



## **The WaReLa concept – Mitigation of floods by land-use management in forested and agricultural areas**

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Floodings by tributaries to the large rivers in the Mid-Mountain areas of Europe cause at least as huge damages as the large flooding of the main streams. This is because the events occur often unexpectedly in small delimited areas and the warning times are short. In addition, technical protection measures are less optimised and the conscience of danger is lower than at the watersides of large rivers.

The Mid-European low mountain ranges show often a widespread morphological structure of relatively flat plains, mostly occupied by farmland and pastures, where most of the headwater catchments are located. These plains are often divided by deeply incised river systems in narrow valleys with steep slopes, where the forests are found.

Surface runoff is generated commonly on agricultural land, but then often routed through forest areas to the small streams. On the other hand, forests have been recognised as runoff generating areas due to a combination of soil surface characteristics and the impact of infrastructure for extraction of wood. For this, precautionary land-use management in rural areas has to be focussed at several levels:

1. The retention capacity of the landscape has to be increased. This is especially possible in agricultural areas, where soil working can be modified for increasing water retention capacity and infiltration capacity. The sustainability of these measures has to be ensured. Hence, a complex combination of management practices is needed to maintain the desired characteristics of the soils and enhance farmland productivity

2. The pathways of runoff have to be cut or at least slowed down. Flow concentrations have to be avoided and overland-flow has to be derived to wide areas to re-infiltrate. Therefore, measures are especially possible in the management practices in the forest areas. Linear structures like ways, forest aisles have to be modified to avoid direct routing of the water to the stream, collection of subsurface flows and concentration of them at surface. Direct runoff generation has to be taken into account as well as the possibilities to create small retention areas in the forests using road junctions and small bridges.

One aim of the project is to evaluate a collection of possible measures on the different land use types. For this, direct measurements and modelisation of the singular implemented actions are performed. In the following, the combination of several measures is tested on its effectivity on each land use system. Especially the routing outward of the singular land use type is focussed, so possible measures in the downward routed system can be selected. In addition, the monitoring of flow and transport processes will provide information about sustainability of the techniques and their combination.

As a last step, the estimation of retention potential in the meso-scale landscape units will be evaluated depending on the applied management techniques