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Due to the steep relief of the mountain massifs, the valleys are strategic locations for the establishment of human activities. Over last decades, the floodplain of alpine rivers has been highly anthropized. However, mountain rivers have a strong erosive power that can threaten human infrastructures. To protect them, riverbanks are regularly protected with civil engineering works. Yet, this environment is home to a high level of biodiversity. Thus, soil water bioengineering techniques appear sustainable by allowing both to protect the anthropogenic assets and to welcome the rich riparian biodiversity and the associated ecological services. To implement these Nature-Based Solutions, it is necessary to draw inspiration from the biotic and abiotic components of natural riverbanks, which are still poorly understood at high altitude due to several pressures (climatic, hydrologic, hydraulic or morphologic). In order to understand the structure and functioning of natural models of alpine riverbanks, a protocol has been implemented on 21 mountain banks with mature vegetation and no signs of erosion. The sites were located in the Vanoise massif (France) on an altitudinal gradient (1331 – 2131 m) ranging from montane to subalpine belts with a wide range of channel slope (0,8 – 28,4 %). By focusing on the bank toe, biotic (vegetation cover and species biological features) and abiotic (altitude and hydrogeomorphology) components have been measured. First observations showed that the grain size distribution of the sediments forming the bank was coarser and more homogeneous than those forming the channel bed. For the step-pool channels, bank grain sizes were coarser than for plane-bed channels. Shields parameters for the 21 banks were well below the thresholds for sediment motion, and were therefore relatively stable. Furthermore, on all the sites the shear stresses were relatively high but according to the literature values, classic bioengineering structures could be implemented on 16 of the sites and would withstand a 100-year return period flood, which is consistent with our observation of mature, stable and healthy vegetation patches. The mineral component of the bank toe is closely linked to the woody plant structure. The vegetation cover was dominated by 12 species of willow and the green alder. Green alder cover increased with the altitude and the bed slope. Willow species cover varied with altitude and was less important for steep river. Thus, the natural models of banks were: (i) for the rivers with steep slope, models mixing mineral and plant units which both took part jointly in the stability of the bank; and (ii) for the rivers with lower slope the stability of the bank was mainly ensured by the vegetation. This work provided additional knowledge on the structure and functioning of the banks of stable and mature high-altitude rivers. Accordingly, these results will allow to design soil

water bioengineering techniques more adapted to mountain environments (plant composition and structure, mineral unit size).