# LOOKING FOR BLINDNESS: A Vulnerability Analysis of Trachoma in Ethiopia

INTRODUCTION

Trachoma is a bacterial infection of the eye caused by *Chlamydia trachomatis* and is the leading cause of infectious, and therefore preventable, blindness worldwide.[1] Trachoma is transmitted through physical contact with contaminated objects including hands, clothing, and eye-seeking flies. It is a water-washed disease, meaning it spreads in environments that lack sufficient water for individuals to practice proper hygiene including washing of hands and face.[2] In 1996, the World Health Organization created the WHO Alliance for the Global Elimination of Trachoma by 2020.[3] The Global Trachoma Atlas is an initiative to map Trachoma prevalence around the world (largely in Africa) in order to assist in the elimination campaign.[4] Ethiopia is a country with one of the highest burdens of Trachoma in the world, even despite the elimination campaign.[2] Several studies have conducted research to determine the preval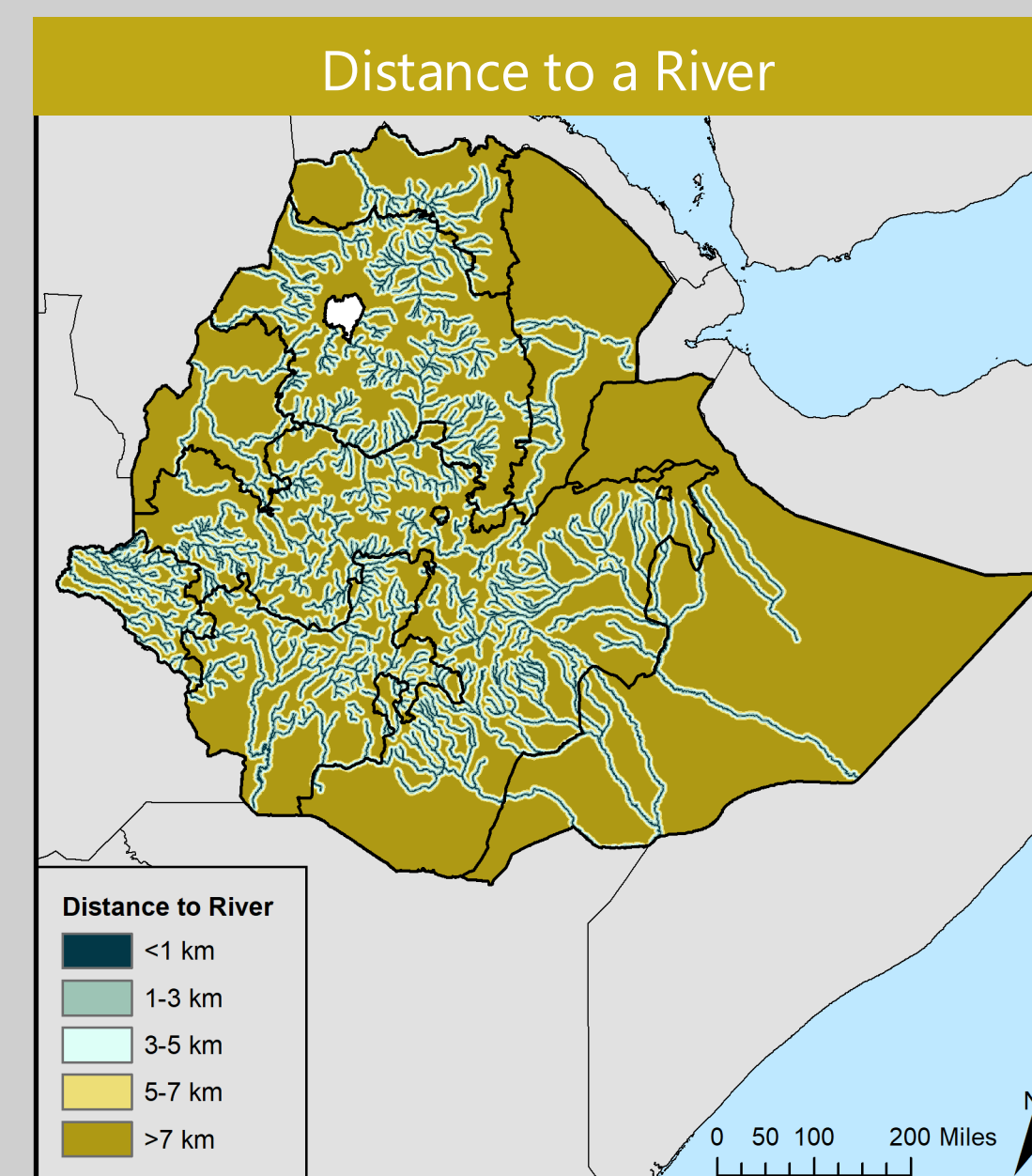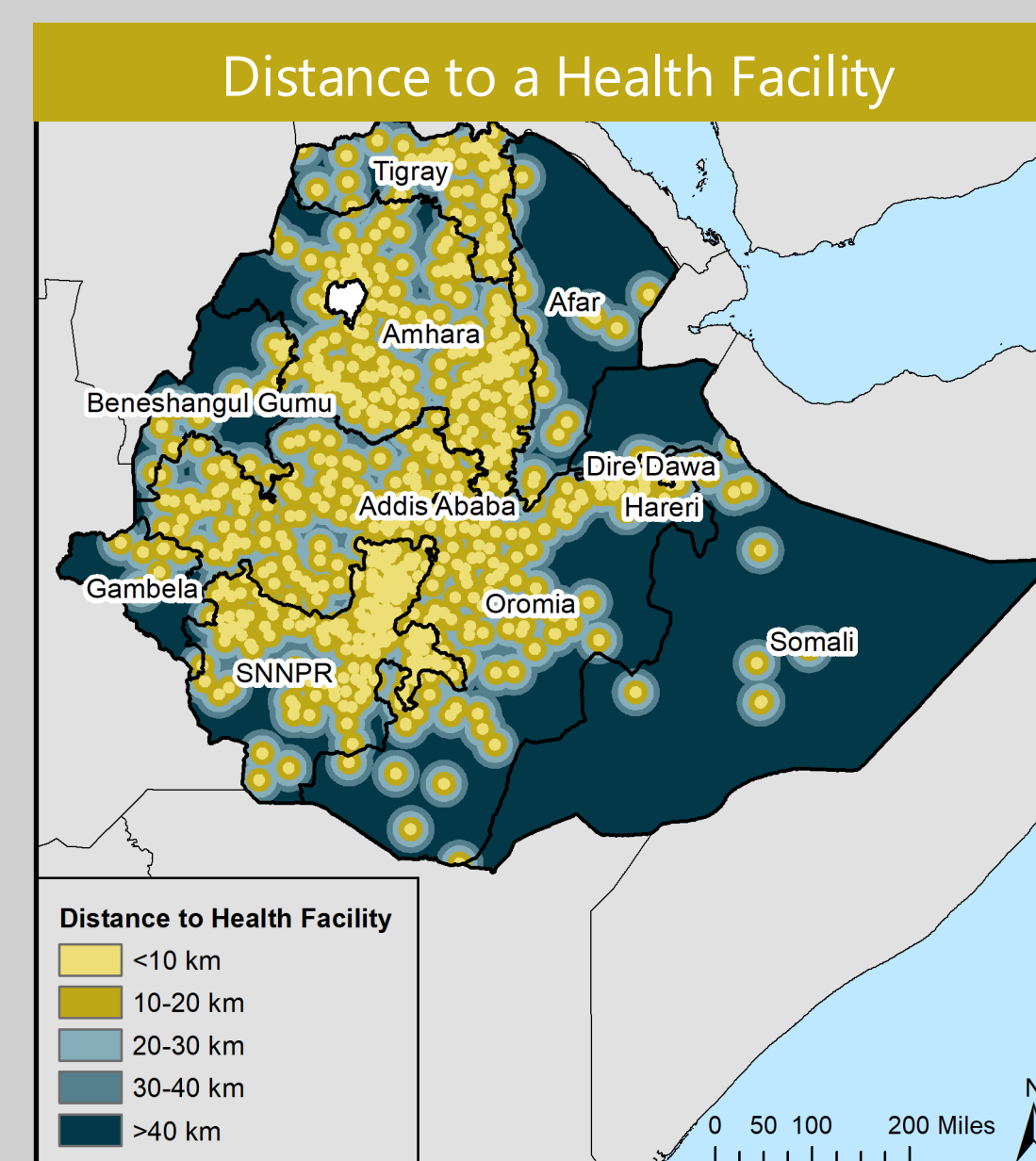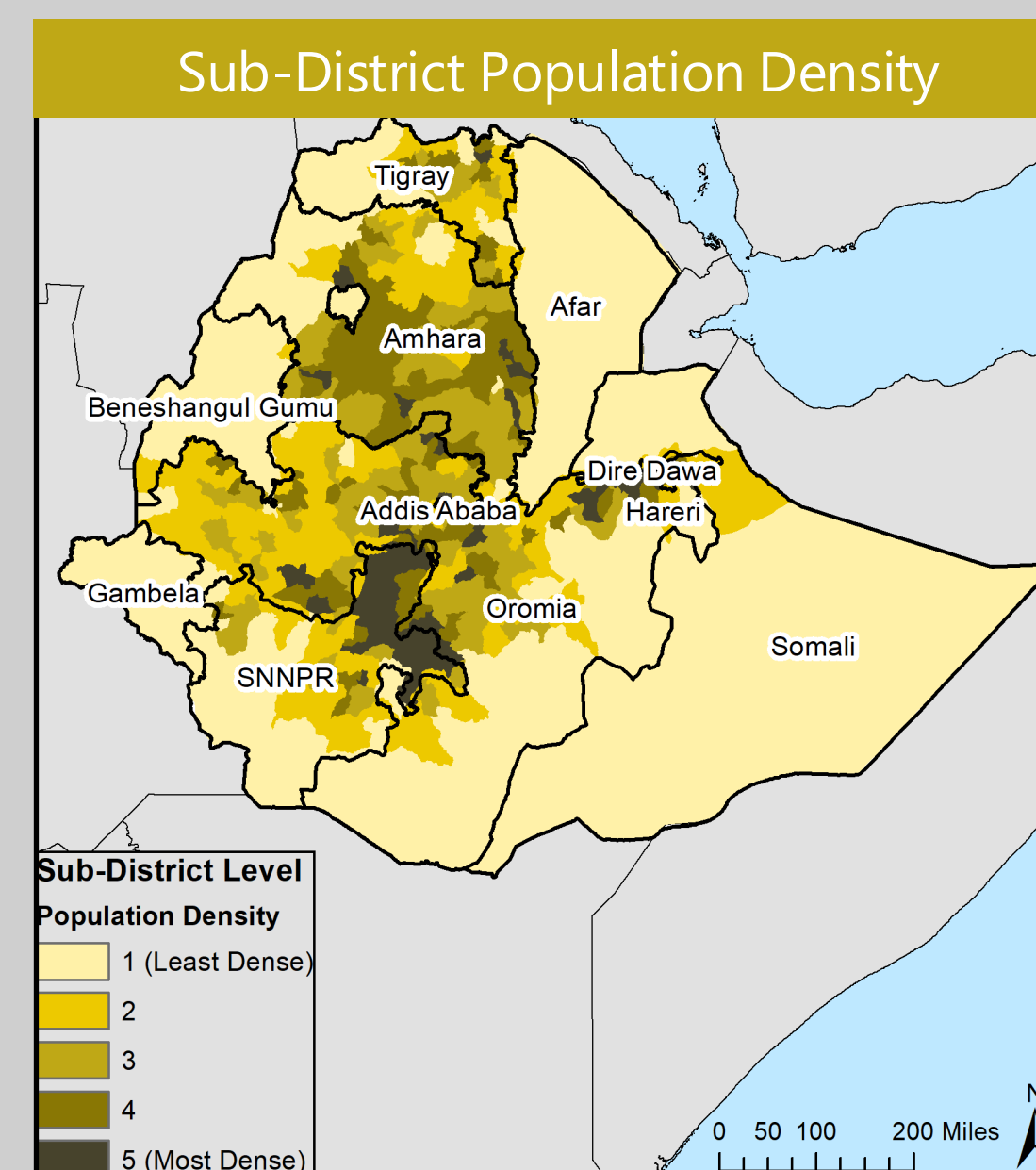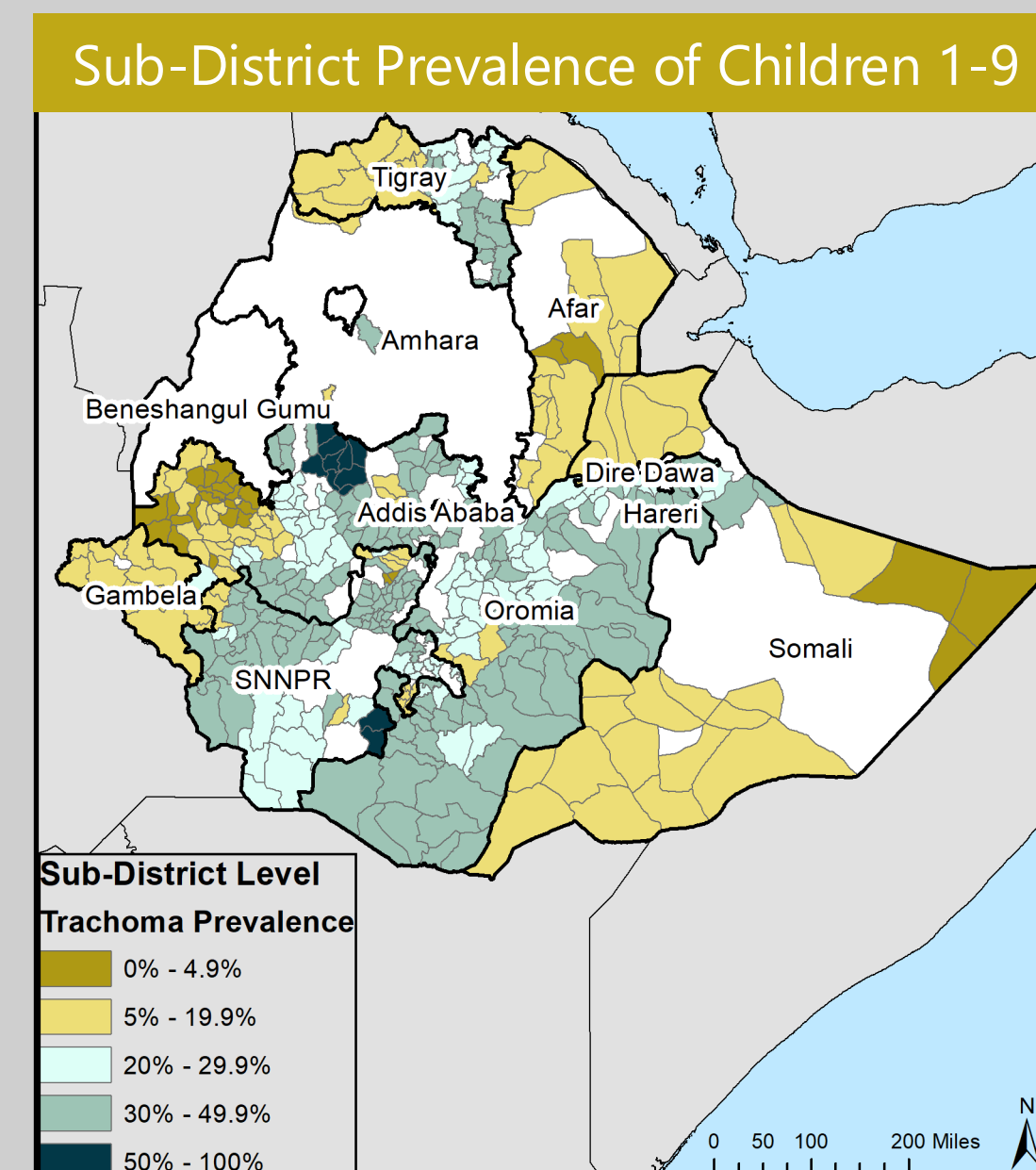ence of Trachoma in different regions of Ethiopia as well as to determine significant risk factors for continued transmission.[5-10] No literature was found that maps Trachoma as well as its risk factors within Ethiopia, however some risk factors related to Trachoma have been mapped on the continent-scale in Africa.[9] This project aims to map Trachoma prevalence at the sub-district level across Ethiopia and conduct a vulnerability analysis of Trachoma according to key risk factors including distance to a health facility, distance to a river, and population density.
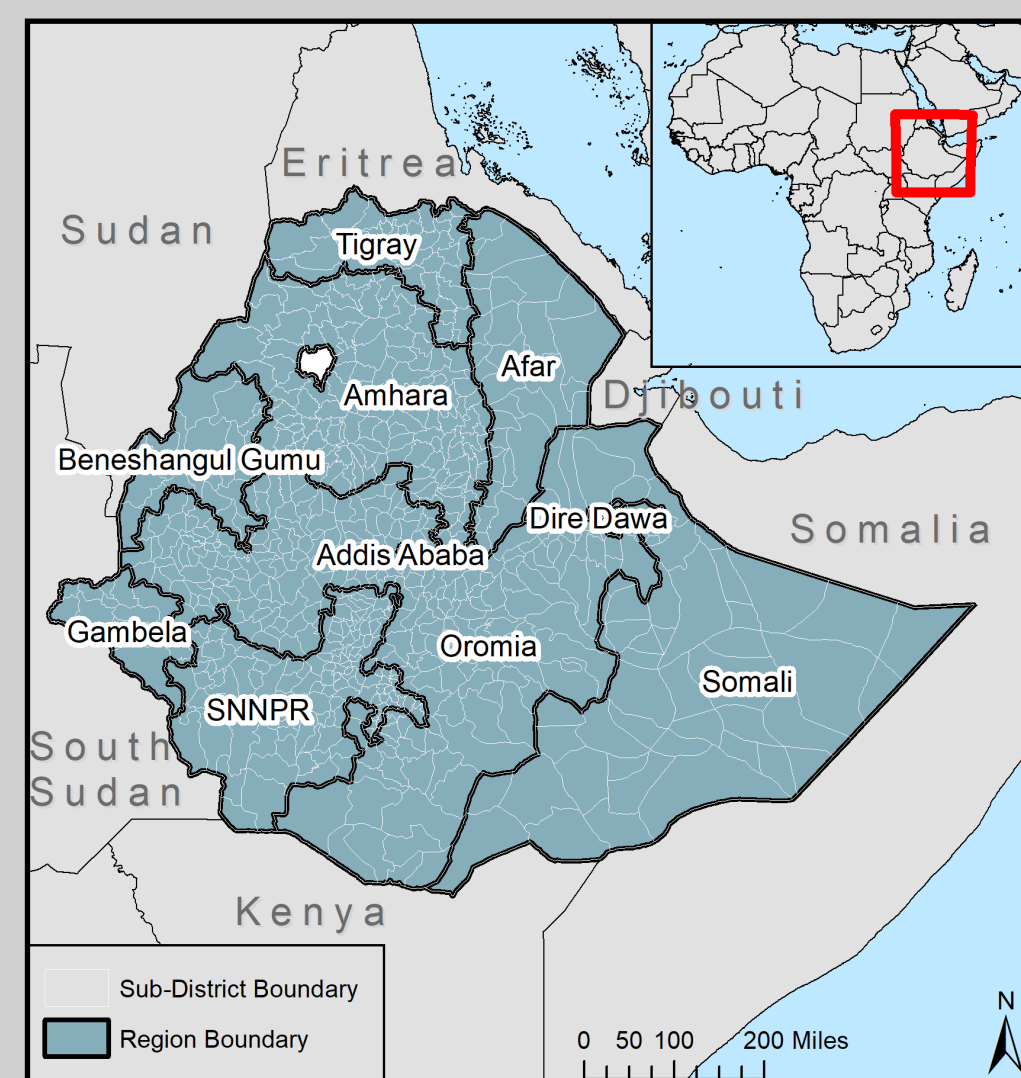
METHODS

Trachoma prevalence data at the sub-district level was compiled into an excel table from several articles and joined to a sub-district vector shapefile. Prevalence data for some sub-districts could not be found.[5-10] The joined vector layer was converted to a raster and sub-districts were reclassified so that 1 represented areas that achieved the elimination target of <5% prevalence and 5 represented high priority sub-districts with >50% prevalence. A vector polygon layer of Ethiopian sub-district population density was converted to a raster and reclassified by quintile so that 1 represented sub-districts with low density. The Euclidean Distance tool was used to create rasters of health facilities and rivers. The distance to a health facility raster was reclassified so that 1 represented areas <10km from a health facility, which is associated with increased positive health outcomes.[11] The distance to a river raster was reclassified so that 1 represented areas within 1km of a river, which is a target of the Ethiopian Universal Action Plan.[12] The raster calculator was used to create a vulnerability map weighing existing prevalence as .5, population density as .1, distance to a health facility as .3, and distance to a river as .1 because Trachoma needs to be endemic for a community to be vulnerable and health facilities are the source of intervention campaigns. Another vulnerability map was created with the raster calculator to equally weigh population density, distance to a health facility, and distance to a river risk in order show vulnerability without taking existing prevalence into account.

Sub-District Prevalence of Children 1-9

Sub-District Level Trachoma Prevalence
- 0% - 4.9%
- 5% - 19.9%
- 20% - 29.9%
- 30% - 49.9%
- 50% - 100%

Sub-District Population Density

Sub-District Level Population Density
- 1 (Least Dense)
- 2
- 3
- 4
- 5 (Most Dense)

Sub-District Boundary
Region Boundary

Distance to a Health Facility

Distance to Health Facility
- <10 km
- 10-20 km
- 20-30 km
- 30-40 km
- >40 km

Distance to a River

Distance to River
- <1 km
- 1-3 km
- 3-5 km
- 5-7 km
- >7 km

Weighted Vulnerability to Trachoma According to Four Key Risk Factors

Weighted Vulnerability Value
- High
- Low
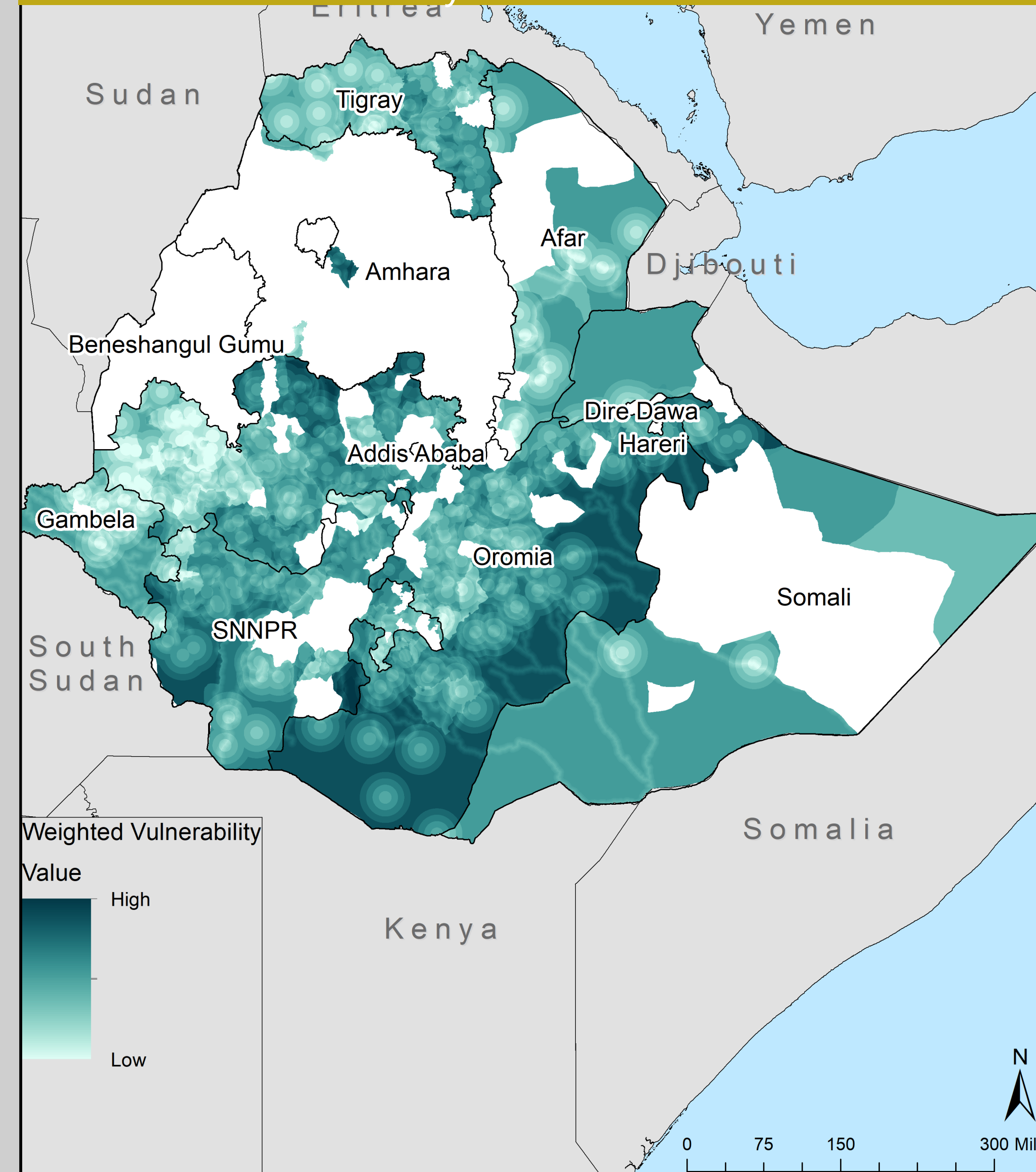
Vulnerability to Trachoma Without Trachoma Prevalence Factor

Vulnerability Value
- High
- Low
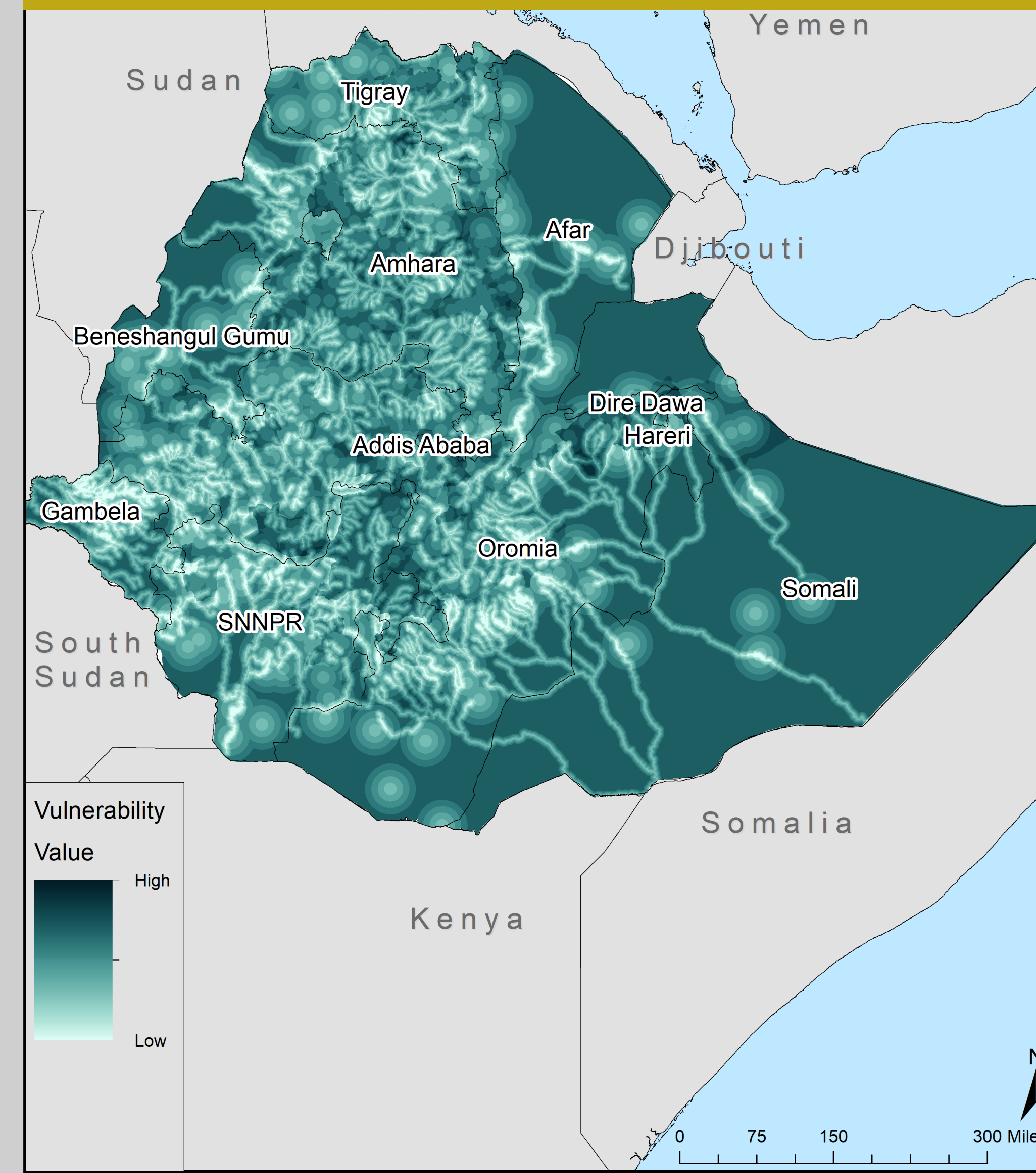
RESULTS AND CONCLUSIONS

The vulnerability analysis accounting for all four risk factors shows that the south and southeastern parts of the Oromia region are particularly vulnerable to Trachoma. The existing disease prevalence in those sub-districts is 30-50% and the distance to a health facility is greater than 40km. There are also smaller pockets of high vulnerability on the border of Oromia and Amhara, and in southern SNNPR. The border pocket has high disease burden and medium to high density while the SNNPR pocket has high disease burden, low health facility access, and low access to rivers. Contrastingly, sub-districts in Gambela and northwestern Oromia are less vulnerable. In those sub-districts the existing disease prevalence is low (between 0% and 20%), the population density is low, there is relatively good access to health facilities, and there are lots of rivers. The unweighted analysis without accounting for Trachoma prevalence indicates that the Somali region might be particularly vulnerable due to a lack of health facilities and rivers, however the known prevalence of certain sub-districts in the region indicates that the situation actually may be better than the analysis suggests. While access to health centers and to rivers appears to be relatively good in the western half of the country, high Trachoma prevalence indicates that other risk factors are at play, for example population density.

FUTURE DIRECTIONS

While Trachoma is known to be endemic in areas with poor access to water, rivers may not be the sole indicator of access to water. It is likely that households not close to a river have other modes of access including boreholes and water vendors, therefore future studies should account for various water sources in order to determine a spatial relationship between Trachoma vulnerability and water. Additionally, several regions and sub-districts are missing Trachoma prevalence data that could help determine which risk factors are key to Trachoma vulnerability. For example, the gap in the Somali region might actually have very low Trachoma prevalence despite the indication by the risk factors that the area is vulnerable. More complete research should be done to map Trachoma in all parts of Ethiopia alongside its risk factors. As the target to eliminate Trachoma by 2020 has not been met, it is critical to focus attention on the geography of remaining hotspots and vulnerable areas, including parts of Ethiopia, in order to successfully eliminate the disease worldwide.

REFERENCES

Sources:
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Data:
Trachoma prevalence data from articles of the Global Trachoma Mapping Project from 2016-2018.[5-10] River and population density data for 2017 from the World Bank. Health facility data from the Humanitarian Data Exchange. Boundaries from Africa Open Data.

Coordinate System:
Adindan UTM Zone 37N
Projection:
Transverse Mercator
Date:
Fall 2019

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