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Spatial Modelling of Irrigation Water Quality: Assessing SAR in South Africa's Agricultural Landscapes

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The Sodium Absorption Ratio (SAR) is a critical metric used to assess the suitability of water for agricultural irrigation, reflecting the potential for sodium to accumulate in soil and negatively affect crop yield and the ecosystem. In South Africa, agriculture is a cornerstone of economic development, contributing significantly to GDP and employment. Identifying geographical locations with poor SAR measures is essential for sustaining agricultural productivity and environmental health. In this study, a generalized additive model (GAM) was employed to analyse the spatial distribution of the SAR across South Africa. The model incorporated a spatial effect based on the geographical coordinates of the sample locations. This allowed for the investigation of how geographical factors influence the SAR in various regions across South Africa, while controlling for predictors, such as other water quality parameters. The study made use of data from inorganic water chemistry analysis of samples from rivers, dams and lakes that were collected between the years 1970 to 2011 in South Africa. The significance of this research lies in its capacity to pinpoint locations with poor water quality, thereby guiding interventions aimed at soil and water management to avert potential degradation of arable land. The findings of this study not only aid in optimizing resource allocation for improving water quality but also contribute to the broader objectives of sustainable agricultural practices and economic stability in South Africa.

Alongside this study, an interactive dashboard is under development for the monitoring and evaluation of water quality data in South Africa. The dashboard incorporates visualizations and important summary measures for SAR as well as other various water quality parameters. This tool democratizes access to vital information, enabling stakeholders to make informed decisions based on comprehensive water data analysis and visualizations. This tool not only enhances transparency and accountability but also facilitates a more targeted and efficient allocation of resources towards improving water quality initiatives in South Africa.

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