**Raster to Vector Conversion and Ecoregion Analysis  
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**Project Overview**

This lab explored the accuracy trade-offs between raster and vector formats in GIS by examining how environmental and demographic data are impacted when converted across formats and resolutions. Students began by analyzing ecoregions in Georgia using both high-resolution (1 km) and lower-resolution (4 km) rasters. The lab also investigated how raster cell resolution influences area calculations, population estimations, and spatial representation of geographic features like coastlines and ecological zones.

In later parts, population counts derived from raster data were compared against original vector-based Census figures to quantify error introduced during rasterization. A final dot density map visualized racial demographics across ecoregions in Georgia.

**Graphic 1: Raster Cell Misalignment with Vector Ecoregions**

**Description:**  
This map shows vector ecoregion boundaries overlaid on a raster grid, highlighting misalignment issues. In the Miami Metropolitan region, raster cells extend into water bodies and omit some land portions, especially along coastlines. The caption notes “hanging” or incomplete cells, underscoring the limitations of coarse raster grids when representing complex geographic boundaries.

**A screenshot of a computer

Description automatically generated**

**Graphic 2: Impact of 4 km Cell Size on Ecoregion Representation**

**Description:**  
This map compares raster and vector ecoregion representations at a 4 km resolution. While fewer gaps exist than in the 1 km raster, coastal and boundary regions display clear mismatches. Raster cells overextend past borders, creating misclassifications. This visualization underscores the trade-off between reduced data gaps and increased generalization.

A screenshot of a computer

Description automatically generated

**Graphic 3: Racial Dot Density Map Across Ecoregions**

**Description:**  
This map overlays racial demographic data on Georgia’s ecoregions. Each dot represents 1,000 people, colored by ethnic group. With tract boundaries removed, the visualization focuses on population distribution across ecological zones, demonstrating how social data interacts with environmental classifications.

A map of georgia with many dots

Description automatically generated

**Table 1: Population Error by Ecoregion (4 km Raster)**

**Description:**  
This table lists the percentage error between raster-derived and actual vector-based ecoregion areas for each Level III ecoregion. The 4 km raster introduced greater errors due to generalization, with the highest underestimation in Blue Ridge and greatest overestimation in Interior Plateau.

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| --- | --- |
| **ECOREGION** | **ERROR (%)** |
| Blue Ridge | -0.700 |
| Southwestern Appalachians | -0.445 |
| Southern Coastal Plain | -0.201 |
| Middle Atlantic Coastal Plain | -0.149 |
| Ridge and Valley | -0.021 |
| Southeastern Plains | 0.064 |
| Piedmont | 0.077 |
| Southern Florida Coastal Plain | 0.546 |
| Interior Plateau | 0.703 |

**Table 2: Population by Ecoregion (Raster-Based Estimate)**

**Description:**  
This table presents the estimated population living within each Level III ecoregion in Georgia, derived from the raster dataset. These values reflect spatial overlay of population raster cells with ecological regions, enabling a basic spatial demographic analysis. The Piedmont ecoregion stands out as the most populated by far, aligning with known urban centers like Atlanta. This table highlights how raster data can be used for regional population assessments when vector data is unavailable or generalized data is sufficient.

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| --- | --- |
| **ECOREGION** | **Population (from the raster)** |
| Southwestern Appalachians | 19,851 |
| Blue Ridge | 219,145 |
| Ridge and Valley | 555,176 |
| Southern Coastal Plain | 812,098 |
| Southeastern Plains | 1,858,020 |
| Piedmont | 6,416,906 |