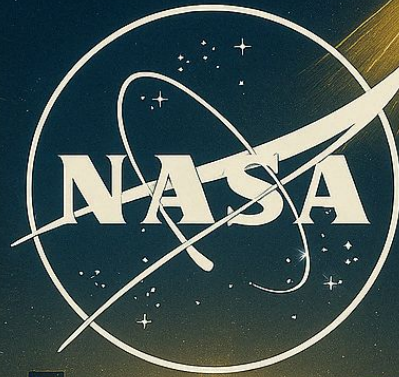


LIGHTS IN THE DARK

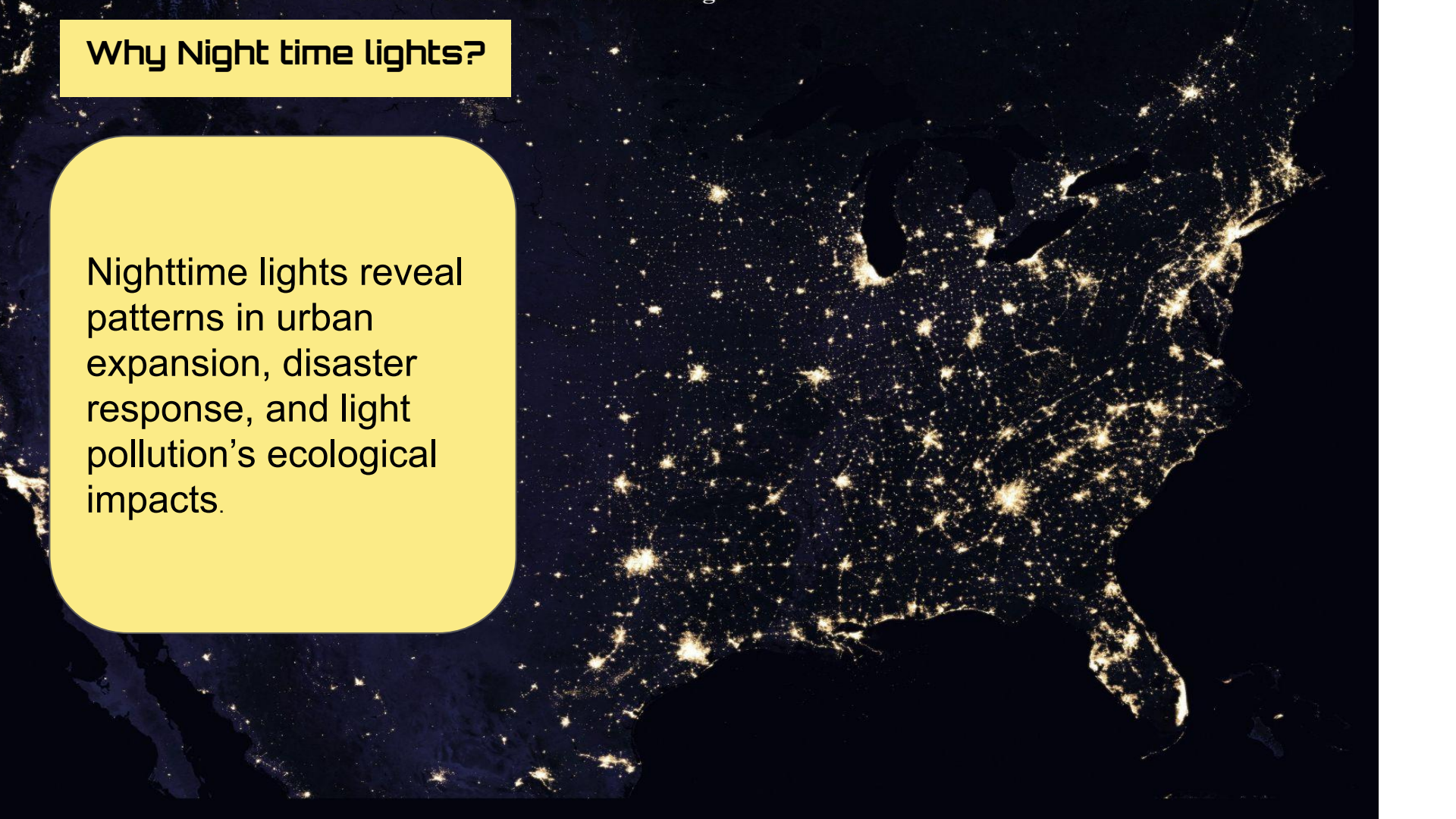
TRACKING URBAN LIGHT POLLUTION
IN MUSIC CITY



By: David Jean
and
Galina Shinkareva

Why Night time lights?

Nighttime lights reveal patterns in urban expansion, disaster response, and light pollution's ecological impacts.



VIIRS BLACK MARBLE DATA (nW/cm²/sr)



BlackMarbleR (R) [Clip Region Around Nashville]



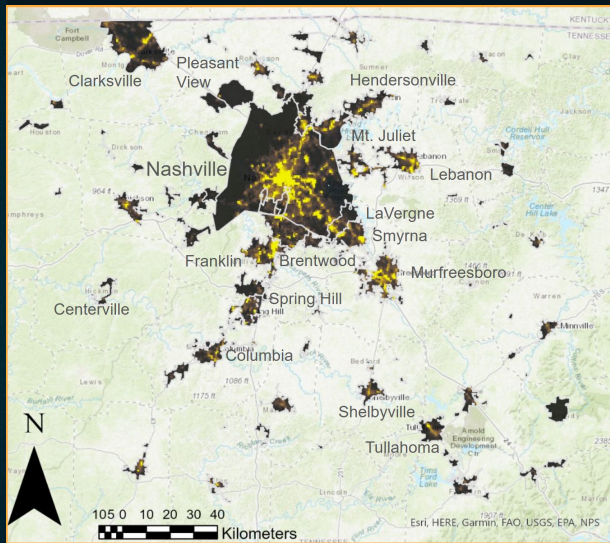
PYTHON ANALYSIS

- Filter radiance > 3 nW/cm²/sr
- Convert to luminance: $\text{cd/m}^2 = \text{radiance} \times 10^{-5} \times 683$
- Merge with land area (sq mi)
- Merge with population data
- Calculate:
 - Light per capita ($\text{cd/m}^2 + \text{people}$)
 - Light per square mile ($\text{cd/m}^2 + \text{are}$)



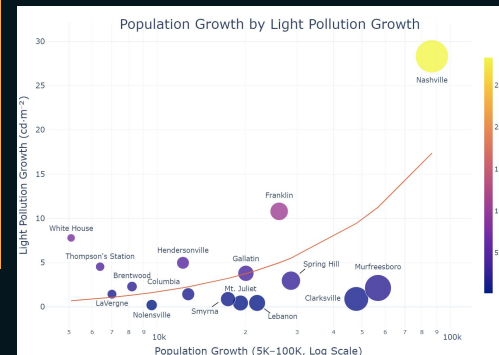
MAPPING & VISUALS (Plotly, ArcGIS Pro)

Workflow



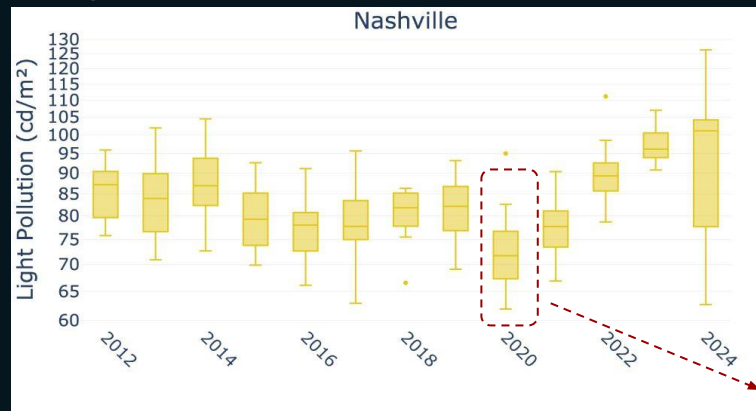
Top 10 Towns by Light Pollution Growth

| Town | Absolute Growth | Percent Growth (%) |
|--------------------|-----------------|--------------------|
| Nashville | 28.32 | 33.04 |
| Cornersville | 11.3 | 284.02 |
| Franklin | 10.79 | 47.96 |
| White House | 7.79 | 59.79 |
| Hartsville | 5.05 | 39.59 |
| Hendersonville | 4.98 | 35.21 |
| Thompson's Station | 4.54 | 29.11 |
| Ashland City | 3.8 | 80.56 |
| Gallatin | 3.79 | 52.96 |
| Goodlettsville | 3.68 | 22.72 |



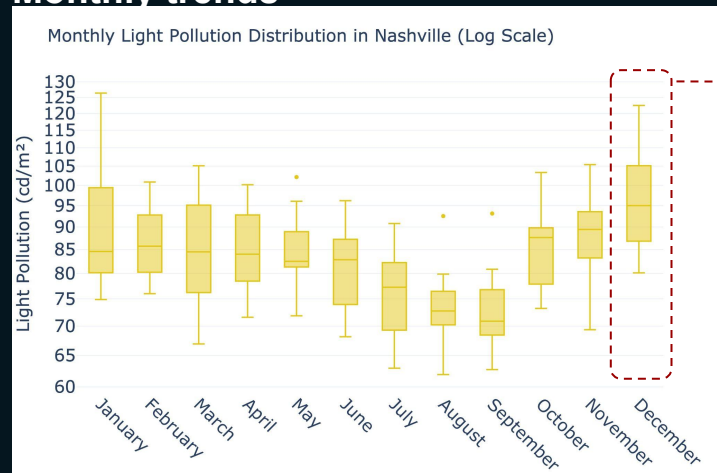
Spatio-Temporal light pollution changes

Yearly trends



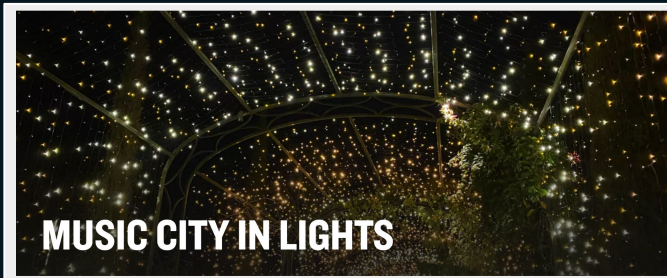
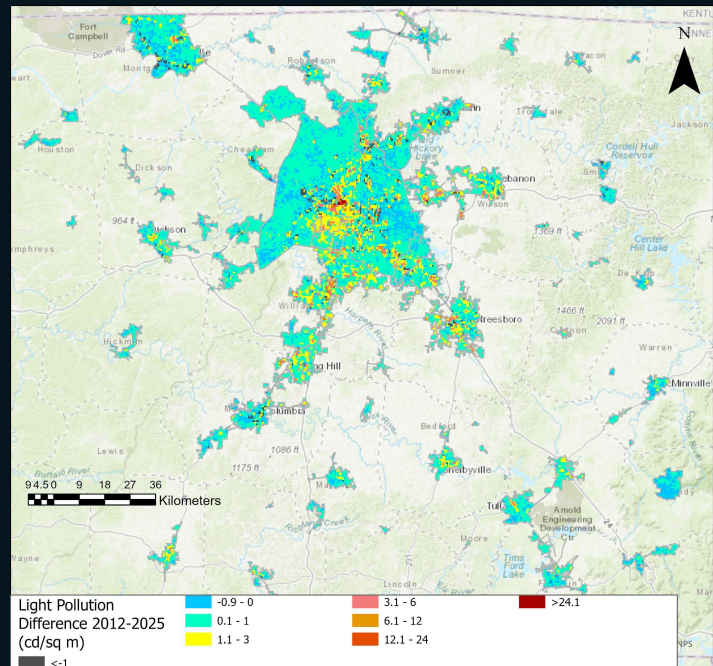
Music City lights are getting brighter over the past decade, especially in the downtown area.

Monthly trends



COVID restrictions

Christmas lights!



Conclusion

- Light pollution has increased **230%** across Middle Tennessee since 2012
- Growth isn't just population — it's **land use, infrastructure, and behavior**
- VIIRS Black Marble + Python/R/ArcGIS enabled **precise, scalable monitoring**
- Satellite data offers a **powerful lens** for policy, planning, and ecology

