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How Efficient is Vegetation in Reducing Wind Erosion and Emission of Health-Threatening Fine Dust PM10? - A Wind Tunnel Approach

K. Burri (1,2) and F. Graf (1)

(1) WSL Institute for Snow and Avalanche Research SLF, CH-7260 Davos Dorf, Switzerland (burri@slf.ch), (2) ETH Zurich, Institute for Integrative Biology IBZ, Forest Pathology and Dendrology, CH-8092 Zürich, Switzerland

World wide, wind erosion and desertification are most alarming processes of environmental degradation. Not only do they cause tremendous losses of fertile soil, but they also seriously affect human health. Pulmonary tuberculosis (silicosis) is one of the major diseases that have been linked to mineral fine dust (PM_{10}) in the atmosphere.

It is widely accepted that the re-establishment of an intact vegetation cover is the most effective measure against wind erosion. However, despite numerous investigations, the mechanisms responsible for the protective effect of vegetation are still not completely understood. Since the phenomenon involves highly variable interactions between soil, plants and atmosphere, it is particularly difficult to quantify the efficiency of vegetation in reducing wind erosion. As an alternative to field investigations, wind tunnel experiments offer the advantage to control specific parameters within this highly complex system.

In this study, a series of wind tunnel experiments was performed including measurements of sediment transport and PM_{10} emission in differently dense grass canopies of *Lolium perenne* (91, 24, 5 and 0 plants per square meter). The novelty of the present wind tunnel study is the use of living plants instead of artificial imitations or dead plant parts. Although more and more sophisticated imitations of vegetation have been used in recent studies, the behaviour of living plants is likely to differ significantly. Coloured quartz sand was used for visualizing sand erosion and deposition patterns. The vertical profiles of aeolian sediment flux were analysed with a stackable sediment sampler composed of 60 collecting boxes, each with a height of 1 cm.

The results of this study confirm that both sediment transport and PM_{10} emission strongly decrease with increasing plant cover. The protective effect of the plants was found to be linked to characteristic changes in the vertical profile of aeolian sediment flux and to specific spatial patterns of sediment deposition. Furthermore, observations indicate that the performance of plants in wind erosion control strongly depends on plant species specific characteristics, particularly growth form and stiffness, as well as on their physiological state.

The use of living plants in wind tunnel experiments offers the possibility to study a wide range of more specific aspects of biological wind erosion control. As a next step it is planned to test the effect of mycorrhizal fungi on the wind erodibility of vegetated soil systems.