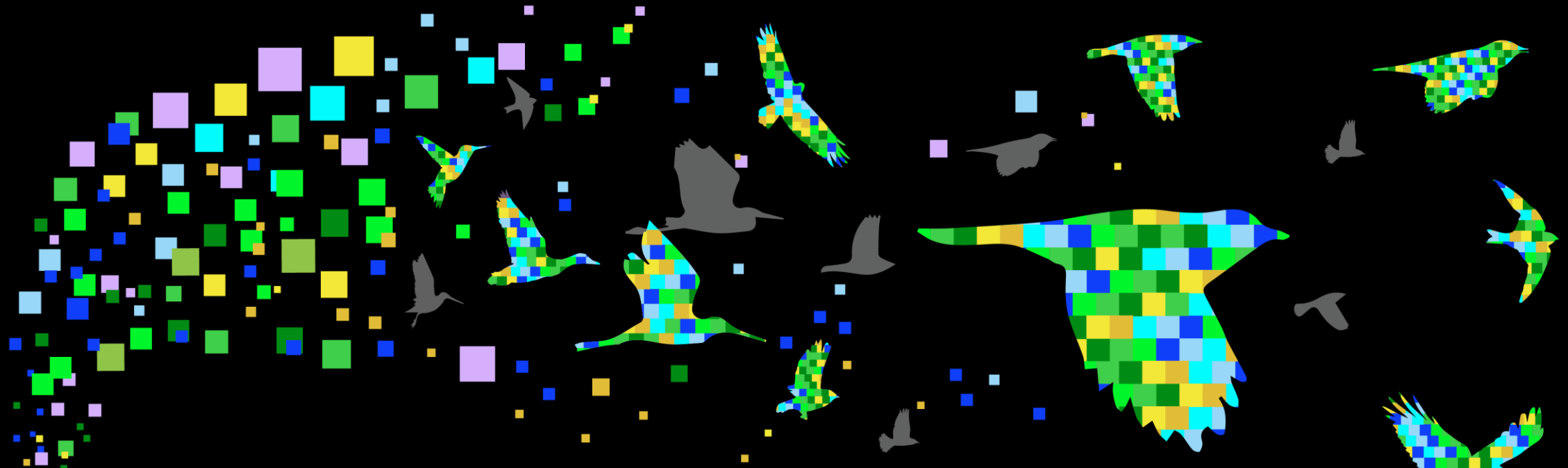
Understanding urban centers as ecological traps for avian migrants



Kyle Horton, Jeff Buler, Amy Collins, Monika Tomaszewska, Maria Belotti, Fengyi Guo, Adriaan Dokter, Daniel Sheldon, Geoff Henebry


80% of North
American migrants
move under the cover
of darkness

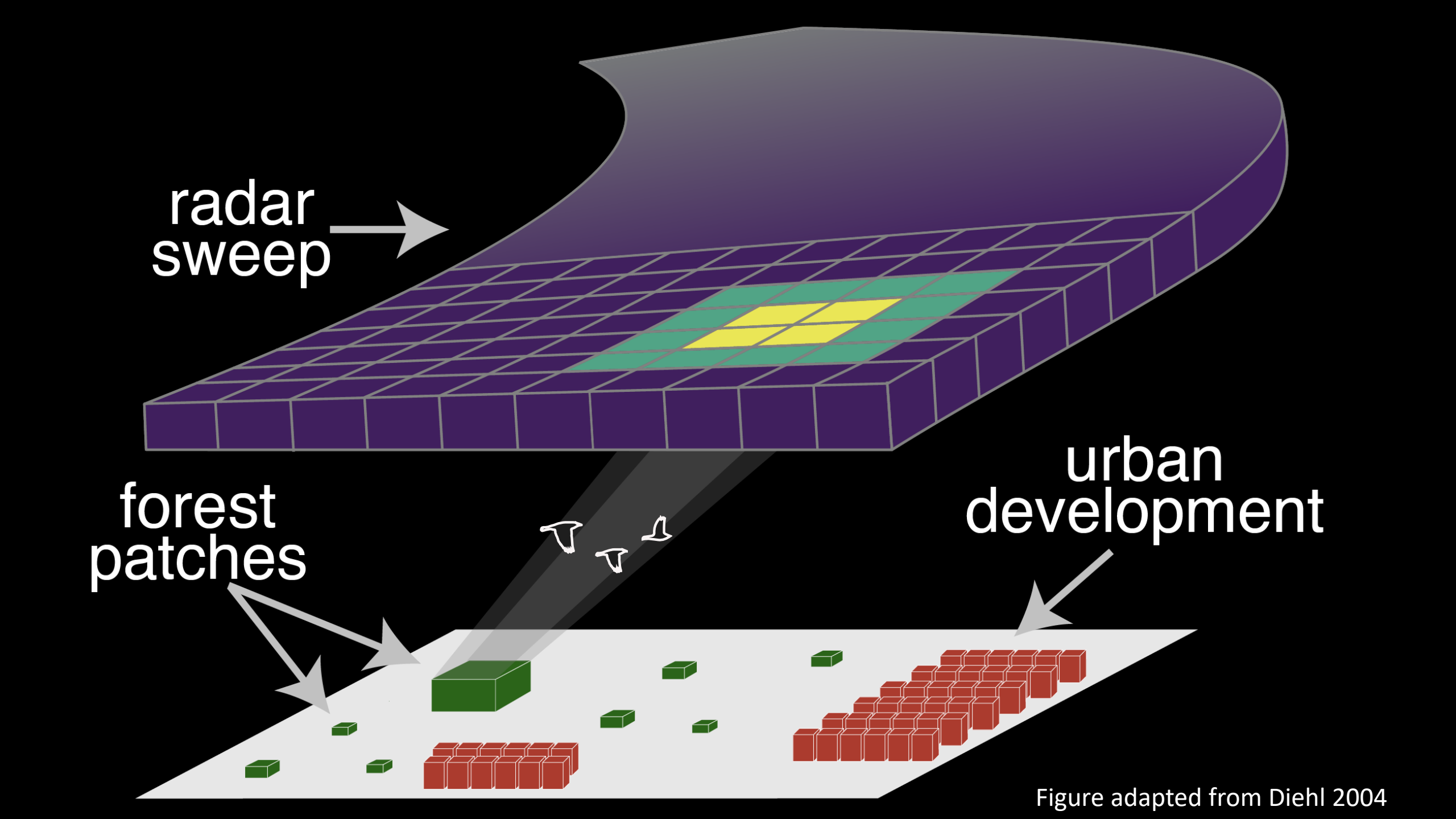
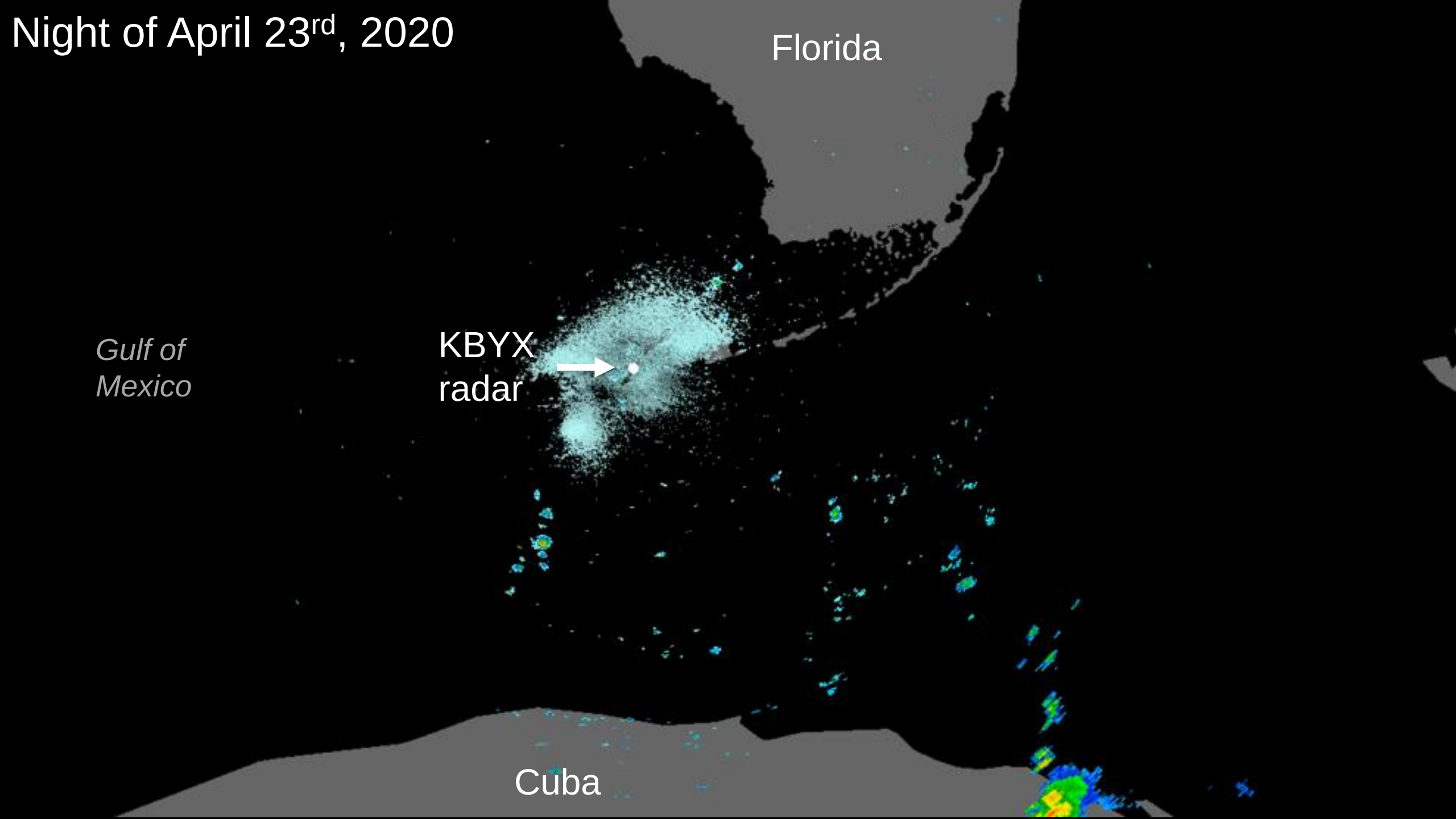
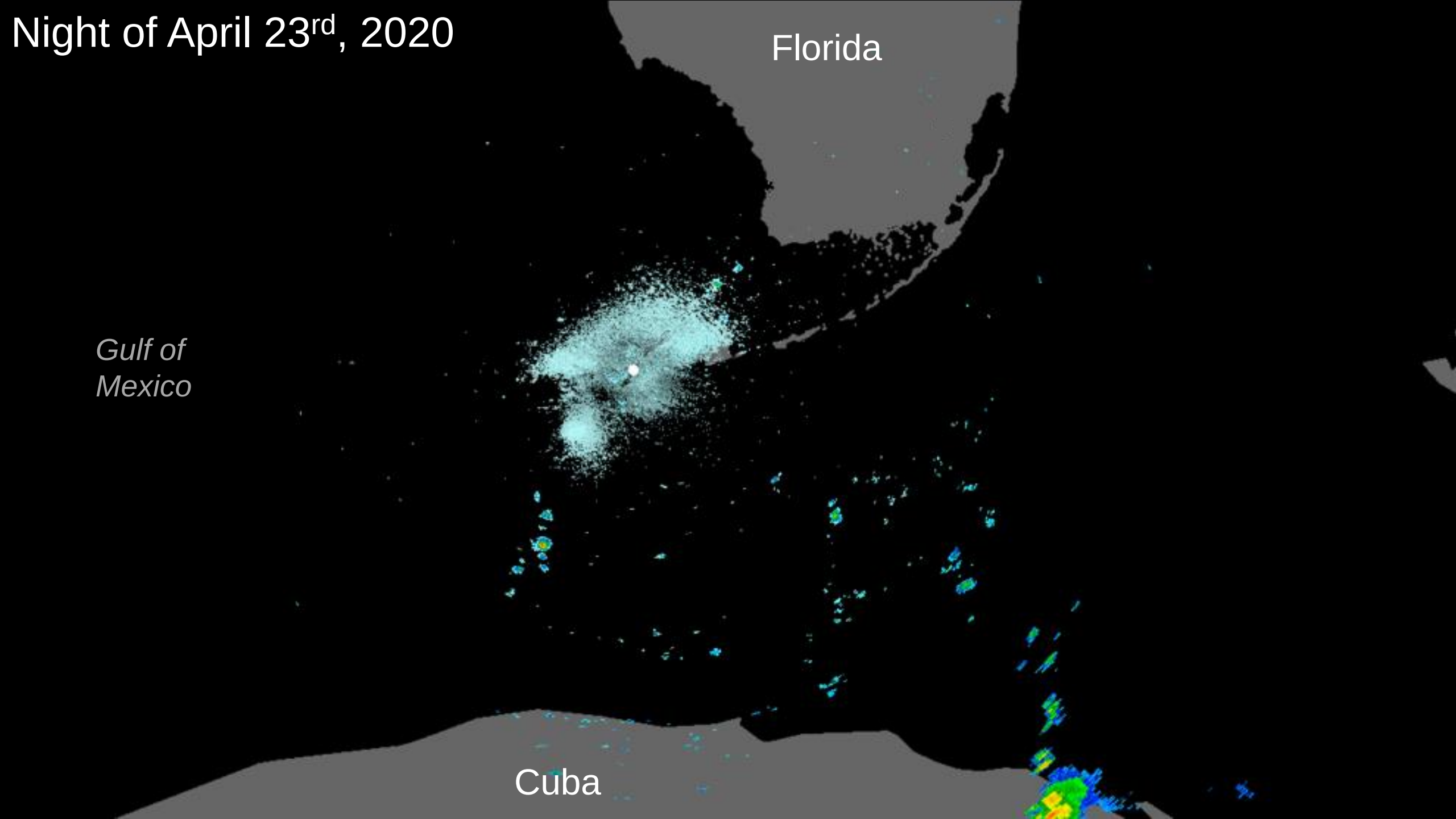


Figure adapted from Diehl 2004

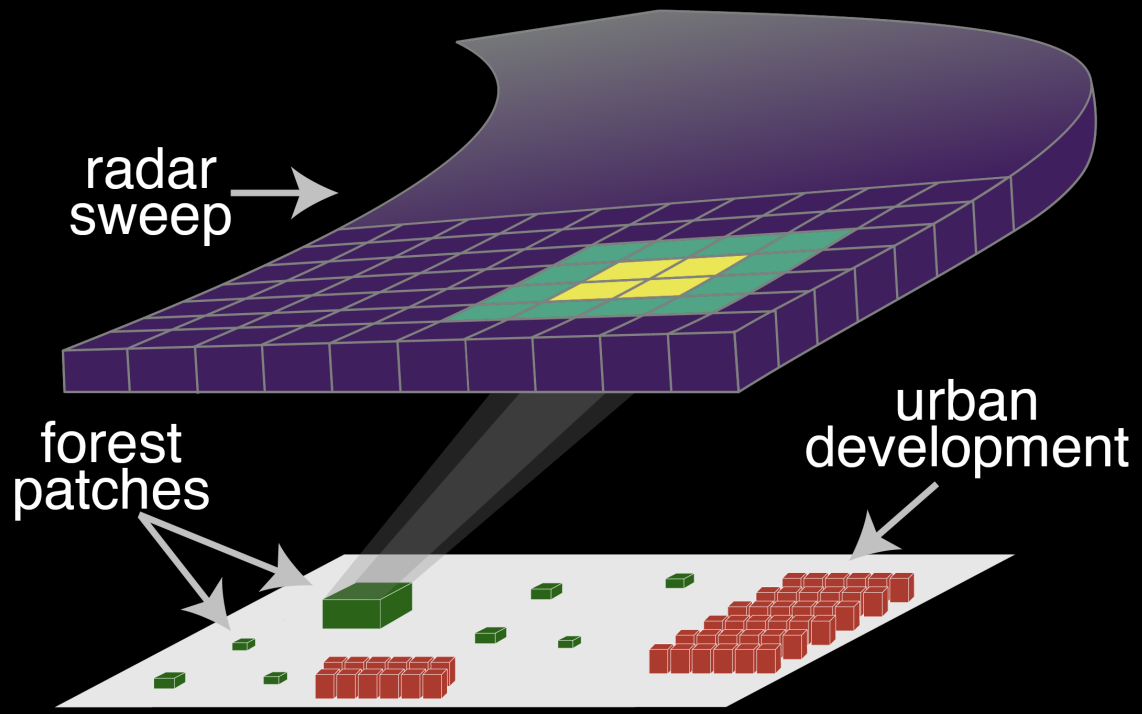

Night of April 23rd, 2020
Florida
Gulf of Mexico
KBYX radar
Cuba


Night of April 23rd, 2020
Florida
Gulf of Mexico
Cuba

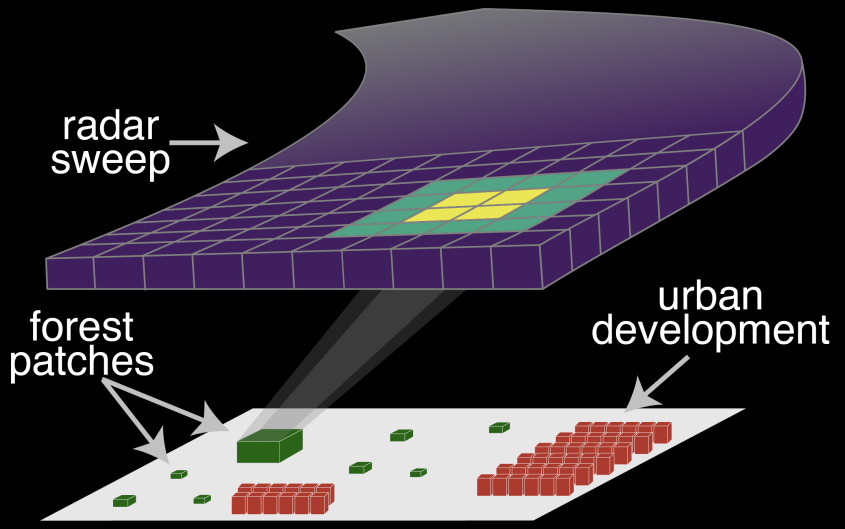
Can we map migrant stopover locations across the contiguous United States to learn spatial drivers?

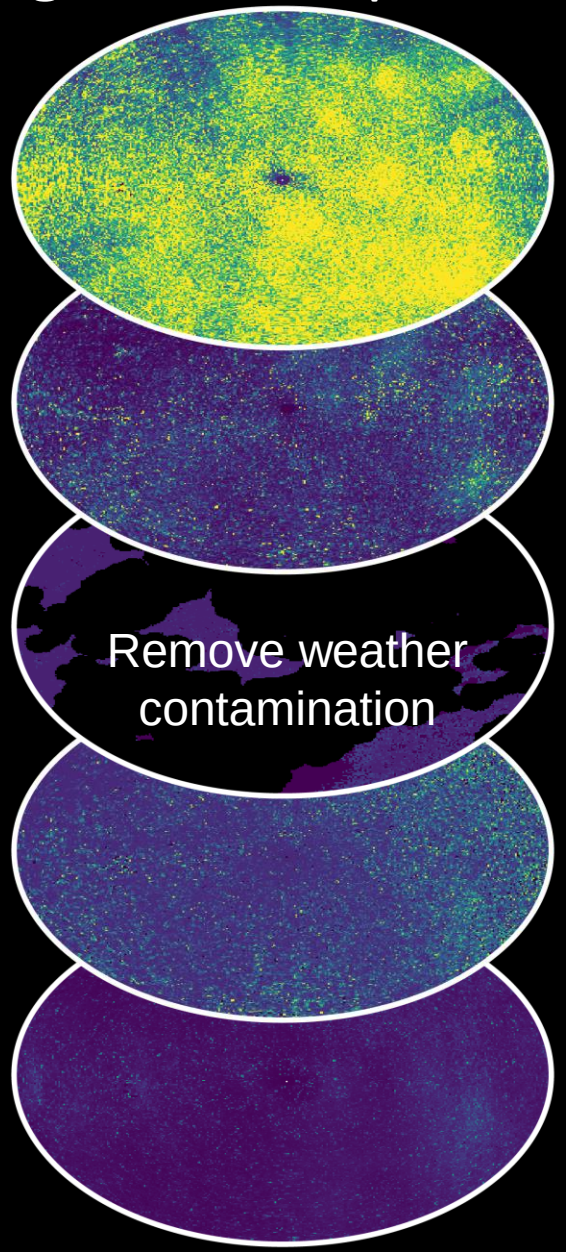
Our approach:

- Spring (March 15 to June 15)
- Fall (August 15 to November 15)
- Selected radar scans corresponding to the maximum rate of increase in activity within 2.5 hours after local sunset (~40-50 min after sunset).
- Mosaic measures from 142 weather surveillance radars from 2016-2020
- Use spatial subsets to model stopover using boosted regression – “prevents long-distance learning”

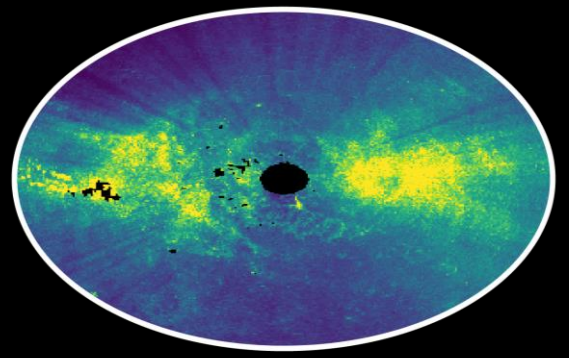


Assemble radar scans
(93 nights/scans per season)



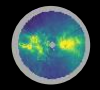


Calculate mean exodus activity



Oklahoma City, OK

Fall 2020



Migrant Stopover Density (cm^2km^{-2})

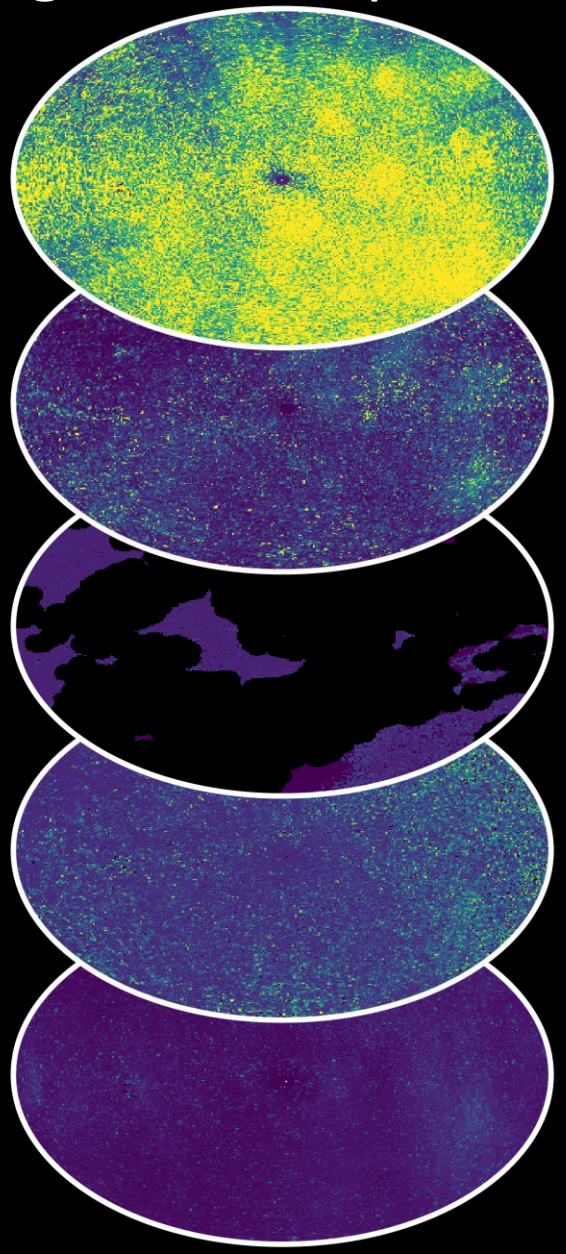
>1000

750

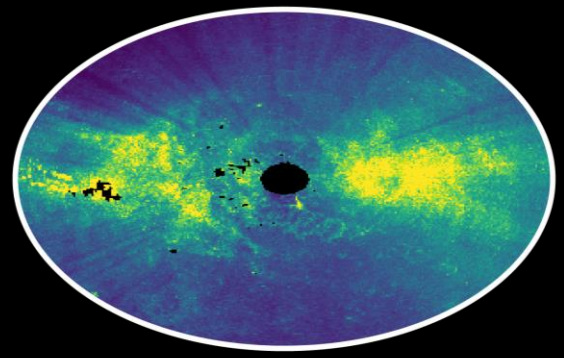
500

250

Assemble radar scans
(93 nights/scans per season)

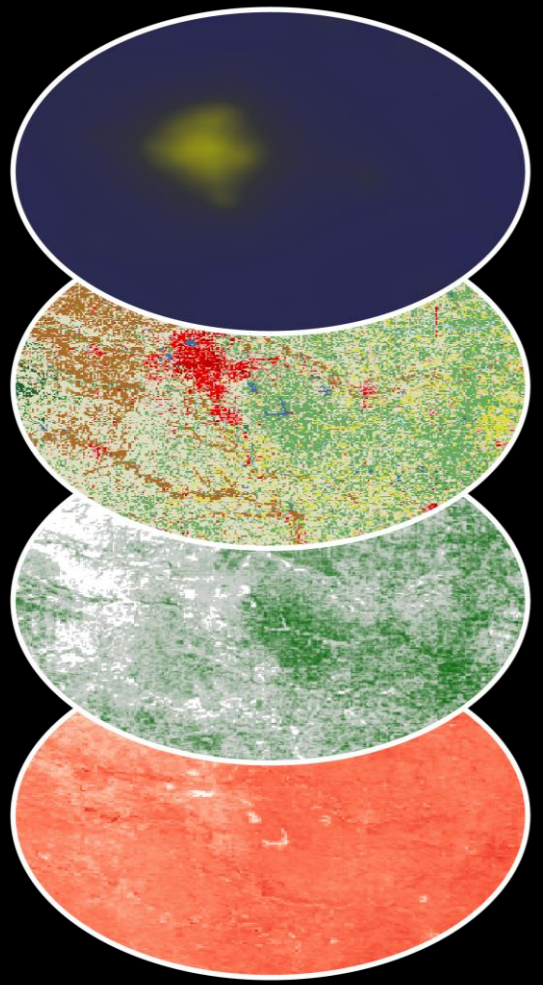


Calculate mean exodus activity



Oklahoma City, OK

Link with predictor variables



- Year
- Distance to radar
- Elevation
- Population density
- EVI – 4 monthly predictors
- Sky glow (VIIRS derived)
- Precipitation – seasonal mean
- Accumulated nocturnal degree days – bimonthly – 8 predictors
- % Tree Canopy
  % Impervious Surface

% of cover type within 1-km pixel

- 11: Open Water
- 12: Perennial Ice/Snow
- 21: Developed, Open Space
- 22: Developed, Low Intensity
- 23: Developed, Medium Intensity
- 24: Developed High Intensity
- 31: Barren Land (Rock/Sand/Clay)
- 41: Deciduous Forest
- 42: Evergreen Forest
- 43: Mixed Forest
- 52: Shrub/Scrub
- 71: Grassland/Herbaceous
- 81: Pasture/Hay
- 82: Cultivated Crops
- 90: Woody Wetlands
- 95: Emergent Herbaceous Wetlands

% of cover type within 5-km buffer

- 11: Open Water
- 12: Perennial Ice/Snow
- 21: Developed, Open Space
- 22: Developed, Low Intensity
- 23: Developed, Medium Intensity
- 24: Developed High Intensity
- 31: Barren Land (Rock/Sand/Clay)
- 41: Deciduous Forest
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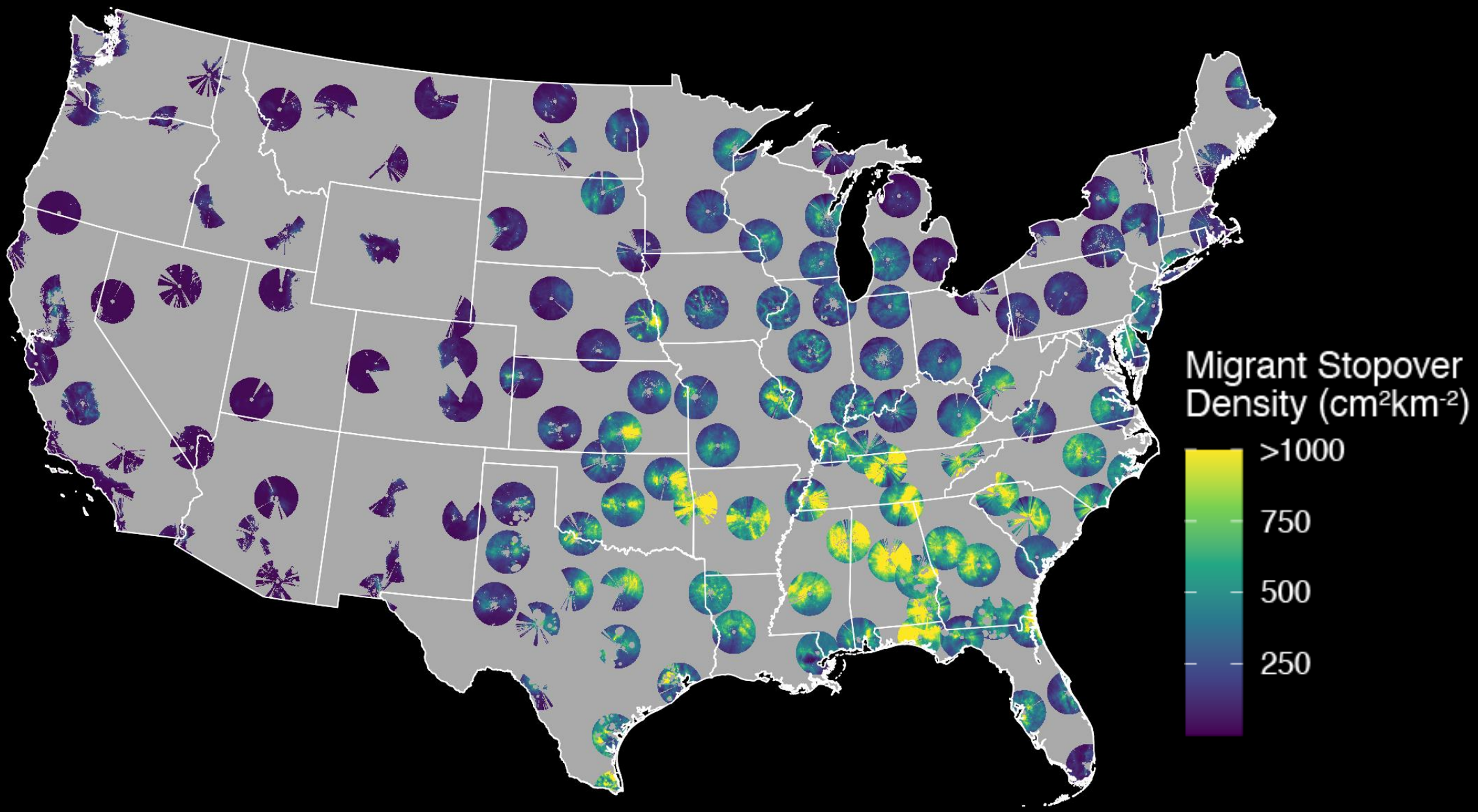
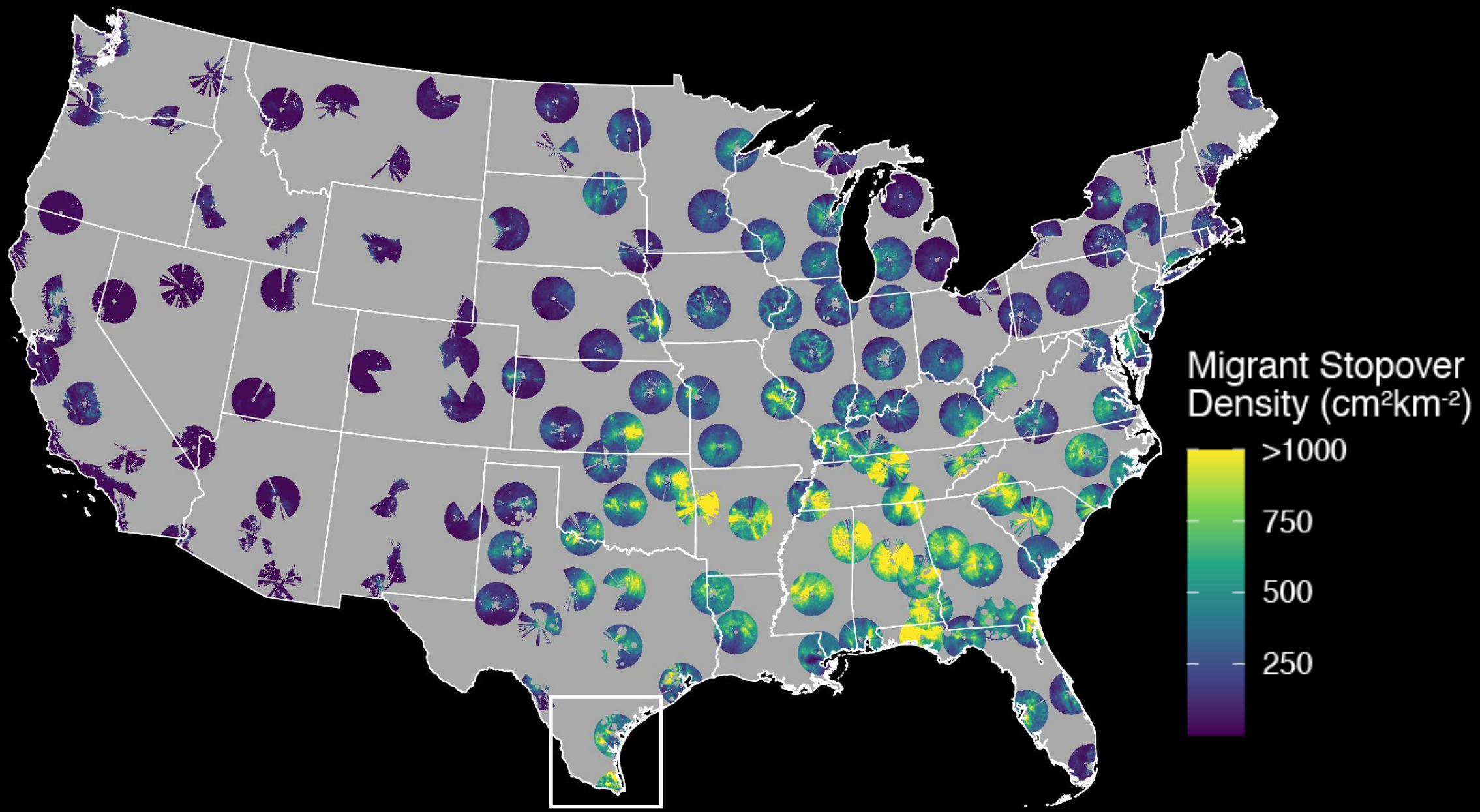
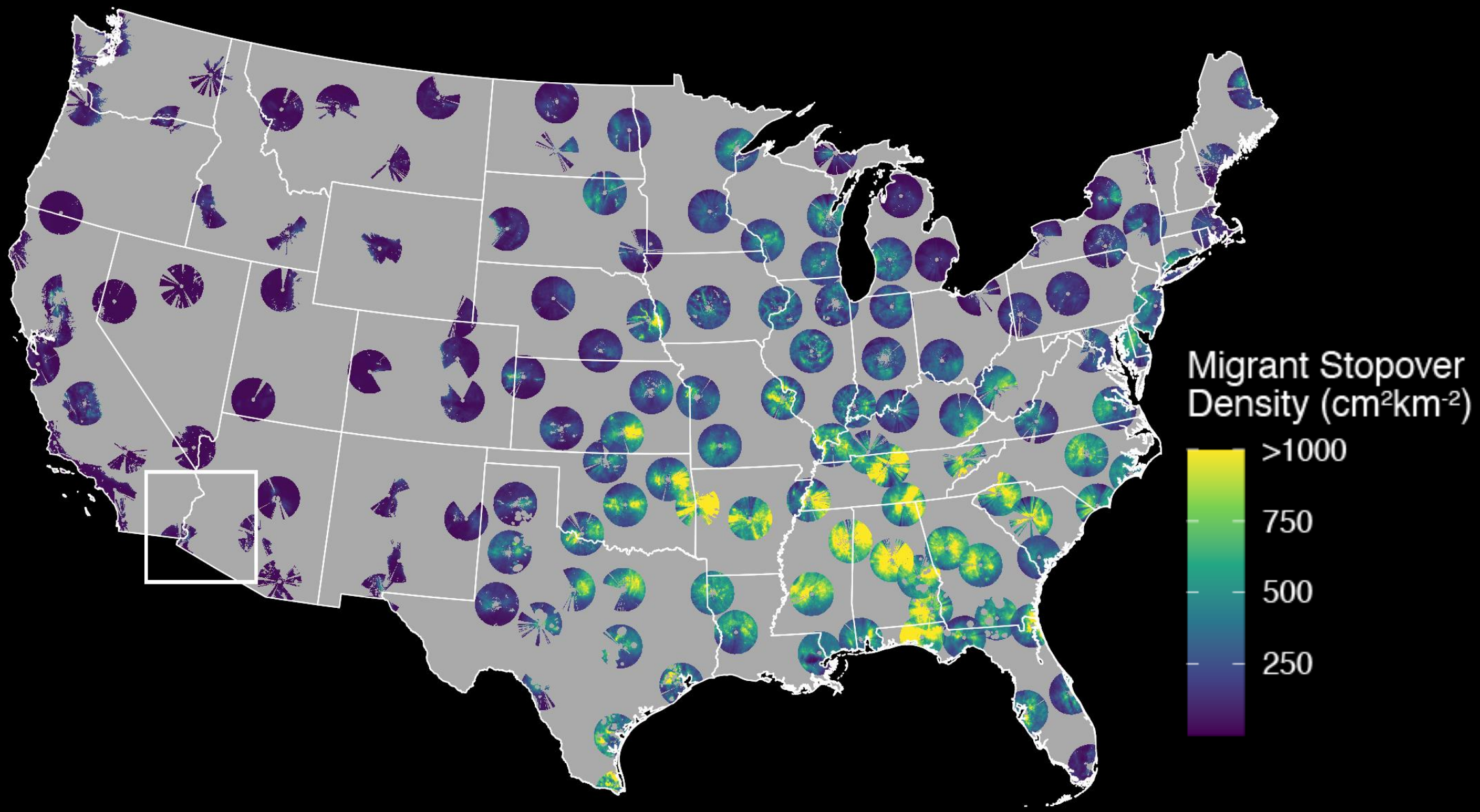
Fall 2020



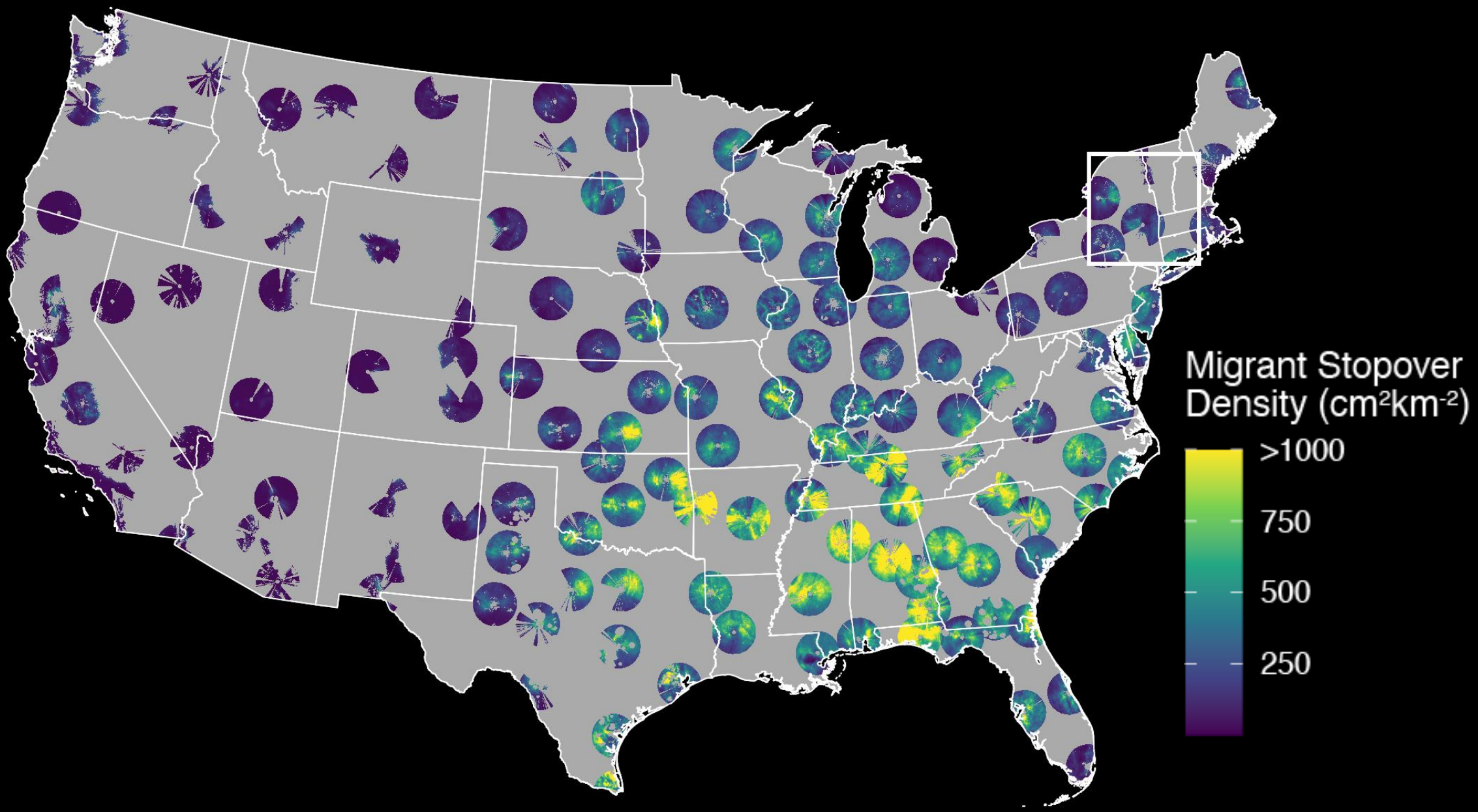
Fall 2020



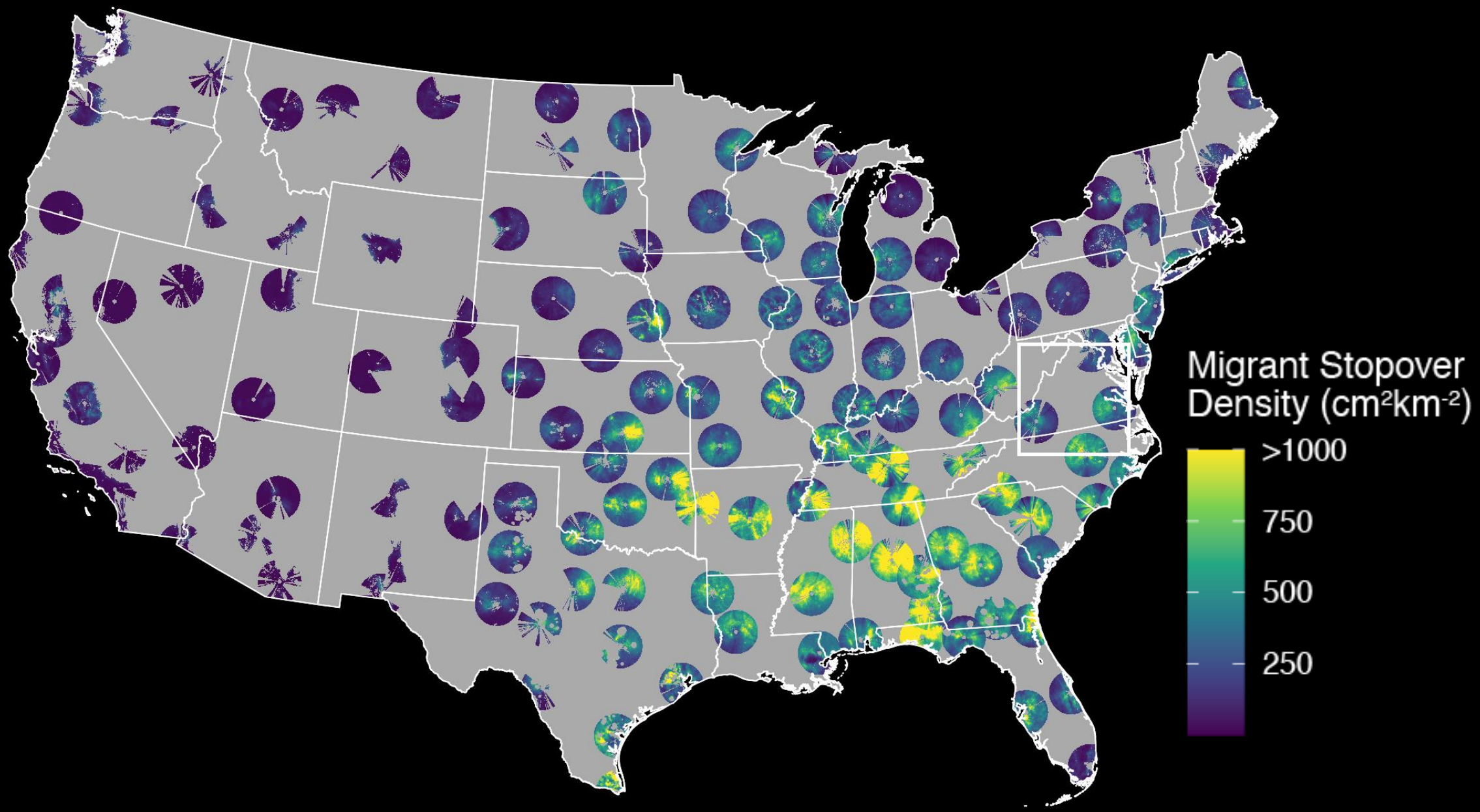
Fall 2020



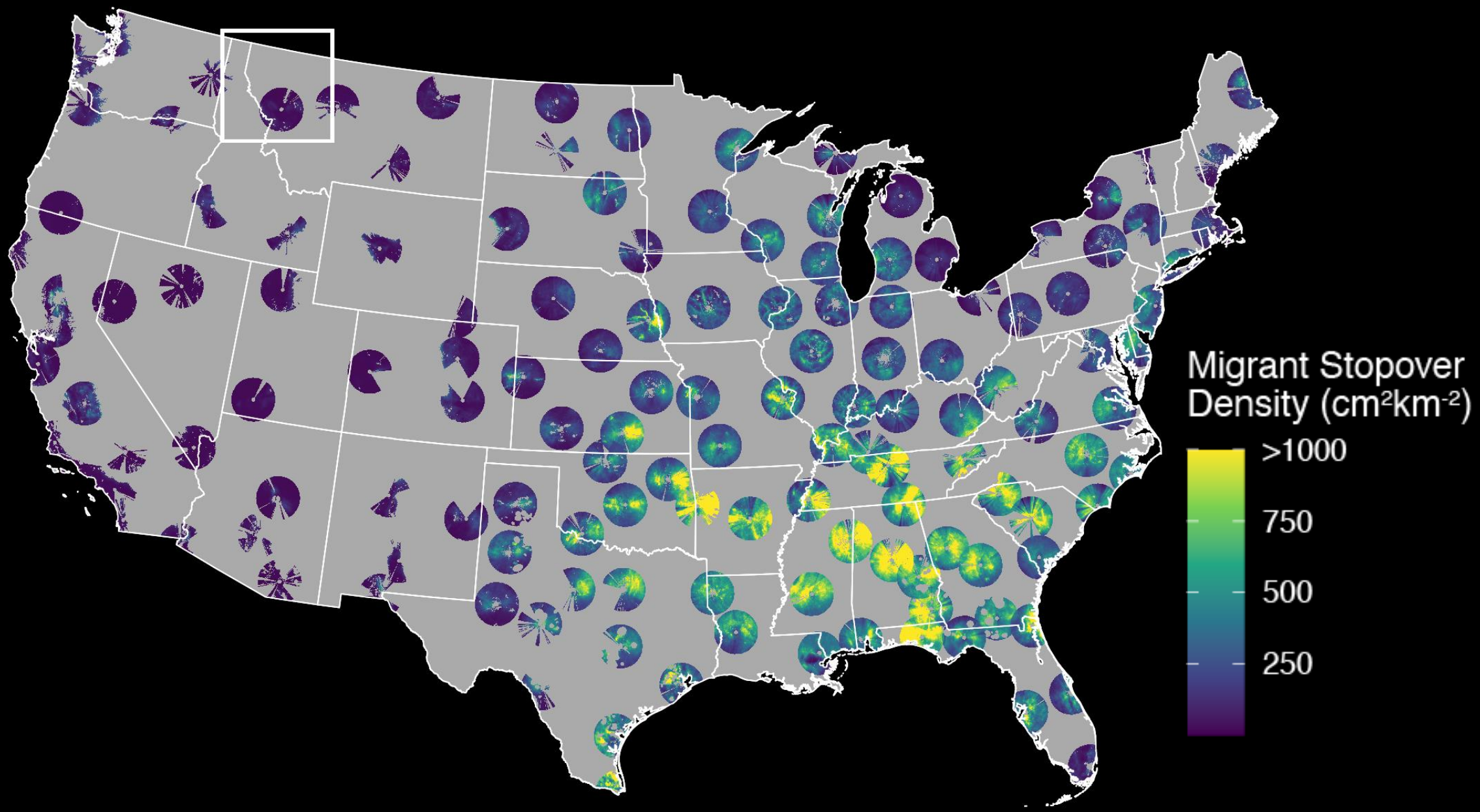
Fall 2020



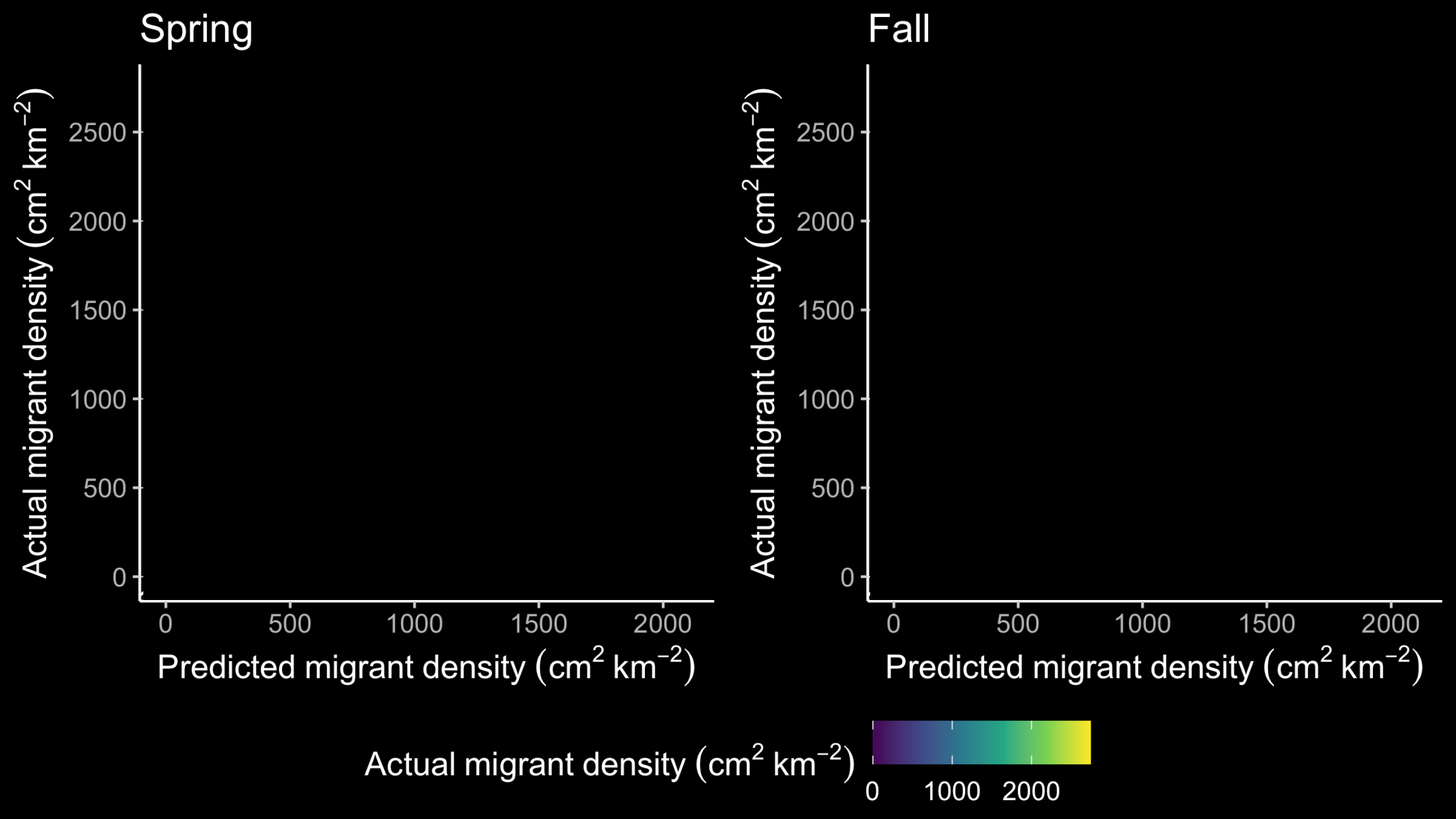
Fall 2020



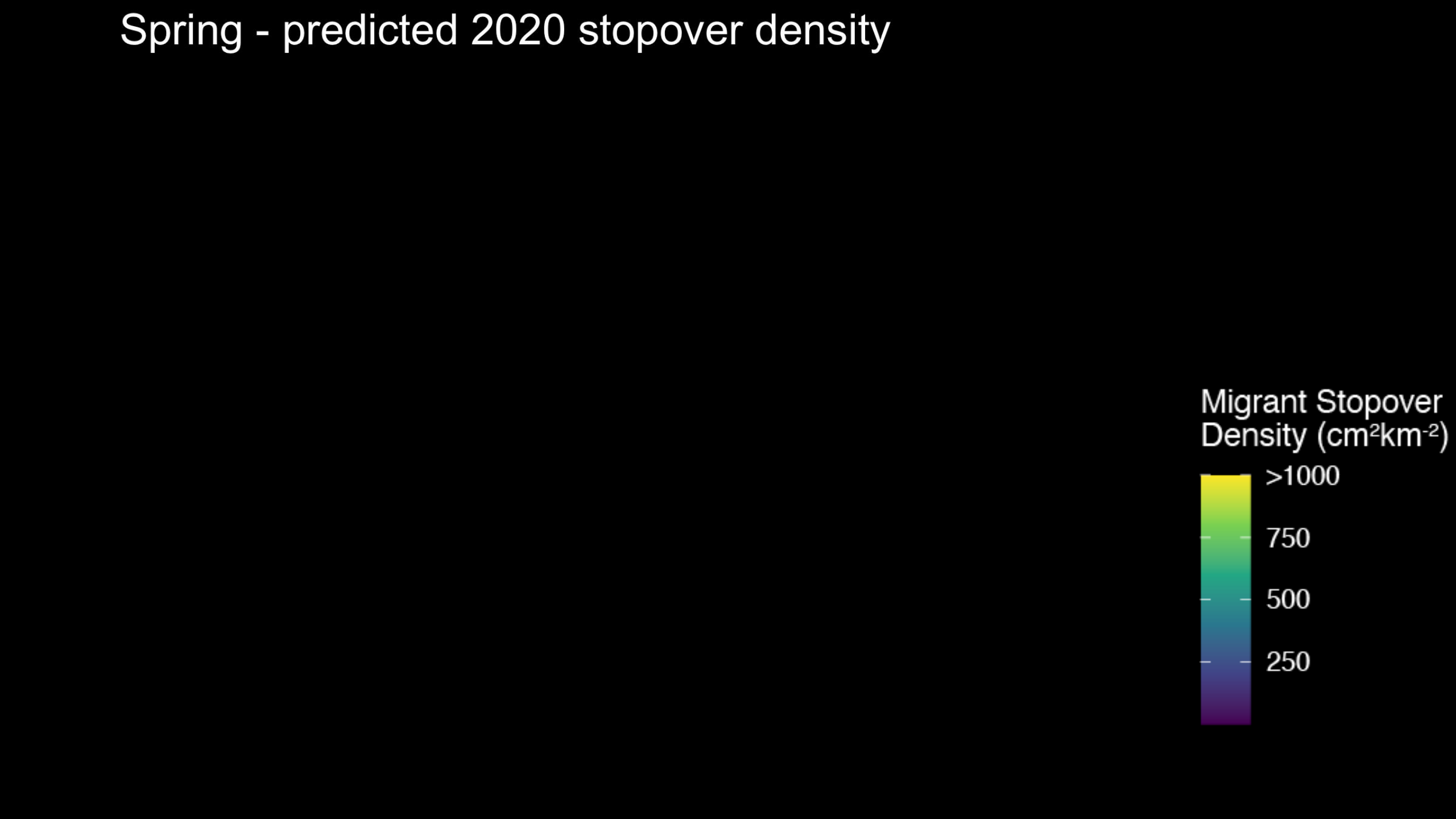
Fall 2020



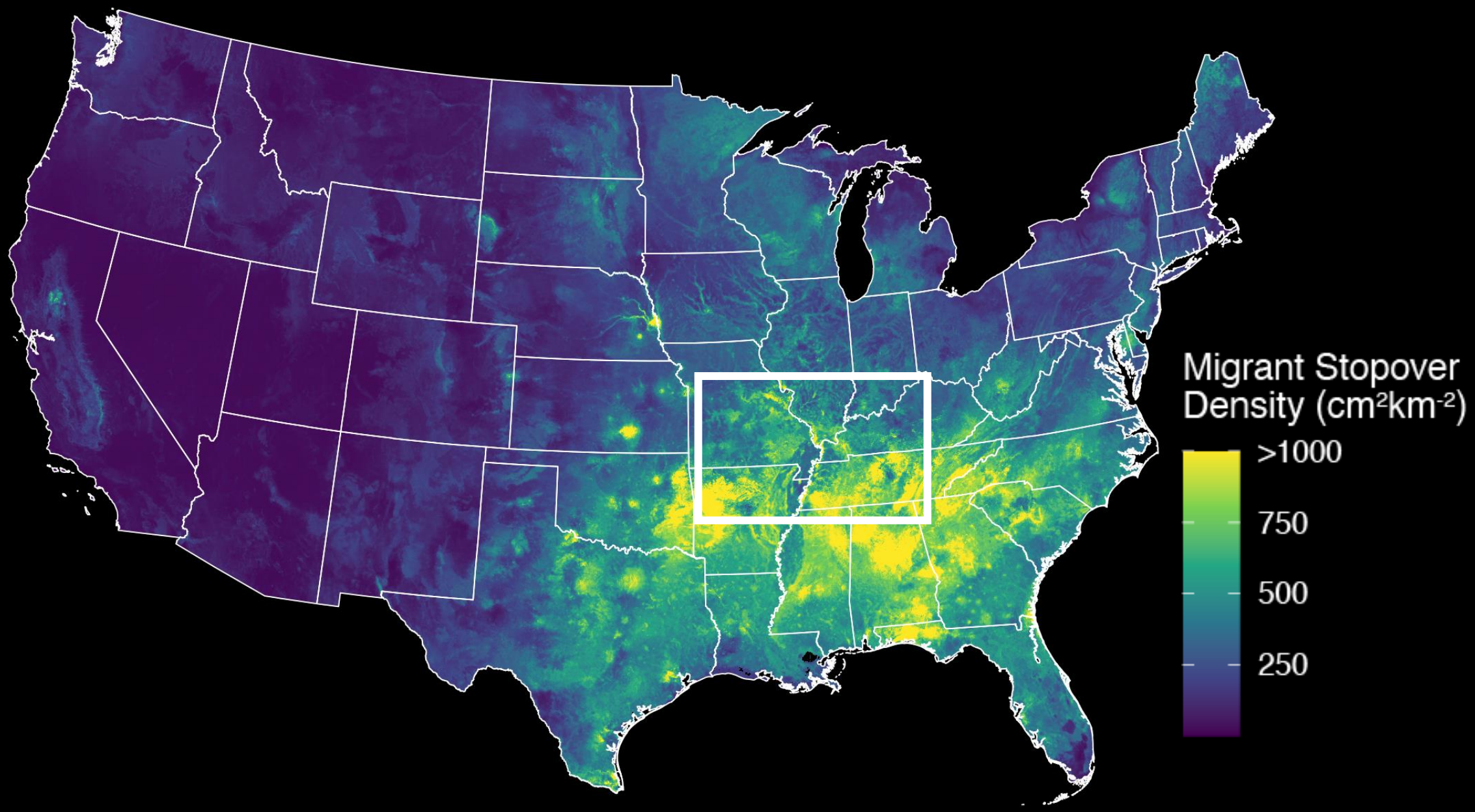

Fall 2020
Migrant Stopover Density (cm²km⁻²)
>1000
750
500
250
x2500

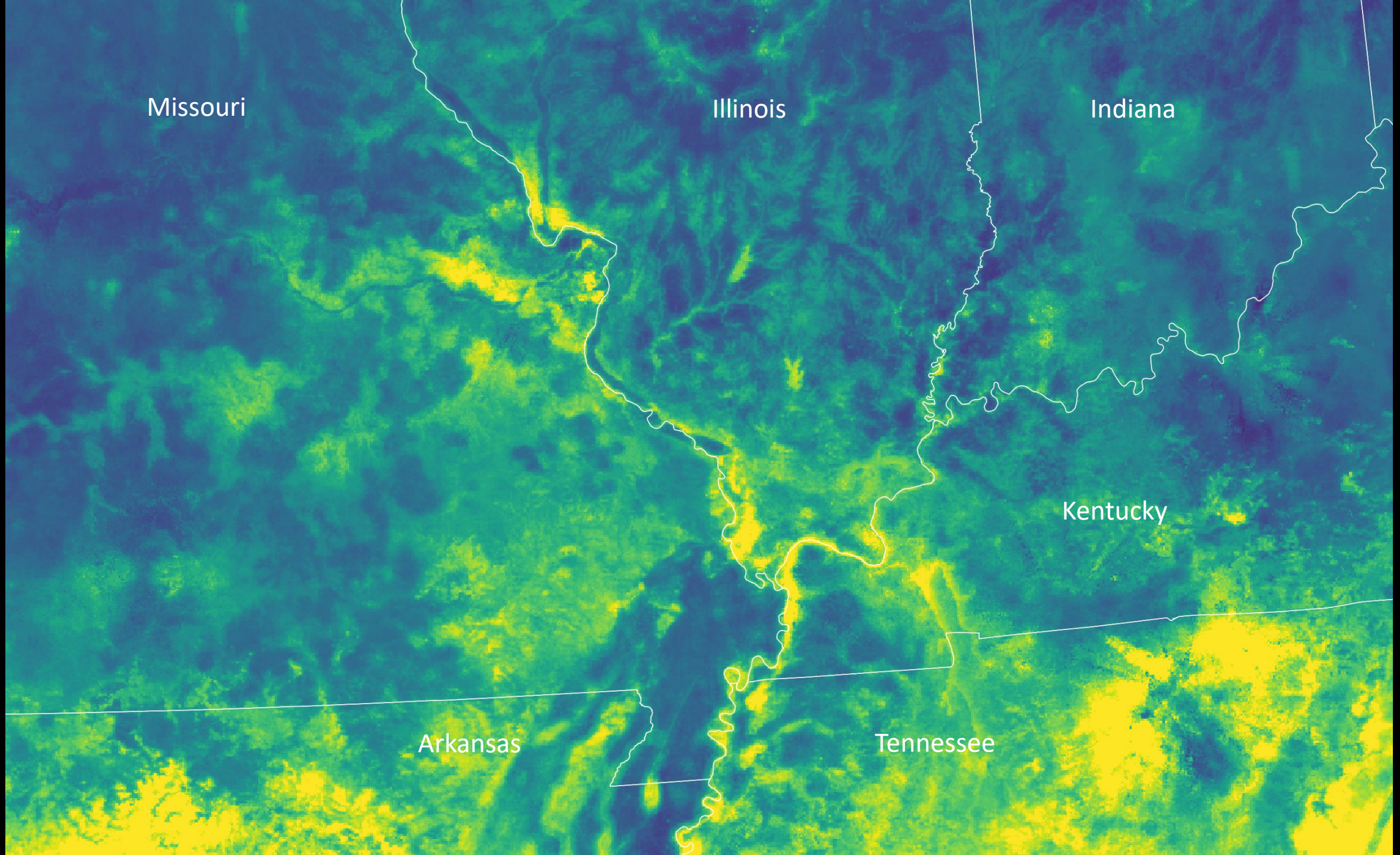

Spring
Fall
Actual migrant density (cm^2 km^{-2})
Predicted migrant density (cm^2 km^{-2})
0
500
1000
1500
2000
2500
Actual migrant density (cm^2 km^{-2})
0
1000
2000

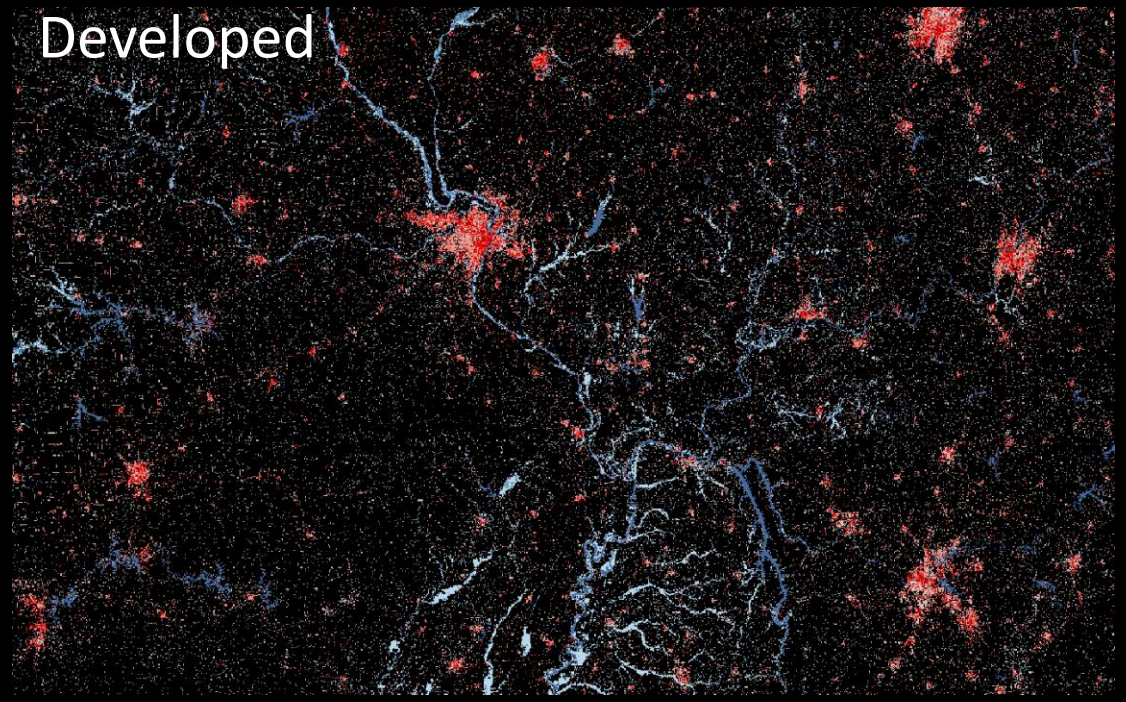
Spring - predicted 2020 stopover density

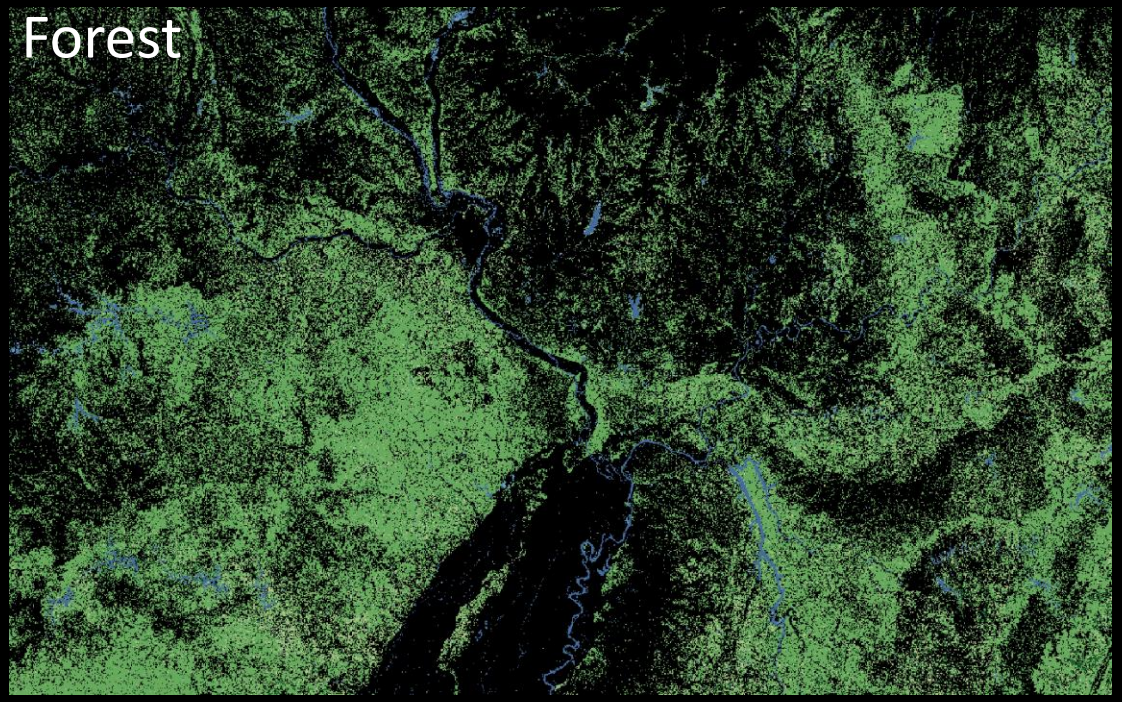


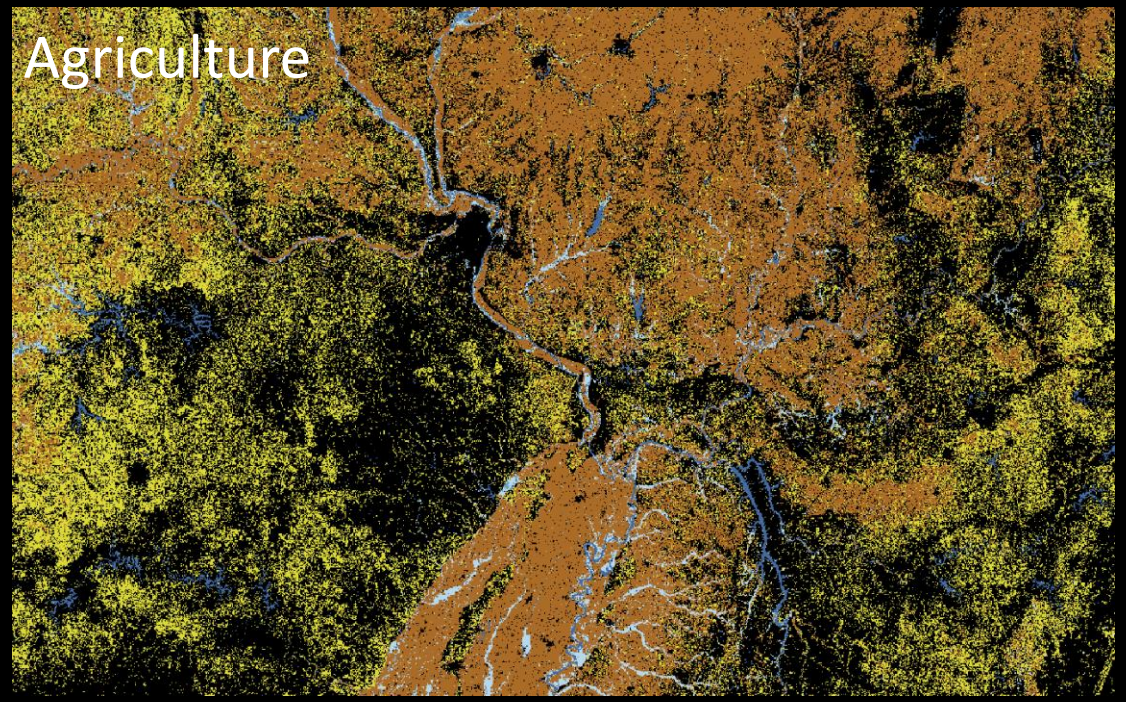
Fall - predicted 2020 stopover density

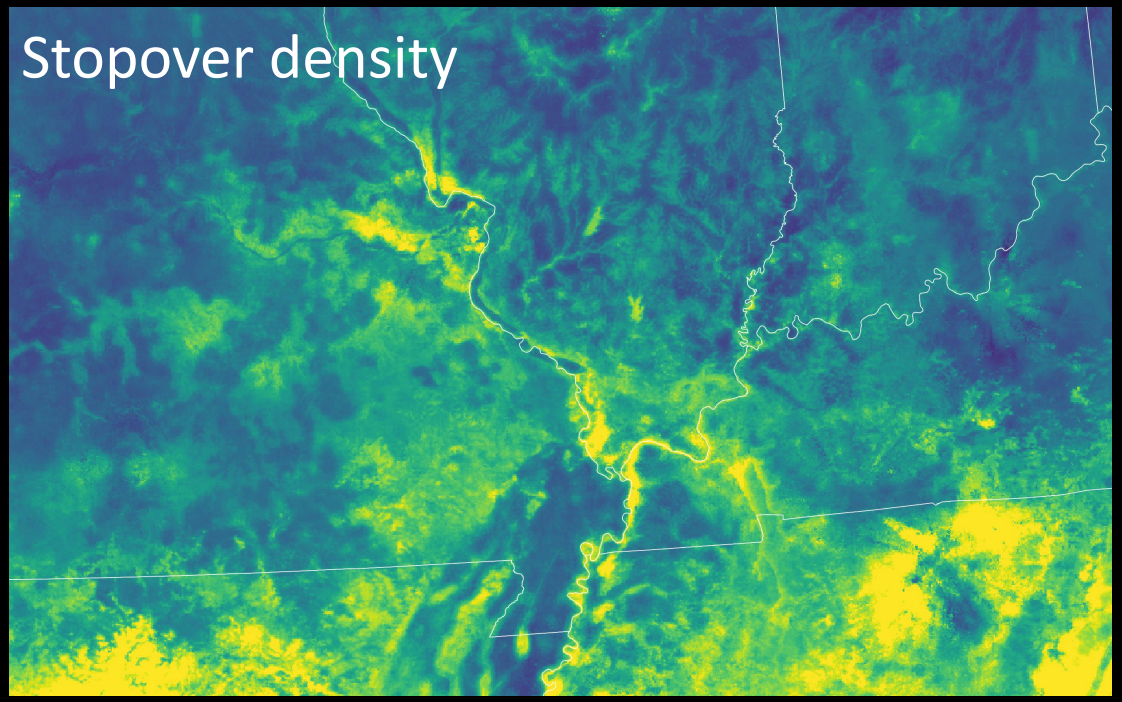



Missouri
Illinois
Indiana
Kentucky
Arkansas
Tennessee

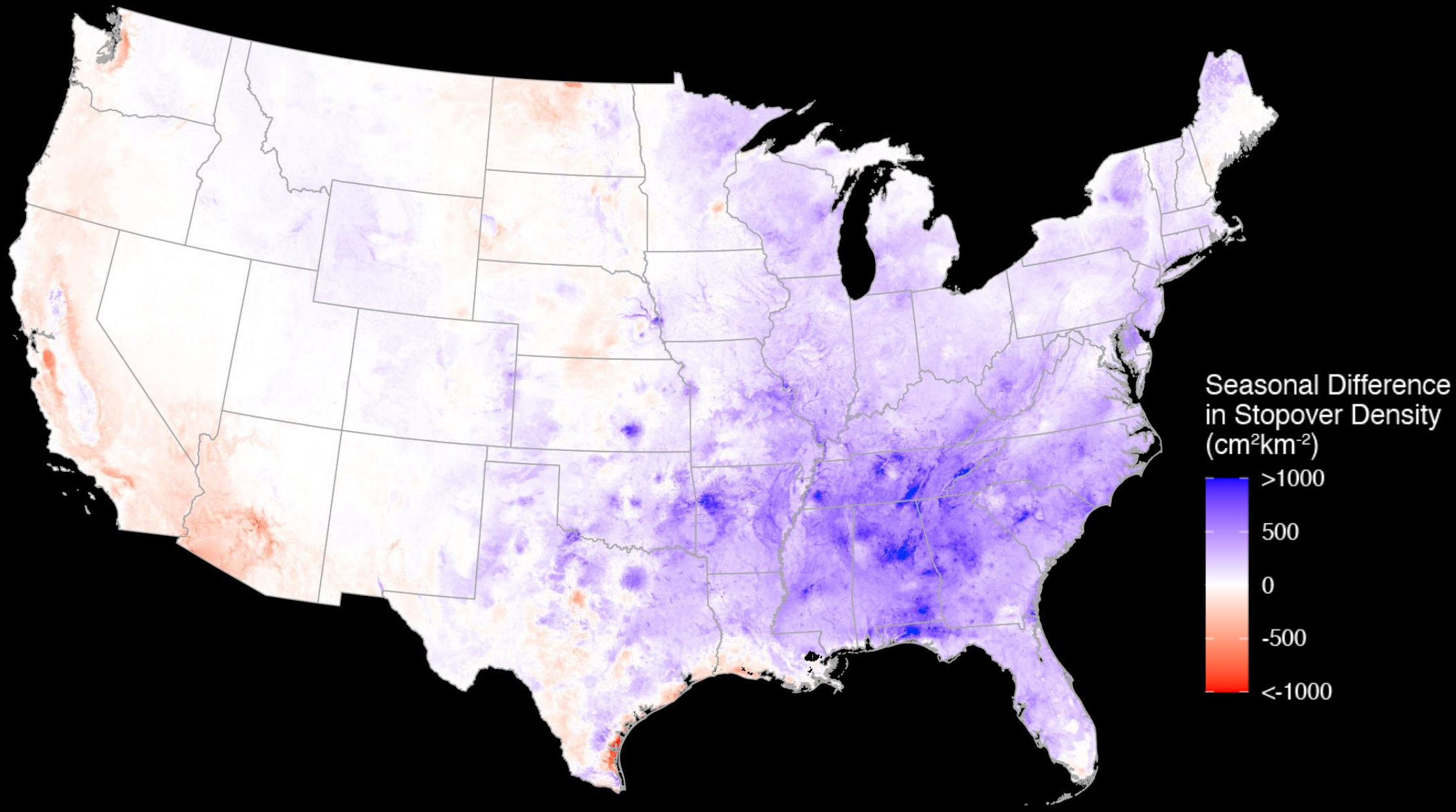

Developed


Forest

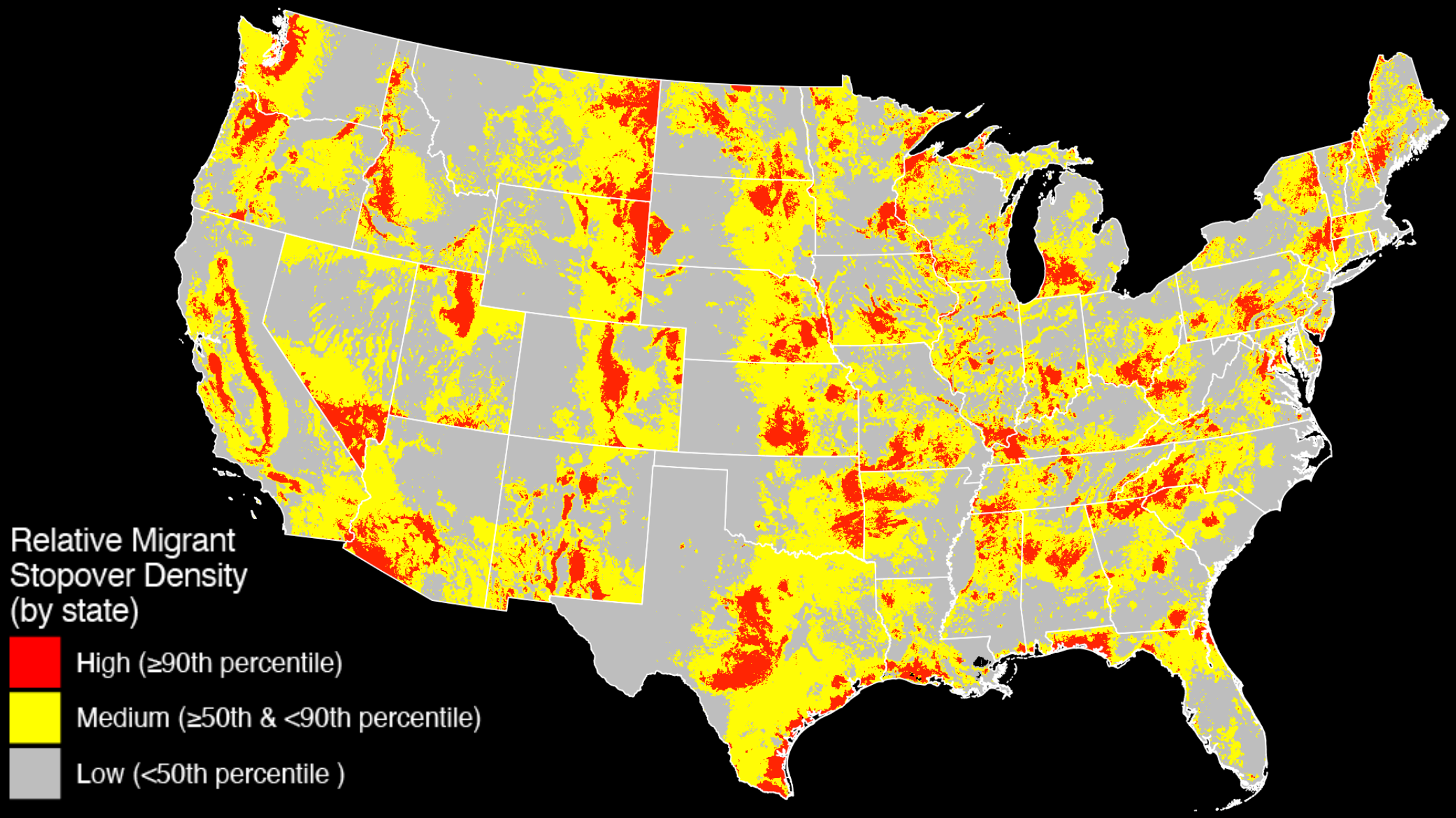

Agriculture

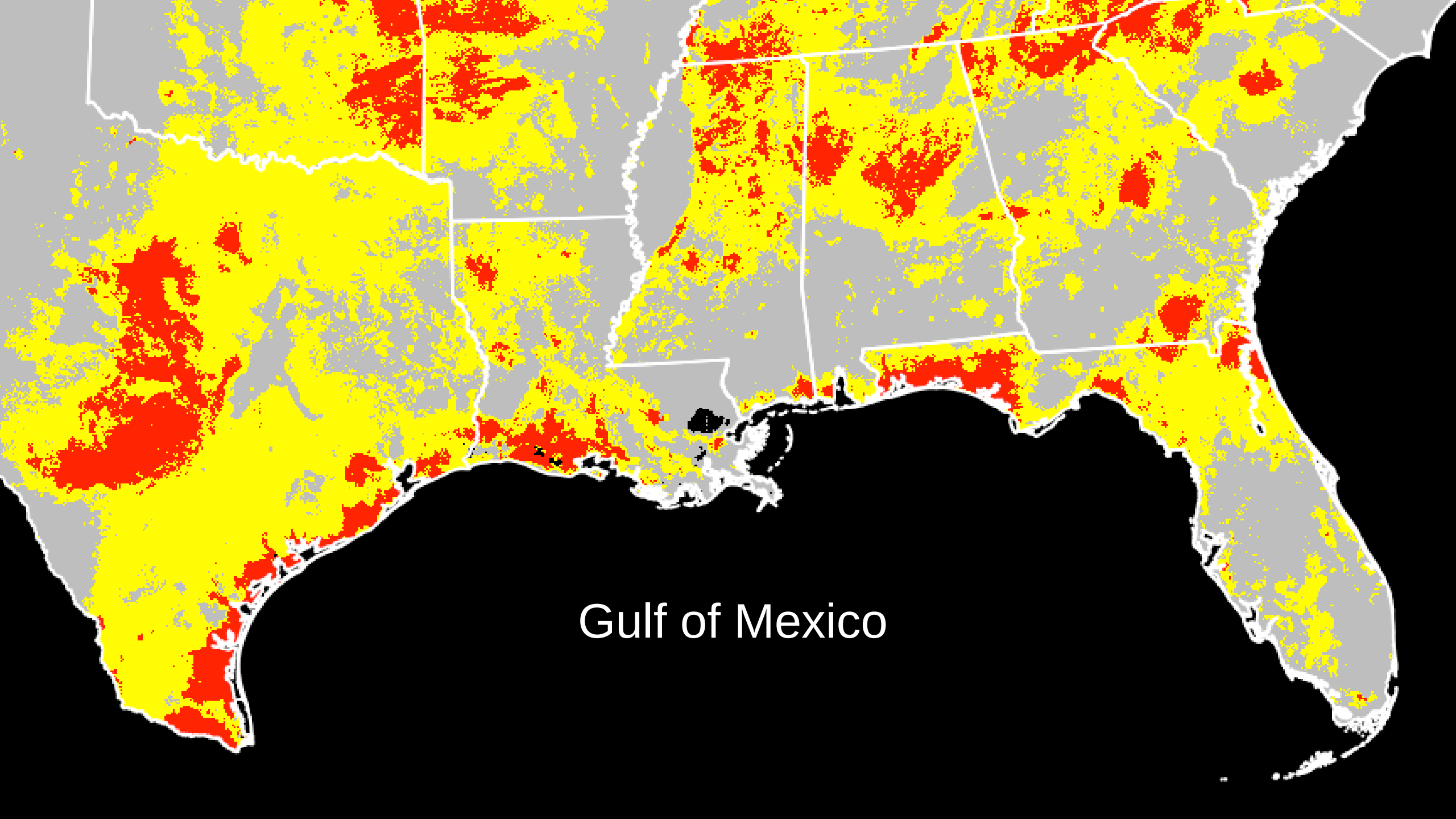

Stopover density

Seasonal Difference

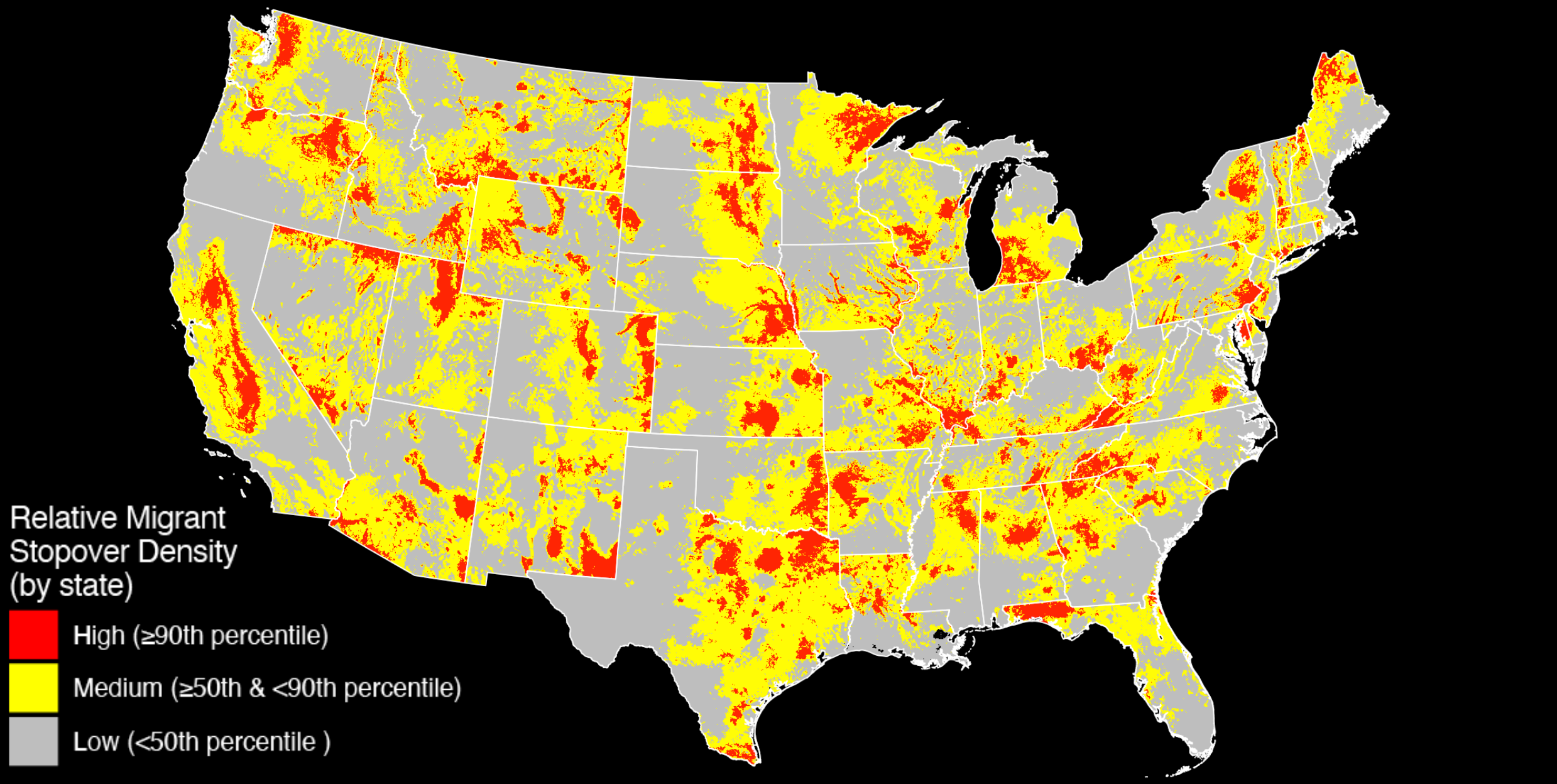


Spring - predicted relative 2020 stopover density




Gulf of Mexico

Fall - predicted relative 2020 stopover density

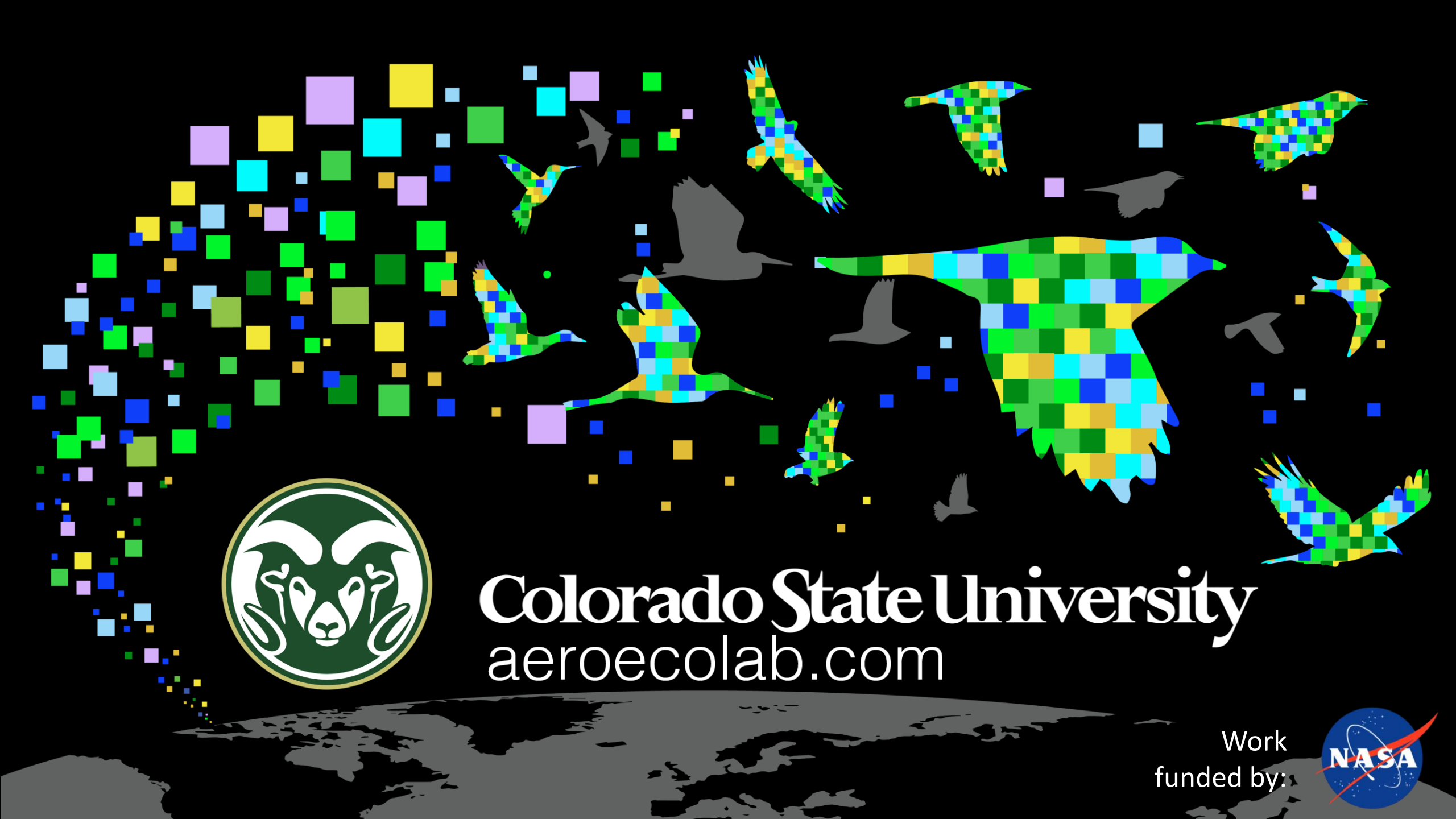


Can we map migrant stopover locations across the contiguous United States to learn spatial drivers?

Questions:

- How are stopover patterns changing?
- How can emerging datasets (GEDI, ECOSTRESS, DESIS) inform and aide our ability to test hypotheses?

Indigo Bunting



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