

First record of acid sulfate soils in a southern African Ramsar estuarine lake

Adams, JB; Penaluna, J; Lakane, CP; Riddin, T; Rishworth, GM; Turner, D; Van Niekerk, Lara; Lemley, DA

Abstract

Rewetting of acid sulfate soils (ASS) that had prevailed after prolonged drought conditions between 2016 and 2021 caused acidification of the Verlorenvlei Estuarine Lake Ramsar site. ASS had not been recorded previously in South African estuarine systems. Historical aerial photographs revealed large areas of orange ASS visible in 2019 and 2020. In late 2021 the main lake basin of Verlorenvlei was highly acidic ($\text{pH} < 3.5$). After water levels increased in June 2023 following high winter rainfall, the pH of the water column in the main lake increased but remained acidic ($\text{pH} \sim 4$). Despite initial buffering of the pH ($\text{pH} \sim 6.5$) during high freshwater inflow and open mouth conditions in September 2023, the water column returned to an acidic state by February 2024 ($\text{pH} \sim 4.7$) once the mouth closed and water levels receded. Coupled to these water column observations, analyses revealed highly acidic ($\text{pH} < 4$) and sulfate-rich conditions in exposed soils during low water levels. Similarly, pyrite and jarosite both occurred in exposed soils in the middle reaches of the Verlorenvlei Estuarine Lake during the drying out phase characterised by extremely low water levels. These minerals are indicative of the presence of ASS that have become exposed and oxidised. The acidic conditions recorded in this study pose a threat to biodiversity and the Ramsar status of this estuarine system and is likely to impact surrounding livestock and agriculture. This study is globally relevant as climate change and freshwater abstraction pressures increase.