

the earth is prevented from hardening by the covering of fallen leaves and needles, and through the crowns of the trees. The ground of a well-kept forest is loose and porous, and can absorb a great deal of "sinking" water.

Many hundreds of experiments, carried out all over Switzerland, show that pasture lands are almost non-porous. Three to five times better is the permeable earth of the hay field and ten to thirty times better that of good, uncultivated forest floors.

If heavy rain falls on a pasture, very little water remains on the vegetation and it can only with difficulty penetrate into the earth and reach the subterranean reservoirs because of the hardness of the ground. Most of the water runs quickly over the surface and causes floods in the streams and rivers.

If the same shower falls on well cared for forest land, most of the water can sink into the loose earth, move slowly through the ground and emerge only through springs, when the stream flow has long since run off. In this way the forests can greatly diminish the danger of floods.

If it rains for many days at a time, the storage capacity of the forest soil can on exceptional occasions be exhausted, and therefore as much water flows away from a wooded district as from an unwooded district. This, however, occurs very rarely.

In their upper course all rivers have a tendency to carve out deeper river beds. The banks therefore become steeper and steeper, till they eventually begin to slip or to be worn away. The river carries the sediment down with it on its course, depositing it at last in the valley, where the water moves more slowly. It thus raises the river bed to such an extent that the water breaks out of the sides and floods fruitful districts, depositing piles of the sediment. Only by building barriers across the river can one make it impossible for the river to cut a deeper bed.

The banks can be held together if they are always completely covered with plants. Every shower of rain sweeps earth off a bare surface, till there is nothing left but the rocky foundation. The rivers always carry a great deal of soil washed from the pasture lands because the earth is partly cut by the trampling of cattle and because most of the rainfall flows away over the hardened ground. Thickly planted grass fields can hinder the fruitful earth from being carried away. Even better are shrubs, trees or vigorous forests, which drain the earth and at the same time bind it with deeply penetrating roots. Slopes planted with woods can withstand far steeper river banks than unwooded slopes. For a successful struggle against mountain torrents and inundations of the plains, a complete collaboration of engineers, agriculturists and foresters is an absolute necessity.