# Kolloquium
# Boden und Wasser

Bodenkunde & Waldernährung

HYDROLOGY

## 27. November 2014, 16 ct – 18 Uhr
## Hörsaal Fahnenbergplatz (Rektoratsgebäude)

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# „Self-organisation of arid landscapes: Formation of vegetation patterns and armouring of soil surfaces”

Self-organised vegetation pattern are a characteristics of semi-arid and arid ecosystems. Their landscape ecological function has been studied for decades and a soil-vegetation feedback has been identified to cause the formation of banded patterns. Vegetation and its associated soil biological activity causes soil properties to increase its storage capacity for water and nutrients leading to water harvesting by runoff and runon in response to rainfall events. This has lead ecologist to formulate the trigger-transfer-pulse framework, which describes resources redistribution and utilisation as discrete events, which depend on the frequency and magnitude of rainfall as the trigger. While water is a limited resource in this context, it is also a geomorphic agent which causes erosion and sediment redistribution. Stability of such landscapes and ecosystems depends therefore on both vegetation distribution and soil surface properties that contribute to the redistribution of water in the landscape preventing frequent and excessive erosion events. Within this context I will present our findings on modelling and observing vegetation patterns and the development of rock amour on soil surfaces within the context of Australian arid regions in which mining has led to severely disturbed landscapes.

The focus of our modelling was to assess how a highly refined temporal or spatial process description of surface runoff and runon affects vegetation pattern at the hill slope scale. On the one hand, we found indicators that banded vegetation as opposed to completely random vegetation was efficiently harvesting surface runoff up to a critical rainfall intensity at which water loss due to excessive runoff through the vegetation can be expected. Such periodic vegetation pattern seems to be vulnerable to sudden perhaps catastrophic shifts due a change in rainfall variability or other external factors changing soil properties such as grazing. On the other hand, by refining the spatial scale of water redistribution by explicitly taking into account the microtopography of the hill slope surfaces using a cellular automaton, we revealed that very different soil vegetation patterns based on the same vegetation-soil feedback could coexist. In order to further identify the role to soil properties and the soil surface for landscape and ecosystems stability, we investigated in the same climatic region stabilisation of soil through rock armouring on natural and engineered hill slopes. By analysing the rock fragment size distribution along natural mesa hill slopes and waste rock dump slopes we identified different mechanisms contributing to stabilising landscapes at different temporal scales, such as soil wash and fragmentation of rock. The talk will conclude with the evaluation of the role of soil surface properties in the context of vegetation distribution for the stability of natural and engineered arid landscapes.