Spread of COVID-19 and accessibility of transportation in Mainland China

Introduction

COVID-19 is an infectious disease caused by a newly discovered coronavirus and the disease was first identified in December 2019 in Wuhan, the capital of China's Hubei province.(1) Due to the high contiguous characteristic of this virus, most countries are experiencing COVID-19 outbreaks from the beginning of 2020.(2) Signs and symptoms of coronavirus disease 2019 (COVID-19), including Fever, Cough, Shortness of breath or difficulty breathing. Even most people infected with COV19 will recover without requiring special treatment, this disease is more deadly for elderly who have chronic medical conditions and compromised immune systems. (3)

This project is aimed to find out the relationship between public transportation and the spread of OCVID-19 disease. As we are experiencing modernization and globalization, the time we spend on transportation is significantly decreased and our technological advancement in transportation also give us more chance to travel around the world. However, this improvement may also help the spread of infectious diseases. As the first country who was experiencing the outbreak, China started to limit train service from Feb 1 and recommended staying at home from Jan,23. I would like to assess the relationship between public transportation by calculating the proportion of the total number of disease cases by the total number of highway and train in each province of China.
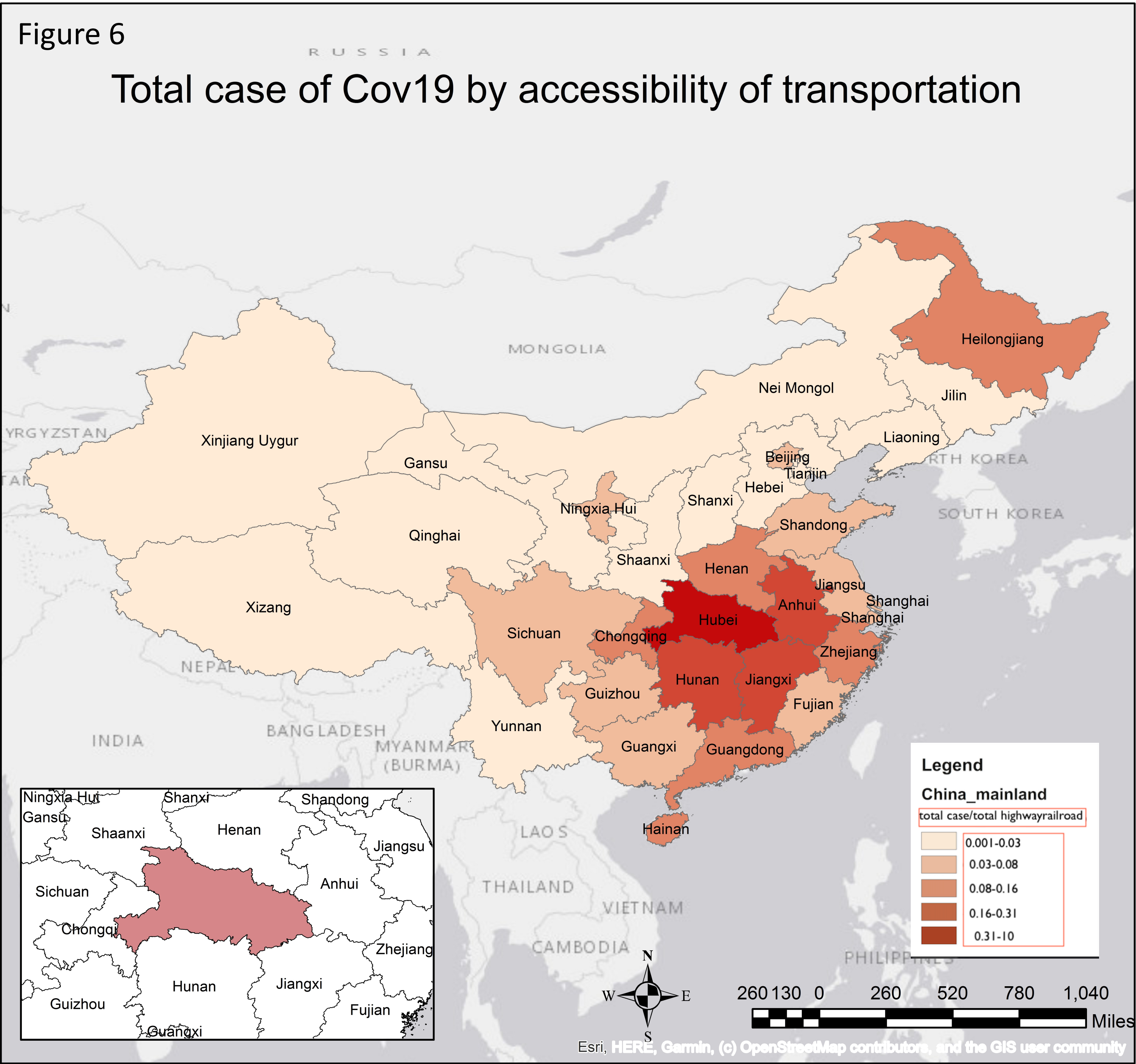
Methodology

Data were gathering from Chinese national government website and online sources. Total number of highway and railroad were calculated using spatial join function separately with china province-level administration layer. Then join attribute table and create new field that sum the number of highway and railroad.

For disease count, data obtained from national website were join to the table, then create map display the disease count from low to high as color get darker.(Figure1-5) The proportion map made by creating new filed and use field calculation total disease case/ total road number, then, break the data into 5 value level and displayed by higher proportion with darker color. (Figure6)

Figure 6

Total case of Cov19 by accessibility of transportation

Legend
China_mainland
total case/total highwayrailroad
- 0.001-0.03
- 0.03-0.08
- 0.08-0.16
- 0.16-0.31
- 0.31-10

Source

1. The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China.
2. Retrieved April 7, 2020, from https://www.ncbi.nlm.nih.gov/pubmed/32064853
3. The latest 2019 novel coronavirus outbreak in Wuhan, China, Retrieved April 7, 202 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7128332
4. WHO, Retrieved April 7, 2020 from https://www.who.int/health-topics/coronavirus#tab=tab_1

Map : CHN_rails, CHN_roads, March 27, DIVA-GIS by Robert Hijimans
National Health Commission of the People's Republic of China

Keyi Wei
NUTR231: Fundamental of GIS
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Result

Table 1: Total number of disease cases by total number of road in each province.

In disease-count map, I found out the number of disease case are gradually increasing in most part of china and dramatically increased in Hubei province. East part of china and province around Hubei tend to have higher number of cases.(Figure 1-5) For total case and transportation, proportions are lower in north-west part of china and higher in province around Hubei.(Figure 6) What's more, I also found potential positive linear relationship between number of road and number of cases.(table 1)
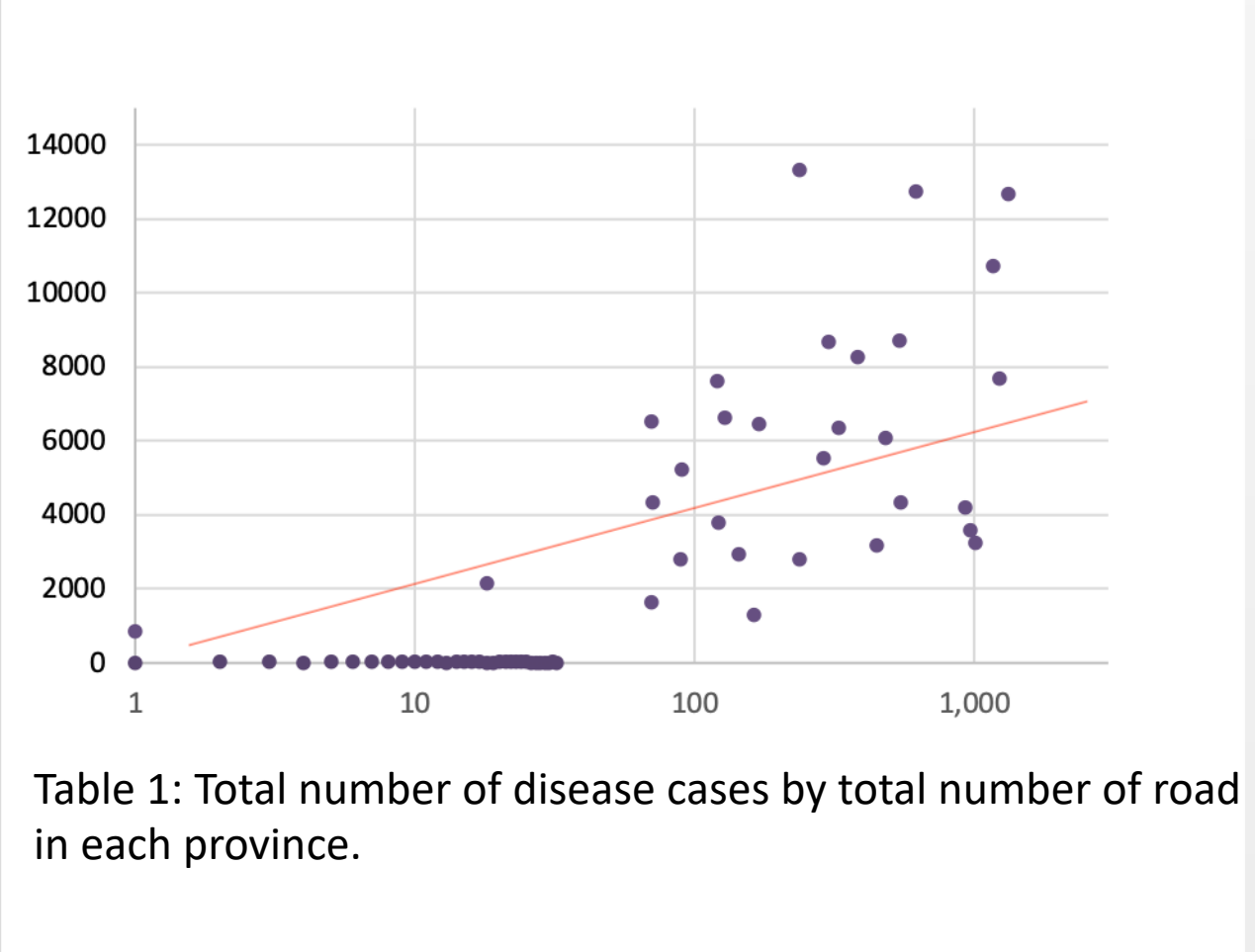
Conclusions and Discussion

Based on figure 6 and table 1, there may have a positive relationship existed between transportation and the spread of disease. A higher number of roads are associated with higher disease count in mainland China.

The result is consistent with the previous understanding that public transportation increases the spread of infectious diseases. Because china started to limit public transportation from Feb 1 and the symptom of COVID-19 normally appeared within two weeks, so the study period in my project is from Jan 21 to Feb 10. The result can be applied to the government for the future prevention of infectious disease. Limiting public transportation at the early stage of infection may reduce the total number of disease case. The result can be used for individuals and let them understand the importance of avoiding public transportation and protection during transportation when an infectious disease is spreading. Future studies can focus on the infection rate inside the public transportation such as trains or airplanes.

Several limitations in my study including using the number of roads to measure the accessibility of transportation, may not be accurate and may cause bias to the measurement, data on road and highway were collected in 2007 and may not be the same as now in China. What's more, the result may only apply to mainland China and may not be useful in other countries.

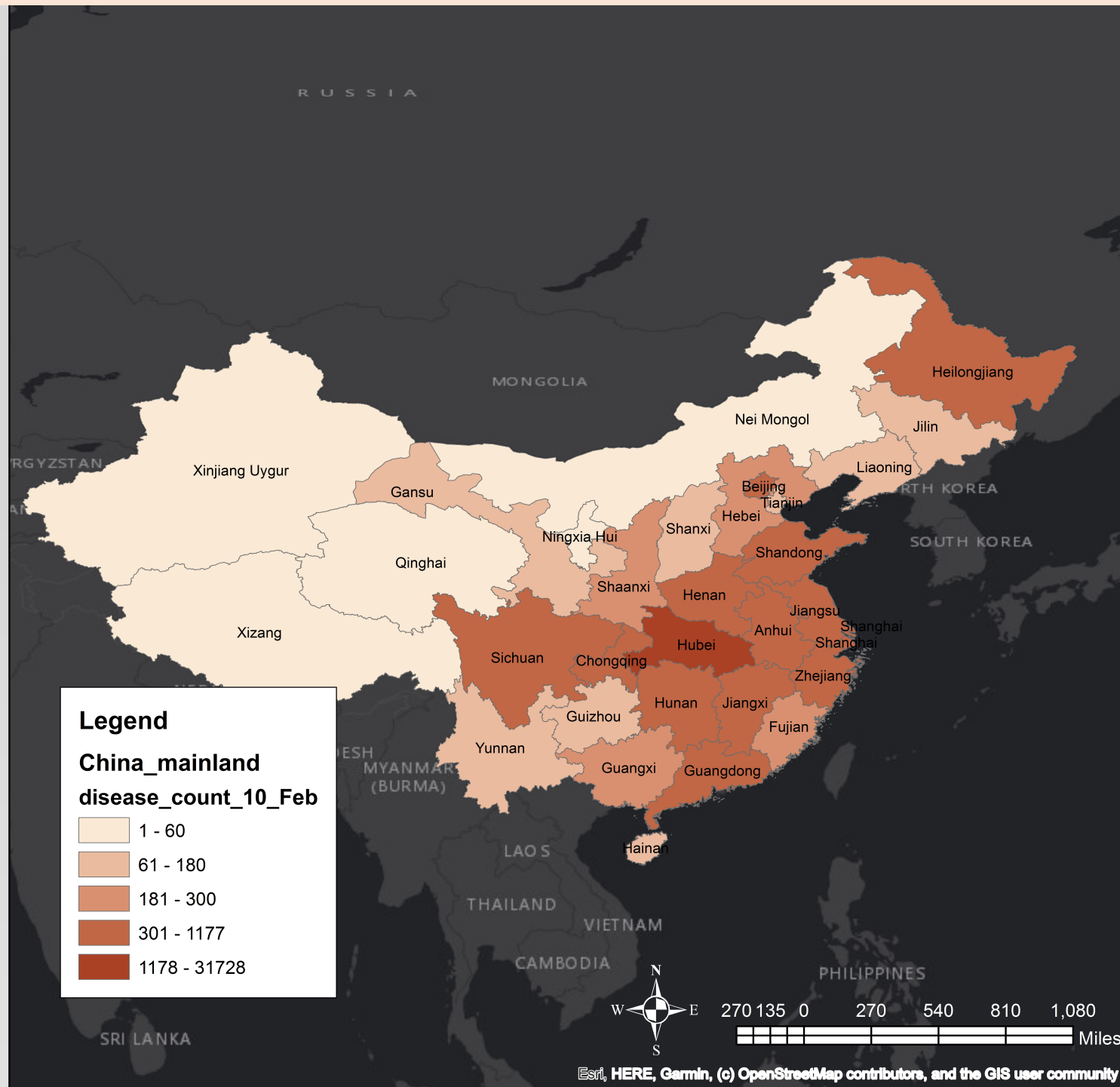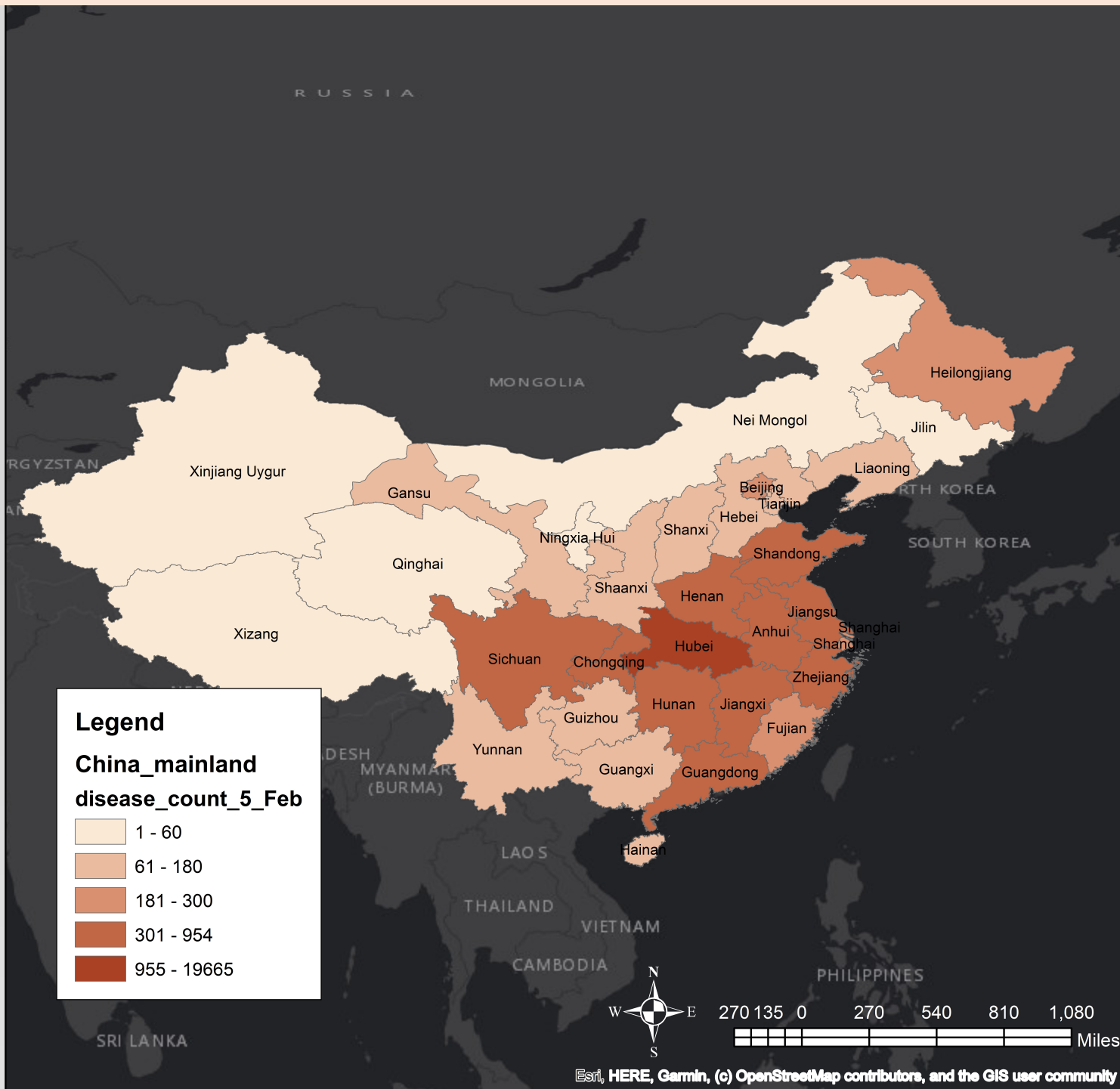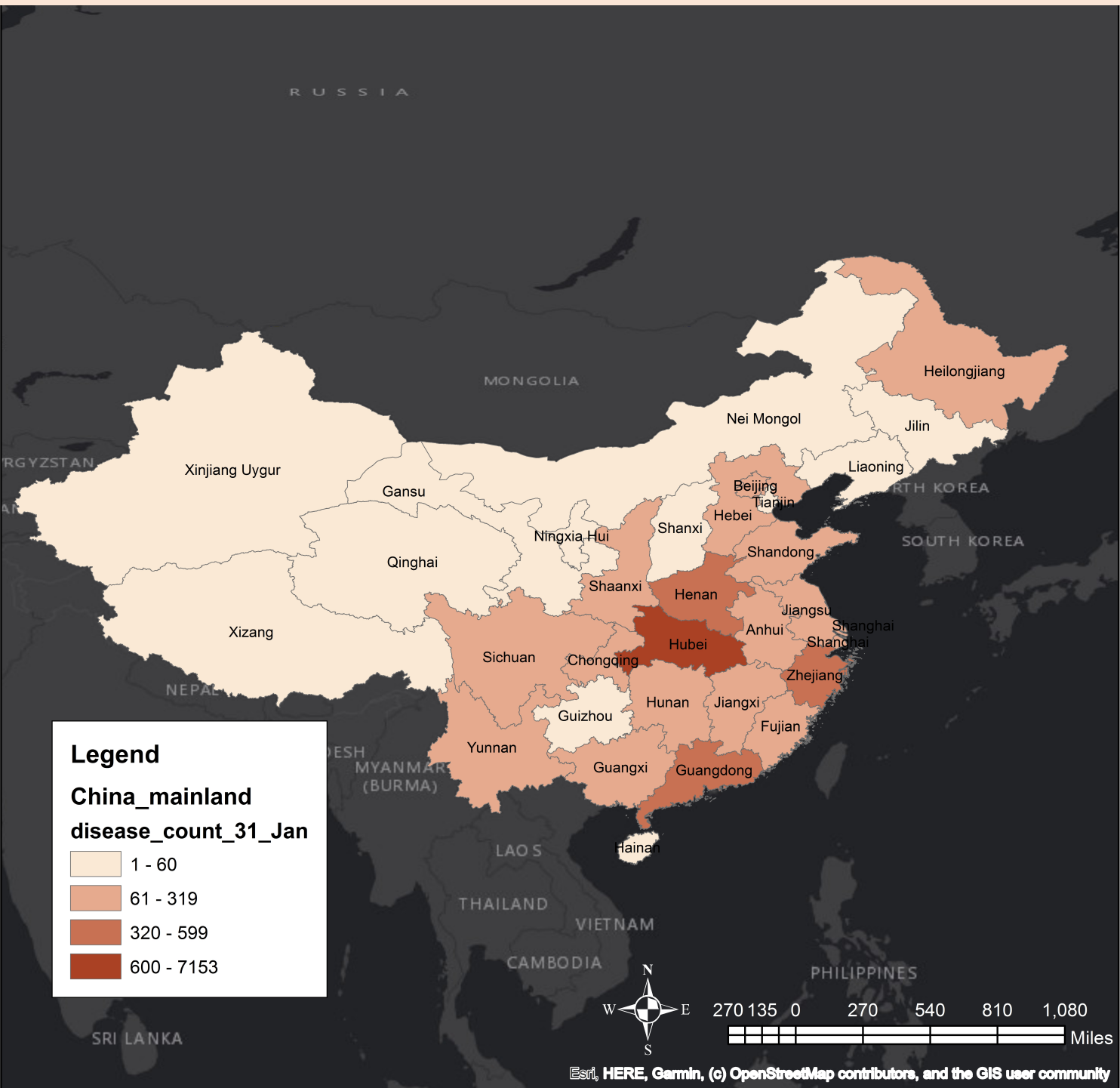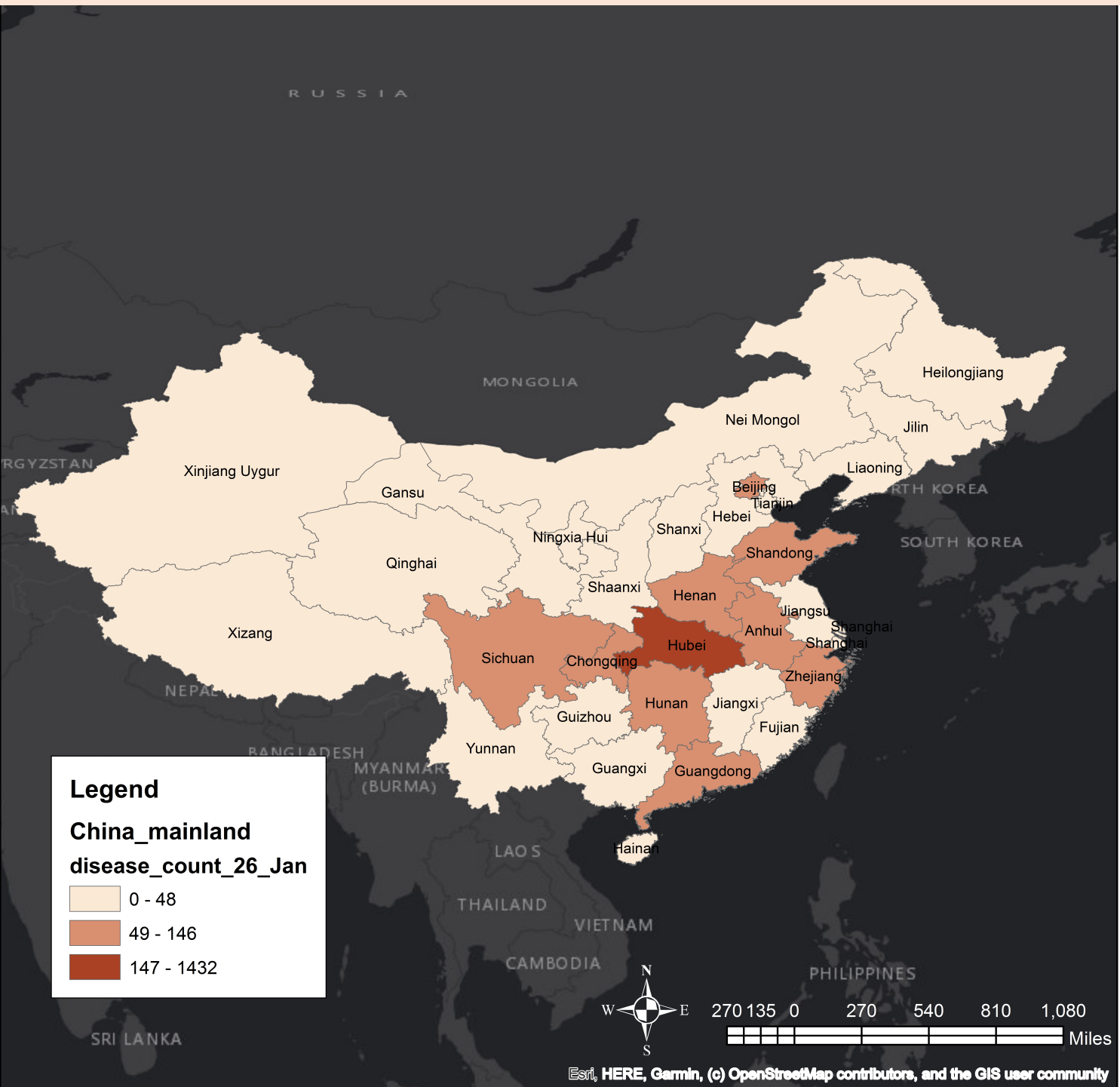## COVID-19 Confirmed Case from Jan 21 to Feb 10 in Mainland China

Figure 1: Disease count of each province in Jan 21

Legend
China_mainland
disease_count_21_Jan
- 0 - 60
- 61 - 120
- 121 - 281

Figure 2: Disease count of each province in Jan 26

Legend
China_mainland
disease_count_26_Jan
- 0 - 48
- 49 - 146
- 147 - 1432

Figure 3: Disease count of each province in Jan 31

Legend
China_mainland
disease_count_31_Jan
- 1 - 60
- 61 - 319
- 320 - 599
- 600 - 7153

Figure 4: Disease count of each province in Feb 5

Legend
China_mainland
disease_count_5_Feb
- 1 - 60
- 61 - 180
- 181 - 300
- 301 - 954
- 955 - 19065

Figure 5: Disease count of each province in Feb 10

Legend
China_mainland
disease_count_10_Feb
- 1 - 60
- 61 - 180
- 181 - 300
- 301 - 1177
- 1178 - 31728