**Capability Modelling for Kudzu Species using GIS**

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**Project Overview:**

This lab focused on environmental suitability analysis using raster-based capability modeling to determine where the invasive plant species Kudzu could potentially grow across the contiguous United States. The modeling integrated climatic and topographic data, including elevation, annual precipitation, temperature, and frost-free days. Using ArcGIS tools like Raster Calculator, Zonal Statistics, and Map Algebra, binary thresholds were applied to environmental raster’s to evaluate regions' capacity to support Kudzu growth. The objective was to create a pass/fail model that visualizes where environmental conditions are sufficient for Kudzu to survive or thrive, based on thresholds for precipitation and temperature.

Core skills applied include raster reclassification, binary modeling, regression-based prediction of frost-free days, and raster-vector transformations for spatial statistical modeling.

Map 1: Elevation Statistics by State

This map pair displays the Mean and Maximum Elevation values across selected U.S. states (Georgia, California, Texas). The data was derived using Zonal Statistics applied to an elevation raster (elev10k). These visualizations support environmental analysis by highlighting topographic variability that may influence ecological distributions.

**A map of the united states with different colored states

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Map 2: Precipitation Threshold Map

This binary classification map shows areas that meet or fall below an annual precipitation threshold of 4000 mm, a condition necessary for Kudzu survival. Using a conditional raster calculation, the dataset was reclassified to mark suitable areas (1) and unsuitable areas (0) for precipitation.

A map of the united states

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Map 3: Frost Free Requirements Days Map

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Map 4: Capability Model Map

This final map overlays the reclassified precipitation and frost-free raster into a composite suitability index using a concatenation method. The resulting grid codes reflect all possible environmental outcomes (e.g., sufficient precipitation and optimal warmth). This comprehensive model identifies areas where Kudzu can thrive, survive, or fail, enabling strategic ecological planning.

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