A Geographic Information System (GIS)-based analysis to predict the suitability of rubber plantation by Extreme Learning Machine and Decision Tree

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Abstract: Rubber trees are important industrial plants in Thailand and the ASEAN region. Thailand is one of the top natural rubber-producing countries. The selection of suitable planting area is crucially important. The objective of this study was therefore to create a model to predict a geographic area suitable for rubber tree cultivation with Extreme Machine Learning, an effective learning scheme of feedforward Neural Networks, and Decision Tree, under GIS-based analysis in the Udonthani province. The study was composed of three main steps. The first step was to determine physical characteristics of land for rubber planting. In accordance with the principle of the FAO 1983 guideline for land evaluation, 9 factors were examined: temperature, radiation regime, nutrient availability index, nutrient retention, oxygen availability, terrain, rooting conditions, water retention, and salt hazards. The second step was to create a model to predict suitable land for rubber tree plantation by using the results from the first step. The last step was to determine the validity of the results obtained from the model by comparing and measuring the efficiency and precision, using the K-fold cross validation by dividing the data into 5 number sets (K=5). The Neural Network technic had an accuracy up to 99.490% and the root-mean-square error (RMSE) of 0.558, whereas the Decision Tree had an accuracy up to 99.780% and the RMSE of 0.032. The study found that the model can reduce the assessment process to find appropriate farming land, is applicable to any other geographic areas, can avoid to use land inappropriately, can reduce the risk of poor rubber production, and support an efficient and more sustainable use of land.

Keywords: GIS, Land Evaluation, Neural Network, Extreme Leaning Machine, Decision Tree