INFLUENCES OF AGRICULTURE TO NATURAL HAZARDS

A REVIEW

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INTRODUCTION

Natural hazards are partially influenced by the type of land use. Beside forests, the largest areas are used by agriculture. But, the knowledge about the influence of agriculture to intensity and frequency of natural hazards is not settled and disseminated widely. The Swiss platform on natural hazards and the Federal Office for Agriculture started a project for compiling the existing knowledge about this topic under the point of view of integrated risk management. The main goal of this study was to find answers to the question of how and how much the different agricultural land use practices are influencing natural hazards.

METHODS

The study was conducted by means of a literature review and by means of expert interviews. We focussed on the processes surface flow, floods, erosion, landslides, snow gliding and wildfire.

RESULTS

The literature about the influences of agricultural land use to natural hazards is dispersed in many disciplines. The topic studied mostly in detail is surface runoff. A high percentage of surface runoff from precipitation contributes to high discharge volumes in rivers and therefore to floods. In some cases where settlements are situated on the foot of a slope with agricultural land of a low infiltration capacity and with preferential flow paths, surface runoff could cause floods in the settlements. The most relevant factors influencing surface flows are soil compaction by heavy truckers and soil crusting on soils without vegetation. Especially soil compaction could reduce infiltration capacity to rates around 0-5% of total precipitation. Therefore, soil compaction could have nearly the same effect as soil sealing. The structure of the agricultural land, e.g. the partition of farmlands by landscape elements such as hedges, shrub belts, microtopographic uneveness and type of vegetation cover influences the velocity of surface runoff. In farmlands without any landscape elements offering possibilities for infiltration, surface runoff contributes fast to the discharge in the rivers. Furthermore, agricultural infrastructures such as drainages or rural roads could influence the contribution to flood discharges, either positively and negatively. Studies indicate a potential of the reduction of flood discharge peaks from 10 to 50 % and discharge volumes to 20 % when large parts of arable land are managed by conservational practices (no-tillage treatments). Soil compaction is widespread in farmland and in pomiculture and will be of future importance in grasslands due to the increasing degree of mechanization, the increase of weight of traction engines and the increase of silage.
Surface runoff is one of the most relevant factors that controls erosion in land cultivated by agriculture. In Switzerland erosion triggered by agriculture is only a problem for specific sites. Erosion in arable land is mainly driven by a high surface flow combined with a lacking vegetation cover and steep topography. Erosion in alpine meadows and in high alpine summering pastures is mainly driven by a lack in the consideration of the special susceptibility of the area in the grazing management strategies, an inappropriate choice of animal species and a lack of staff responsible for managing the

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pastures. Erosion on steep alpine meadows is often triggered by snow gliding. The snow cover is dragging the grass and ruptures the superficial vegetation covers. The resulting scars in the vegetation cover are initial points for further erosion. In steep slopes with pomiculture and viniculture, terraces and therefore the maintenance of its play an important rule for erosion controls.
In principle it's difficult to distinguish between erosion and superficial landslides. Some investigations showed relevancies of changes in vegetation cover due to fertilization and in some degree an increase of the frequency of superficial landslides after the intensification of the mown practice in some cases or after abandonment of alpine meadows in other cases. The latter is a consequence of the increase of snow gliding on abandoned meadows.
Agricultural land plays an important role in planning of flood retention basins or flood corridors for overloading of river reaches and therefore for risk prevention measures. The installation of these types of flood prevention measures requires the agreement of land owners and farmers. Most of the agreements between public authorities responsible for risk management and farmers bases on laws, prescriptions or on individual contracts of services with a compensation of the damages in case of a flood event. In some cases, farmers are compensated annually by the public in relation to the benefits of this service to the settlements. In most regions, this topic lacks on a regulatory basis for securing the purpose of these reserved areas on the communal land use plan.

DISCUSSION AND CONCLUSIONS

The review revealed several interesting studies and consolidated the knowledge about the influences of the different agricultural land use practices to natural hazards. In general, agriculture is not influencing negatively natural hazards. But, agriculture could aggravate an existing disposition for natural hazards. The trend of intensifying the farmlands and especially the grasslands in the fore Alps increases remarkably the disposition for surface runoff and therefore for flood discharges.
Agriculture and risk prevention disciplines can use the interdisciplinary compendium for adopting their practice in regards of the state-of-the-art. The study showed also that the involvement of all possible actors in integrated risk requires interdisciplinary competencies.

Keywords: surface runoff, erosion, landslide, agriculture, snow gliding