Youth Connect

Youth Community Resilience to Climate Change in the Mekong Delta (Y-CoRe)

Monitoring and assessing salinity on rice land – A case study in Chau Thanh District, Tra Vinh Province

Project background

The timely and accurate collection of information on soil salinisation is of vital practical significance for preventing land degradation and restoring ecosystems in arid regions. Monitoring soil salinity using traditional methods such as field measurements and laboratory analysis rarely provides large-scale salinity distribution data and is both time-consuming and costly.

This study proposes a method for mapping soil salinity using freely available remote sensing data and building a WebGIS platform to visualise salinity levels and rice field areas. The system aims to provide timely information to farmers about saltwater intrusion, enabling them to plan proactively, enhance their climate change resilience, and strengthen connections between agricultural officers and farmers through this accessible digital information tool.

The research area, Chau Thanh district in Tra Vinh province, was selected for its large rice cultivation area and high vulnerability to saltwater intrusion. The project was conducted until the end of August 2023.

Project objectives

- To develop a crop season map for rice cultivation in Chau Thanh district, Tra Vinh province.
- To propose a method for mapping soil salinity.

Project overview

The study created a current crop season structure map using multi-temporal Sentinel-1 satellite imagery. VH polarisation images were extracted monthly to monitor the characteristic fluctuations of land cover throughout the year. Classification was conducted using a supervised Random Forest algorithm. Then, salinity data was collected from 70 rice field sampling points to estimate and map soil salinity levels using two methods: Inverse Distance Weighting (IDW) interpolation and multivariate regression based on spectral bands from Sentinel-1, Sentinel-2, and a Digital Elevation Model (DEM).

Outstanding outcomes

The study developed a rice cropping pattern map for Chau Thanh district, Tra Vinh province, including three current statuses: triple rice cropping, double rice cropping, and rice-shrimp farming. The classification map demonstrated high reliability, with an overall accuracy of 92.64 per cent and a Kappa coefficient of 0.89. Subsequently, the study collected 63 samples corresponding to 63 surveyed rice field points in Chau Thanh district, Tra Vinh province, to analyse two soil indicators: pH and EC (electrical conductivity). The sample analysis results showed that EC values ranged from 112.9 µS/cm to 1676.5 µS/cm, with an average value of 351.4 µS/cm. Additionally, the soil pH values across the study area ranged from 4.2 to 7.6, with an average of 5.3.

Soil EC estimation in the study was conducted using the Inverse Distance Weighting (IDW) interpolation method and multivariate regression analysis. Specifically, the IDW method was applied using data from 44 survey points (70 per cent), followed by a comparison through univariate regression with 19 survey points (30 per cent). The results showed a coefficient of determination (R^2) of 0.42 and a correlation coefficient (r) of 0.64. On the other hand, the multivariate regression method was conducted using input data from 44 survey points (70 per cent), Sentinel-1 and Sentinel-2 spectral bands, and salinity indices (SI). Through Bayesian Model Averaging (BMA) analysis, the model yielded a BIC value of -41.64 and a posterior probability of 15.6 per cent. A univariate regression comparison with 19 survey points (30 per cent) showed a correlation between the EC estimated by the multivariate regression method and the actual EC, with an R^2 of 0.61 and a correlation coefficient (r) of 0.78.

In addition, the study developed a WebGIS to display the rice cropping pattern map and the salinity maps estimated using interpolation and multivariate regression methods, based on the Google Earth Engine platform through the Earth Engine Apps tool.

Team member's information

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