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Spatio-temporal effects of vegetated windbreaks on wind erosion and microclimate as basis for model development

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Wind erosion of arable soil is considered a risk factor for Austrian fields, but direct measurements of soil loss are not available until now. Despite this uncertainty, vegetated windbreaks have been established to minimize adverse wind impacts on arable land. The study addresses these questions: i) How relevant is wind erosion as a factor of soil degradation? ii) How important is the protective effect of vegetated windbreaks? iii) Are systematic patterns of spatial and temporal variability of wind erosion rates detectable in response to weather conditions?

Two experimental fields adjacent to windbreaks were equipped with sediment traps, soil moisture sensors, and meteorological measurement equipment for microclimatic patterns. Sediment traps were arranged in high spatial resolution from next to the windbreak to a distance of ten times the windbreak height. Beginning in January 2020, the amount of trapped sediment was analyzed every three weeks. The highest wind erosion rates on bare soil were observed in June and July. For unprotected fields with bare soil, upscaled annual erosion rates were as high as 0.8 tons per hectare, and sediment trapped increased in a linear fashion with distance from the windbreak. Soil water content near the surface (5 cm depth) was three percent higher at a distance of two times the height of the windbreak than at a distance of six times the height. For the same respective distances from the windbreak, we observed 29 days of soil water contents below the wilting point compared with 60 days.

The preliminary outcomes confirmed the expected effects of windbreaks on soil erosion and microclimate in agricultural fields. Prospective results from multiple vegetation periods will be used in an upscaling approach to gain informations for the whole basin. That is meant to be done by a combination with a soil wind erosion model which was so far used for regional modelling of wind erosion susceptibility.