METEORITE LANDINGS

FATIMAH NIYAS

INTRODUCTION

Main Goal:
To analyze global meteorite landings and uncover how discovery patterns are shaped by time, technology, and human presence.

Objectives:

- Track changes in meteorite discoveries over time
- Examine the technological and human impact on the detection
- Identify geographic trends in discoveries

Why It Matters:
This analysis helps us understand how meteorite activity intersects with human activity, and reveals where our current understanding may be limited by visibility, infrastructure, or technology.

DATASETS & TOOLS USED

Meteorite Landings Dataset (Data.gov):

- Includes name, type, mass (g), year, coordinates, and classification (Fell/Found)

Population Density Dataset (OurWorldInData.org):

- Annual country-level data (people/km^2)
- Used to analyze demographic influence on meteorite reporting

Tools

- Data Cleaning & Ingestion: R (tidyverse, dplyr)
- Exploratory Analysis: R (ggplot2)
- Main Analysis: Hypothesis testing, correlation analysis, trend modeling
- Visualization Tools: ggplot2 and Tableau (dashboards, geographic maps)

PROJECT GOALS

- Analyze patterns in global meteorite discoveries since the 1850s
- Understand the influence of population density on reported landings
- Evaluate the impact of technological advancements on detection
- Reveal gaps or biases in reported data due to human activity or geography

DATA CLEANING PROCESS

- Removed entries with missing/invalid year, mass, reclat, reclong
- Renamed columns for clarity (e.g., mass..g. to mass)
- Filtered years ≥ 1850
- Applied valid geographic range:
- Latitude: -90 to 90
- Longitude: -180 to 180
- Excluded extreme mass values (≤ 0 or > 1,000,000g)

DESCRIPTIVE STATISTICS

Dataset Overview:

- ~37,000 meteorite records (1850–2013)

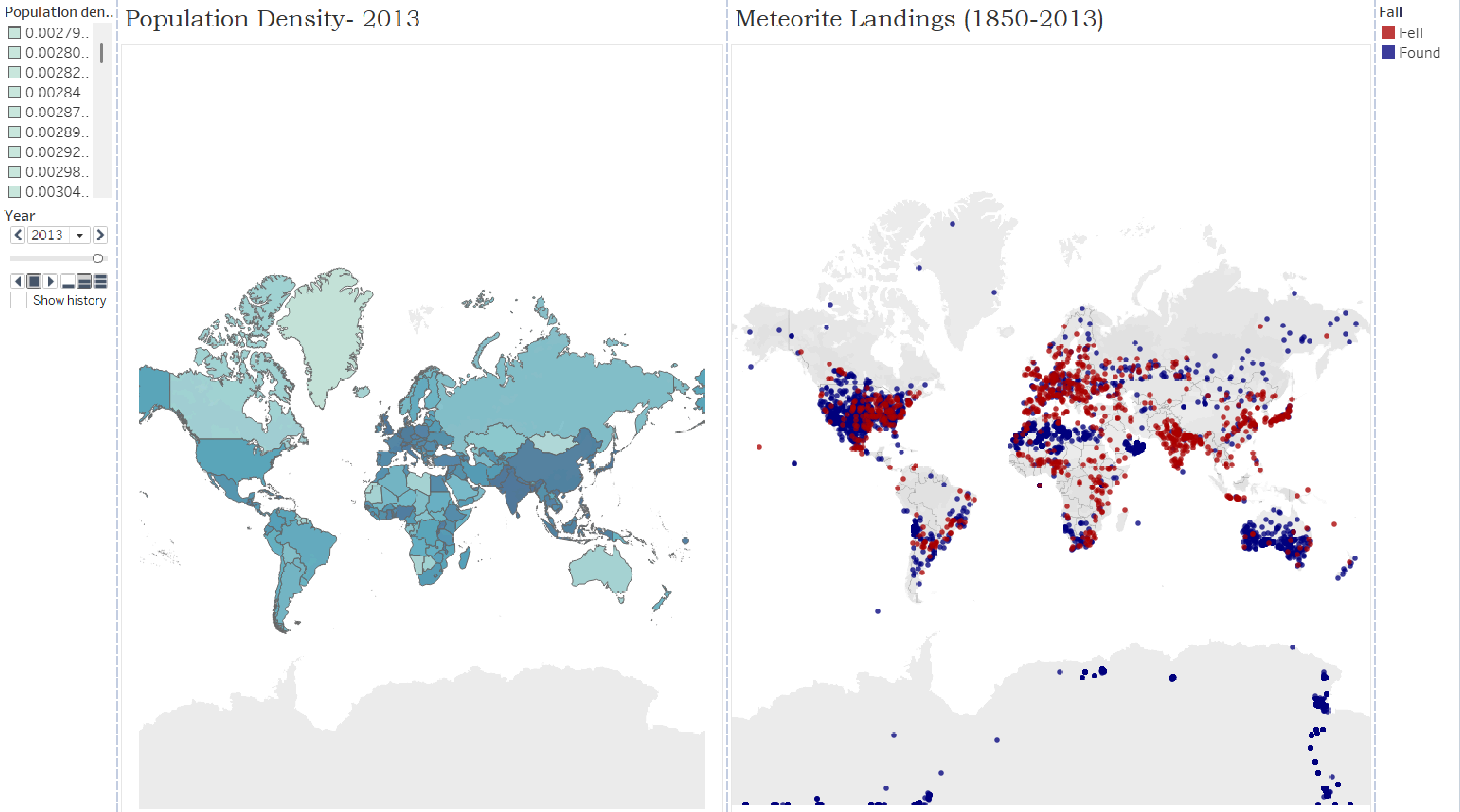
Key variables used:

- Mass (g) – Highly skewed; mean ~2,400g, median ~28.6g
- Year – Used to analyze discovery trends and link to tech milestones
- Latitude / Longitude – Enabled geographic visualizations and population overlays
- Status – “Fell” (~7%) vs. “Found” (~93%)
- Type – Common classes: L6, H5, Iron, CM2
- Country – Highest entries: USA, Australia, Libya, Argentina, Russia

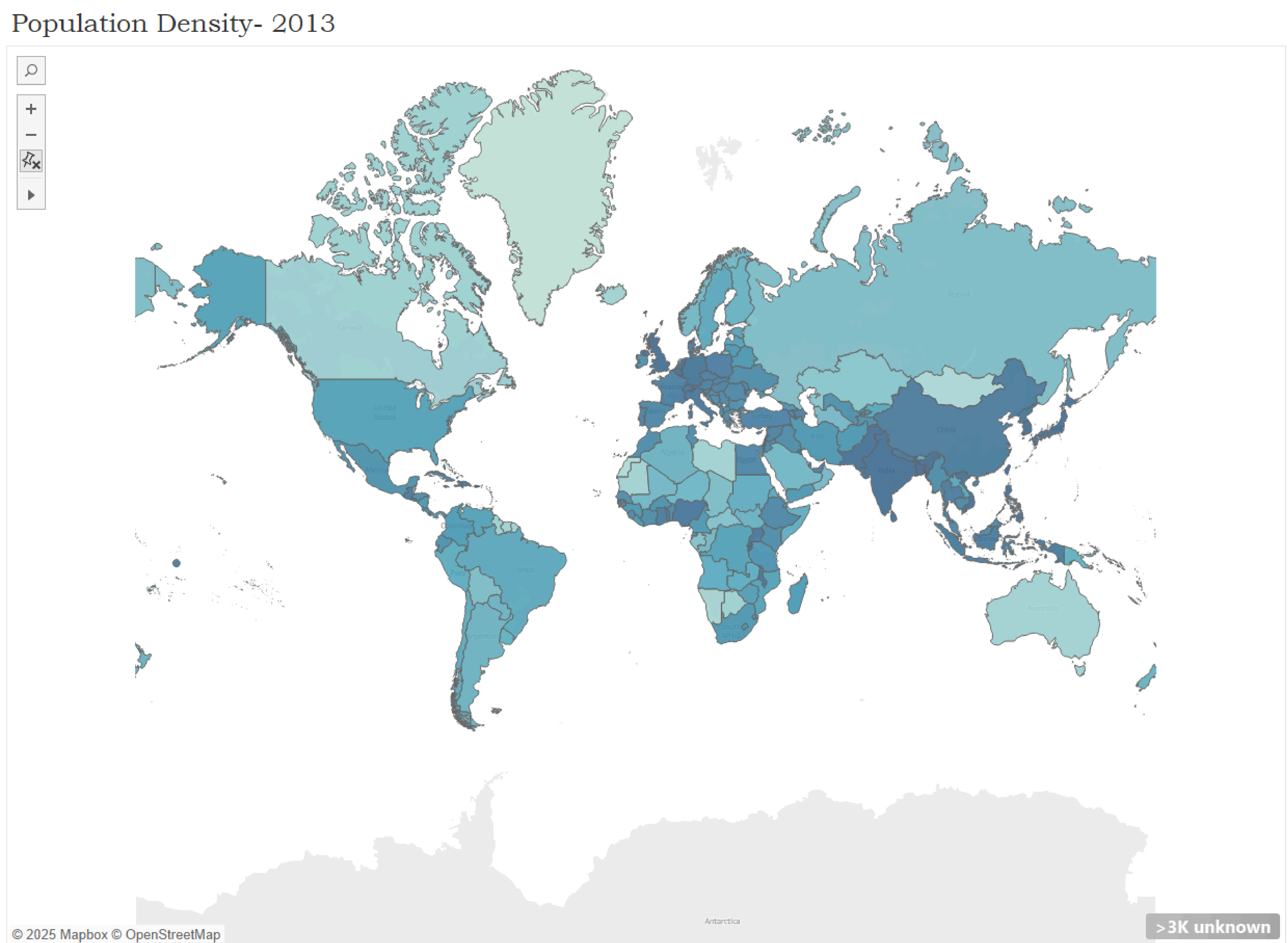
TECHNOLOGICAL MILESTONES:

Milestone Year	Technological Advancement	Observed Change
1858	Introduction of Photography	Rise in documented meteorite falls
1939	Radar use in WWII	Increased detection, especially during/after war
Post-1970s	Civilian access to military tech	Major spike in discoveries

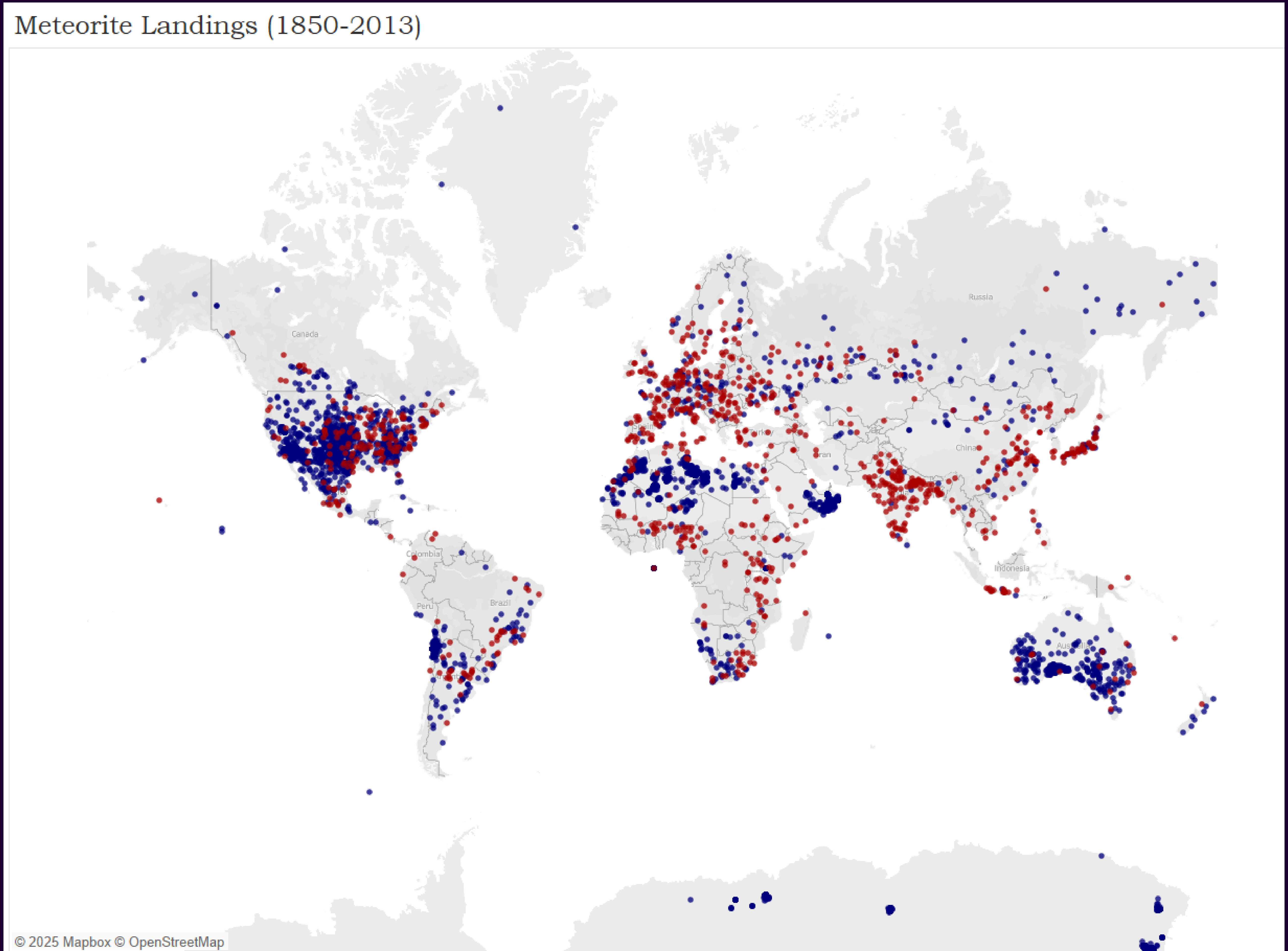
FINAL PRODUCT #1



FINAL PRODUCT #1



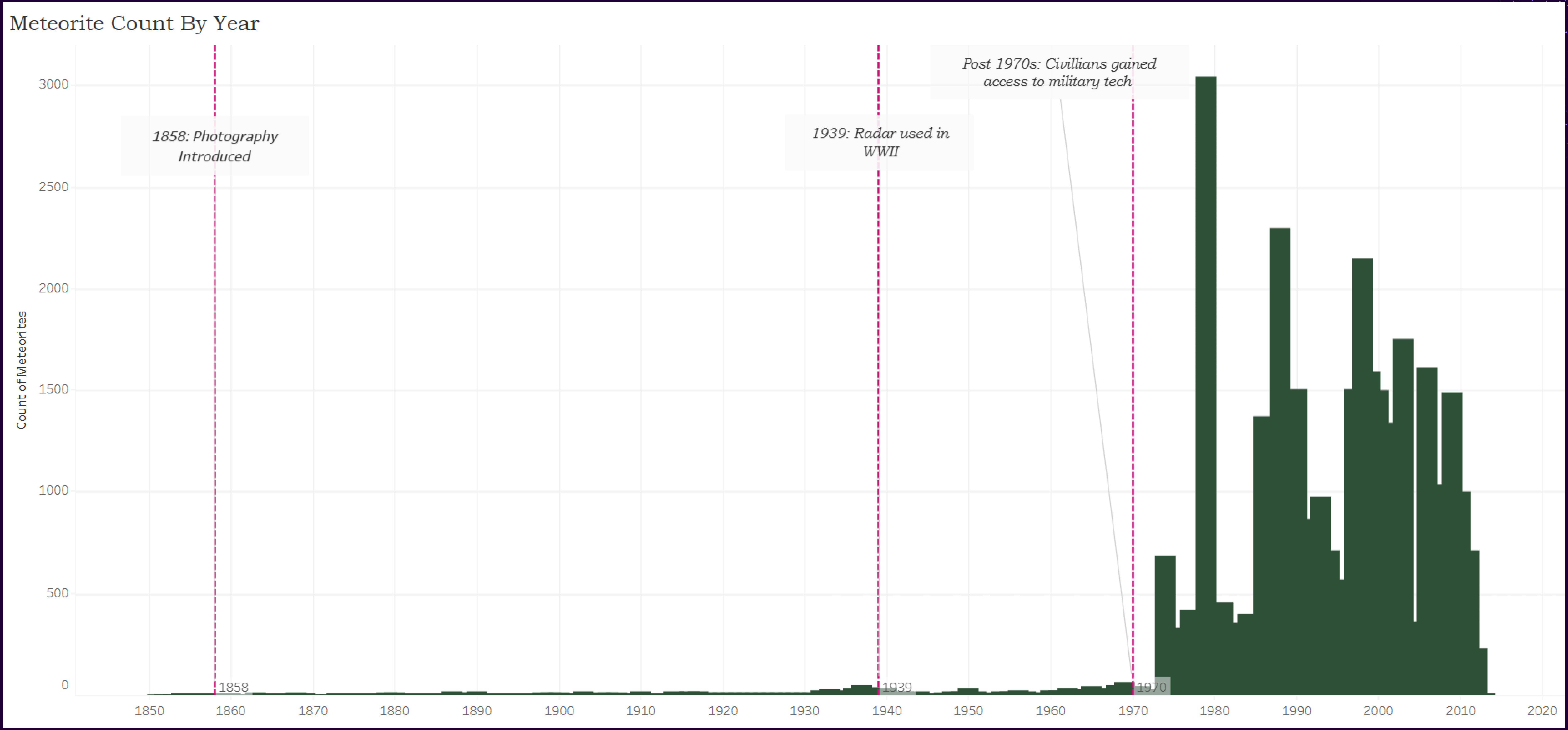
FINAL PRODUCT #1



FINAL PRODUCT #1

- High discovery rates correspond to countries with large land areas and developed scientific infrastructure, such as the United States and Australia.
- Densely populated but less technologically advanced regions, such as parts of South Asia and Africa, have comparatively lower discovery counts.
- In the U.S., although population density may not be visually obvious in the map, the eastern half shows a higher concentration of "fell" meteorites, events witnessed and reported by people, while the western half, characterized by remote terrain, has more "found" meteorites, likely the result of organized searches.
- In contrast, Australia demonstrates a unique pattern: despite having one of the lowest population densities among developed nations, it shows a disproportionately high number of meteorite discoveries. The vast desert regions like the Nullarbor Plain provide ideal search environments where meteorites are well-preserved and easily visible on the barren landscape.

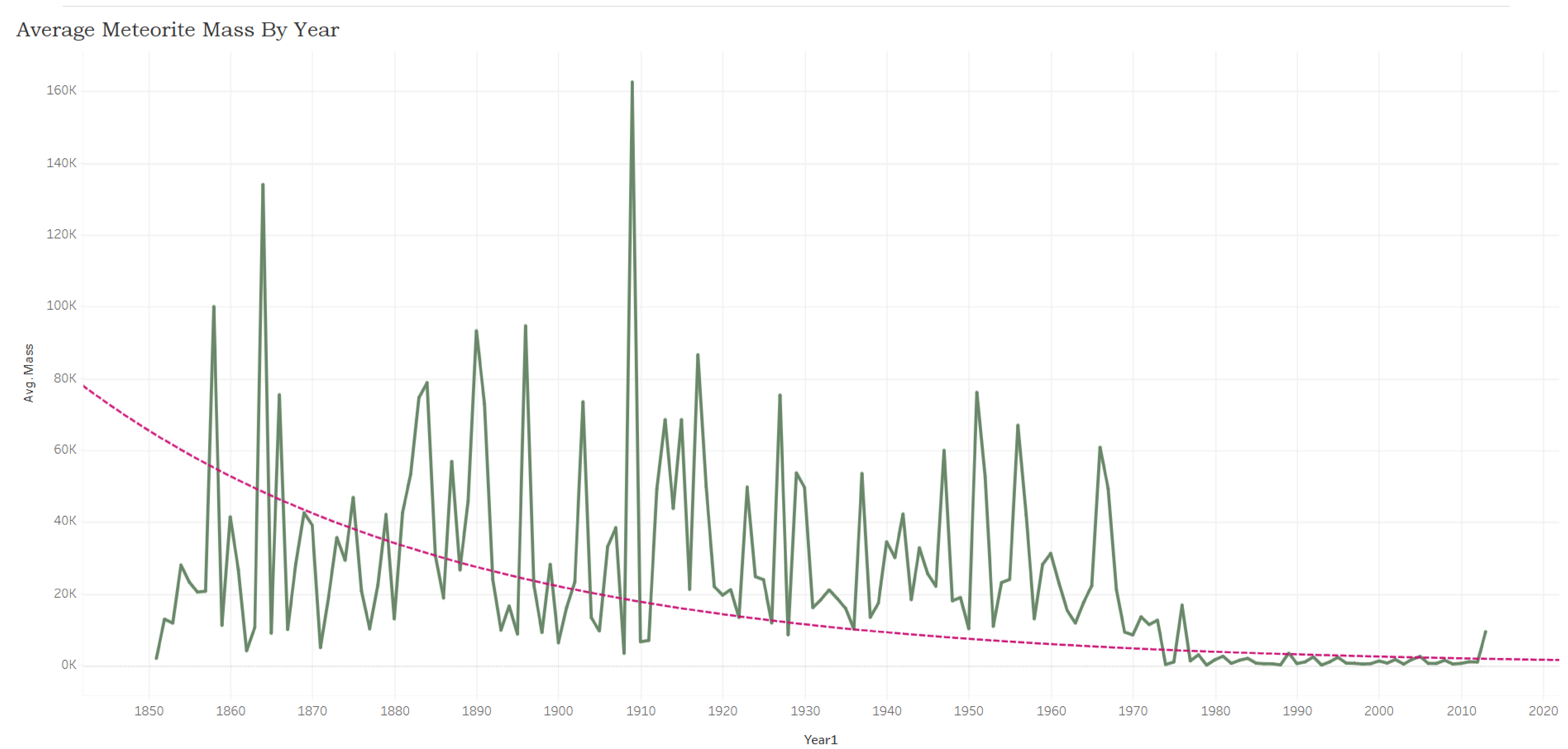
FINAL PRODUCT #2



FINAL PRODUCT #2

- A dramatic rise in meteorite findings after the late 1800s
- Noticeable spikes following each annotated milestone, especially post-1970s
- This timeline clearly suggests that technological advancements have enabled greater observation and recording of meteorite events. The increasing slope after each annotation indicates stronger detection capacity over time.

FINAL PRODUCT #3



FINAL PRODUCT #3

Model

- Formula: log(Mass) = -0.0217 * Year1 + 51.29
- R-squared: 0.407, indicating moderate explanatory power
- p-value: < 0.0001, statistically significant

- A decreasing trend in average mass, with a steeper decline after 1950
- Clear visual and statistical support for the hypothesis that smaller meteorites are increasingly being discovered
- The results support the idea that smaller meteorites, once difficult to detect, are now routinely found thanks to modern tools. The trend is significant and highlights the shifting nature of what kinds of space materials are being recorded.

CONCLUSIONS

- Meteorite data reflects both natural and human-driven factors
- Reporting is skewed toward areas with more people and advanced tools to detect
- Gaps exist where meteorites may fall but remain unreported
- Future work can target underreported regions and detection methods

REFERENCES AND ACKNOWLEDGEMENTS

- **Data Sources:**
  Meteorite Landings: Data.gov
  Population Density: OurWorldInData.org

- **Visualization Tools:**
  Tableau Public, R (ggplot2)

- **Contextual Sources:**
  Meteororbs.org
  University of Plymouth

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