A Novel Physics Based Predictive Model for Wetland Eutrophication

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Estuaries are wetlands where freshwater from streams mixes with salt water from sea. Also known as “kidneys of our planet”- they are extremely productive environments that filter pollutants, absorb floods from sea level rise,and shelter a unique ecosystem. However, eutrophication and loss of native species are ailing our wetlands. There is a lack of uniform data collection and sparse research on correlations between physical phenomenon affecting wetlands and in situ measurements. This project attempts to find correlations between the physical phenomenon and in situ observations, collected at five west coast estuaries. The physical phenomenon impacting estuaries may be natural or anthropogenic. Natural factors are influenced by the sun, tides and seasons. The anthropogenic factors considered are sea level rise and farm fertilization (represented by spring and fall runoffs). Math models (MMs) were used to represent these factors. Publicly available data from estuaries was used to obtain 10 parameters (OPs) critical for measuring eutrophication. Average OP values were calculated per month for 23 years. Correlations between the MM data and 10 OPs were made by running five regression based machine learning models. The Random Forest ML model had the best R2 values. P-values were low demonstrating statistical significance. Feature importance charts provide quantitative proof that anthropogenic factors impact estuarine health. This novel approach can be used to get periodic analysis of overall wetland health. It supports the hypothesis and can be scaled to other estuaries. Additionally MMs can be used to develop correlations with critical parameters that measure eutrophication in situ data and used by practitioners to easily monitor wetland health.