Geophysical Research Abstracts
Vol. 21, EGU2019-469-1, 2019
EGU General Assembly 2019

Seasonal Reversals of Vegetation on Opposing Hillslopes in Semi-arid Ecosystems

Nikul Kumari (1), Omer Yetemen (1), Samuel A Johnstone (2), Ankur Srivastava (1), Jose F Rodriguez (1), and Patricia Saco (1)

(1) University of Newcastle, University of Newcastle, Civil, Surveying and Environmental Engineering, Callaghan, University drive, Australia (nikul.kumari@uon.edu.au), (2) Geology, Geophysics, and Geochemistry Science Center, U.S. Geological Survey, Denver, Colorado, USA

Contrasts in insolation lead to the development of aspect-controlled ecosystems characterized by heterogeneity in vegetation type and density in semi-arid ecosystems. Vegetation dynamics are strongly influenced by the availability of soil moisture on opposing hillslopes in semi-arid landscapes. Aspect controls on vegetation type and density have long fascinated ecologists as well as geomorphologists, and they mostly claim that polar-facing slopes (PFS) have denser vegetation than equator-facing slopes (EFS). While this observation characterizes the mean state of ecosystems, here we examine the seasonality of aspect-controlled ecosystems to gain insights about the vegetation protection for erosion. Here, we extracted NDVI values derived from Landsat 5, 7, and 8 (obtained from Google Earth Engine) for a 17 year period for 80 different catchments across the world having a size from 5 to 200 square km, where aspect-controlled vegetation has been reported. For each of the 80 catchments, we calculated the mean monthly NDVI values for PFS and EFS. Patterns of monthly mean NDVI reveal two broad categories for aspect dependent ecosystems; 1) higher NDVI on PFS all-year-round; (2) higher NDVI on EFS during the winter season. Higher NDVI on PFS is attributed to less insolation preserving valuable moisture in this semi-arid landscapes. One explanation for the observed winter reversal in NDVI may be attributed to preferential snow cover on PFS. The spatial NDVI analysis at such sites shows the seasonal reversal of NDVI on opposing hillslopes. Using the NDSI (normalized difference snow index) datasets for the last 17 years and air temperature records, we show that snow cover is absent from some sites still displaying a winter reversal in NDVI contrasts. Another explanation for this NDVI reversal in snow-free sites is favourable winter growing conditions for vegetation when the wet season in Mediterranean climate meets with relatively higher insolation on EFS. We suggest the winter reversal in NDVI in those sites can be ascribed to vegetation functionality and relatively higher insolation on EFS in winter with available soil moisture. These findings show that in aspect-controlled ecosystems, seasonal reversals in erosion protection provided by vegetation can alter erosion mechanisms on PFS and EFS.