Dealing with Woody Debris in Switzerland

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WPMMW
Agenda

• Introduction
• Level of awareness
• Reasons and causes for woody debris: Flood 2005
• Possibilities and legal aspects related to the reduction of woody debris
  • Legal aspects: technical structures and protection forests
  • Delimitation of protection forests in catchments
  • Treatment of protection forests in catchments: current state and ideas for further development of requirements
• Summary
Flood 2005
Event Analyses Flood 2005: Reasons and Causes of Driftwood

Focus of Event Analyses:

1. Relevant **processes** that transport driftwood into channels: landslides, bank erosion, debris flow

2. **Origin of driftwood**: fresh wood, deadwood, timber stockyard
Processes that transport wood to channels

- Driftwood deposition
- Debris flow
- Bank erosion
- Landslides
Origin of Driftwood 2005

- Fresh wood
- Deadwood
- Deadwood from windstorm «Lothar»
- Construction timber and firewood
## Costs to remove and recycle driftwood from lakes / logjams

<table>
<thead>
<tr>
<th>Location</th>
<th>Driftwood volume m³</th>
<th>Costs (CHF)</th>
<th>Cost / m³ (CHF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lakes of Thun, Brienz, Biel</td>
<td>31’000</td>
<td>2’300’000</td>
<td>74.-</td>
</tr>
<tr>
<td>Lake Luzern</td>
<td>1’000</td>
<td>150’000</td>
<td>150.-</td>
</tr>
<tr>
<td>Urnersee</td>
<td>10’000</td>
<td>630’000</td>
<td>63.-</td>
</tr>
<tr>
<td>Bremgarten</td>
<td>3’000</td>
<td>400’000</td>
<td>133.-</td>
</tr>
<tr>
<td>Aare, Bern</td>
<td>1’200</td>
<td>65’000</td>
<td>54.-</td>
</tr>
</tbody>
</table>

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Lessons Learned: Flood 2005

- **Mobilisation** of driftwood mainly by **debris flow**, **landslides and bank erosion** (channel specific!)
- **Long-distance transport of wood** to channels by natural hazard processes
- **High percentage of driftwood was fresh wood**, natural deadwood and wood from timber stockyards were secondary
- The gross costs to harvest 1 m$^3$ of wood comply with the costs to remove and recycle 1 m$^3$ driftwood from a lake or a river. The net costs for harvesting are much lower. → **Forest management is cheaper than removing driftwood**...
Possibilities and legal aspects related to the reduction of woody debris

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Responsibilities for Hazard Mapping, Protection Structures and -Forest

**Strategic management:**
- Legal framework
- Technical guidelines
- Financing

**Operational management**
- Project management
- Regional master plans
- Financing

**Practical implementation**
- Local development plans
- Land-use planning …
Subsidies

- **Subsidies protection forest management**: Confederation 65 millions € per year = 40 % of the assumed total net costs (after deduction of the timber revenues)
  - About 145 millions € spent annually for the management of protection forest
  - Silvicultural measures according to the guideline NaiS (Sustainability and success monitoring in protection forests)

- **Subsidies protection structures and hazard data and documentation** (hazard maps, hazard register, data modelling etc.): Confederation approximately 150 millions per year = 35 – 45 % of the total net costs for protection structures and 50 % for hazard data and documentation.
  - About 370 millions € spent annually for protection structures and hazard data and documentation
Flood Hazard Maps: 96 % of the Swiss Territory is Mapped
Protection Forest Management in Channel Slopes

Definition of protection forest (SilvaProtect-CH): “A protection forest is a forest, which protects an acknowledged damage potential against a natural hazard or reduces the involved risks”.

Hazard processes in catchments:

- Directly damage-related: debris flow, driftwood, overbank sedimentation, floods
- Indirectly damage-related: landslides, avalanches, debris flow, rockfall

Protection forests should protect against both directly and indirectly damage-related processes.
Example of Protection Forest Delimitation

**Purple**: channels that are relevant for debris flow deposition

**Salmon**: debris flow depositions

**Beige**: trajectories of shallow landslides that can transport material in relevant channels

**Brown**: trajectories of shallow landslides that *not* transport material in relevant channels
**Channel-relevant processes**

Purple: relevant channels; beige: 50 m buffer for driftwood, brown: landslides; grey: rockfall; blue: starting zones of avalanches
Present requirements according to NaïS

<table>
<thead>
<tr>
<th>Locality</th>
<th>Potential contribution of forest</th>
<th>Hazard-related target profile (minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forest on channel slopes:</strong></td>
<td><strong>Small to large</strong></td>
<td>No unstable trees or stems prone to slide.</td>
</tr>
<tr>
<td>Prevention of negative impacts</td>
<td>Depends on channel characteristics (e.g. potential bottlenecks)</td>
<td></td>
</tr>
<tr>
<td>of timber in the channel</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In areas where there are also landslide problems, the target profiles must be adjusted to each other.
Ideas for new requirements of protection forest management

General framework:
• The damage-relevant channels are known.
• Different processes may transport damage relevant material into channels.
• The damage relevant process areas vary in their spatial extend.

Idea
Define different zones with different silvicultural requirements based on hazard processes and process areas.
Three different zones

1. **Direct process area along the channel**: flood zone, debris flow zone

2. **Direct channel slope**: Area from that damage relevant material can be transported directly within an event to the channel by natural hazards as landslides, avalanches or rockfall.

3. **Indirect channel slope**: Area from that damage relevant material can *not* be transported within an event to the channel by natural hazards.
Characteristics of the «Fluppibach»
Impressions Fluppibach

© Raphael Schwitter
Cross Sections of Fluppibach

Site 1

Site 2

Site 3

Rockfall  
Flooding  
Landslides / Erosion

Bank erosion  
Windthow
Zones 1 to 3

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Forest management in flooding zone

Trees in the flooding zone…
…stabilise the banks
…reduce erosion
…hold back driftwood
…potential driftwood
…biodiversity
…subjective value of a landscape

Key questions: What is tolerable, what is necessary and what is unacceptable?
Forest Management in the Direct Channel Slope

- Forest management aims at reducing the impact of processes that transport damage relevant material into the channel.
- Requirements according to the hazard specific targets as defined in NaiS (root density, basal area, stability, etc.)
Forest management in the indirect channel slope

- Focus only secondary on the protective function of the forest
- Forest management may be focused on other forest functions like wood production, biodiversity, recreational forest etc.
Summary

- Strategies to reduce negative impacts of driftwood: spatial planning, protection forest management, technical structures
- Protection from natural hazards is a joint task between the confederation, the cantons and the municipalities.
- Defining areas of different processes and silvicultural targets are necessary and helps to determine measures: Importance of forest planning!
- Cooperation between the stakeholders (forest, fishery, hydraulic engineering, nature conservations) is mandatory
Thank you for your attention
Flood protection forests

- Forests influence the water cycle
- Modelling: Not possible
- Influence of forest on peak discharge: not quantifiable
- Define a target profile: not really useful
- No subsidies for flood protection forest from confederation
### Requirements according to NaiS

<table>
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<tr>
<th>Locality</th>
<th>Potential contribution of forest</th>
<th>Hazard-related target profile (minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Catchment area:</strong></td>
<td><strong>Large:</strong> sites with intermediate to large soil depth and limited permeability</td>
<td>Canopy cover permanently ≥ 60%. Minimum requirements of site related target accomplished.</td>
</tr>
<tr>
<td>Reduction of peak discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>in the whole catchment</td>
<td><strong>Intermediate:</strong> sites with shallow to intermediate soil depth and limited permeability or with large soil depth and normal permeability</td>
<td>Canopy cover permanently ≥ 50%. Minimum requirements of site related target accomplished.</td>
</tr>
<tr>
<td></td>
<td><strong>Small:</strong> sites with shallow soils and normal permeability or soils with high permeability.</td>
<td>Permanent regeneration ensured.</td>
</tr>
<tr>
<td><strong>Forest on channel slopes:</strong></td>
<td><strong>Small to large</strong>. Depends on channel characteristics (e.g. potential bottlenecks)</td>
<td>No unstable trees or stems prone to slide.</td>
</tr>
</tbody>
</table>
Delimitation of protection forests in catchments

- **Modelling hazard perimeter**: Relevant hazard processes for channels (debris flow, avalanches, rockfalls, landslides, 50 m buffer along channels) were modelled over whole Switzerland with data that are available national wide at consistent quality. → Determination of the spatial hazard perimeters (hazard indication map).

- **Determining the damage potential**: The protecting infrastructure (damage potential) was defined based on digital data that are available at consistent quality for whole Switzerland.

- **Evaluating damage-relevant process areas**: hazard perimeters that may damage the protecting infrastructure directly (debris flow, driftwood, overbank sedimentation) or indirectly via the channels (avalanches, rockfalls, landslides) were specified.

- **Determining the damage-relevant process areas in catchment’s forests**: evaluation of damage-relevant process areas within forests.

- **Delimitation of protection forests in catchments by the Cantons**: 80 % of all protection forests in CH protect against channel relevant hazards!