

THE “NON-EFFECT” OF GRASSLAND MANAGEMENT ON LOCAL AND WATERSHED ECOHYDROLOGY

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Grassland and pastures are among the principal components of land surface in alpine environments covering about 20-30% of the surface in Switzerland. Grassland cover and seasonal dynamics mediate exchanges of energy, water, and carbon between the soil and the atmospheric surface layer, ultimately influencing the availability of water. Alpine grasslands are typically managed ecosystems, sometimes heavily managed, to support the traditional grassland farming system, “Alpwirtschaft”. In most of the alpine meadows grass undergoes several cuts during the growing season to be used as a source of food (in the form of hay or silage), while the animals are housed indoors. During spring and summer periods pastures are grazed by cattle or sheep that contributes to remove a significant portion of aboveground biomass. Grassland management in the form of cutting affects hydrology mainly through the physical effect of defoliation, animal grazing has a double effect because it sums to defoliation a compaction of soil structure that generally leads to a reduction in infiltration capacity. The objectives of the study are: (a) to quantify and compare the response of a grassland ecosystem in terms of hydrological and energy fluxes, and vegetation productivity to different management conditions summarized in grazing intensity (number of cattle per hectare), and height of grass cut; (b) to quantify the integrated effect of grassland management at the catchment scale, for instance on downstream discharge. In order to achieve these goals, a mechanistic ecohydrological model “Tethys-Chloris” is validated at three grassland “Fluxnet” sites in Switzerland: Oensingen, Chamau, and Fruebuel, where energy and carbon fluxes were measured through the eddy-covariance system. The three locations cover a gradient of elevations and of management intensities. The hydrological performance of the model is confirmed in a small Swiss catchment, Rietholzbach, mostly covered by grassland. Synthetic experiments are carried out with the ecohydrological model at the plot-scale and at the watershed scale to investigate the effects of an increasing management activity on hydrological components and vegetation productivity. Results show that only most extreme management actions such as low grass cutting or very heavy grazing intensity are able to influence significantly the hydrological behavior. Common grassland management practices are likely to be mostly non influential for hydrology.