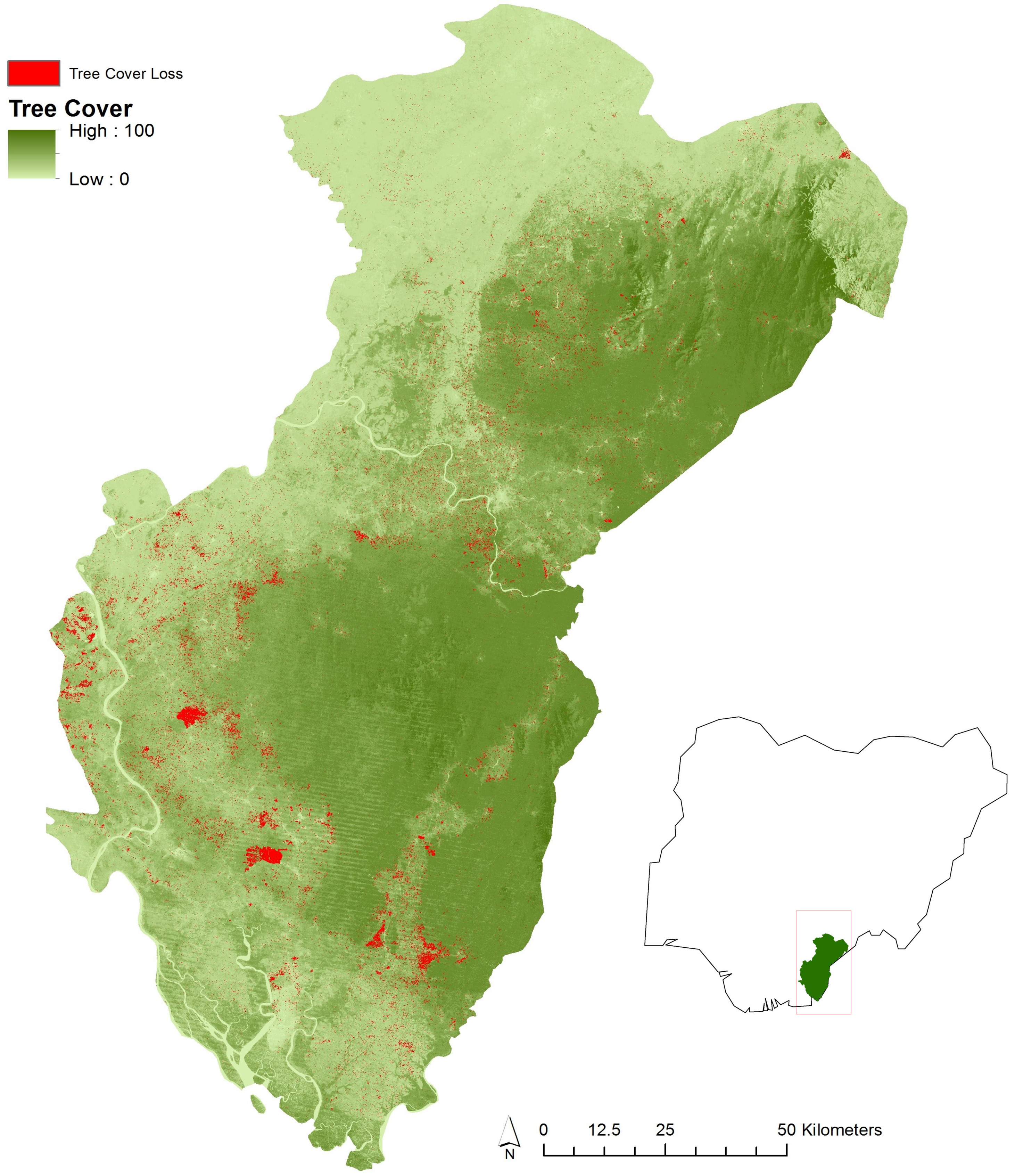
Optimal Sites for Agroforestry in Nigeria's Cross River State

Introduction

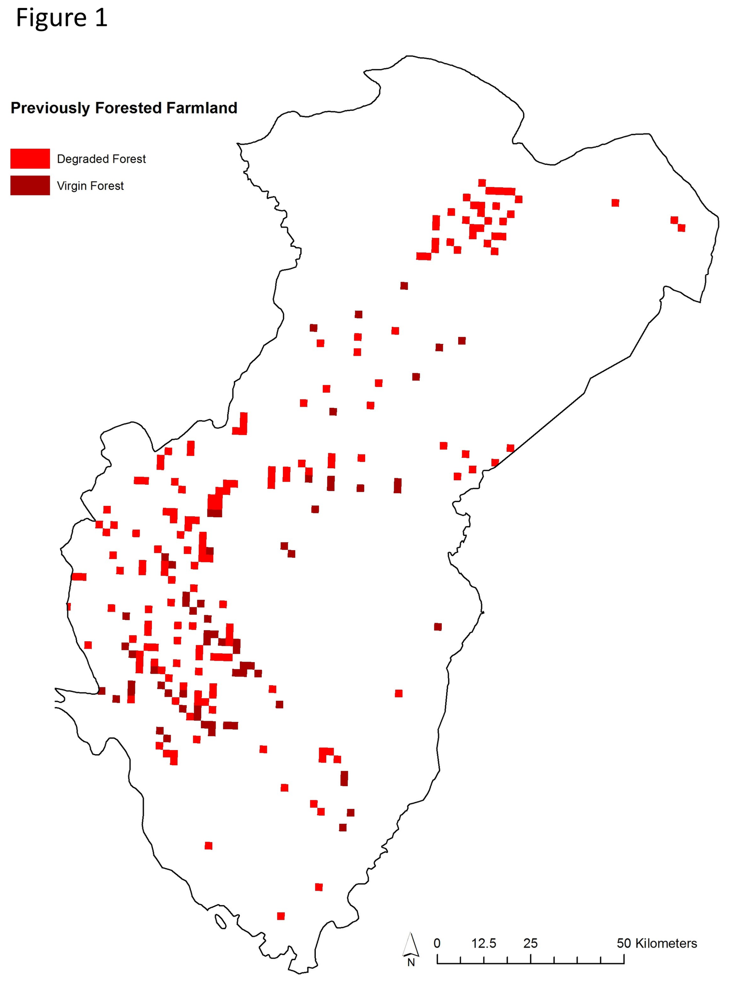
The Federal Republic of Nigeria, home to a diverse range of ecosystems, including large tracts of tropical and mangrove forests, currently has one of the highest deforestation rates in the world[1]. Nigeria has lost 50 percent of its forest cover since 1990, and is losing its remaining forests at a rate of approximately 100,000 hectares per year, driven primarily by agriculture[2]. Nigeria's Cross River state contains more than half of the country's remaining tropical high forests, but is experiencing both high rates of deforestation and agricultural expansion[1].

Agroforestry, a suite of agricultural techniques involving the retention or introduction of trees with crops or pasture, can help curb deforestation while supporting farmer livelihoods and mitigating climate change. This project seeks to locate optimal areas in Nigeria's Cross River state for targeted rural advisory services aimed at increasing adoption of agroforestry, helping ensure successful transitions to the practice and efficient use of extension resources.



Methodology

Figure 1

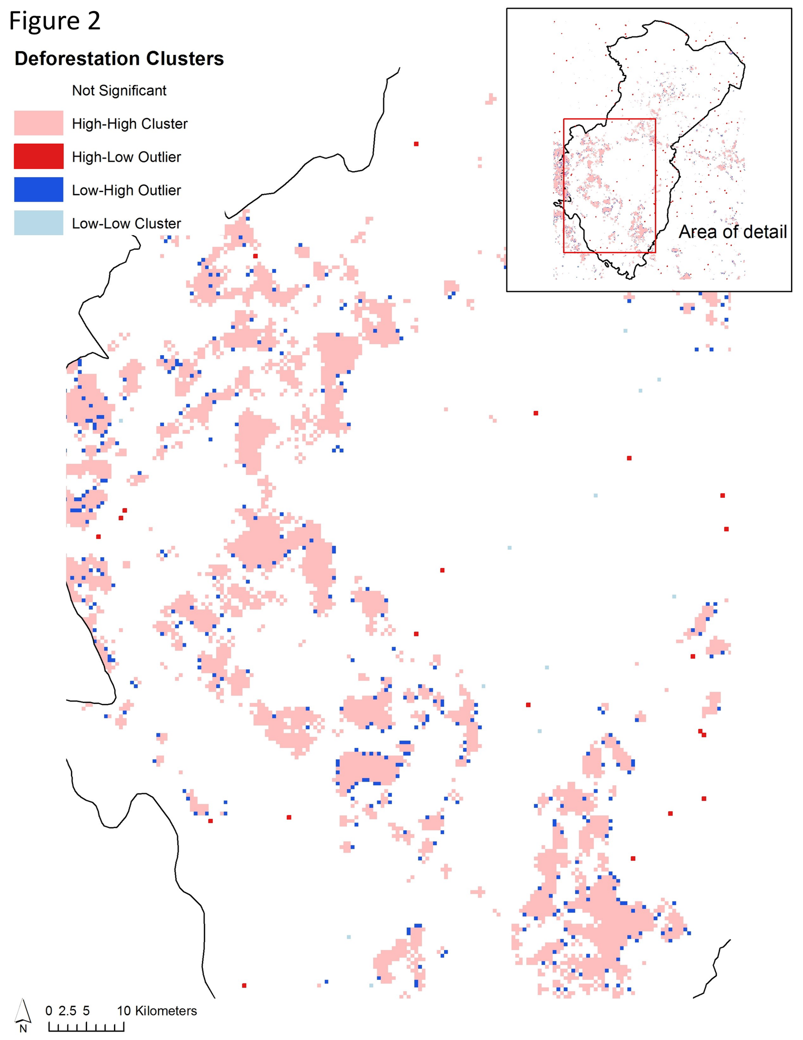


The spatial analysis consists of two main approaches: a cluster analysis to find significant areas of deforestation, and a suitability map to find optimal regions for rural advisory services to target agroforestry interventions.

USGS data for land use and land cover measured at two points time was used to identify the previously forested agricultural land, which is prioritized for agroforestry adoption. With the raster calculator I subtracted the year 2015 land use layer from the year 2000 layer to find the regions that had transitioned from forest typologies to agriculture over those fifteen years, as seen in Figure 1.

Using a forest loss layer from Global Forest Watch, I calculated the mean forest loss per fishnet cell using zonal statistics. I joined the resulting table to the fishnet and ran a Local Moran's I to find significant clusters and outliers of deforestation, found in Figure 2.

Figure 2



To create the suitability maps, I first reclassified my raster layers to a common scale, with higher numbers denoting a better suited area, then used the weighted overlay tool to combine variables. The suitability region map (Figure 3) includes slope, precipitation, density of farmland, land that has transitioned from forest to agriculture, distance to roads, and proximity to communities. Transitioned land and areas with large amounts of farming received the heaviest weights. The priority region map includes proximity to forest loss, transitioned land, distance to roads, and proximity to communities, with transitioned land and forest loss receiving the highest weights.

Results

As we can see in Figure 2, there are significant clusters of deforestation in Cross River, particularly in the southwestern part of the state. The high -high outliers show acute risk areas where forest loss is likely to continue. Understanding where these risk areas are can help identify where advisory services can have an impact on reducing deforestation.

Figure 3 shows the suitability map for regions where rural advisory services should focus their efforts, with the dark green areas being the most suitable for a transition to agroforestry. These areas consider impact on forest loss and the potential magnitude of outreach by locating near communities and roads. Figure 4 shows priority areas that are smaller than the suitability regions, thus offering more targeted locations for potential implementation.

This analysis offers a good starting point for where to begin extension services for agroforestry in the Cross River state. More detailed data is required to find suitable plots, especially if the group of interest is smallholder farmers. Data of various types of farming systems at more granular scales could greatly help identify suitable plots. Significant sources of uncertainty remain—importantly that the ability for agroforestry to effectively curb deforestation hinges in part on strong conservation regulation. Continued research in this area will be important to achieve the dual benefits agroforestry offers: increased farmer livelihoods and climate change mitigation.

Figure 3

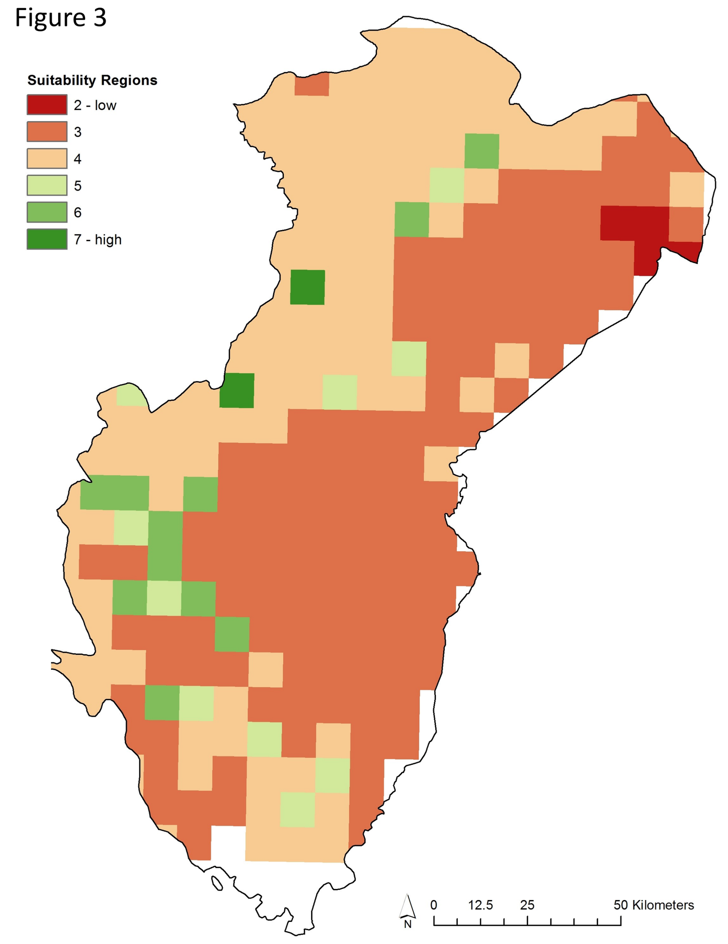
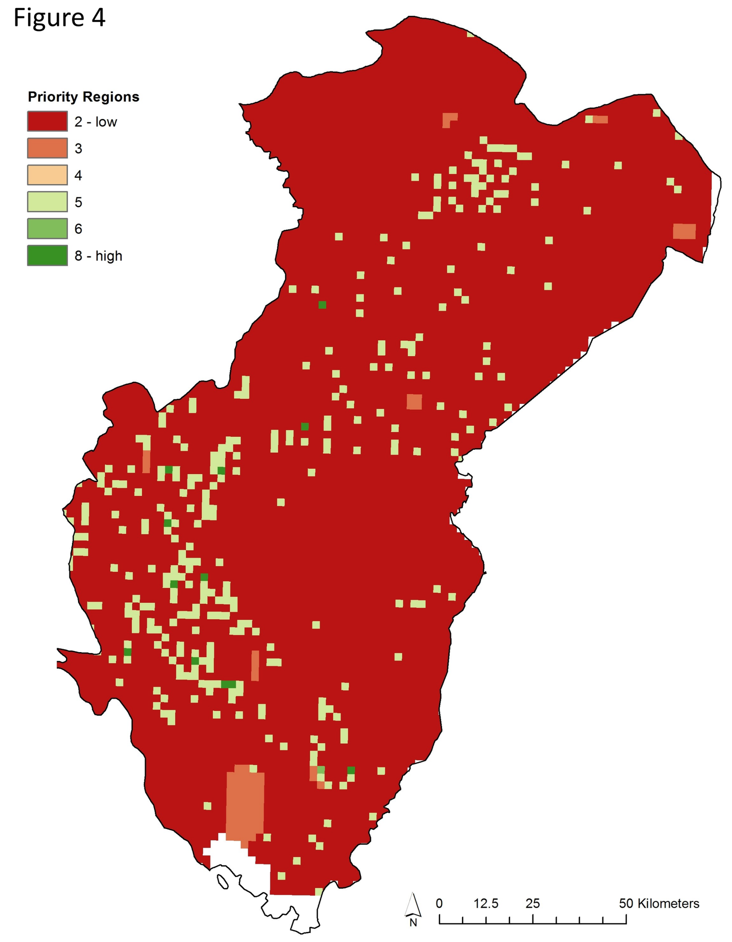


Figure 4



Sources

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Projection: Lambert Conformal Conic, GCS_WGS_1984

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