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Random Forest Algorithm for Wetland Inundation Prediction in a Semi-arid Floodplain

Sara Shaeri Karimi (1), Neil Saintilan (1), and Li Wen (2)

(1) Department of Environmental Sciences, Faculty of Science and Engineering, Macquarie University, Sydney, NSW 2109, Australia , (2) Science Division, NSW Office of Environment and Heritage, Sydney, NSW, Australia

Floods are the primary force behind floodplain ecology, as such, comprehending their temporal and spatial variability is imperative for efficient resource management, particularly when seeking a suitable equilibrium between extractive use and environmental water allocation. However, it is challenging to accurately quantify flooding at the fine spatial and temporal scales essential for ecological modelling. In this paper, a machine learning technique, denominated Random Forest, was applied to predict the daily pattern of flooding in a large (1200 km2) semi-arid floodplain, the Upper Darling River Floodplain, Australia, at a fine spatial resolution of 30 m. The model attained very good performance with an average accuracy of 0.915 based on the Area under the Receiver Operating Characteristic (AUROC) curve. For highly biased data, results showed that the down-sampling method was effective to balance the data, and to increase the predictive power for minority classes. The model revealed that the landscape shape (local deviation from global mean elevation), the river discharge magnitude accumulated over thirty days, and the location (elevation-weighted distance to the river) were the dominant variables in forecasting flood incidence. This method is applicable to floodplains worldwide where the comprehension of a fine-scale inundation pattern is overriding for operational ecological management and scenario testing.

Keywords: Machine learning, down-sampling, inundation regime, wetland