the Forest-technical Service of Torrent and Avalanche Control, legally based on the federal forest act, are executed on the level of the federal states and communities by land-use planning and building trade (building permit). Besides they represent an important tool in all disaster prevention affairs, alarm planning for catastrophic events and safety regulations, consulting and advice and the support for the local avalanche commissions. After an intensive course of internal evaluation, public announcement as well as commissionial examination the hazard-zone map is authorised by the federal minister of forestry and enacted by the headquarters in the federal states.

Defence works, carried out by the Forest-technical Service of Torrent and Avalanche Control, enclose technical protection measures against hazards of torrents, avalanches, rock-fall and mass-movement, the restoration of protection forests and measures in watershed

management. Financing of these measures is based on the federal water constructions financing act, the financial resources come from the federal catastrophe fund, the federal states and the beneficiaries (communities, traffic systems, others).

In charge of evacuations and closings in case of impending disasters are the mayors of the communities and the directors of the district administration. The legal basis is found in the disaster control laws, the rescue laws and the fire police regulations of the federal states. A staff of the Forest-technical Service of Torrent and Avalanche Control is usually member of the steering committee for regional disaster rescue operations.

Urgent measures in torrents and immediately after avalanche, rock-fall and landslide disasters are carried out by the Forest-technical Service of Torrent and Avalanche Control. Comparable to the regular defence works financial resources come from the catastrophe fund, the federal states and the beneficiaries. Urgent measures in case of disasters are organised in close co-operation with the steering committee of the rescue operations and the acting task forces.

### **NEW INSTRUMENTS OF SUSTAINABLE AND INTEGRATED RISK MANAGEMENT IN THE TECHNICAL DIRECTIVE FOR PLANNING AND FINANCIAL SUPPORT OF PROTECTION MEASURES**

A new technical directive for planning and financial support of protection measures based on the Austrian federal water constructions financing act was worked out recently. By means of this directive regional surveys, the prioritization of projects and general planning were introduced to risk management.

**Regional surveys** are technical examinations related to a certain region which serve as a basis of judgement for the planning of integral protection measures against hazards caused by torrents, avalanches or erosion. It is an instrument of risk assessment that shows the results of investigations on the type, degree and extent of endangering for a region, a valley, or an other larger spatial unity by natural hazards. Due to the deficits of protection established in the regional survey the required protective measures are fixed roughly and subdivided spatially, the regional consequences and connections of the intended measures are represented and a ranking for possible measures is made. The integrated safety planning encloses as well measures that can be granted financial support from the catastrophe fund as other measures and legal and organisational precautions. With a regional survey the base for a close co-operation of the torrent and avalanche control service and the water engineering services is created in order to realize a watershed management taking into account the goals of the EC-water framework directive.

A **prestudy** will be the basis for the admission of intended planning of protective measures to the regional ranking and serves as a prerequisite for the conception of general projects and projects. From the prestudy the fundamental justification of financial support of a project, the urgency of the measures and the beneficiaries of the project can be derived. The prestudy contains the prioritization of a planned project according to fixed criteria.

**General projects** are outlines (framework planning) going in front of the detailed planning, which represent both the targets of safety planning and the way of the intended fulfilment in all the essential features. A general project has to be worked out for one or more catchment areas of torrents and avalanches as well as for risk areas if different natural hazards cause extensive, economically meaningful protective measures or require an execution due to the

extent of the measure over a longer time period and if a complex plan seems to makes a general planning necessary as a decision basis. In the general project the planned measures are represented with regard to the conception, effect and the costs in the essential features including intensive variant studies. Furthermore the general project covers the temporal order of the measures to be executed and a concept of the project putting into action.

## **STRATEGIC GOALS FOR THE FUTURE IN RDM CONCERNING TORRENTS, AVALANCHES AND EROSION**

The experiences of the disastrous events of the last years lead to the development of new strategies and concepts in Austria, the following lessons were learned:

1. The force and frequency of catastrophic events causing severe damage and destruction to buildings, roads and infrastructure is constantly increasing. The possibilities of forecast are rather limited.
2. Defence works have widely fulfilled their function and prevented even more extensive destruction. But the limits of active protection clearly turned out. An acceptance for the remaining risk has to be developed.
3. Due to the intensive use of endangered areas for settlements and infrastructure the great importance of areal regulation and land-use management turned out. Hazard mapping as an effective tool in land-use planning has to be realised country-wide within the next 10 years and will be further developed.
4. The investigation of hydrological and geotechnical processes and the analysis of risk potential in the framework of regional studies has to be intensified.
5. Protection measures have to be carried out regarding the ecological capability of rivers and the surrounding eco-systems and in accordance to the tasks of the EC-water-framework directive. Planning has to be focused on the whole watershed or catchment area.
6. The self- organizing force of torrents and the protective function of natural retention areas has to be integrated in the planning of measures.
7. Public financial resources for the realisation of active protection measures are limited. Thus the development of instruments for the resources management will be a important task for the future.
8. The tending and restoration of the protection forest of paramount importance for the preservation of the natural resources and the safety from natural hazards.
9. One important goal for the future has to be a well organised maintenance of the rivers and torrents as well as the realised protection measures.
10. The standardised documentation of disasters will serve as an important source of information for further planning of active and passive protection measures.

## **CONCLUSION**

A integrated system for the safety planning of natural hazard caused by torrent, avalanches and erosion, that encloses all relevant technical, organisational, legal and financial measures and resources, could not be totally established in Austria until now. The development of practicable solutions was made more difficult by the distribution of competencies between the state, the federal states and the communities and by the missing legal basis for the co-operation of all relevant actors. A holistic approach to natural hazard protection besides

should also take into account other natural sources of risk like rock avalanches, earth quakes, fire, hail or storms. The development of the technical directive for planning and financial support of protection measures towards the principles of integrated and supra-regional planning was nevertheless an important step on the way to reach this target. The business field “natural hazards”, established in the Federal Ministry of Agriculture, Forestry, Environment and Water management will serve as a basis for the further development of the strategic steering and co-operation in RDM.

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