



Endurance of Australian dry-savannah cyanobacteria regulated by extra-cellular polysaccharides - EPS and environment

W. Williams (1), B. Budel (2), H. Reichenberger (2), and N. Rose (1)

(1) The University of Queensland, Arid Soil Ecosystems, Agriculture and Food Sciences, Gatton Campus, Australia (wendy.williams@uq.edu.au), (2) Department of Plant Ecology and Systematics, Institute of Biology, University of Kaiserslautern, P.O. Box 3049, D-67653 Kaiserslautern, Germany

Cyanobacterial crusts are an important driver of ecosystem function throughout Queensland's dry savannah. Annually there is very little rainfall during the winter-dry season. In the summer-wet season build-up early storms precede its onset; days are low in humidity with high ambient ($>40^{\circ}\text{C}$) and soil surface temperatures ($60\text{-}74^{\circ}\text{C}$). In the wet season monsoon rains and tropical storms result in vast flooded plains and ephemeral wetlands, leaving the ground saturated for several weeks.

At Boodjamulla National Park (NW Qld), cyanobacterial crusts were sampled during the dry season, after 125 days without rain. An Imaging PAM (Walz) was used to determine the resurrection and quantum yield of Photosystem II (PSII). The crusts were periodically watered for ten days and multiple PAM measurements were made on a daily basis. PSII in cyanobacteria showed no signs of resurrection; however new *Nostoc* colonies emerged on the eighth day. Microscopic examination revealed other cyanobacteria remained in a desiccated state and EPS seemed hydrophobic.

In the following dry season, crust samples were preserved at 40°C at low humidity. During the wet season these samples were reintroduced into their natural environment of high humidity and subject to periodic rains. The resurrection of PSII commenced within two hours of the first rainfall and was fully functional within 24 hours at which time existing cyanobacterial cells rapidly re-hydrated and EPS exhibited hydrophilicity.

These are the first field studies demonstrating the environmental conditions controlling the function of cyanobacterial EPS and the resurrection of PSII. Mass EPS production occurs several times throughout the wet season. Eventually, as the humidity drops, temperatures remain high and sunny conditions prevail the EPS hardens and dries forming thick hydrophobic polymeric surfaces. As temperatures rise and fall, crusts crack and curl, then start to disintegrate after the first rains of the wet season before new crusts start to grow.