Geophysical Research Abstracts
Vol. 17, EGU2015-15301, 2015
EGU General Assembly 2015

Design droughts as planning tool for ecosystem establishment in post-mining landscapes

Devanmini Halwatura, Alex Lechner, Thomas Baumgartl, Neil McIntyre, and Sven Arnold
The University of Queensland, Centre for Mined Land Rehabilitation, Brisbane, Australia

Eastern Australia has considerable mineral and energy resources and areas of high biodiversity value co-occurring over a broad range of agro-climatic environments. Water is the primary abiotic stressor for (agro)ecosystems in many parts of Eastern Australia. In the context of mined land rehabilitation quantifying the severity-duration-frequency (SDF) of droughts is crucial for successful ecosystem rehabilitation to overcome challenges of early vegetation establishment and long-term ecosystem resilience.
The objective of this study was to quantify the SDF of short-term and long-term drought events of 11 selected locations across a broad range of agro-climatic environments in Eastern Australia by using three drought indices at different time scales: the Standardized Precipitation Index (SPI), the Reconnaissance Drought Index (RDI), and the Standardized Precipitation-Evapotranspiration Index (SPEI). Based on the indices we derived bivariate distribution functions of drought severity and duration, and estimated the recurrence intervals of drought events at different time scales. The correlation between the simple SPI and the more complex SPEI or RDI was stronger for the tropical and temperate locations than for the arid locations, indicating that SPEI or RDI can be replaced by SPI if evaporation plays a minor role for plant available water. Both short-term and long-term droughts were most severe and prolonged, and occurred most frequently in arid regions, but were relatively rare in tropical and temperate regions.
Our approach is similar to intensity-duration-frequency (IDF) analyses of rainfall crucial to design infrastructure. In this regard, we propose to apply SDF analyses of droughts to design ecosystem components in post-mining landscapes. Together with design rainfalls, design droughts should be used to assess rehabilitation strategies and ecological management based on drought recurrence intervals, thereby minimising the risk of failure of initial ecosystem establishment due to ignorance of fundamental abiotic and site-specific environmental barriers.