Linking biogeochemistry and groundwater salinity at Clark's Floodplain, Bookpurnong, South Australia

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ABSTRACT

Salinisation of the Murray River and adjacent floodplains is an ongoing problem in southeast Australia, affecting human populations and the environment. Until now, monitoring rising salinity typically requires access to bores or geophysical data that can be expensive to obtain and require specialised knowledge to interpret. Emphasis over the past 50 years has been placed on developing biogeochemistry as a mineral exploration tool. The potential of biogeochemistry as an environmental monitoring tool, specifically its innovative application in salinity detection, is explored in this study as well as proposing a multi-disciplinary index for assessing the risk of floodplain areas prone to salinisation. A biogeochemical sampling program using *Eucalyptus camaldulensis* (river red gum) and *Eucalyptus largiflorens* (black box) was designed for the study area at Clark's Floodplain, near Loxton, South Australia. Results of the survey were then compared with three geophysical surveys, groundwater analyses, and a regolith-landform map to assess how well the survey acted as a proxy for groundwater quality and salinity. Key factors contributing to salinity were also identified. Statistical and spatial analysis of Na, Mo, Cu, Mn, Fe, U, Au, Cd, Ca, P, Mg, Ti, K, and S biogeochemical data was also conducted. From the biogeochemical survey, it is evident that Na, K, and Mo show strong correlation with conductivity variations in the upper 9 m of sediment, which corresponds with the location of saline groundwater in the area and are suitable pathfinder elements for groundwater salinity. The proposed assessment index uses a scale of 1 to 14 to express risk from factors including flooding frequency, depth to the water table, and Na, K, and Mo concentrations in vegetation. The study supports the potential for plant biogeochemistry to be used as a viable tool for groundwater monitoring and salinity risk assessment but works best as part of an integrated, multi-disciplinary approach, incorporating regolith-landform mapping and, where available, geophysical and water chemistry data. The study also demonstrates potential for further research in areas where contaminated groundwater and groundwater salinity are environmental management issues. Future research will ideally focus on temporal studies that are beyond the scope of this study, as well as different landscape settings and groundwater chemistry and the application of biogeochemistry to monitoring acid sulphate regolith.

Keywords: Biogeochemistry, salinity, river red gum, black box, groundwater, Murray River, Bookpurnong