

*Presentation of GIS
Middleton Regional High School
April 1, 2026
Grade 12 - Global Geography
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Presenter: Adam Nearing*

Introduction:

This workflow will allow students to learn about population densities, land usage, and human water consumption. All three topics are intertwined throughout this demonstration, and we will look at multiple layers related to these topics while performing three real life GIS analysis.

For this demonstration, we will be using National Geographic MapMaker (composed of Esri data).

Like to the home page can be found at [here](#)

Click “Launch Mapmaker” to begin.

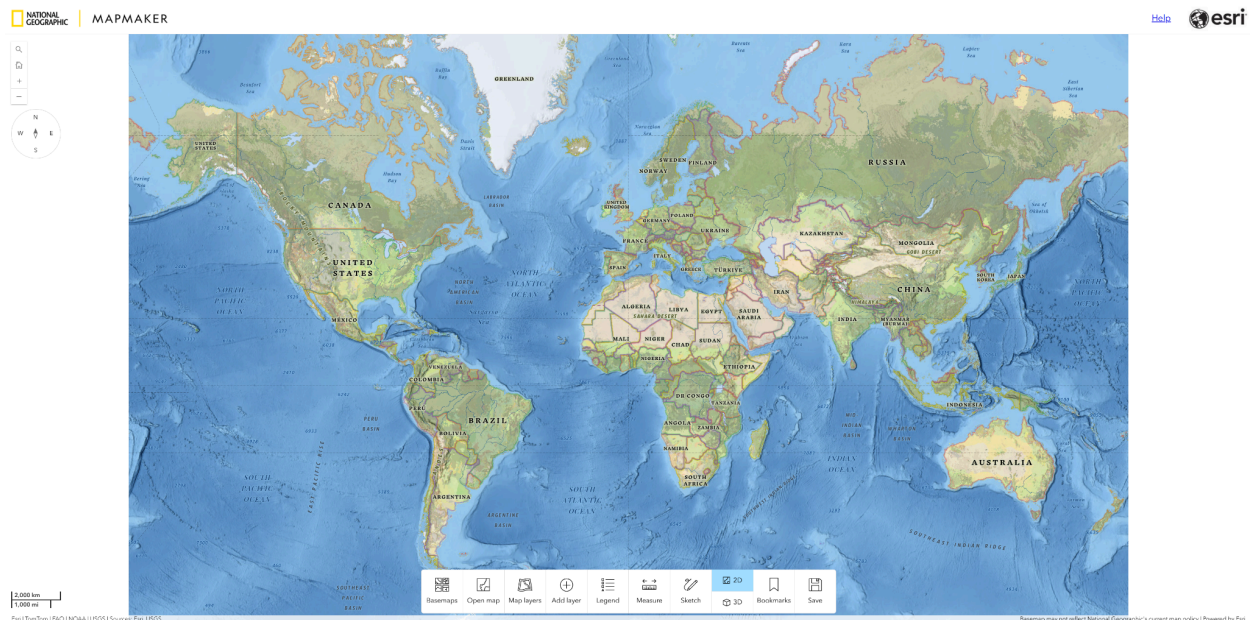


Image 1.1: After clicking Launch Mapmaker, the default display will open

Analysis 1: Light Pollution and Population Density

The purpose of this first analysis is to compare satellite images taken at night, which show us the light pollution around the world, to population density. The goal is to notice how highly populated areas emit more light pollution and low populated areas have little light pollution. Further analysis is made for areas of higher than expected population for the amount of light pollution; why might this be?

- On the task bar, click “Open Map” to choose the “Light Pollution” layer.
 - This is applied to the Globe.

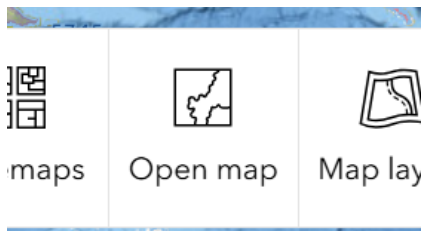


Image 1.2 (left): Open map button

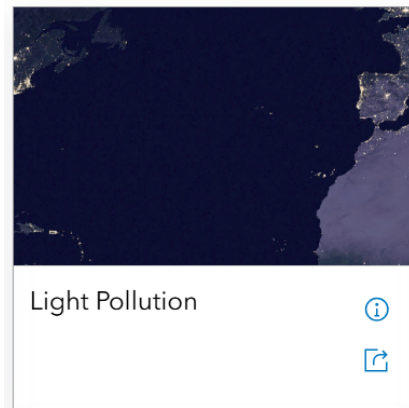


Image 1.3 (right): Select Light Pollution map

- On the task bar, click “Add layer” to choose the “Cities of the World” layer.

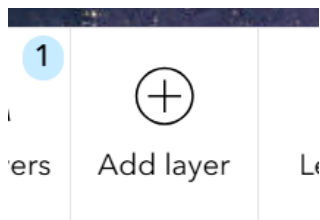


Image 1.4 (left): Add layer button

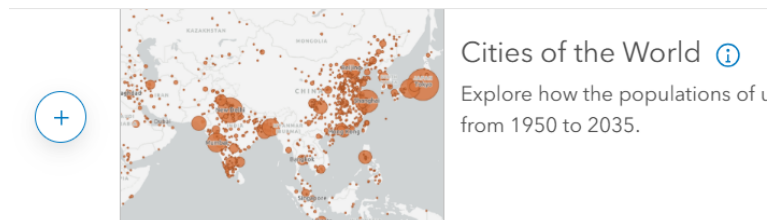


Image 1.5 (right): Select Cities of the World

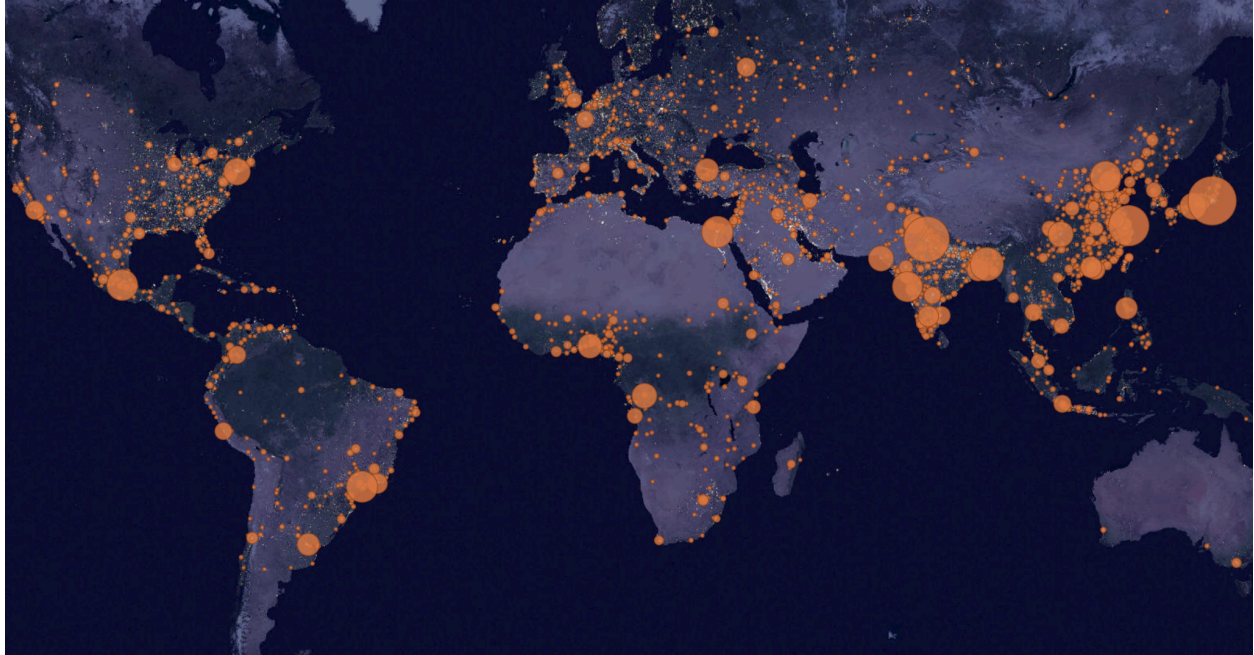


Image 1.6: Light Pollution map with Cities of the World layer adding on top

- Look at areas of the world where high light pollution = high population.



Image 1.7: A closer look at Tokyo, Japan, to analyze the light pollution and population

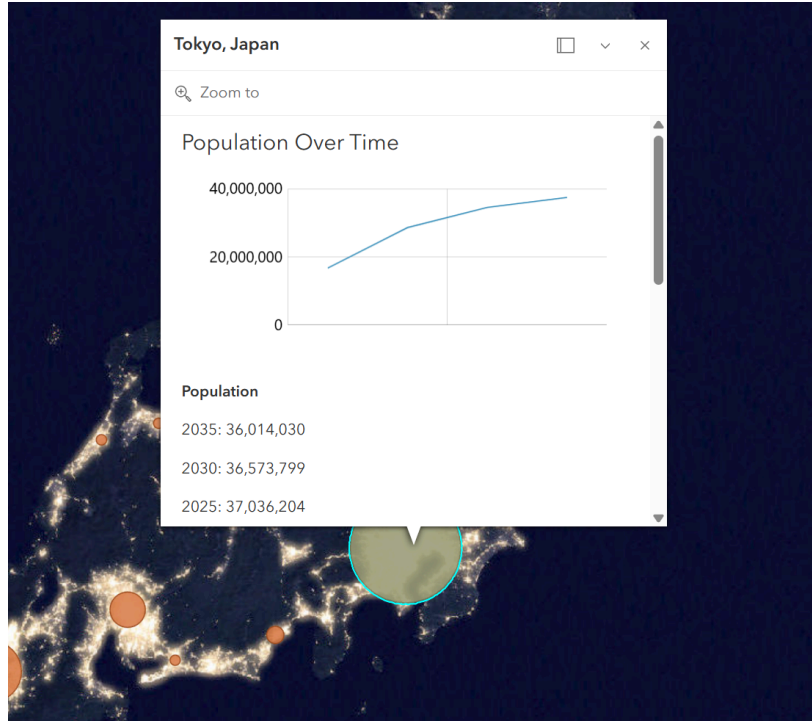


Image 1.8: Clicking on the population circle will tell us more details about population history and trajectory

- Look at areas of the world where low light pollution = no data on population.



Image 1.9: St. John's, Newfoundland, does not have population data, although still considered a city

- However, some areas with low light pollution = high population?

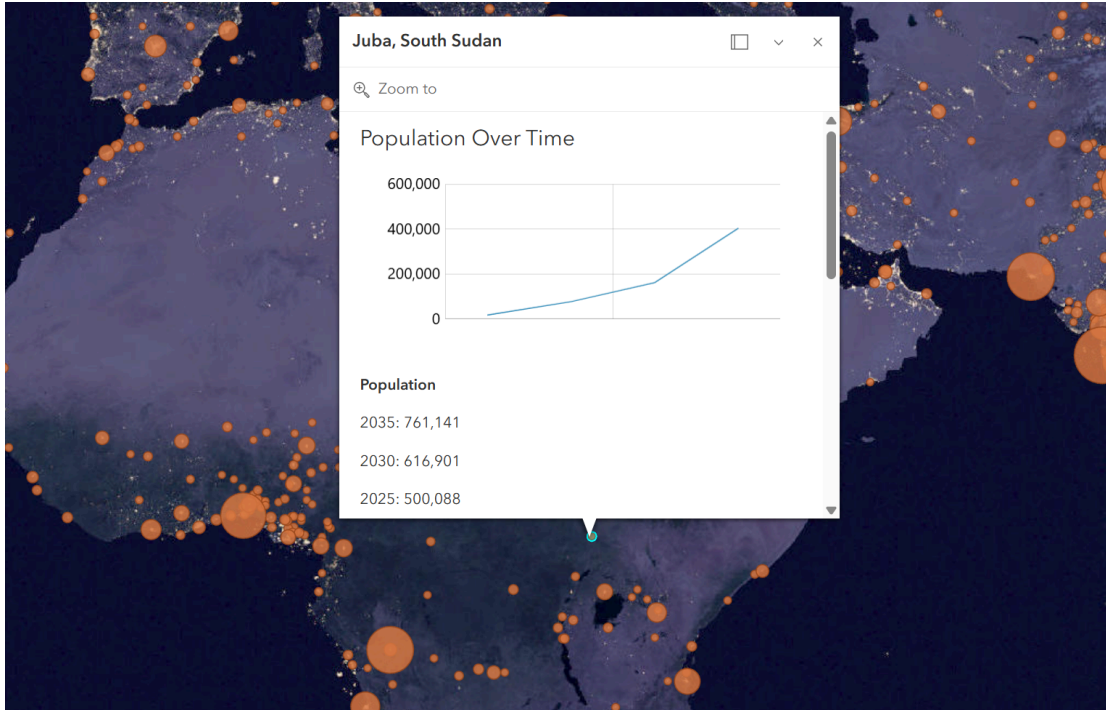


Image 1.10: Juba, South Sudan, with low light pollution yet considerably high population

- Why might there be areas of low light pollution yet high population?
 - Electricity desert; there is likely not enough energy for the amount of people living there.

Analysis 2: Land Cover Type and Water Demand

The purpose of this next analysis is to look at areas which are in high demand of water. We will learn about how specific areas are splitting their water usage across irrigation, domestic, and industry uses. We will also look at land cover to see how it relates to water usage. In areas of high crop yield, how much of their water is being used for irrigation? In highly populated, metropolitan areas, how much water is being used for industrial use? Can we cross check the population of these areas?

- Go back to “Open Map” and select the World Water Map: Demand layer

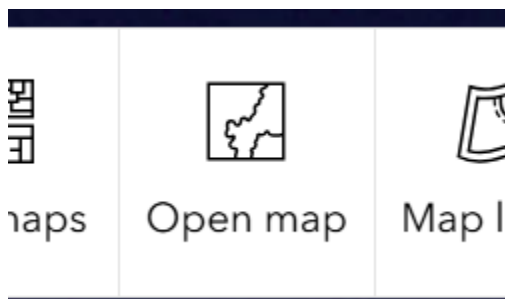


Image 2.1 (left): Open map button

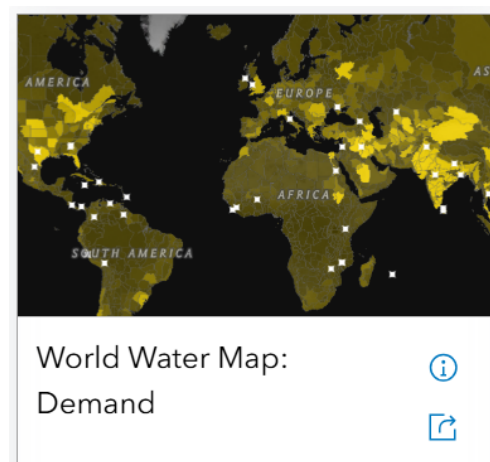


Image 2.2 (right): Select World Water Map: Demand map

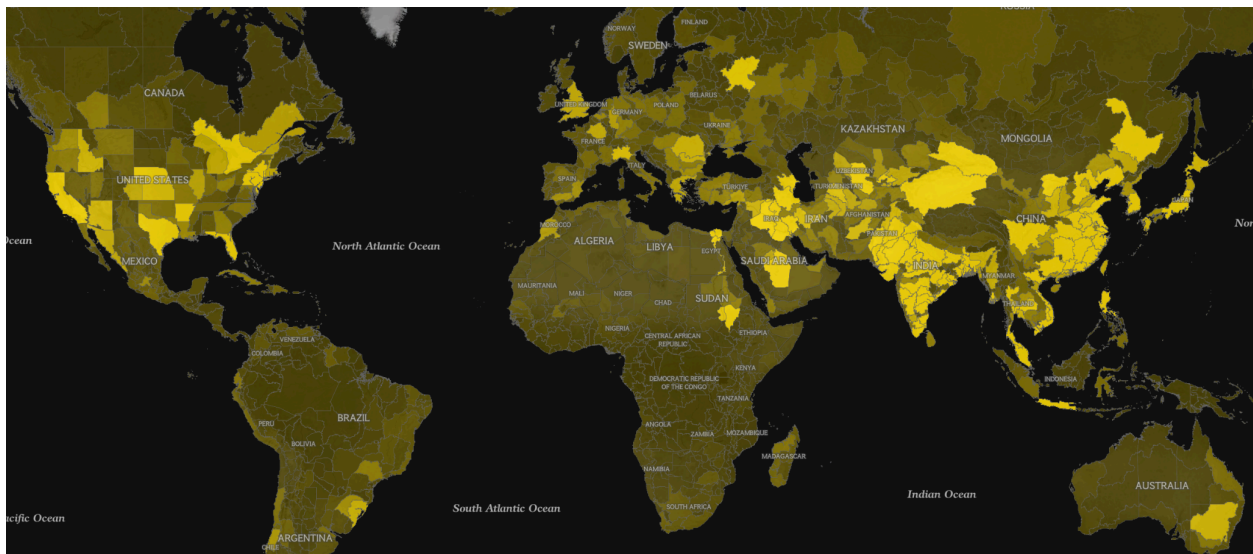


Image 2.3: World Water Map: Demand map open

- Click on some bright yellow areas



Image 2.4: Water demand information on the northern region of the Philippines

- Notice the three categories of water usage:
 - Irrigation: crops
 - Domestic: human and home consumption
 - Industry: production and energy
- Add layer “Land Cover” overtop

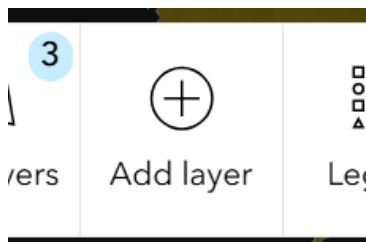


Image 2.5 (left): Add layer button

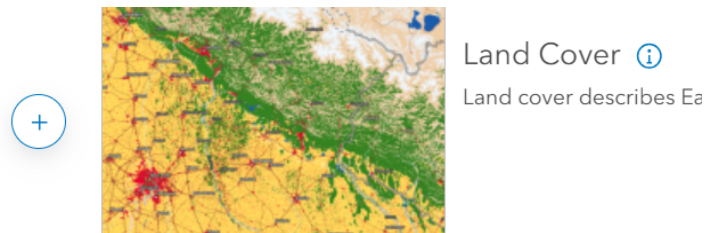


Image 2.6 (right): Select Land Cover

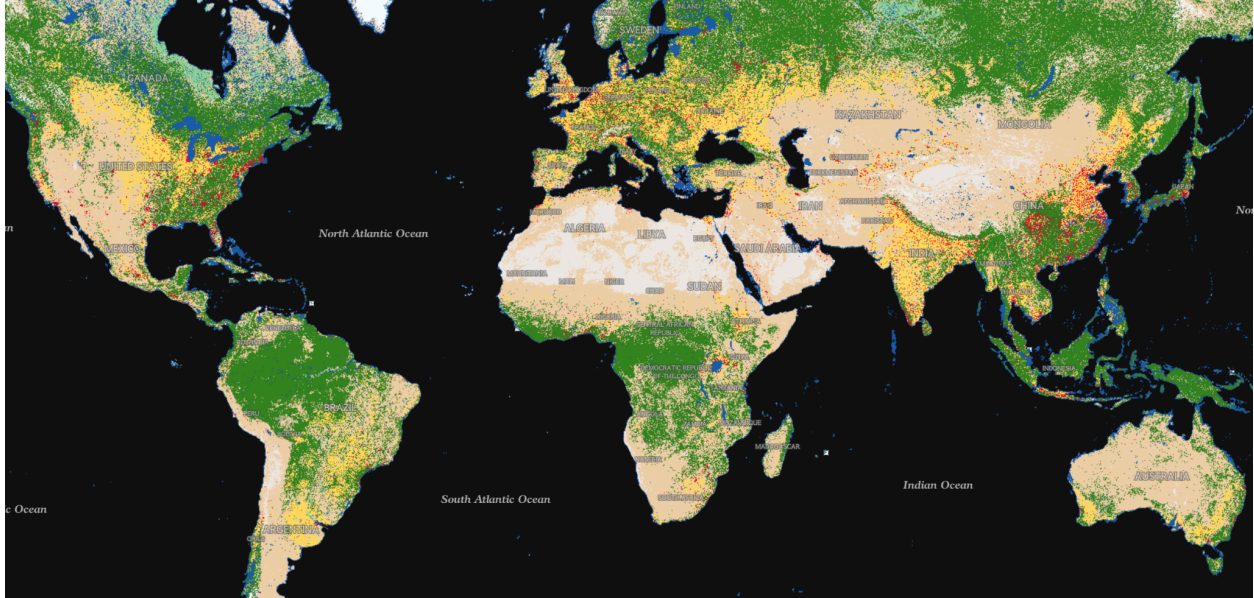


Image 2.7: Land Cover layer open

- Take a look at the legend to understand the different colors; with particular focus on
 - Yellow = Crop
 - Red = Built Area

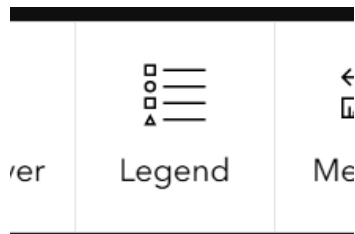


Image 2.8 (left): Legend button

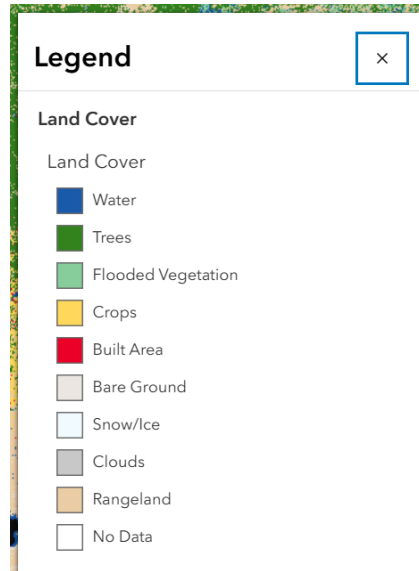


Image 2.9 (right): Land Cover Legend

- Now use the slider to easily look at both layers; what do we notice?

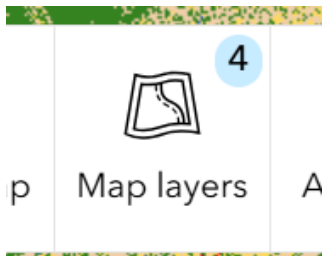


Image 2.10 (left): Map layer button

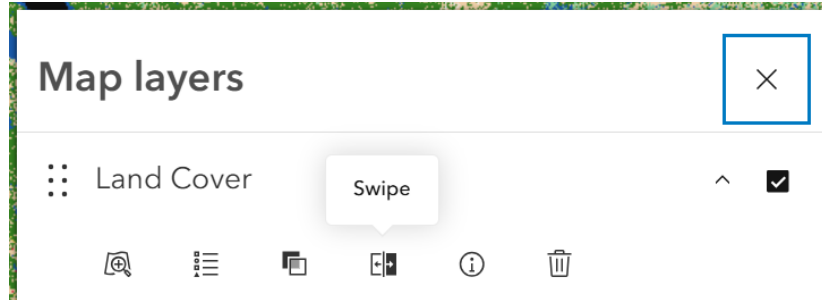


Image 2.11 (right): Click the "Swipe" icon

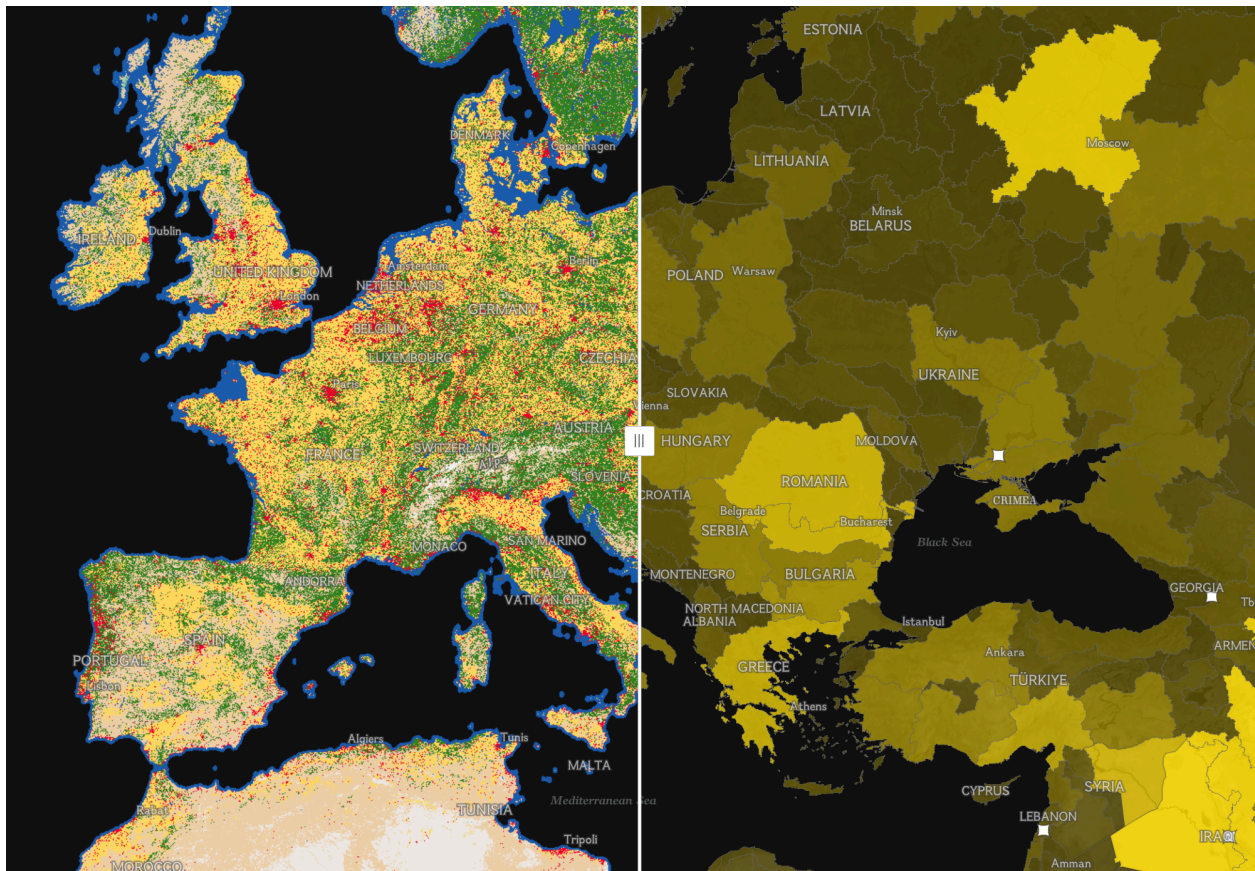


Image 2.12: Both Land Cover and Water Demand layers open

- Large crop areas use most of their water (nearly 93% in Nebraska State) for Irrigation
 - In Nebraska State, 6% of water is used for production and energy



Image 2.13: Looking at the water usage for the state of Nebraska

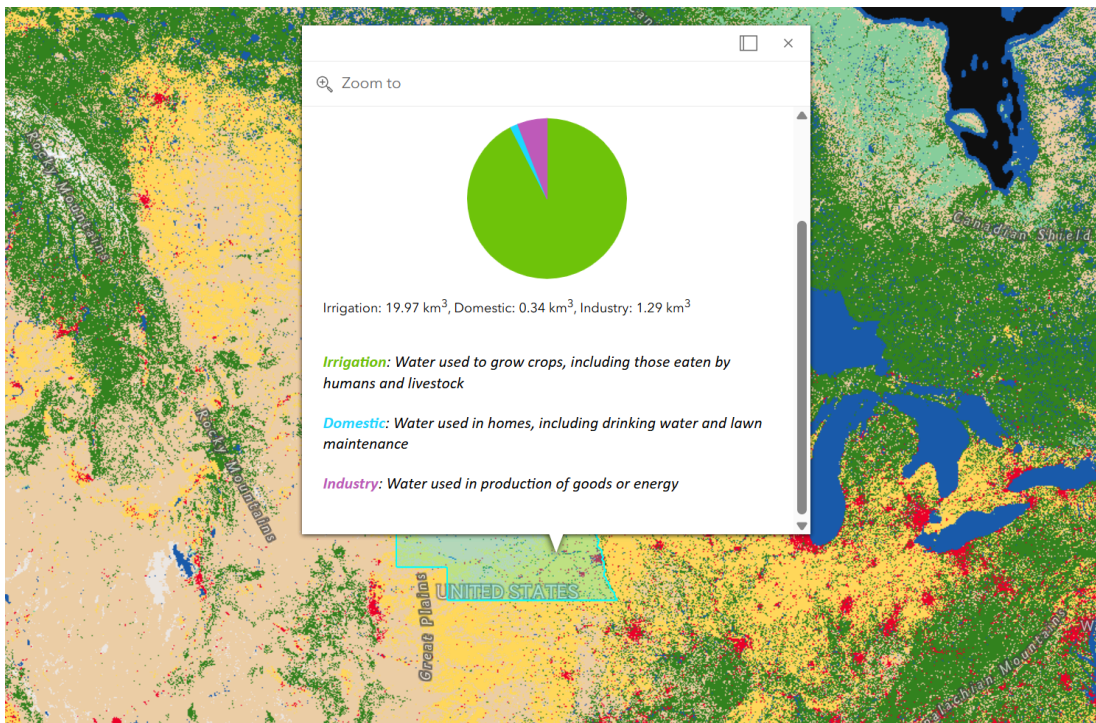


Image 2.13: Use the swipe tool to look at the same area, but now with Land Cover as the map

- Large urban areas use most of their water (nearly 84% in Southern Ontario) for production and energy
 - In South Ontario, 0.2% of water is for irrigation

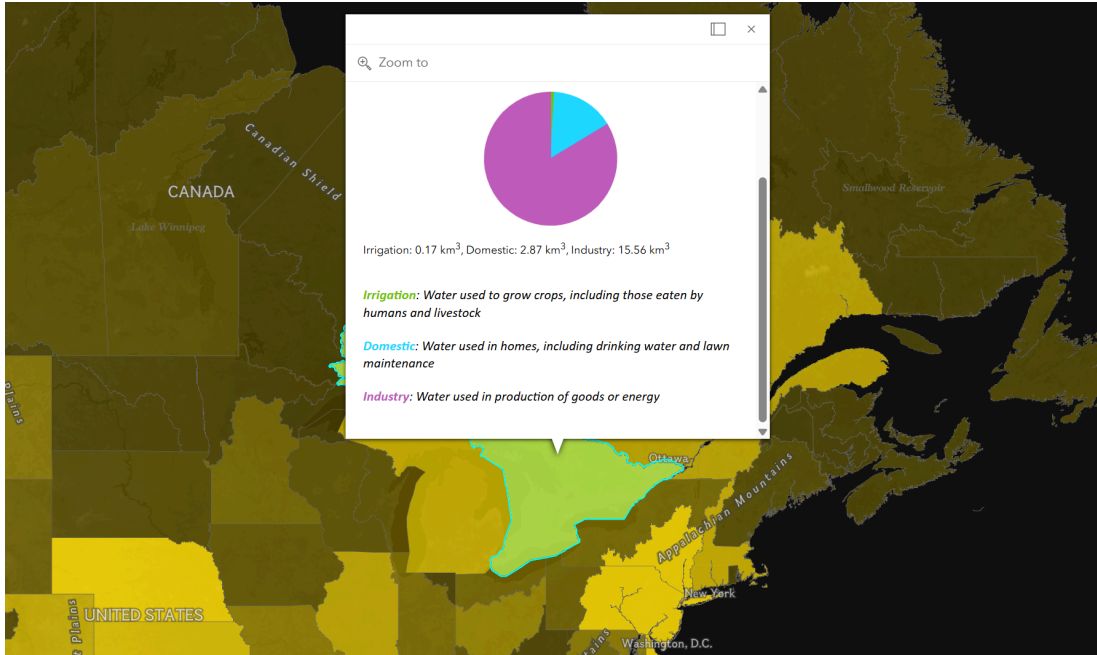


Image 2.14: Looking at the water usage for the Southern Ontario

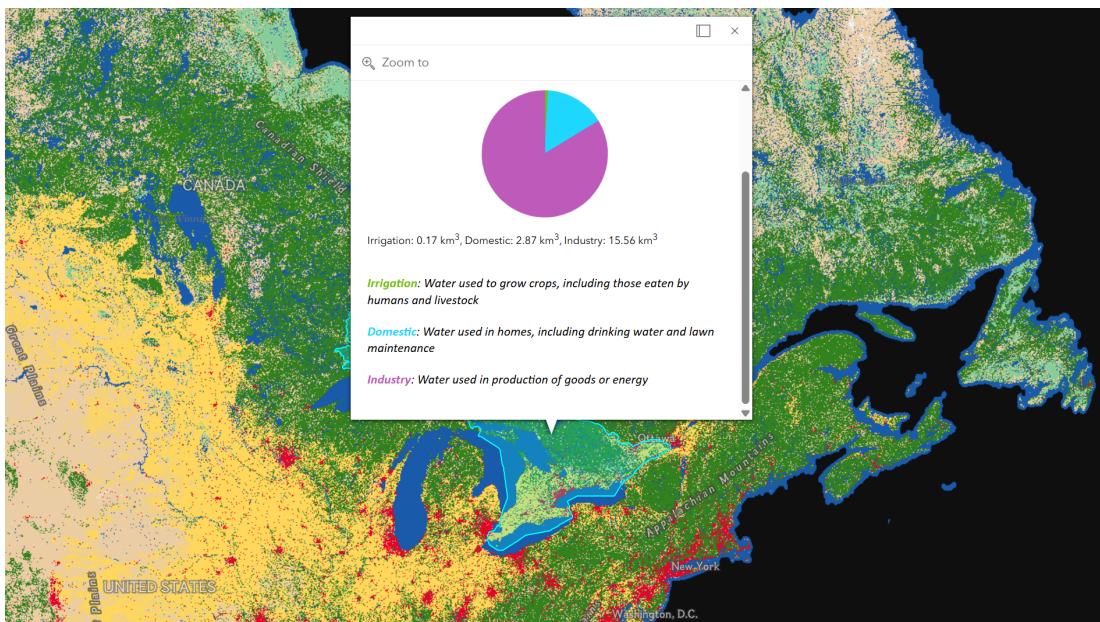


Image 2.15: Use the swipe tool to look at the same area, but now with Land Cover as the map

Analysis 3: Water Demand, Light Pollution, Population Density

In this analysis, we will look at how highly populated cities split their water needs, and discover locations which might not give us the results we were expecting. Our lessons learned from Analysis 1 could be applied to this analysis, by looking once again at the light pollution and population density data. We can also take what we learned from Analysis 2 to apply the land cover layer for better visualization of land usage in our areas of interest.

- Click on Add layer button and choose the “Light Pollution” layer again

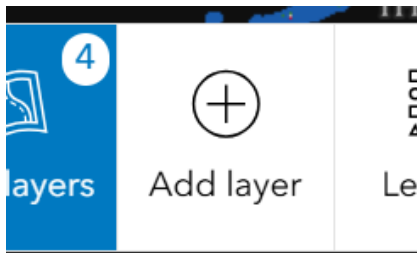


Image 3.1 (left): Click the Add layer button



Image 3.2 (right): Select Light Pollution map

- Turn off Land Cover Type for now

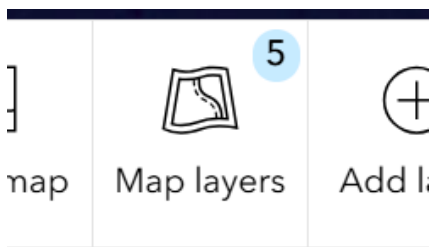


Image 3.3 (left): Map layers button

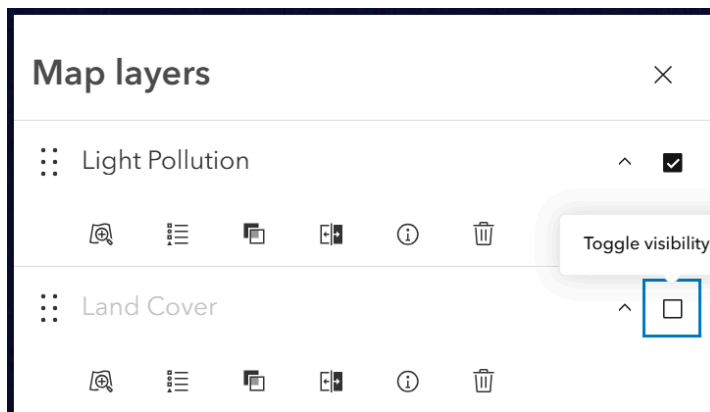


Image 3.4 (right): Uncheck the Toggle box for Land Cover

- Now click the Swipe icon on the Light Pollution layer

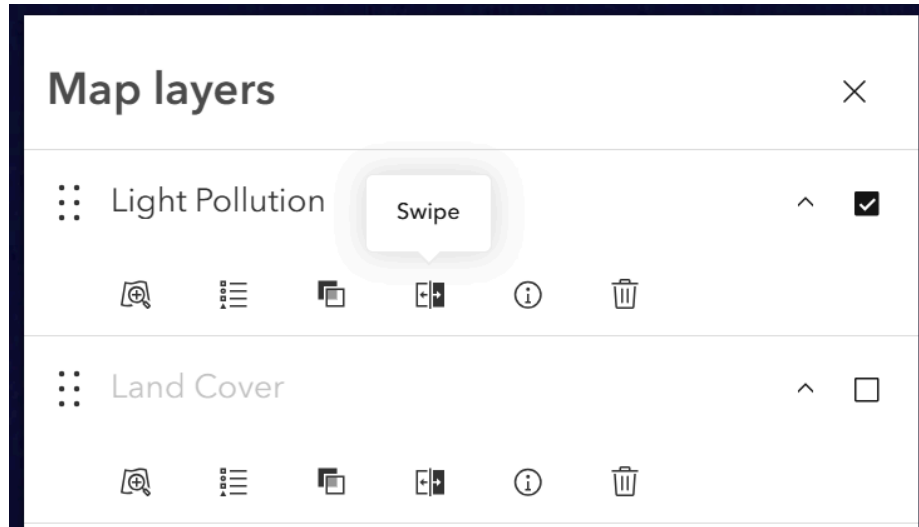


Image 3.5: Click the Swipe icon on the Light Pollution layer

- We can compare the light pollution of our two areas of interest (Nebraska vs. Southern Ontario)
 - On a larger scale, we can compare the large crop areas of the Mid-West to Big cities on the East Coast.
 - In this split view, click on some bright yellow regions to understand their water usage
 - Swipe to view that same areas light pollution

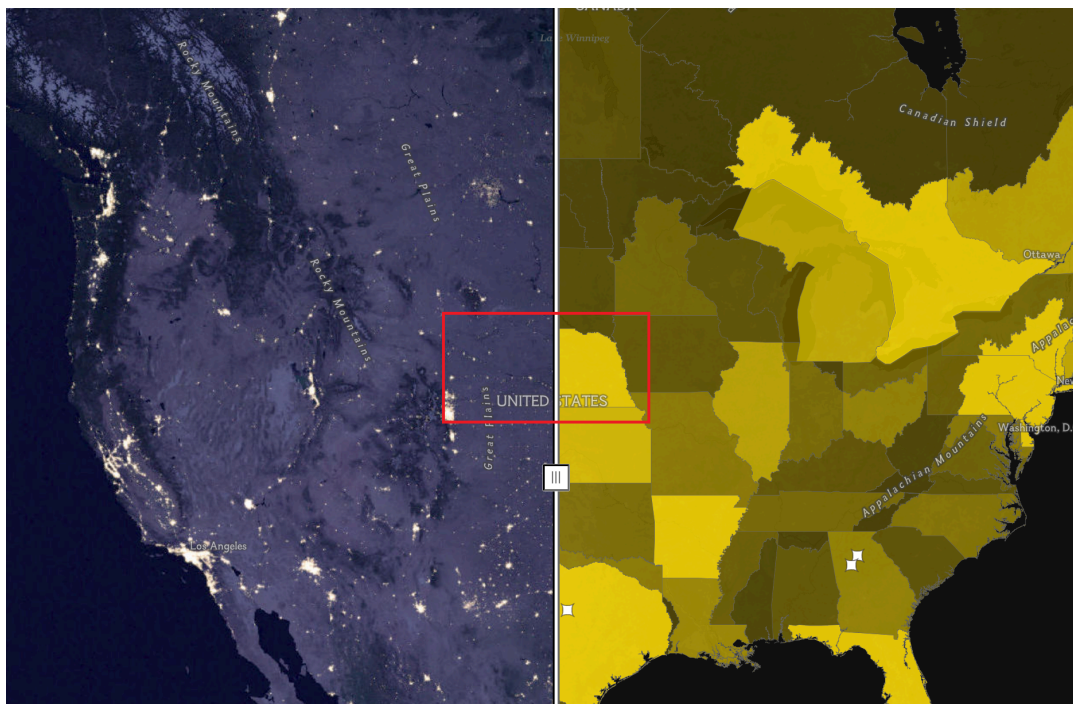


Image 3.6: Click on the yellow shape of Nebraska to see its water usage, then swipe to see it light pollution

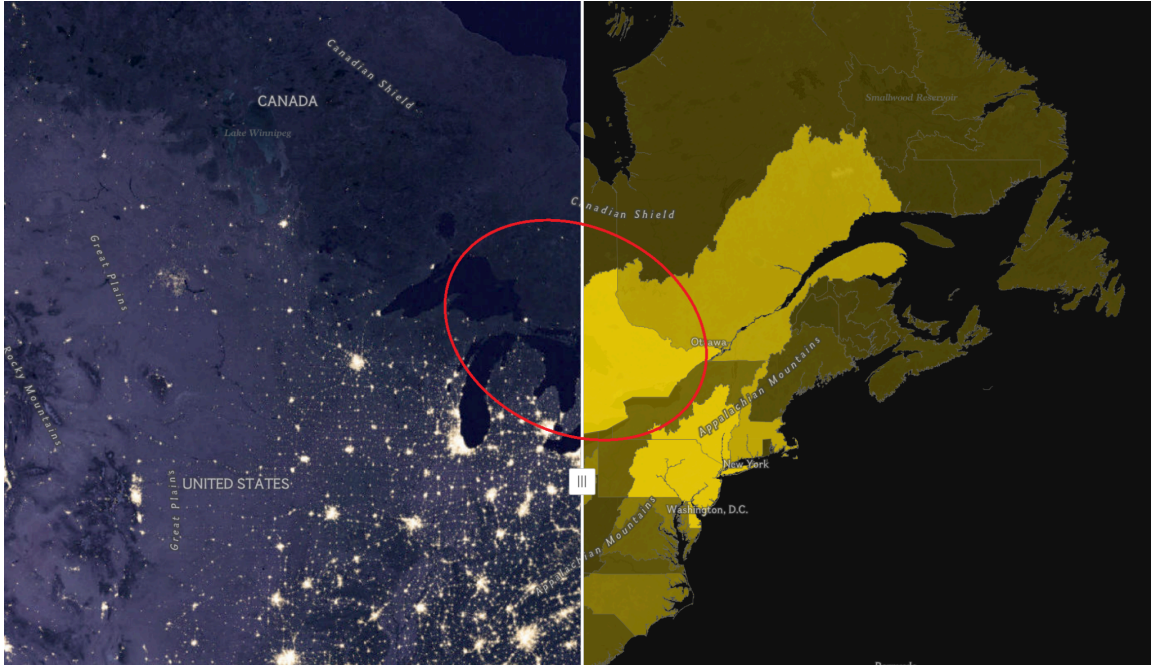


Image 3.6: Click on the yellow shape of Southern Ontario to see its water usage, then swipe to see it light pollution

- Add the Population Density layer again to compare the amounts of people living in each of these areas
 - With the focus being that the higher the population, the more energy consumption

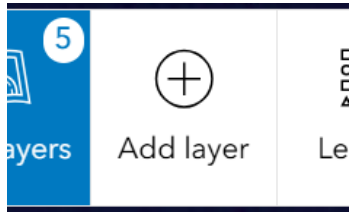


Image 3.7 (left): Add layer button



Image 3.8 (right): Select Cities of the World

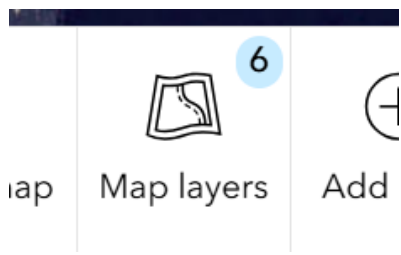


Image 3.9 (left): Map layers button

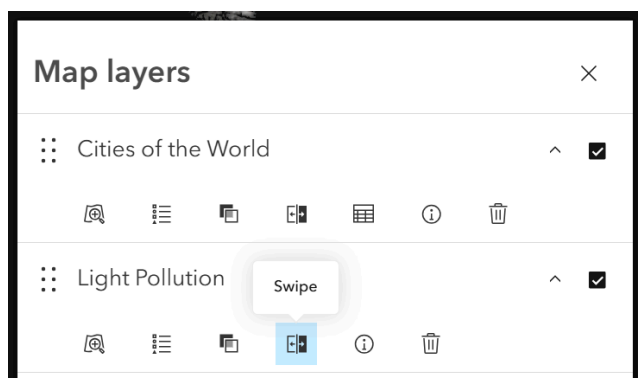


Image 3.10: Click the Swipe icon on the Light Pollution layer

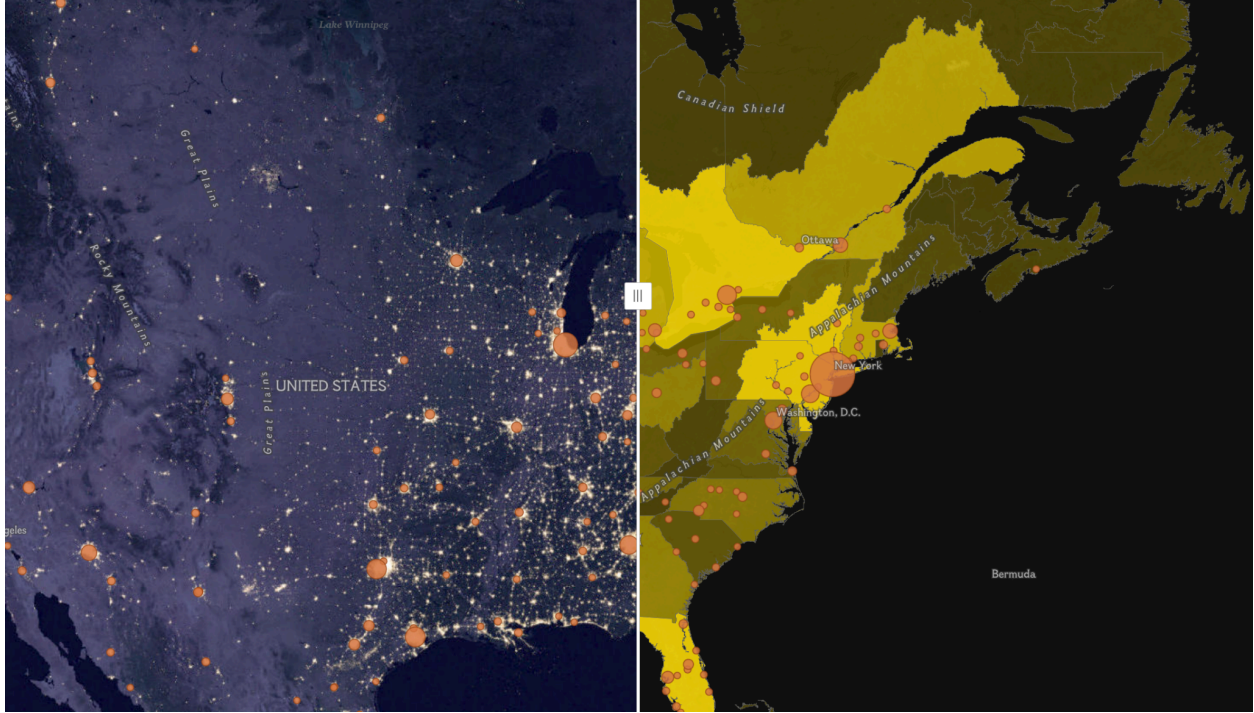


Image 3.11: Three layers are active; Water Demand, Light Pollution and Cities of the World

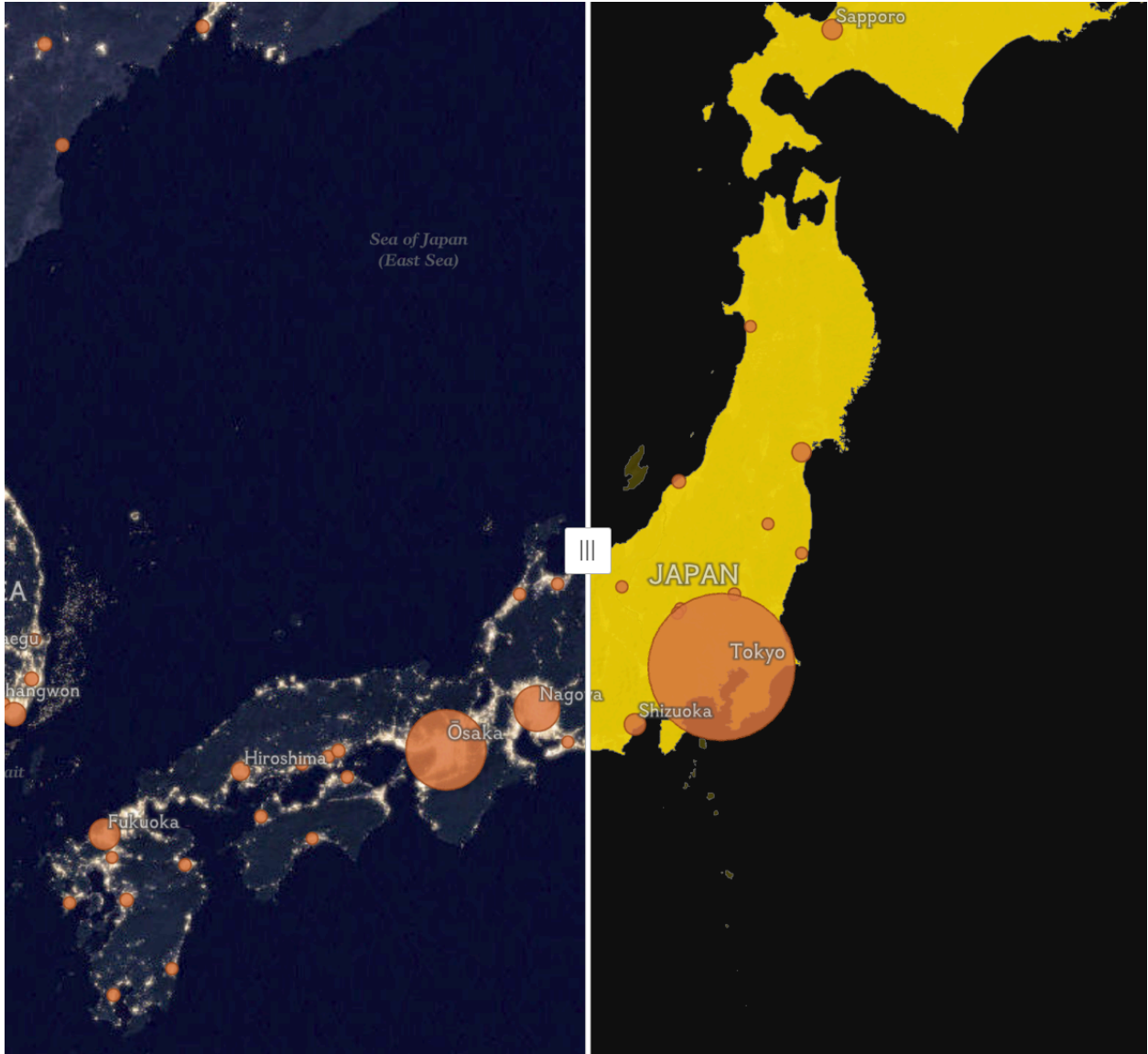


Image 3.7: Using this method of Water Demand vs. Light Pollution vs. Population, what can we learn about Japan?

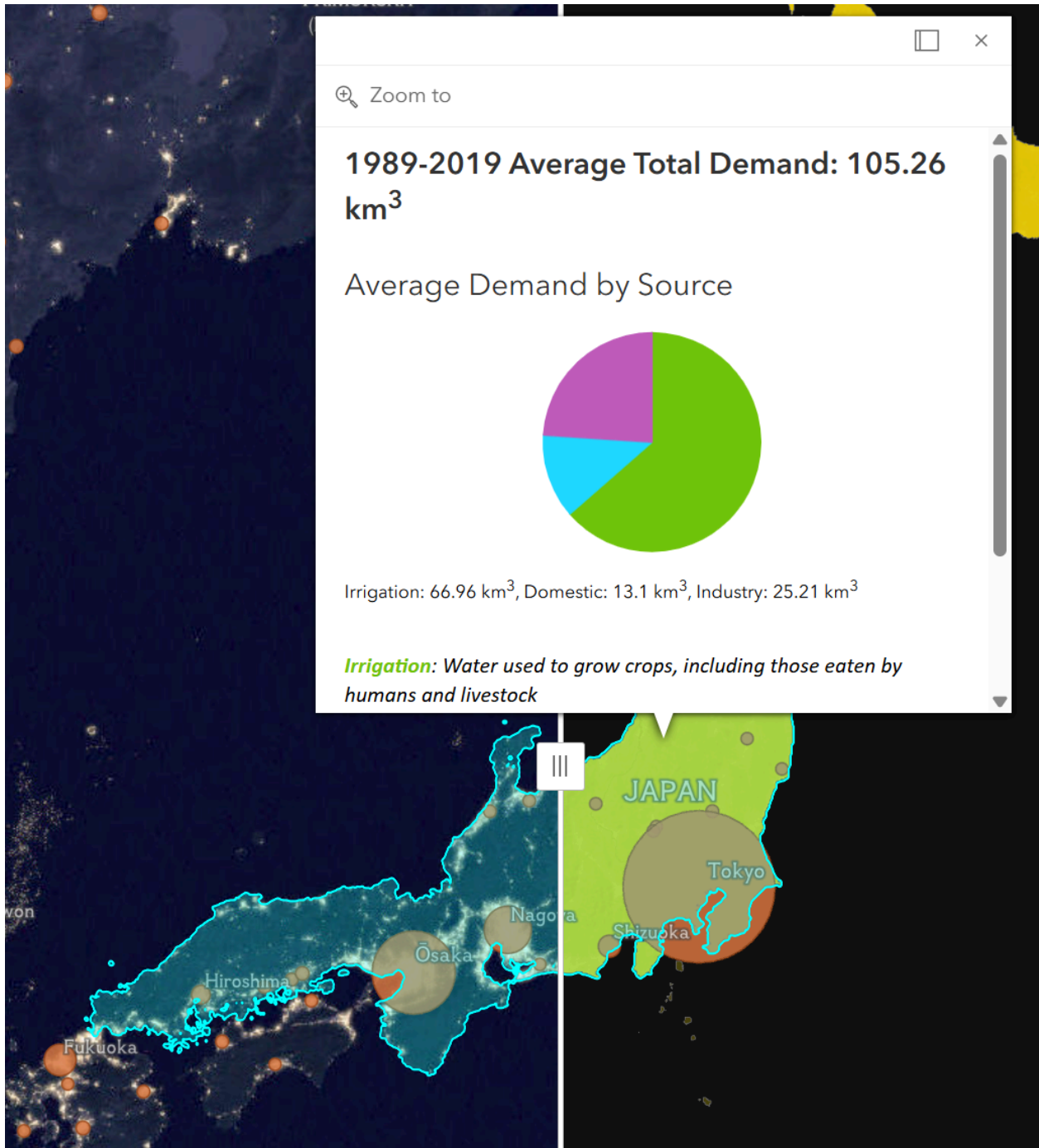


Image 3.8: Surprisingly, Japan's main island uses more water for Irrigation than Industry, even though it has the one of the most populated city in the world

- Turn on the Land Cover layer again
 - Have a closer look at the land cover of Japan
 - The crop areas are few, but we know nearly 67% of their water is used for irrigation.

- This is likely due to the type of irrigation. For example, rice fields require an immense amount of water. We can assume that the crop areas in Japan would use more water than a similar sized crop area of a wheat field.

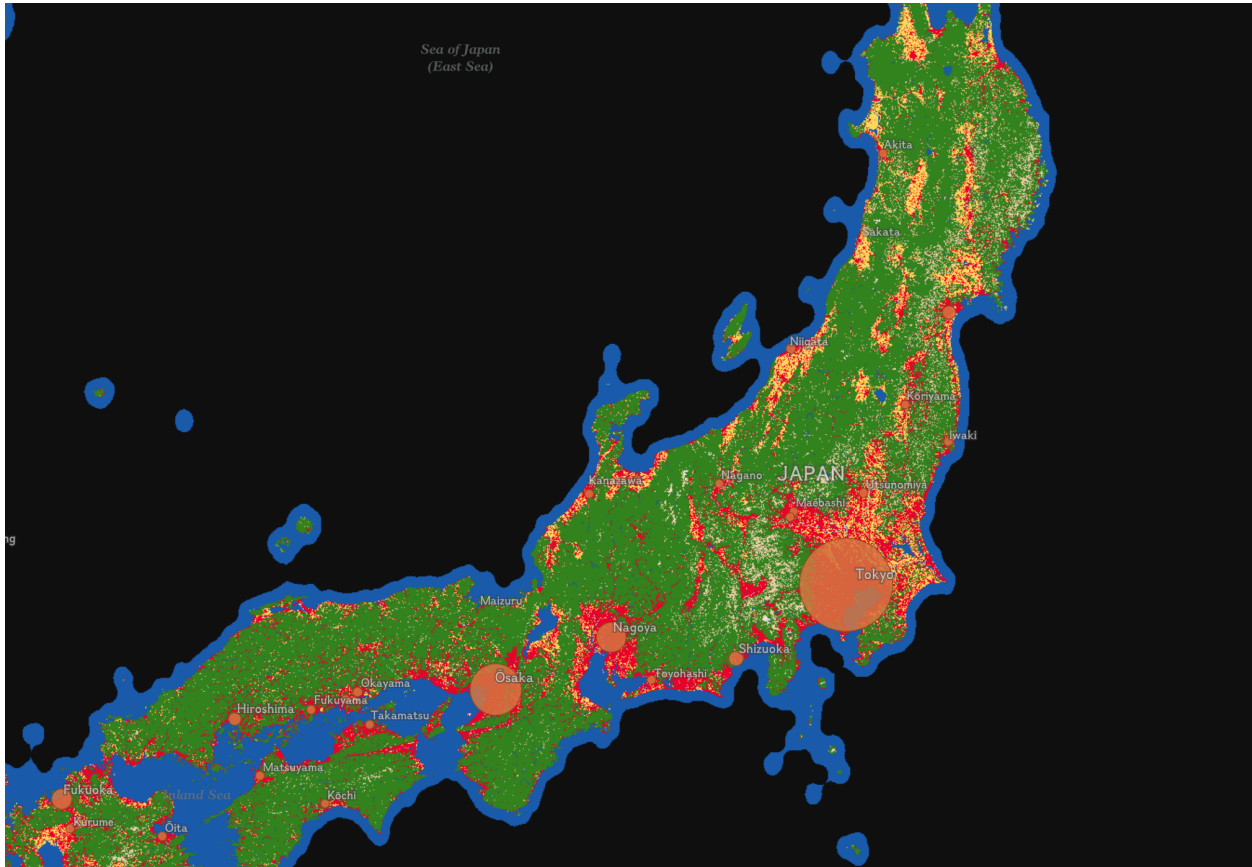


Image 3.8: Land Cover types and population density of Japan, with a surprising few crop areas when taking into consideration the nearly 67% water demand for crops

Conclusion:

In this demonstration, we learned how to compare light pollution with population density, which led us to finding potential “electricity deserts”. We also learned about how, in most cases, large cities will use a vast majority of their water for industrial use, while prairie lands would use it for irrigation. This was done by analysing the water demand and land cover layers of our map; swiping between the two for easy visualization.

All three analyses could be related through the assessment of human impacts on earth, human migration, and the usage of water for every day consumption of our food and electricity.

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