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Model based optimization of wind erosion control by tree shelterbelt for suitable land management

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The degradation of soil by wind erosion causes huge problem in many parts of the world. The wind erodes the upper, nutrition rich part of the soil, therefore erosion causes soil productivity loss. The length of tree shelterbelts was significantly reduced by the collectivisation (1960-1989) and the wind erosion affected areas expanded in Hungary. The tree shelterbelt is more than just a tool of wind erosion control; by good planning it can increase the yield. The tree shelterbelt reduces the wind speed and changes the microclimate providing better condition to plant growth.
The aim of our work is to estimate wind erosion risk and to find the way to reduce it by tree shelterbelts. A GIS based model was created to calculate the risk and the optimal windbreak position was defined to reduce the wind erosion risk to the minimum. The model is based on the DIN 19706 (Ermitlung der Erosiongefährdung von Böden durch Wind, Estimation of Wind Erosion Risk) German standard. The model uses five input data: structure and carbon content of soil, average yearly wind speed at 10 meters height, the cultivated plants and the height and position of windbreak. The study field (16km2) was chosen near Szeged (SE Hungary). In our investigation, the cultivated plant species and the position and height of windbreaks were modified. Different scenarios were made using the data of the land management in the last few years. The best case scenario (zero wind erosion) and the worst case scenario (with no tree shelter belt and the worst land use) were made to find the optimal windbreak position. Finally, the research proved that the tree shelterbelts can provide proper protection against wind erosion, but for optimal land management the cultivated plant types should also controlled.
As a result of the research, a land management plan was defined to reduce the wind erosion risk on the study field, which contains the positions of new tree shelterbelts planting and the optimal cultivation.