Objective
Joint identification of challenges and potential solutions in the context of woody debris.

Agenda

**Wednesday, 11.05.2016**
- 13:00 – 13:15 Welcome address on behalf of the Austrian Ministry for Agriculture, Forestry, Environment and Water Management
- 13:15 – 16:30 Country Presentations, Discussion
- 16:30 - 17:00 Introduction to field trip

**Thursday, 12.05.2016**
- 09:00-16:00 Field trip – district „Pongau“, Zauch – Enns catchment, Municipalities of Flachau and Altenmarkt

**Friday, 13.05.2016**
- 08:30 – 09:00 Extended discussion on the field trip
- 09:00 – 11:30 Discussion on results of the workshop (possible recommendations) and final report
- 11:30 – 12:00 Conclusions

Participants

**France**: Anthony Dubois (Office National des Fôrets (ONF) International), Romain Paulhe (ONF RTM Savoie), Bruno Demolis (ONF RTM Haute Savoie)

**Switzerland**: Benjamin Lange (Federal Office for the Environment)

**Germany**: Peter Dressel (Bavarian Environment Agency)

**Italy**: Sandro Guis (Autonome Provinz Bozen Südtirol)

**Austria**: Rudolf Schmidt (Austrian Service for Torrent and Avalanche Control), Hansjörg Hufnagl and Catrin Promper (Austrian Federal Ministry for Agriculture, Forestry, Environment and Water Management)
Context of the workshop

From 11 to 13 of May a workshop for practitioners on the topic of “woody debris” was held by the European Forestry Commission Working Party on the Management of Mountain Watersheds (EFC WPMMW) in Salzburg, Austria. These workshops cater small groups of experts from all member countries of the EFC to discuss various topics evolving around natural hazard management and forest on a very practical level along concrete examples in the field in order to identify good practices and common challenges.

This year’s workshop dealt with the topic of “Woody debris – Questions and answers”. Participants from Austria, France, Germany, Italy and Switzerland gathered for three days to discuss in detail:

- Sources of woody debris,
- Problems related to woody debris,
- Legal responsibility of woody debris,
- Financial responsibility of woody debris and
- Methods on how to deal with woody debris.

Moreover topics like awareness and details about strategies on how to cooperate with stakeholders were discussed. On the first day the topics above were detailed for each country by presentations (see annex) and a first round of discussion was initiated. The participants had the opportunity to compare the different situations and practices related to woody debris. The results of this comparison can be seen in the table below.

This table lists the different aspects for all countries: sources of woody debris as well as the basic legal and administrative aspects; methods applied in dealing with woody debris; the integration of woody debris in natural hazard management e.g. hazard zone mapping; and the ecological effects of woody debris. The statements indicate that there are many similarities in the countries that participated (Alpine region) however also major differences could be observed. Details on the excursion can be seen in part two of this report.

Conclusions and recommendations

There are different types/groups of catchments that require different approaches regarding woody debris management:

- Alpine torrents (woody debris mainly caused by direct input into the runoff section of torrents e.g. by slope erosion /failure)
- Alpine rivers (woody debris mainly caused by the input from tributary torrents)
- Lowland rivers (woody debris caused by the input of tributaries, direct input into the runoff section by bank erosion and erosion of vegetated river sections where bed load is successively supplied, deposited and removed).
It has been noted that various processes leading to woody debris require different measures in managing it:

- Erosional scars along the watercourse / slips, landslides
- Type (amount) of sediment transport
- Debris flows
- Avalanches
- Windthrow, snow break
- Log jam failure
- Human impact (obstacles, pipes, power plants, waste ….)

Another important aspect is the high number of objects at risk and the damage potential of these objects. In case of hazard (zone) mapping clogging of bridges or other obstacles is not taken into account in all participating countries. The following recommendations identified refer mainly to torrents and alpine rivers.

**Non-technical recommendations**

- A stronger focus should be put on forestry measures covering important areas of the catchment. These measures have a more sustainable and ecological effect e.g. water quality, retention effects, biodiversity, reduction of soil and bank erosion and reduction of the probability of landslides into the channel.
- More research on the particular influence (positive or negative) of trees and vegetation (and its age and species diversity) on the stability of watercourse plus embankment and of dead wood within the immediate discharge section should be conducted.
- A system of continuous inspections /supervision of catchments (torrents, rivers) on a regular basis is well-proved (e.g. in Austria) and is recommended to be installed in all countries. Trainings on a regular basis should be offered.
- Scenarios related to woody debris e.g. clogging, log jam failure should be taken into account in hazard (zone) mapping.
- Giving back space to rivers and torrents is one of the best possibilities to manage flood control and woody debris.

**Technical recommendations**

- Also possible negative influences of technical measures on erosion, river bed level, sediment transport and ecological permeability has to be kept in mind when planning and designing technical structures
- When designing discharge profiles, possible higher impacts or an increase of the design event discharge should be taken into account (e.g. by applying an intensity factor like the Austrian intensity factor for flood, sediment transport and debris flow).
- Regulations on construction and designing elements of technical structures related to woody debris (e.g. steel grills) should be elaborated
- Work on regulations, technical guidelines or estimation formulas to calculate/estimate the amount and volumes of woody debris (need for further research - e.g. in Switzerland one project is running on this topic at the moment)
- Possibilities and capabilities of net or cable based structures for woody debris retention should be investigated. Best by analysing the functionality of existing structures (e.g. Rienza gorge, Italy)
## Comparison of Countries approach to managing woody debris

<table>
<thead>
<tr>
<th>Main causes for woody debris</th>
<th>Austria</th>
<th>Germany (Bavaria)</th>
<th>Italy</th>
<th>Switzerland</th>
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<tr>
<td>Lateral and depth erosion along the torrents, snow avalanches, windthrow, biological calamities (beetles etc.), lack of river care, lack of sensitizing the landholders and communities</td>
<td>Avalanche, landslide, river bank erosion, hydropower plant and reduce of sand bank mobility, the reforestation in river catchment</td>
<td>Bank erosion, windfall, landslides, bank tillering, avalanches; in some cases: timber yards and mills</td>
<td>Wind throw, snow damage, landslide, erosion</td>
<td>According to the analyses of the floods 2005, most of woody debris is freshwood, which is transported by bank erosion, debris flow or landslides to the channels.</td>
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| Legal situation on inspecting torrents | Authorities: District water authorities (WRG 1959, §130), District forest authorities (FG 1975, §101(1)) Communities: annual inspections on an obligatory basis (FG 1975, §101(6)). training courses for inspection staff is provided by ÖWAV society | Evolving Up to 2018 : No obligation From 2018 : Communities will have obligation to control the security level of protection structure. Unclear concerning inspecting torrent without structure. | No commitment concerning intervals or time. Regular inspections by the Watermanagement Authorities concerning consolidated torrents. Casually inspections by municipalities concerning non constructed torrents. | Responsibility of authority: province in the public waters, municipalities in the other cases |

| Legal situation on acting in torrents referring to woody debris | Landowners are responsible for keeping the channel free of woody debris – if reasonable. (WRG 1959, §47 / FG 1975, §101(6)) | Up to 2018 : Riverbank owner is responsible of riverbank management No obligation for local authorities to manage flood hazard and river bed. Some structures (group of municipalities) manage river at watershed scale (including vegetation and woody debris). In RTM state forest, vegetation management is realised by ONF RTM with state finances. From 2018 : Communities will have obligation to manage river environment and flood hazard. Aim: to create intercommunal structures at the river catchment scale, for the river management | Watermanagement Authorities are in duty of “cleaning” the torrent bed and remove flow obstacles (including woody debris) in consolidated torrents. Municipalities fulfil this duty in natural torrents | Responsibility of authority: province in the public waters, municipalities in the other cases |

| Responsibilities for managing woody debris in the river channel and surrounding forests | Authorities for the River channel: communities, district water authorities. Authorities for Surrounding forests: district forest authorities Execution: Service for torrent and avalanche control, Service for river control, landowner | Owners responsibility | Watermanagement Authorities are in duty of “cleaning” the torrent bed and remove flow obstacles (including woody debris) in consolidated torrents. Municipalities fulfil this duty in natural torrents. Concerning the surroundings the | River channel: agency for civil protection (public waters), municipalities in the other cases |

<p>| | | | | The cantons have to ensure flood prevention and maintaining channels (hydraulic engineering act). Moreover, the cantons have to ensure that the forest protects from natural hazards (Federal act on forest). The prioritisation of measures in protection forests is in |
| Regulations and guidelines on woody debris, both handling or designing structures (authored by) | There are no regulations and no guidelines exclusively for designing woody debris structures, but there are regulations as a part of the technical guidelines for constructing screen/grill dams (ONR 24802:2011, 22.4.4.3) | No regulation on woody debris. Recent guideline to manage vegetation on dikes. No recent guideline to manage woody debris and to design structures. | Bavarian Watermanagement Authorities | No regulations and no guidelines on woody debris are officially approved. There are no regulations and no guidelines exclusively for designing woody debris structures. Some aspects concerning woody debris are included in the guideline “Hochwasserschutz an Fließgewässern”. |
| Financing forestry measures | Channel clearing, removing unstable trees: Austrian disaster fund 33,3% (province 33,3% /stakeholder 33,3% (WBFG 1985 § 28). Afforestation: Austrian RDP 2020 (rural development programme): mainly studies and management plans | - State forest&lt;br&gt;- State or national forestry office&lt;br&gt;- Communal forest&lt;br&gt;- European benefit (80% of the deficit forestall measure)&lt;br&gt;- Community for 20% remaining | - Offices for Nutrition, Agriculture and Forestry (state forest)&lt;br&gt;- Owners (private forest) | Forestry authority through financial contributions to the forest owners | If the forest in the catchment is delimited as protection forest, forestall measures are financially supported. Based on program agreements with the cantons, the confederation pays 40 % of the average net costs for protection forest management. 60 % are paid by the cantons and beneficiaries. |
| Financing technical measures | Measures of the Service for Torrent and Avalanche Control (WBFG 1985): Financial contributions usually by federal state (disaster fund, approx. 56%), province (approx. 20%) and stakeholder (community, water cooperative etc., approx. 24%), in case of measures of catchment /torrent care also 33,3/33,3/33,3% | - Financing 25% to 40% by a fund alimented by insurance&lt;br&gt;- Local authorities benefit (region or department)&lt;br&gt;- Community&lt;br&gt;- State in public forest | In torrents bed:&lt;br&gt;- 30 % municipality&lt;br&gt;- 70 % Free State of Bavaria&lt;br&gt;Comparable percentage for measures in the area. | Torrent control authority | Technical structures are subsidised by the confederation (35-45 %, dependent on the effectiveness of the structure). The remaining part is paid by the canton and beneficiaries. |</p>
<table>
<thead>
<tr>
<th>Given the visited catchment of Zauch (Morning of field trip), which methods/approach would be used in your country</th>
<th>Austria</th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Switzerland</th>
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<tr>
<td>See report on field trip</td>
<td>Intervention on riparian forest (spruce logging to maintain young riparian vegetation) - Strong intervention on vegetation up-stream small bridges - Enlargement of the channel in the lower part to create mobility space. - Probably no trap or only one trap structures directly up-stream first stakes.</td>
<td>Smaller check dams in the upper catchment to stabilize the main channel and in parts of the tributaries Probably only one check dam in the lower catchment to retain driftwood and to filter bed load transport</td>
<td>chain system of different types of check dams</td>
<td>Spatial planning (hazard map), forest management to reduce erosion, landslides and debris flow as well as to increase the stability of the stands. If a risk analyses shows an unacceptable remaining risk, technical structures are used to reduce the impact of natural hazards</td>
<td></td>
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<tr>
<th>What forestry methods are used to reduce woody debris</th>
<th>Austria</th>
<th>France</th>
<th>Germany</th>
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<tr>
<td>Using autochthonic tree species and trees with strong root stability, development of a stable forest community, selective thinning, individual removing of heavy trees on unstable slopes, cutting into length</td>
<td>In accessible torrent and in presence of under-designed structures, woody debris are cut in logs of 0,5m or 1 m - In lager river bed, management rules are usually to cut oldest trees and to maintain vegetation in coppice state.</td>
<td>Thinning; trimming Mixed Forests – adaptation to climate change</td>
<td>thinning, clear cutting, cleansing</td>
<td>The legally binding guideline for protection forest management (Sustainability and Success Monitoring in Protection Forests, NaS) defines the how protection forests in channel slopes has to be treated. The main requirements are: no unstable trees or stems prone to slide and, if landslides may occur, no large openings, a canopy cover of at least 40 % and a species mixture according to the natural site conditions.</td>
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<tr>
<th>Which protective technical measures are used to deal with woody debris</th>
<th>Austria</th>
<th>France</th>
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<tr>
<td>Different types of screen/griddle dams, steel net barriers occasionally (solid rock anchorage!)</td>
<td>River bed enlargement - Woody debris trap (most of existing structures are designed to trap sediment)</td>
<td>Check dams, rakes (combination with check dam, V-shaped, other forms), rope nets</td>
<td>grid check dams, cable filter check dams</td>
<td>Mostly grid check dams</td>
<td></td>
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<tr>
<th>Methods quantifying potential volumes/amounts of woody debris</th>
<th>Austria</th>
<th>France</th>
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<th>Switzerland</th>
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<tr>
<td>balancing assessment of debris wood in situ, formulas (e.g. Rickenmann) are rarely used</td>
<td>No definite method</td>
<td>GIS-Tool based on the potential natural vegetation; field inspection, expert assessment</td>
<td>Rickenmann, gis based estimation, estimation in situ</td>
<td>There is no &quot;gold standard&quot;. Observations of events, empirical formula and field observations are used to quantify potential volumes of woody debris. Current, a research project is running (financed by the Federal Office for the Environment) that aims, among other, at quantifying the potential amount of woody debris.</td>
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<tr>
<th>Methods calculating possibilities of clogging of obstacles (e.g. bridges)</th>
<th>Austria</th>
<th>France</th>
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<tr>
<td>estimation in situ in combination with hydrological formulas</td>
<td>Probabilities of clogging is evaluated via expert opinion depending of calculated available section under bridges.</td>
<td>GIS-Tool [quantitative result in m³/m²] in combination with expert knowledge, event documentation and hydraulic 2D-modeling</td>
<td>Empirical estimation in percent of the discharge section</td>
<td>Hydraulic 2D-modeling. Sometimes 3D-modeling for specific problems.</td>
<td></td>
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<tr>
<th>Ecological effects of woody debris</th>
<th>Austria</th>
<th>France</th>
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<td>WD increases the diversity of morphological and ecological</td>
<td>Organic material trap, physical environment diversification, and</td>
<td>Increase of biological diversity, refuges for fish and other organisms</td>
<td>Important for biological diversity, may stabilize the riverbed in some</td>
<td></td>
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<tr>
<td>Structures, creates habitats for fish and benthos</td>
<td>Perhaps in some case, can contribute to stabilize channel and to trap sediment during some event (?)</td>
<td>Formation of new benthos, new habitats concerning meta- and hyporithral.</td>
<td>Cases.</td>
<td></td>
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| **Is woody debris taken into account in hazard (zone) mapping (clogging, log jam failure, increase of design event …)** | Clogging of bridges is be taken into account | - Woody debris isn’t always take into consideration in hazard mapping  
- New guideline on torrent hazard mapping in progress and expected for late 2016. | Only bridge clogging |
| | | Clogging of bridges has to be taken into account if it is (very) probable happening within a design event (100 years)  
(Bavarian Water Law Art. 46 Para. 2) | Clogging of bridges is taken into account for known bottlenecks. |
| **Usage of woody debris (e.g. wood chips for heat/power stations)** | No special use for debris wood because of its soiling, on the contrary: there is a issue of legal correct disposal.  
Thermic utilization of silvicultural used wood only | No known special use | No special usage. |
| | | The utilization is problematic when the wood is silted | No special usage. Woody debris is partially hazardous waste. |
Further reading


SedAlp Synthesis report - Sediment management in Alpine basins: integrating sediment continuum, risk mitigation and hydropower

Field Trip, Thursday 12 May 2016

In order to give the participants an impression of the practical work done in Austria by the Technical Service for Torrent and Avalanche Control a field trip to two catchment areas in the south-eastern part of Salzburg was organised.

Catchment of the river Zauch

The Zauch is located in the community of Altenmarkt.

Catchment area = 36 km².

\[HQ_{100} = 95 \text{ m}^3/\text{s}\]

Potential debris load = 56.000 m³ + woody debris

Damage scenario:

Flooding and outbreaks due to clogging of bridges, Erosion and concentrated floodings along with deposition of sediment and woody debris within the settlement area of the Altenmarkt region
History

The great flooding of 1884 was the reason for the start of systematic protection works in 1890 on the river Zauch. Since then, numerous stabilisation and consolidation structures have been built. Also some sediment retention basins have been built, which are all silted up by now, and in km 7.67 a filter dam. In addition to the existing river channel of the “Old Zauch” river, a new channel; the “New Zauch” was built.

The most dangerous tributaries have been secured by numerous consolidation works along with, in the meantime silted up, retention structures.

In the years 2001-2007 protective structures in the catchment of the remaining “Old Zauch” have been carried out, therefore reducing problems due to sediment and woody debris transport.
The current project “New Zauch” started in 2011 consists of:

- 2 woody debris filter structures in the main river
- 1 combined woody debris and sediment filter structure in the main river
- Woody debris and sediment filter structures in the tributaries Rettenbach and Neuhäuslgraben (closest to the settled areas)
- Renovating existing structures in more remote tributaries Reichertalgraben, Unsinniggraben and Labeneckgraben

The total costs for the project amount to appr. 8 Mio Euros.

**Aim of the Project**

To reduce sediment and woody debris transportation rate to a minimum in order to limit flooding within the endangered areas to pure water.

The chairman of the responsible cooperative for the protection structures also accompanied the group and gave some valuable insight in the structures and processes of protective cooperatives.

**Catchment of Iglsbach**

The second river visited is a left tributary to the main river of Fritzbach. The ongoing project includes protection structures in the main river Fritzbach and in total 4 tributaries. The structures include debris flow breakers, which are very effective in the retention of woody debris, like the at the Iglsbach river, filter dams along with consolidation structures.

The structures in the neighbouring torrent of Sattelbach were built right after the disaster in 2013 (see photos below) which initiated this ongoing project at the Fritzbach river. The total costs amount to 12 Mio Euros.

![Debris flow in the neighbouring catchment of the Sattelbach torrent in 2013 (Source: R. Schmidt)](image-url)