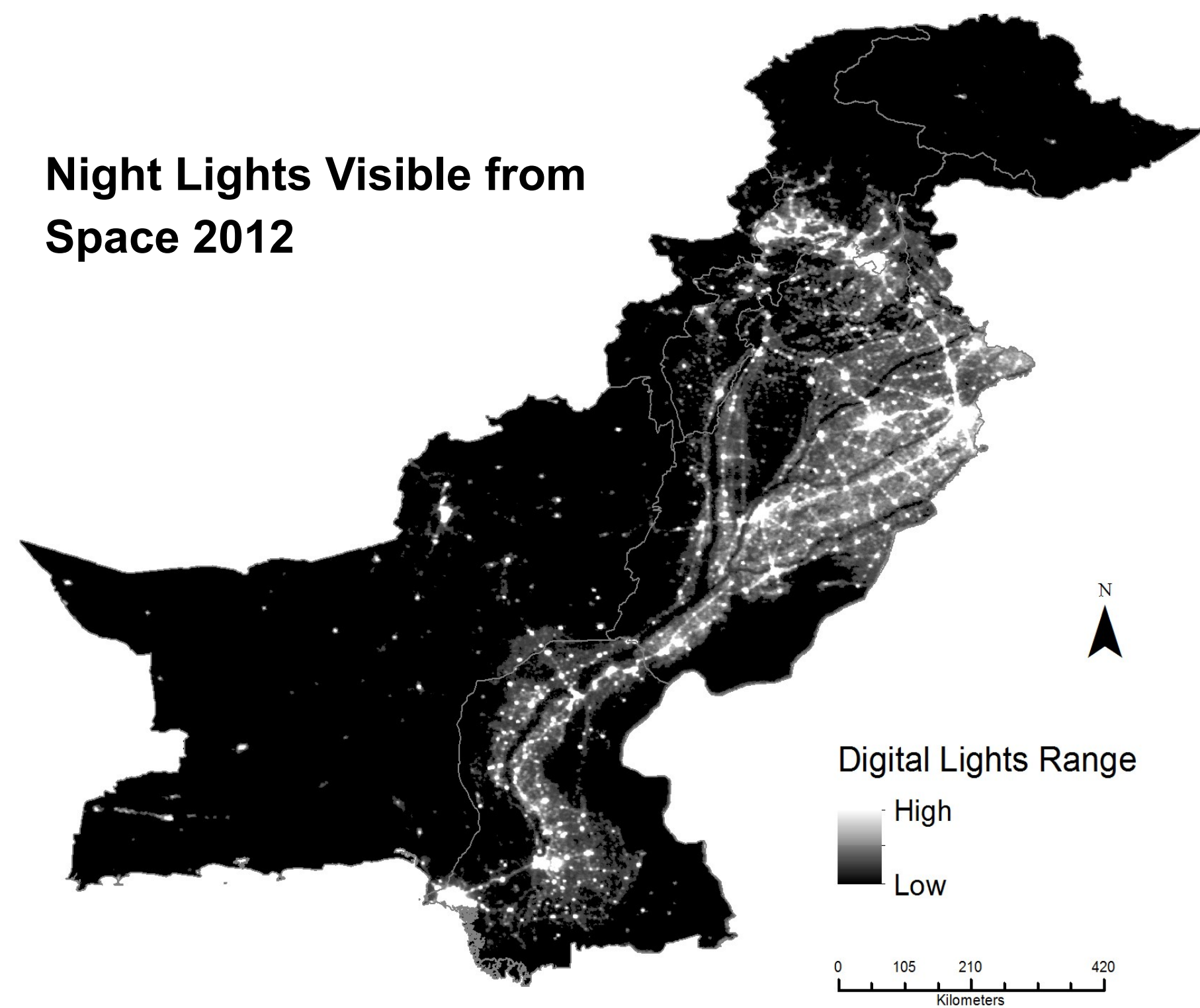


MOVING IN THE OPPOSITE DIRECTION: A Look at Pakistan's Energy Supply and Demand

Introduction

Energy is indispensable for both economic and human development. Pakistan, the sixth most populous country in the world, is facing the worst energy crisis in its history. According to the Asian Development Bank the energy crisis has held down GDP growth by 3-4% during 2011 and 2012, costing roughly 10% lost growth in the last five years. While the world is moving towards universal access to energy and electricity in particular, Pakistan is struggling with maintaining the level of energy it can provide to its citizens. This project looks at the change in energy (electricity) availability along with change in population. The question I try to answer is what is the change in availability of electricity over the last ten years and in what areas?

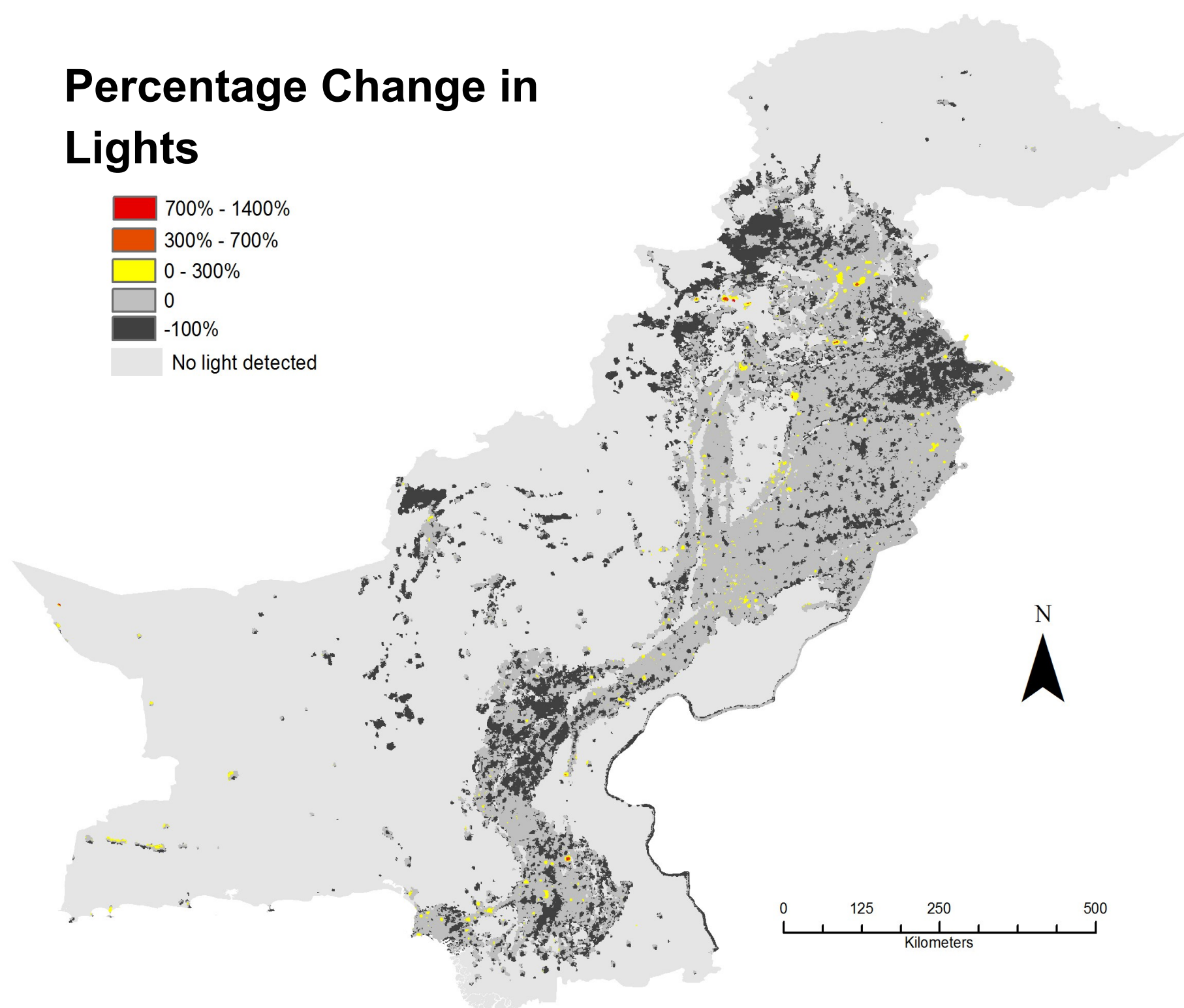
Night Lights Visible from Space 2012



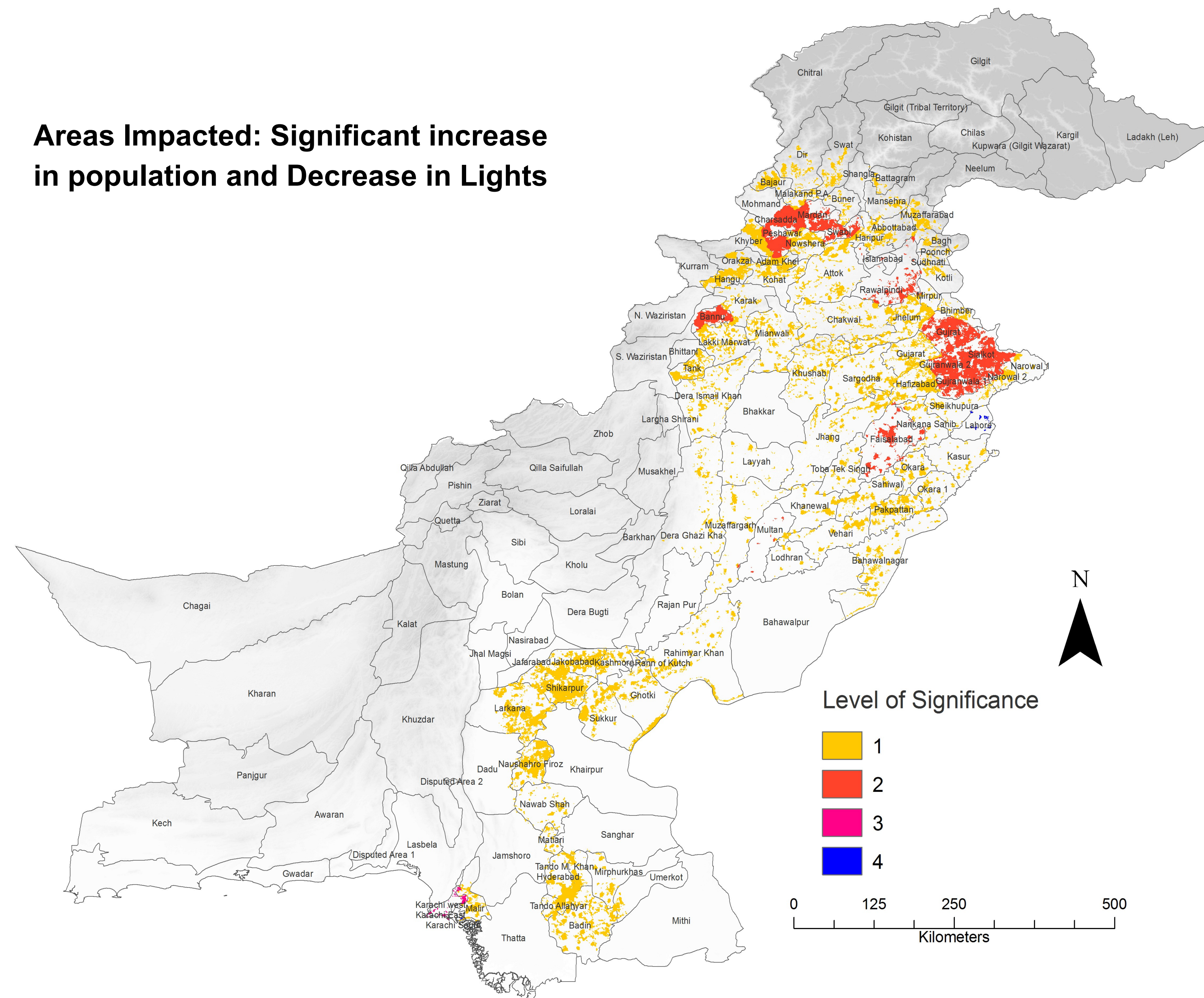
Methodology

I used nights at light data from National Oceanic Atmospheric Administration (NOAA) as a proxy of energy consumption/availability. The night lights data are drawn from lights observed by satellites every night, and averaged over

Percentage Change in Lights



Areas Impacted: Significant increase in population and Decrease in Lights



each calendar year. Each pixel represents .86 square kilometers, and is assigned a Digital Light Number between 0—63 based on brightness of light in that area. I used the estimate of Pakistan's census conducted by U.S. Census Bureau for population and demographic data.

To calculate a percentage change in lights from 2002 to 2012 I subtracted the two raster layers using the raster calculator. I used the census data from 1998 and 2010 to calculate the change in population density over that period. What was interesting was that though there has been increase in lights there was rather a more spread out decrease in lights all over the country. This was alarming at first but can be attributed to the energy crisis and the regular black outs. I use the overlay tools to map the areas that had a significant increase in population density but a reduction in availability of electricity. The map shows that. I then used zonal statistics to estimate the number of people impacted by this lack of electricity and then look at how many of these were in rural areas and how many in urban areas.

Results

My analysis showed that overall more than 135 million are impacted by this reduce in availability of electricity. Around 75% of these belong to the rural areas where more than 30 % of the population lives below \$1.25 per day. According to the pie chart more than 21 million are impacted by the lack of availability in energy in rural Pakistan.

It is important to look at this geographically because development in Pakistan has been skewed towards Punjab and then Sindh, whereas Baluchistan and Khyber Pakhtun Khawa (KPK) and Gilgit-Baltistan have always been neglected.

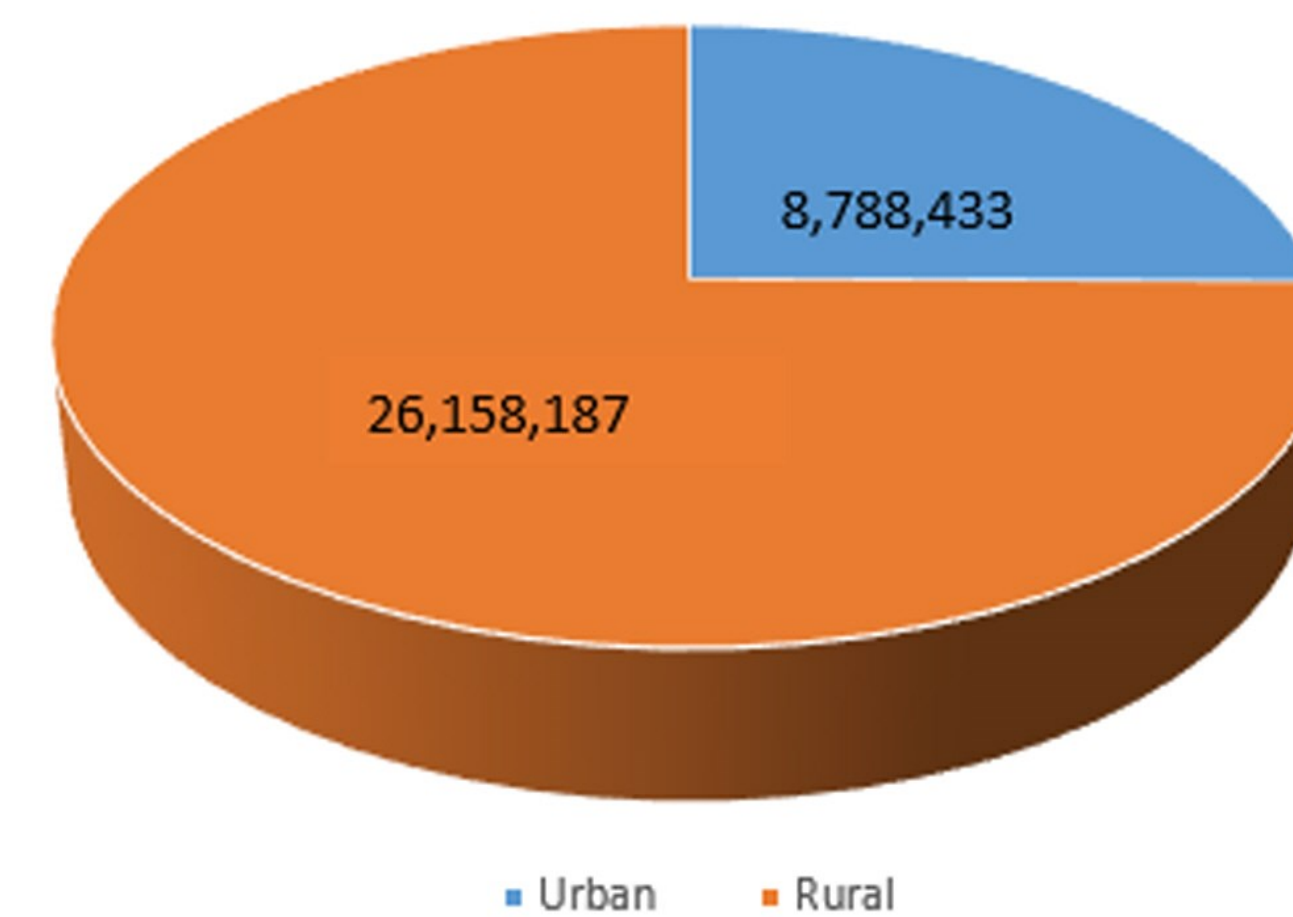
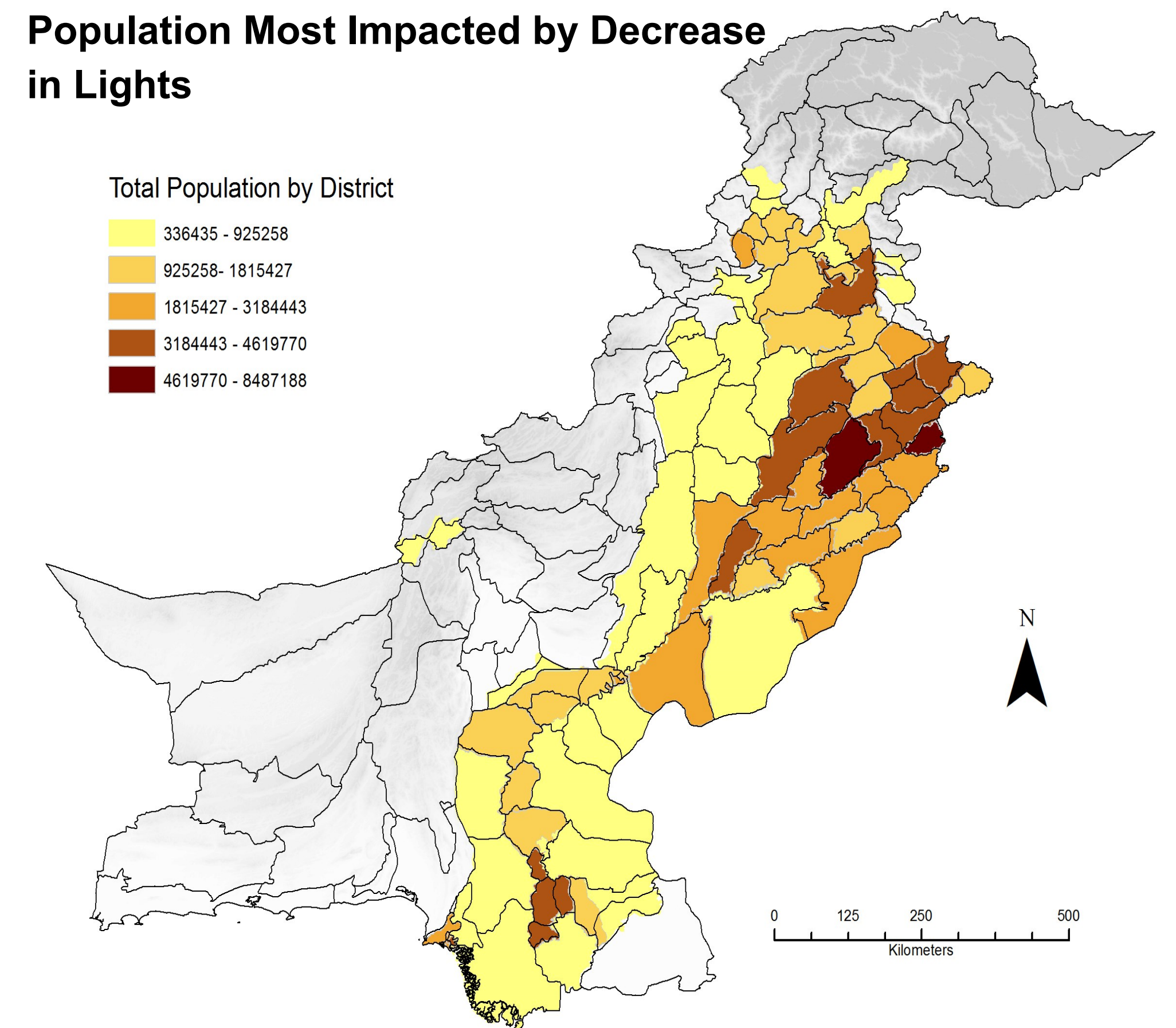


Fig 1: Urban and Rural Population Impacted

Population Most Impacted by Decrease in Lights



Limitations

All these figures are estimates. As the Government of Pakistan has not conducted a full census since 1998 the dataset released by the US Bureau was the best estimate, and itself is a little outdated. There is lack of availability of any energy consumption data at the district level and hence nights at lights was used as a proxy.

This analysis is incomplete as it requires one to look into further specifications of these areas. It is important to mention here that the percentage change in lights might not be very accurate as the data

Another major limitation is that I have looked at significant impact which I have defined as more than 300,000 people which is why Baluchistan does not show any results.

Future Work

This analysis is incomplete and requires future work looking at the characteristics of areas identified. Other important questions to be raised include: what are the characteristics of these areas? What is impact on health variables and education of the reduce in energy available. Has the reduction in energy increased conflict in these areas?

Cartographer: Seher Abbas Haider

Date: May 5th 2014

Sources: Image and data processing by NOAA's National Geophysical Data Center. DMSP data collected by US Air Force Weather Agency | Raleigh, Census data from US Census Bureau under Department of Commerce, Urban and Rural extent by Columbia University Center for International Earth Science Information Network and The World Bank.

Projected Coordinate System: UTM_Zone_42N