

Human-Caused and Lightning-Caused Wildfires In United States

By Jingyi Yang

Introduction:

The U.S. Department of Agriculture's Forest Service states that in the past decades, \$2.9 billion per year has been spent on wildfire suppression¹. As many conversations are concentrated on climate change will increase potential wildfire risk, scholars like Jennifer K. Balch are using their efforts to start the public dialogue about people's role in igniting wildfires and increasing wildfire risk². According to data from US Forest Service Fire Program Analysis-Fire Occurrence Database (FPA-FOD), human-started wildfires accounted for 84% of wildfires². Additionally, these fires contribute to a threefold increase in the length of the fire season and are responsible for nearly half of the total areas burned². In some regions, human-started fires are several times larger than those caused by lightning².

This final project aims to use the Spatial wildfire occurrence data for the United States in 2006, EPA Level 2 Ecoregions, and Public Areas Database of the U.S. to answer the question: 1) How do human ignitions and lightning ignitions vary seasonally and geographically?, 2) How do the stated causes of human ignitions and lightning ignitions vary by different regions or land use? The answers to some of these questions can draw insights from research conducted by Balch and other scholars. However, it is still worth using different datasets and various GIS Acre functions like "Select by Attribute," "Clip," and "Spatial Join" to analyze human-caused and lightning-caused wildfires through both space and time.

Methods:

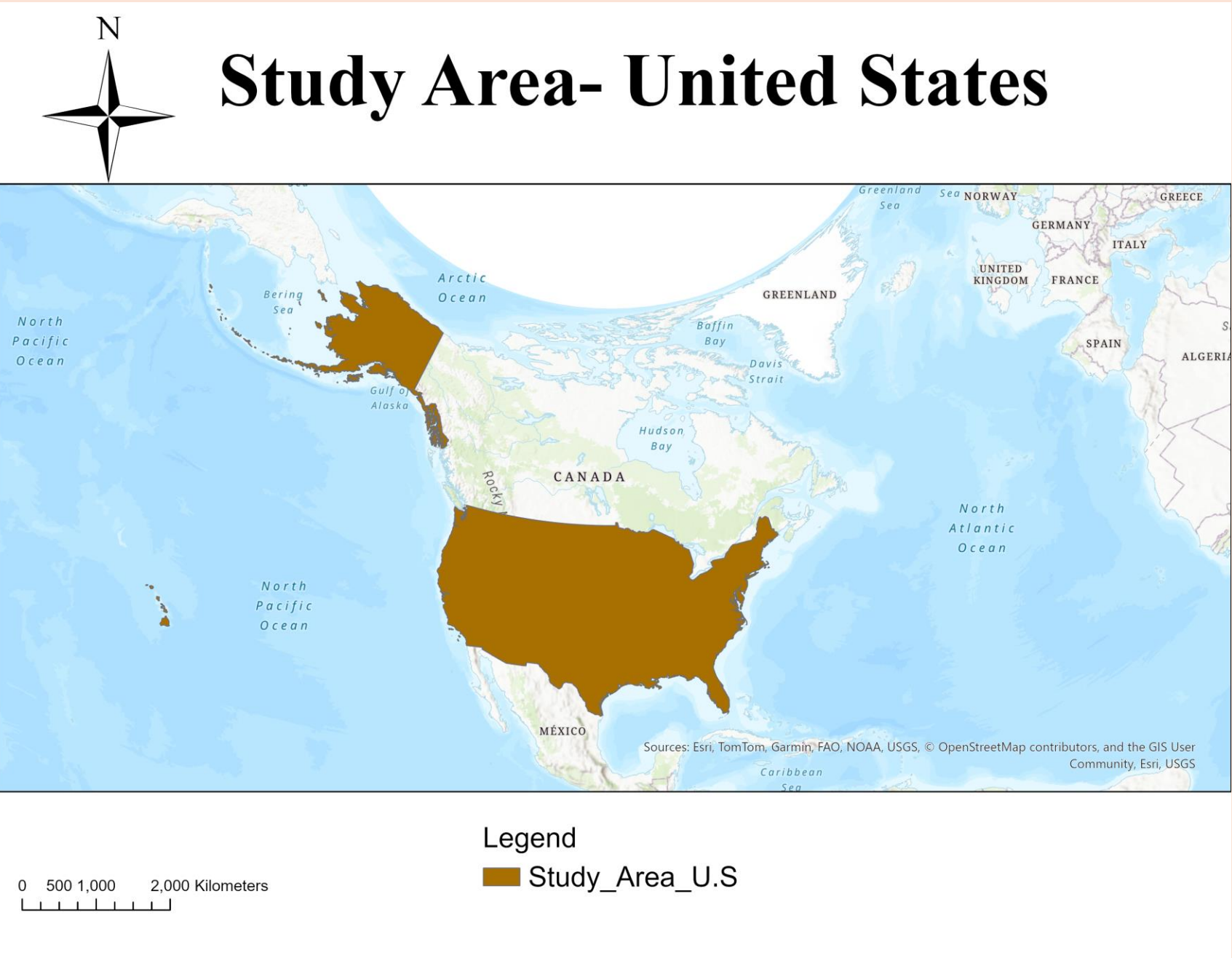


Figure 1

Study Area:

Get the shape of the territory for the U.S. through the "countries" file from lab three.

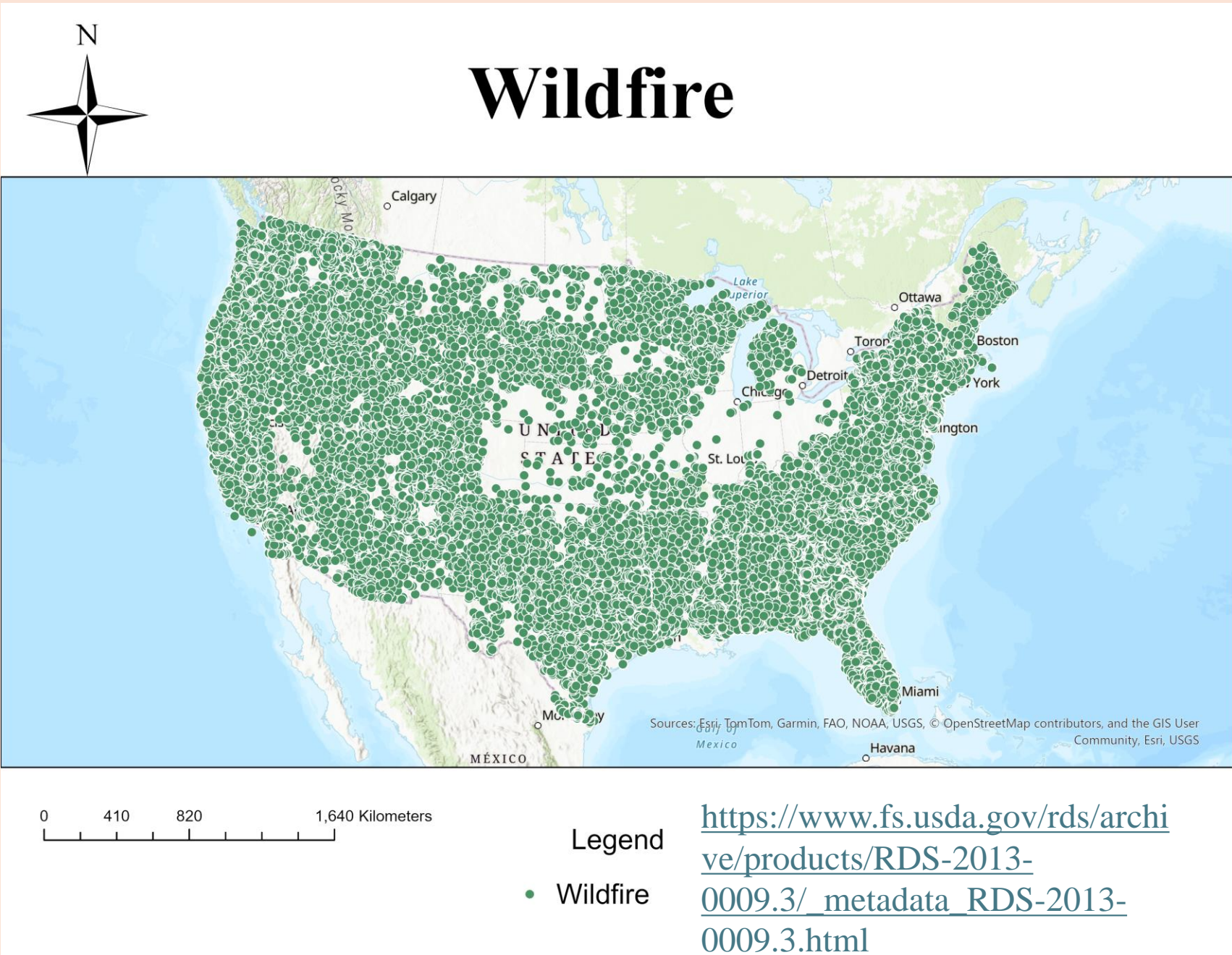


Figure 2

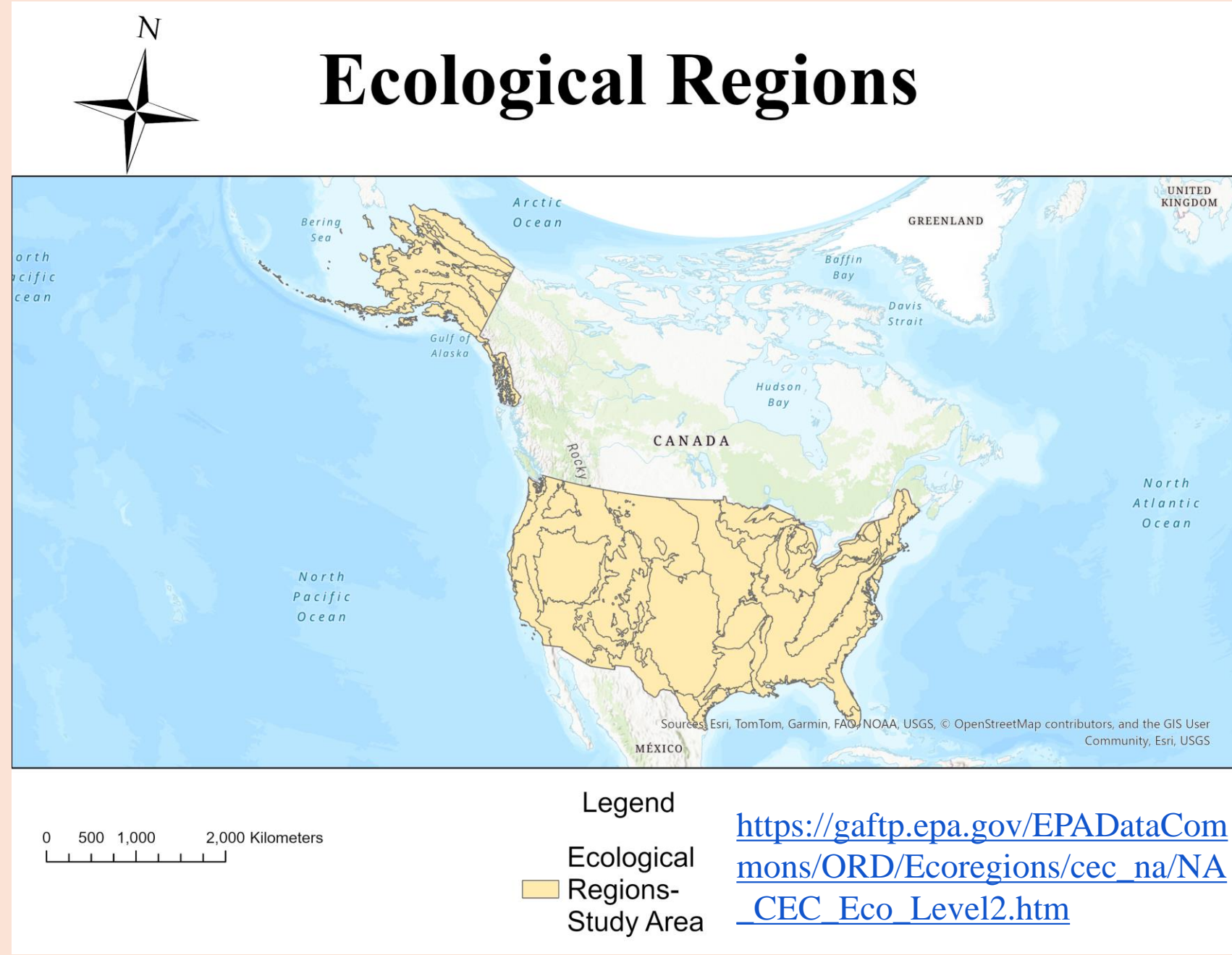


Figure 3

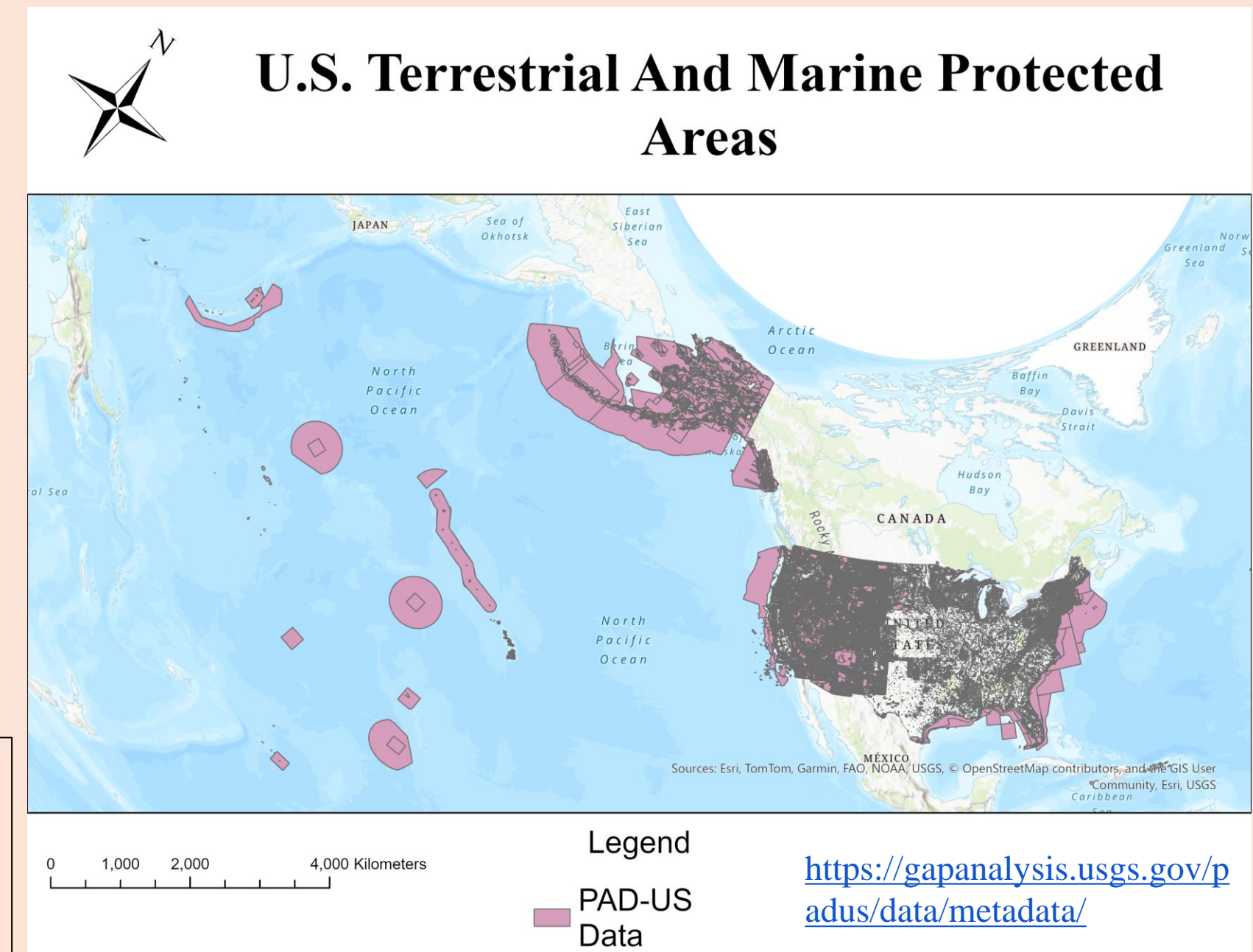


Figure 4

FPA FOD 2006

(Wildfire):

Use the "Select by Attribute" function to filter the information from the "Wildfire" shapefile, then use the "Add Field" and "Calculate Field" functions to create a new column for wildfire cause (human and ignitions), various seasons (spring, summer, fall, and winter), and various regions (Northeast, Midwest, South, West).

NA CEC Eco Level2

(Ecological Regions):

Use the “Clip” function to ensure the information in the “Ecological Regions” shapefile is within the study area. Use the “Spatial Join” function to join “Ecological Regions” and “Wildfire” shapefiles based on their spatial relationship to find human-caused and lightning-caused wildfires in various ecological regions.

PADUS1 4Combined

(U.S. Terrestrial And Marine Protected Areas):

Use the "Spatial Join" function to join "U.S. Terrestrial And Marine Protected Areas" and "Wildfire" shapefiles based on their spatial relationship to find the human-caused and lightning-caused wildfires in various International Union for Conservation of Nature (IUCN) categories.

Results:

Objects	More Likely to happen in ...	Count (Percentage)
Overall		
Human-caused wildfires	\	86886 (79%)
Lightning-caused wildfires	\	16871 (15.3%)
Season (Seasonally)		
Human-caused wildfires	Spring	37531 (43.2%)
Lightning wildfires	Summer	13662 (81%)
U.S. Regions (Geographically)		
Human-caused wildfires	South of the U.S.	54018 (62.2%)
Lightning wildfires	West of the U.S.	11808 (70%)
Ecological Regions (Regions/Land Use)		
Human-caused wildfires	“EASTERN TEMPERATE FORESTS” Region	55172 (63.5%)
Lightning-caused wildfires	“NORTHWESTERN FORESTED MOUNTAINS” Region	5818 (34.5%)
U.S. Terrestrial And Marine Protected Areas (Region/Land Use)		
Human-caused fires	“Unassigned” Category	7256 (47.7%)
Lightning-caused wildfires	“Other Conservation Area” Category	9071 (80.2%)

Discussion:

- Summary:** This project analyzes humans and lightning-caused wildfires spatially and temporally.
- Future work with the data:** 1) Focus on human-caused wildfires, such as campfires and arson, various spatially and temporally. 2) Regression and other models will be used to compare wildfires caused by humans with those caused by lightning.
- Limitations of the analysis:** Do not explain why human-caused and lightning-caused wildfires are more prevalent in some time and space than others.
- Other ideas/connections:** Wildfires will accelerate climate change by releasing carbon dioxide³.

3. “Yes, Climate Change Is Raising the Risks-and Stakes-of Extreme Wildfires,” The Nature Conservancy, July 9, 2024, <https://www.nature.org/en-us/what-we-do/our-priorities/tackle-climate-change/climate-change-stories/extreme-wildfires-are-getting-worse-with-climate-change/#:~:text=Unhealthy%20air%20isn%27t%20the,the%20impacts%20of%20climate%20change.>

1.Farmer, Sarah, and Jenni Moore Myers. “Economic Risks: Forest Service Estimates Costs of Fighting Wildfires in a Hotter Future.” US Forest Service, May 14, 2024. <https://www.fs.usda.gov/about-agency/features/economic-risks-forest-service-estimates-costs-fighting-wildfires-hotter>.
2.Balch, Jennifer K., Bethany A. Bradley, John T. Abatzoglou, R. Chelsea Nagy, Emily J. Fusco, and Adam L. Mahood. "Human-started wildfires expand the fire niche across the United States." Proceedings of the National Academy of Sciences 114, no. 11 (2017): 2946-2951.