# Global Food Security Parameter Studies Using Satellite Remote Sensing

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## Abstract

Climate change and a growing population make achieving food security an intimidating challenge. Advancements of remote sensing technology make cropland estimates possible at the global scale. Crop yield is equal to the total crop harvest per unit cultivated area. Between planting and harvesting, both human and climate-related effects determine a country's contribution towards global food security.
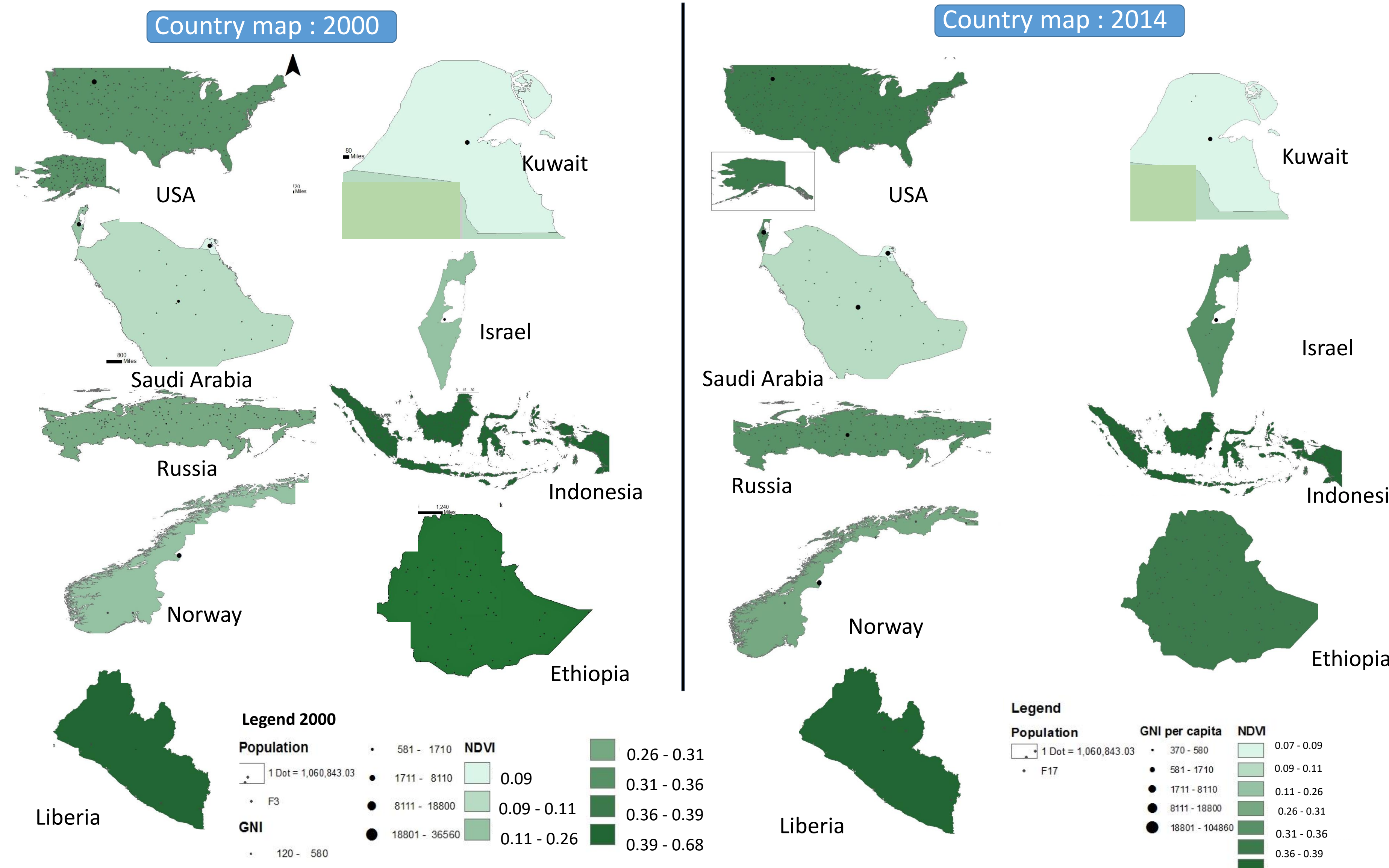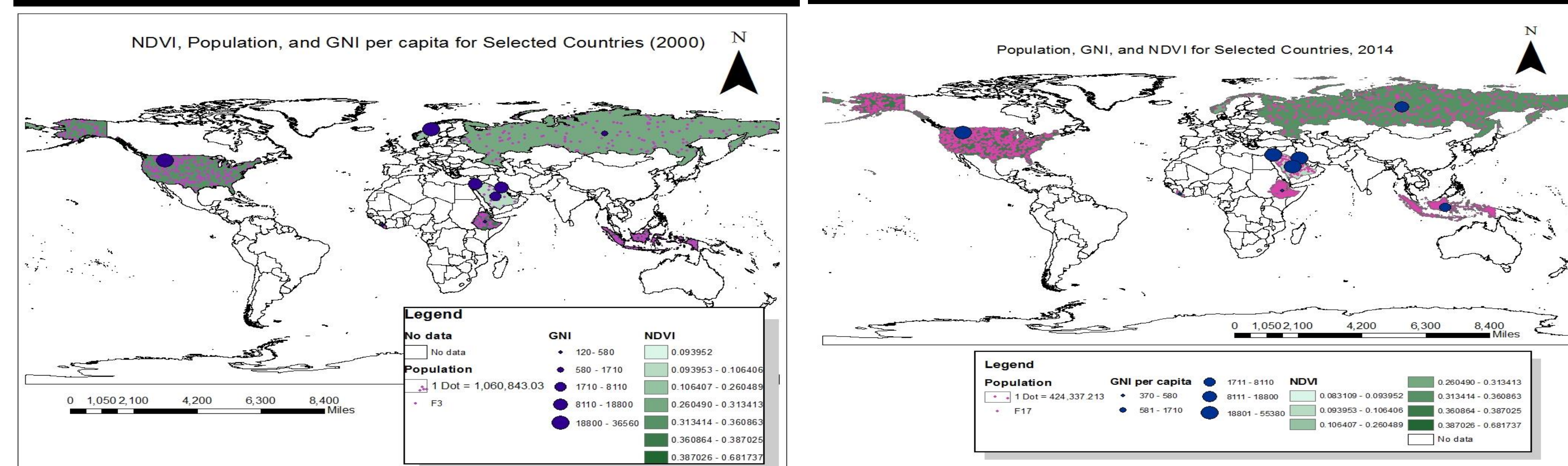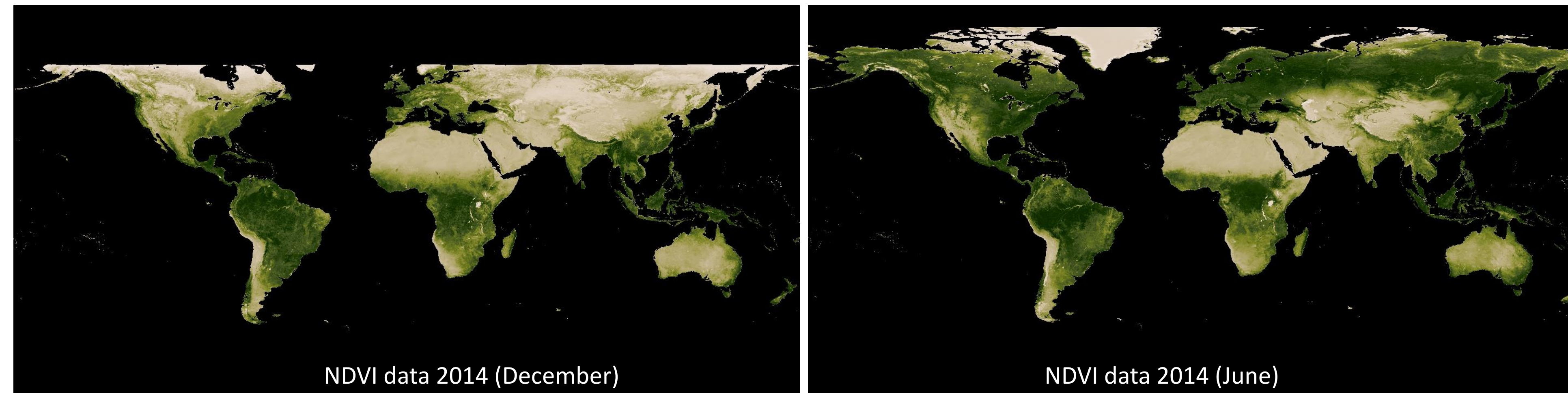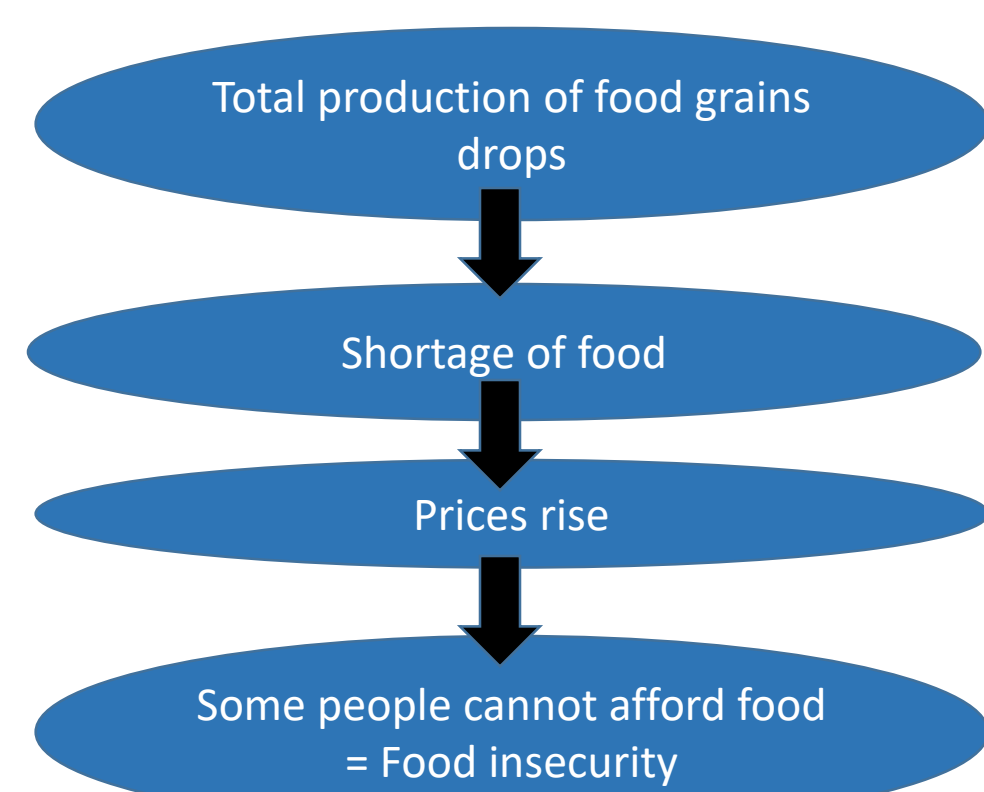
To maintain supply and demand of agricultural products, forests are often cleared. Deforestation causes a reduction in soil quality, resulting in fertilizer to become a requirement for sufficient crop yields. These additives and the inefficiencies caused by poor soil may result in an increase in production cost and reduce affordability.

## Objective

Find correlations between population, crop production, cultivated area, GNI (Gross National Income) per capita, and vegetation for nine countries (Ethiopia, Indonesia, Israel, Kuwait, Liberia, Norway, Russia, Saudi Arabia, and United States) using data from the years 2000 to 2014.

## Methodology

- Criteria followed when choosing countries for research included total population, area, tropical conditions, income, and crop yield.
- Global *Normalized Difference Vegetation Index* (**NDVI**) data was collected biannually and processed to find mean values for the selected countries..
- Software programs such as ArcGIS, MATLAB, and Excel were used to determine how population size, income, and deforestation correlate with crop yields.
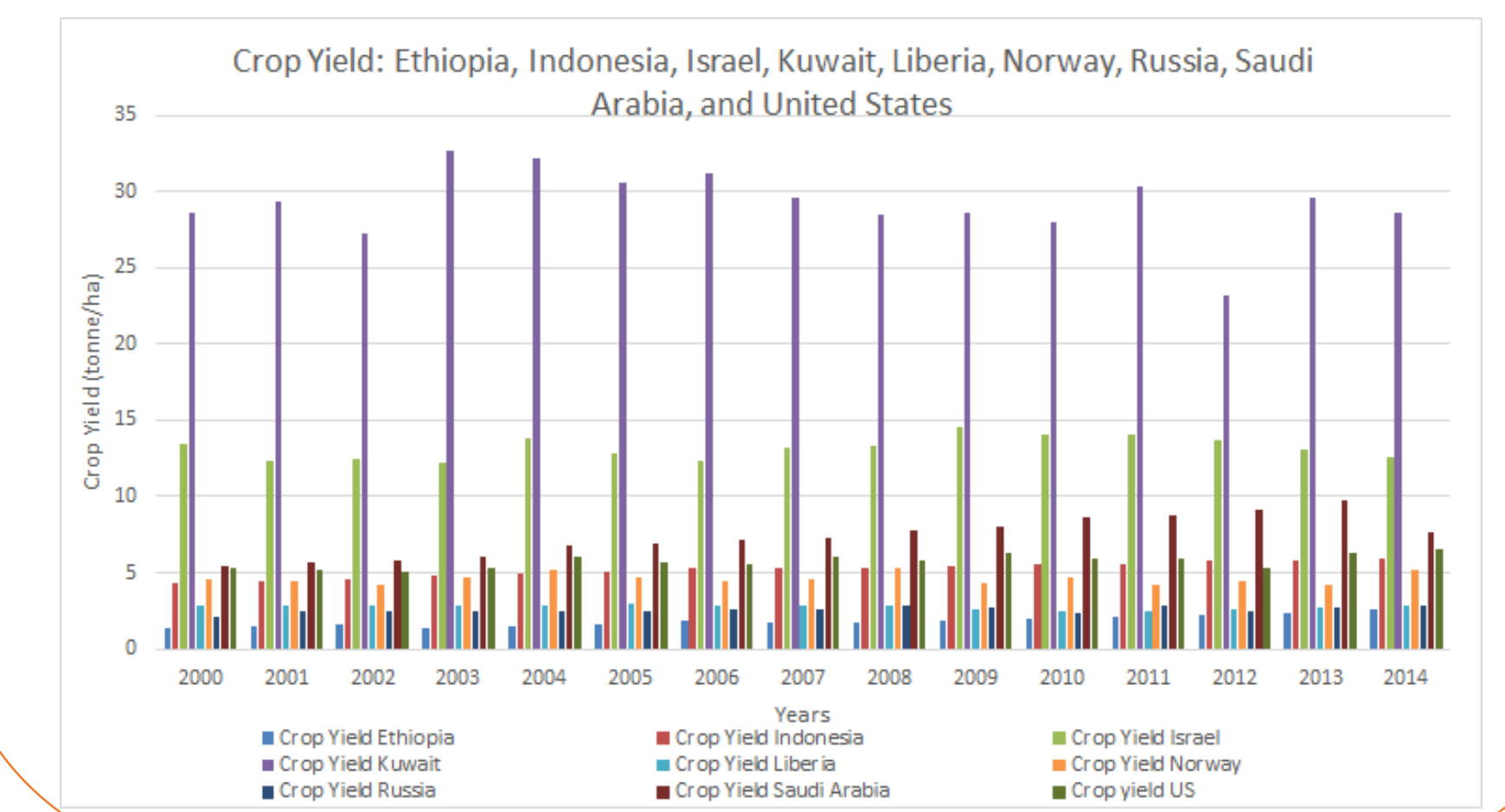
Total production of food grains drops → Shortage of food → Prices rise → Some people cannot afford food = Food insecurity

NDVI data 2014 (December)

NDVI data 2014 (June)

NDVI, Population, and GNI per capita for Selected Countries (2000)

Population, GNI, and NDVI for Selected Countries, 2014

Country map : 2000

Country map : 2014

## Results

Using the methodology described, the population, income per capita and vegetation was plotted using ArcGIS for the selected countries from 2000 to 2014. These maps show that poor countries like Liberia have plentiful vegetation but less income and population. Some developed countries like the USA have had increases in income per capita as well as population.

Crop Yield: Ethiopia, Indonesia, Israel, Kuwait, Liberia, Norway, Russia, Saudi Arabia, and United States

## Conclusion

Understanding the interactions between food security and global environmental change is highly challenging. Most of our research shows that population and per-capita-income are strongly related to crop yield and thus affect food security in our selected countries (Ethiopia, Indonesia, Israel, Kuwait, Liberia, Norway, Russia, Saudi Arabia, United States). This study shows that population has increased without corresponding increases in crop yields for certain countries, resulting in concerns that the risk of food insecurity will grow. The study shows that income of the country is also a basic component of food security and is important in crop production, nutrition, and technology.

## References

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## Acknowledgements