Geophysical Research Abstracts
Vol. 16, EGU2014-11377, 2014
EGU General Assembly 2014

Ecological Maturity and Drought Stress of Biological Soil Crusts along a Central European Inland Dune Catena

Thomas Fischer (1), Maik Veste (2), Larysa Mykhailova (1,3)

(1) Brandenburg University of Technology Cottbus-Senftenberg, Central Analytical Laboratory, Konrad-Wachsmann-Allee 6, 03046 Cottbus, Germany (thomas.fischer@tu-cottbus.de), (2) CEBra - Centre for Energy Technology Brandenburg e.V., Friedlieb-Runge-Straße 3, 03046 Cottbus, Germany (maik.veste@me.com), (3) Kharkiv National Automobile and Highway University, 25 Petrovskoho str., Kharkiv, Ukraine (lora_net@list.ru)

In the early stages of ecological succession, the rate of primary production, or total photosynthesis (P) exceeds the rate of community respiration (R), so that the P/R ratio is greater than 1. In the special case of organic pollution, the P/R ratio is typically less than 1. Odums theory (Odum, 1969) is that P/R approaches 1 as succession occurs. The P/R ratio, therefore, should be an excellent functional index of the relative maturity of the system. Photosynthesis and respiration of biological soil crusts (BSCs) sampled along a mobile inland dune catena were determined to evaluate the applicability of Odums P/R ratio for estimation of crust ecosystem maturity under progressing drought stress. Samples of BSCs were collected near the dune crest (aeolian deflation zone, BSC type 1, thickness 1-2 mm, 13.8 mg/m2 Chlorophyll a), at the at the dune slope (protected from wind by tussocks of Corynephorus canescens, BSC type 2, thickness 2-4 mm, 24.5 mg/m2 Chlorophyll a) and near the base (BSC type 3, thickness 4-6 mm, 27.3 mg/m2 Chlorophyll a) of a carbonate-free, siliceous, east-facing inland dune. The P/R-ratio decreased with crust biomass downslope, with the exception that the highly disturbed and seemingly most immature BSC type 1 did not have the highest P/R ratio as could be expected according to our working hypothesis (mean arithmetic P/R=0.85), but the lowest compared to BSC types 2 and 3 (mean arithmetic P/R values 1.78 and 1.25, respectively). Dümig et al. (2013) reported decreasing relative amounts of fossil and increasing amounts of recent carbon downslope for the same BSCs as studied here. At the same time, the 14C ages of the crusts decreased from 570 years for the mineral substrate, to 165, 80 and ∼5 years for BSC type 1, 2 and 3, respectively (Dümig et al., 2013). We attribute the unexpectedly low P/R ratio of crust 1 to the influence of fossil, non-crust organic matter which was inherited from former pedogenesis, and which can be considered as „organic pollution“ in the Odum's sense. Decomposition of inherited organic matter possibly superimposed decomposition of the ecosystem's recent C, thus lowering P/R. Soil water potential did not significantly influence the P/R ratio, indicating that the maturity can be compared between different BSC types under varying soil moisture conditions.

References

Dümig, A., Veste, M., Hagedorn, F., Fischer, T., Lange, P., Spröte, R., Kögel-Knabner, I., 2013. Biological soil crusts on initial soils: organic carbon dynamics and chemistry under temperate climatic conditions. Biogeosciences Discuss. 10, 851-894.

Odum, E.P., 1969. The strategy of ecosystem development. Science 164, 262-270.