Geophysical Research Abstracts
Vol. 18, EGU2016-917, 2016
EGU General Assembly 2016

Biological soil crust as a bio-mediator alters hydrological processes in stabilized dune system of the Tengger Desert, China

Xinrong Li

Shapotou Desert Research and Experiment Station, Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences, 730000 Lanzhou, China (spd@cern.ac.cn)

Biological soil crust (BSC) is a vital component in the stabilized sand dunes with a living cover up to more than 70% of the total, which has been considered as a bio-mediator that directly influences and regulates the sand dune ecosystem processes. However, its influences on soil hydrological processes have been long neglected in Chinese deserts. In this study, BSCs of different successional stages were chose to test their influence on the hydrological processes of stabilized dune, where the groundwater deep exceeds 30m, further to explore why occur the sand-binding vegetation replacement between shrubs and herbs. Our long-term observation (60 years) shows that cyanobacteria crust has been colonized and developed after 3 years since the sand-binding vegetation has been established and dune fixation using planted xerophytic shrubs and made sand barrier (straw-checkerboard) on shifting dune surface, lichen and moss crust occurred after 20 years, and the cover of moss dominated crust could reach 70 % after 50 years. The colonization and development of BSC altered the initial soil water balance of revegetated areas by influencing rainfall infiltration, soil evaporation and dew water entrapment. The results show that BSC obviously reduced the infiltration that occurred during most rainfall events (80%), when rainfall was greater than 5 mm or less than 20 mm. The presence of BSC reduced evaporation of topsoil after small rainfall (<5 mm) because its high proportion of finer particles slowed the evaporation rate, thus keeping the water in the soil surface longer, and crust facilitated topsoil evaporation when rainfall reached 10 mm. The amount of dew entrapment increases with the succession of BSC. Moreover, the effect of the later successional BSC to dew entrapment, rainfall infiltration and evaporation was more obvious than the early successional BSC on stabilized dunes. In general, BSC reduced the amount of rainfall water that reached deeper soil (0.4–3m), which is where the roots of shrubs are primarily distributed. These changes in the soil moisture pattern induced shifting of sand-binding vegetation from initial planted xerophytic shrub communities with higher coverage (35%) to complex communities dominated by shallow-rooted herbaceous species with low shrub coverage (9%). In correspondence with these changes, soil water balance of the initial vegetation systems (mean soil water kept 3.5%) was turned into a new balance of current vegetation (mean soil water maintains 1.5%). Above findings provide an important enlightenment for future desertification control and sand hazards prevention by revegetation.