Geographic analysis of immunization patterns using the Michigan Care Improvement Registry (MCIR)

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Data source: MCIR
(Michigan Care Improvement Registry)

- Operational since 1998
- Birth-to-death immunization registry
  - < 20 y age restriction removed June 2006
- ~95% of providers participate
- Part of CDC's IIS sentinel site project
- Michigan's population is large
  - 10 million people
  - 130,000 births/year

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Methods: Choropleth maps

- Generate iz. data aggregated by region
  - counties, school districts, census tracts, ZIP codes
- Easy to do
  - No geocoding necessary
  - Conceptually simple
- Limitations
  - Can’t visualize fine scales
  - Limited to your units of aggregation

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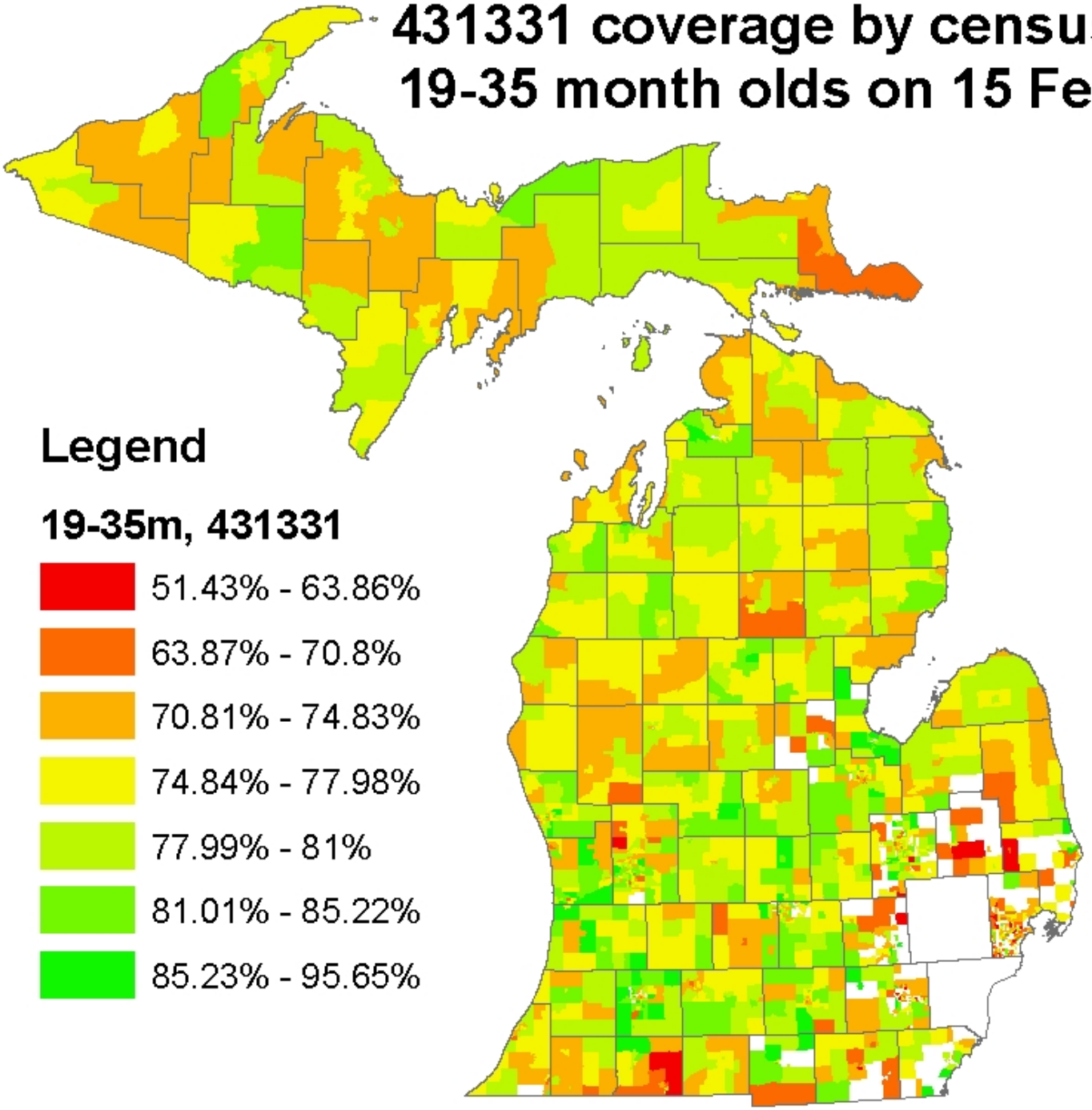
431331 coverage by census tract, 19-35 month olds on 15 Feb. 2007



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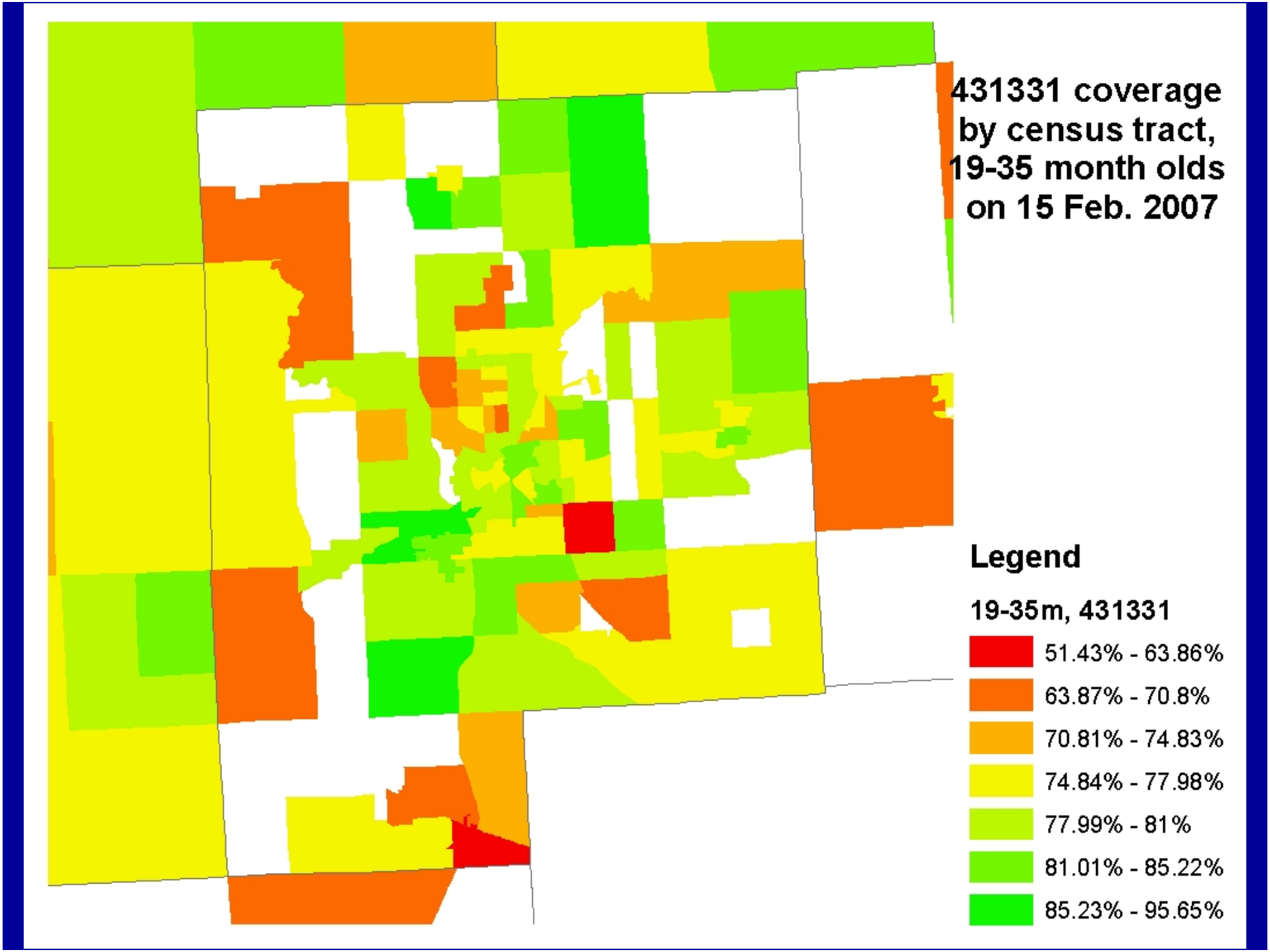

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Methods: Geocoding

- MCIR receives ‘responsible party’ addresses from birth certificate or clinicians
- Address is converted to geographic coordinates by the MI Dept. of Human Services (DHS) using Postalsoft
- ~85% of addresses yield good coordinates
- Very easy to view using GIS (ArcView)
- Enables more advanced GIS methods

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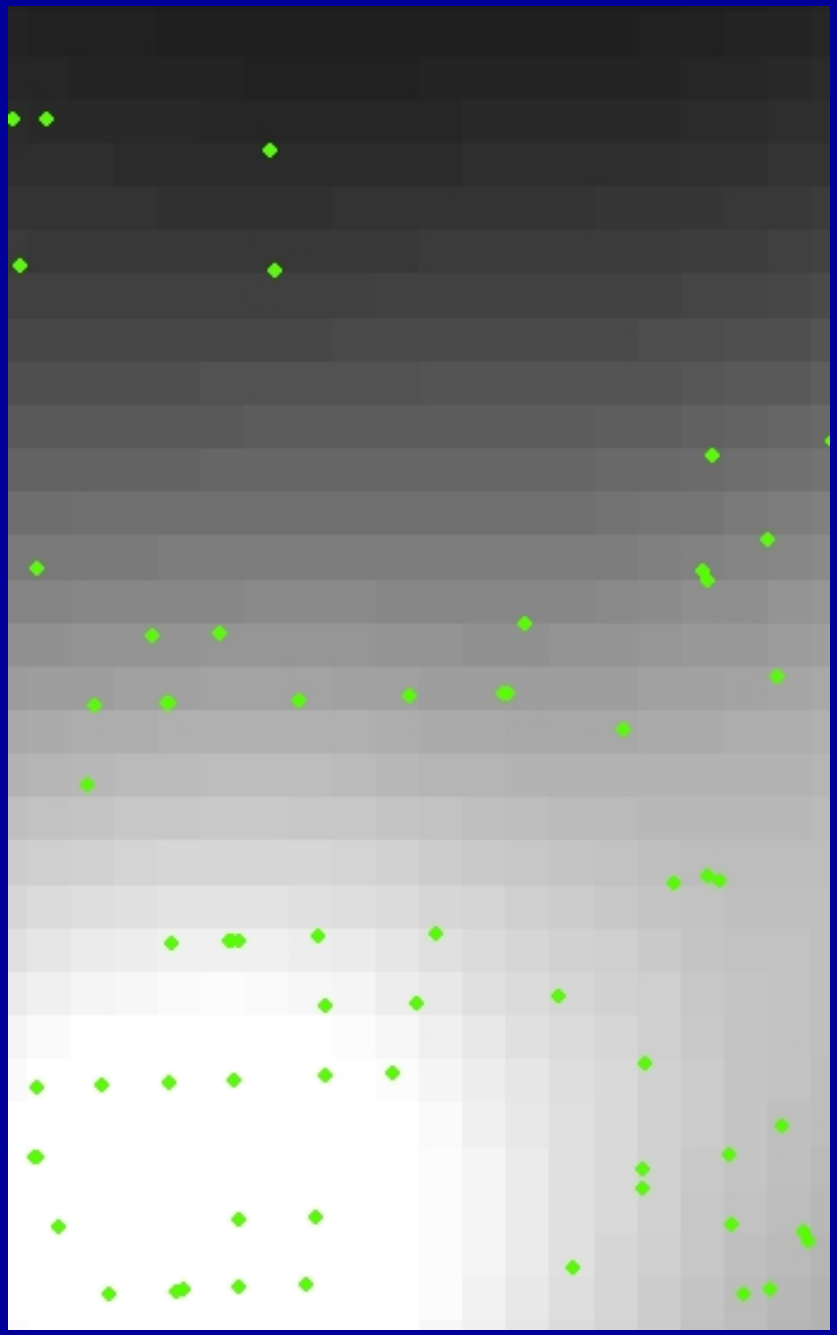
Methods: Density mapping

- Converts point data to a continuous surface
- Similar to a drip castle – each point gets a drip, and drips can stack on each other
- ‘High’ areas are bright; ‘low’ areas are dark
- Brightness=kids/mile^2
- ArcGIS Spatial Analyst



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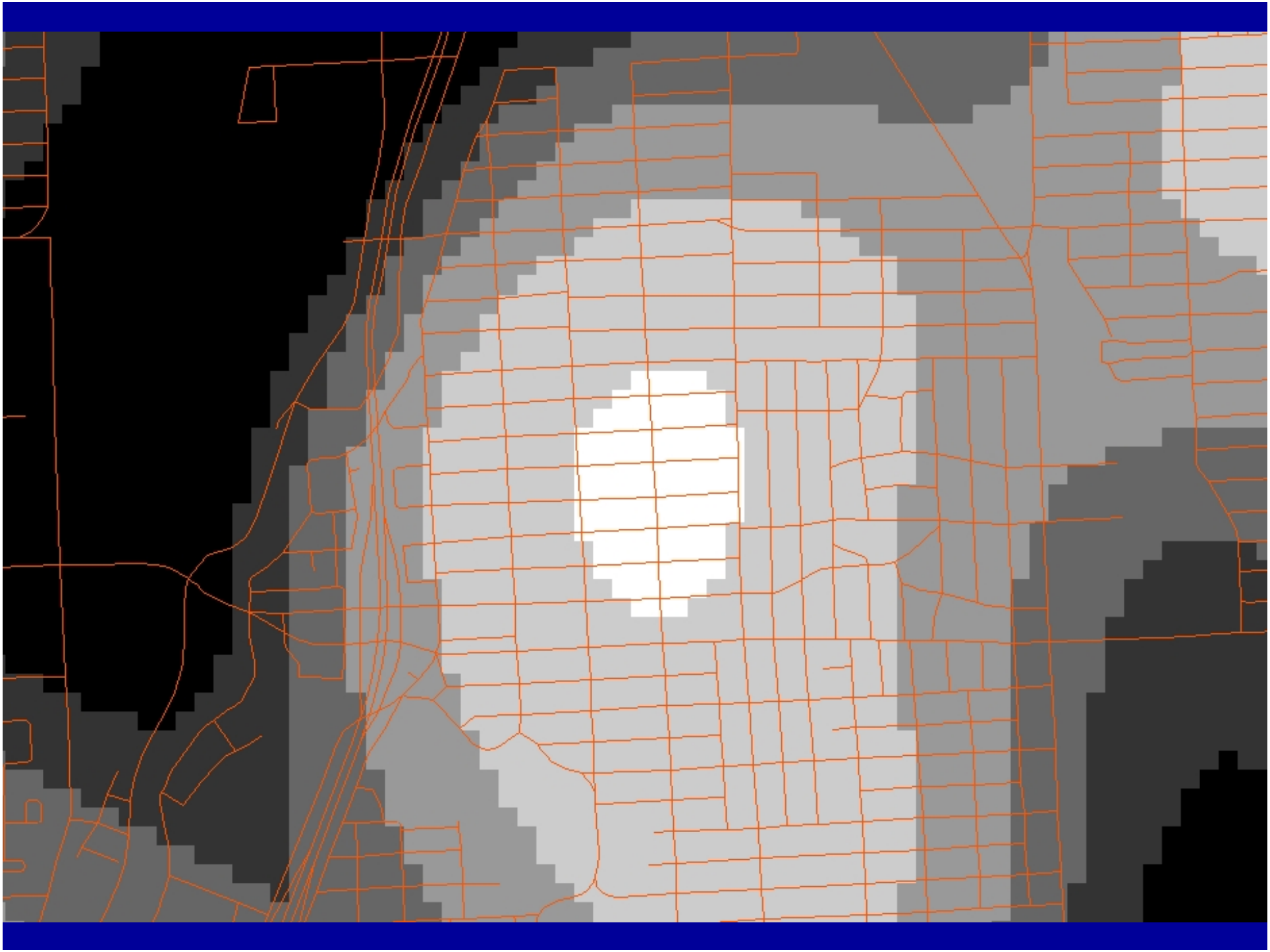

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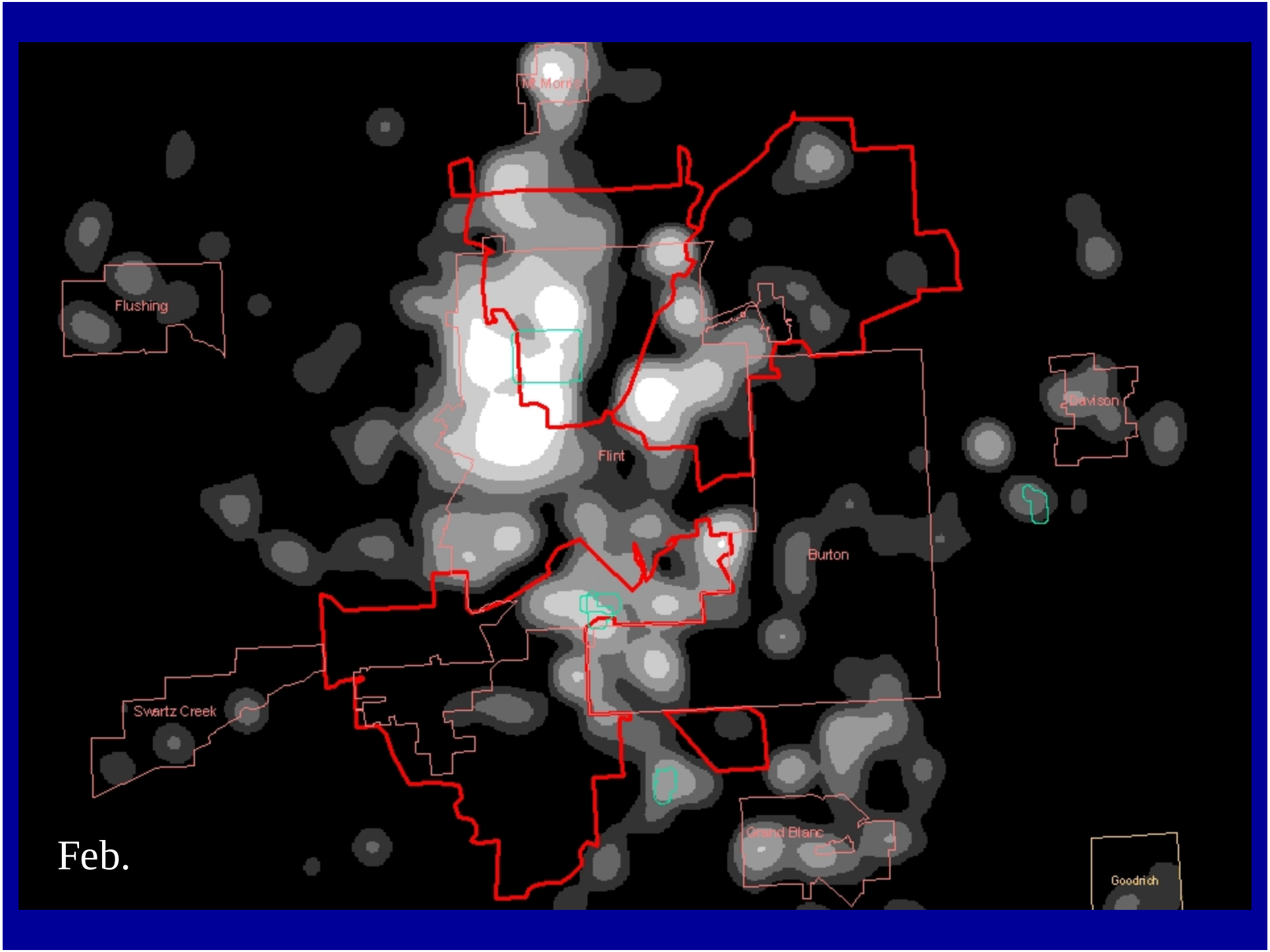

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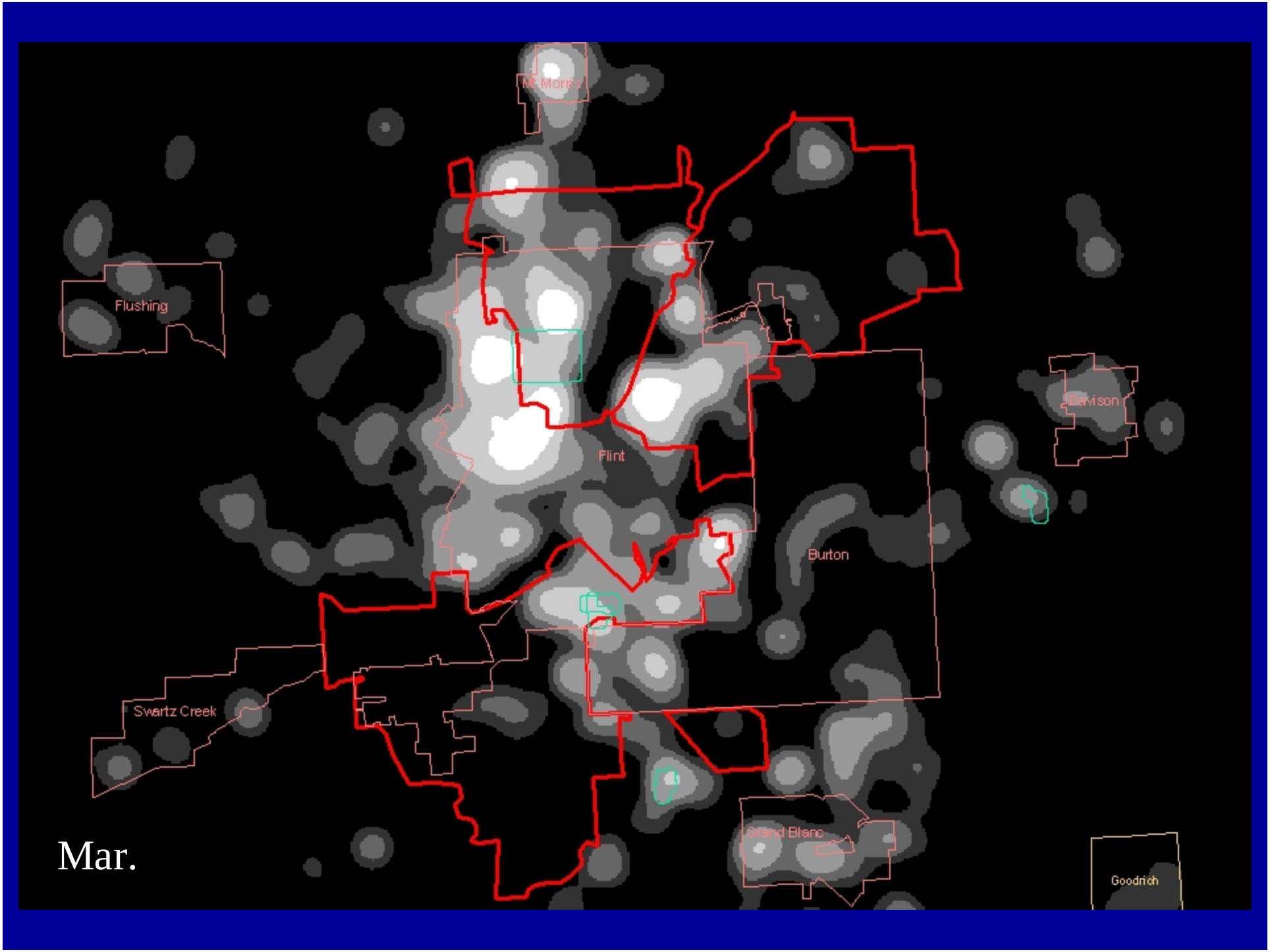

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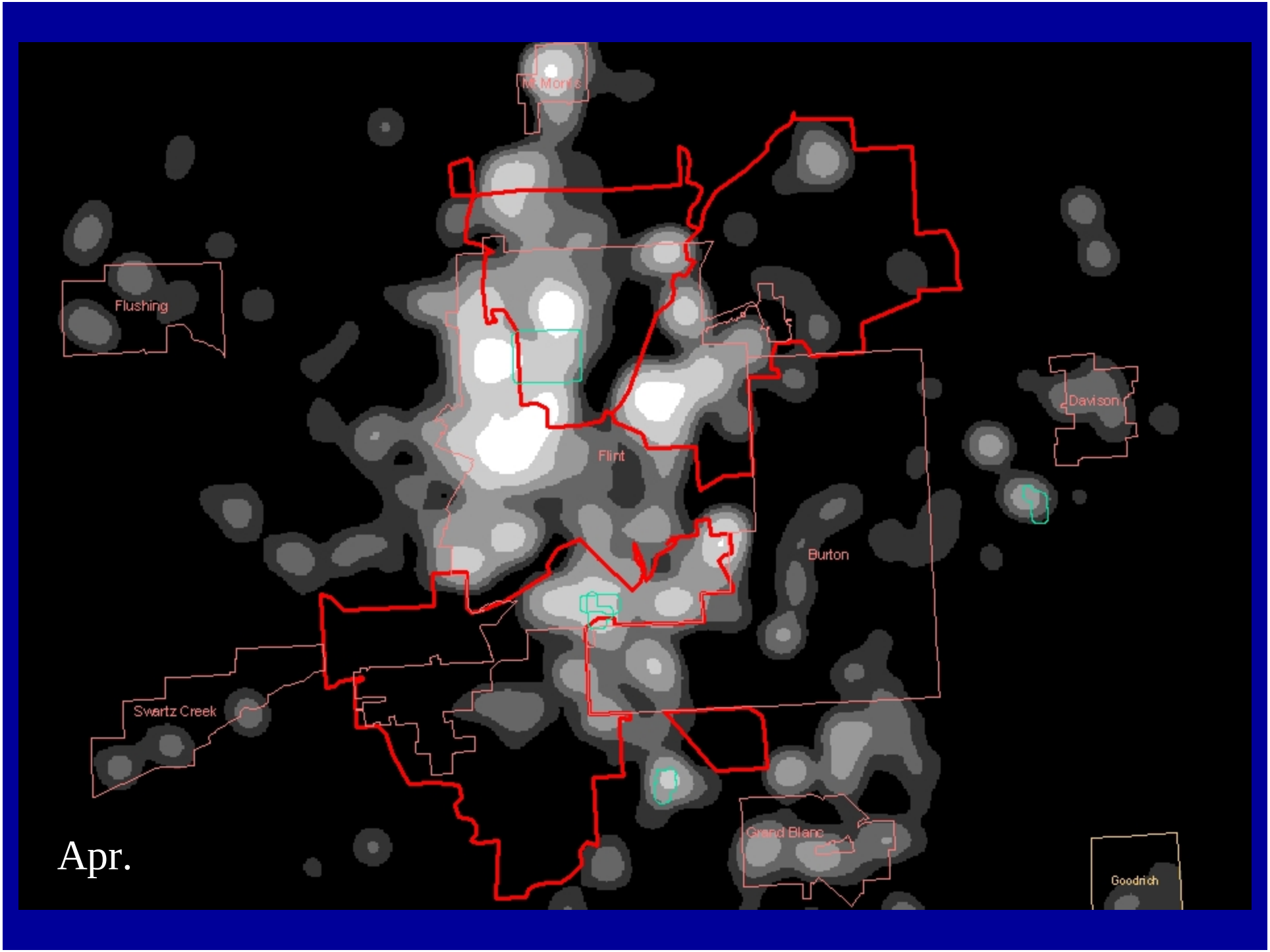

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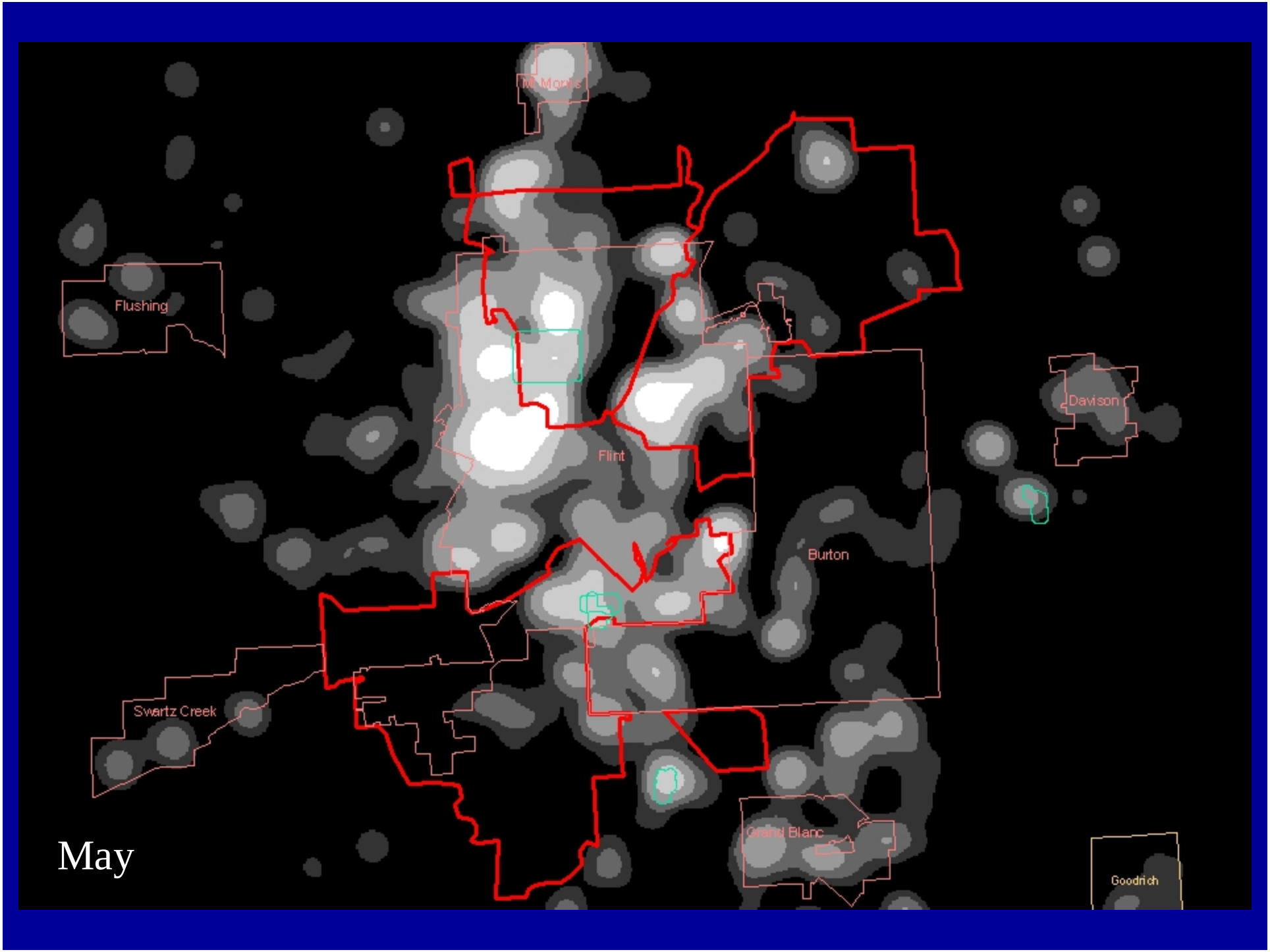

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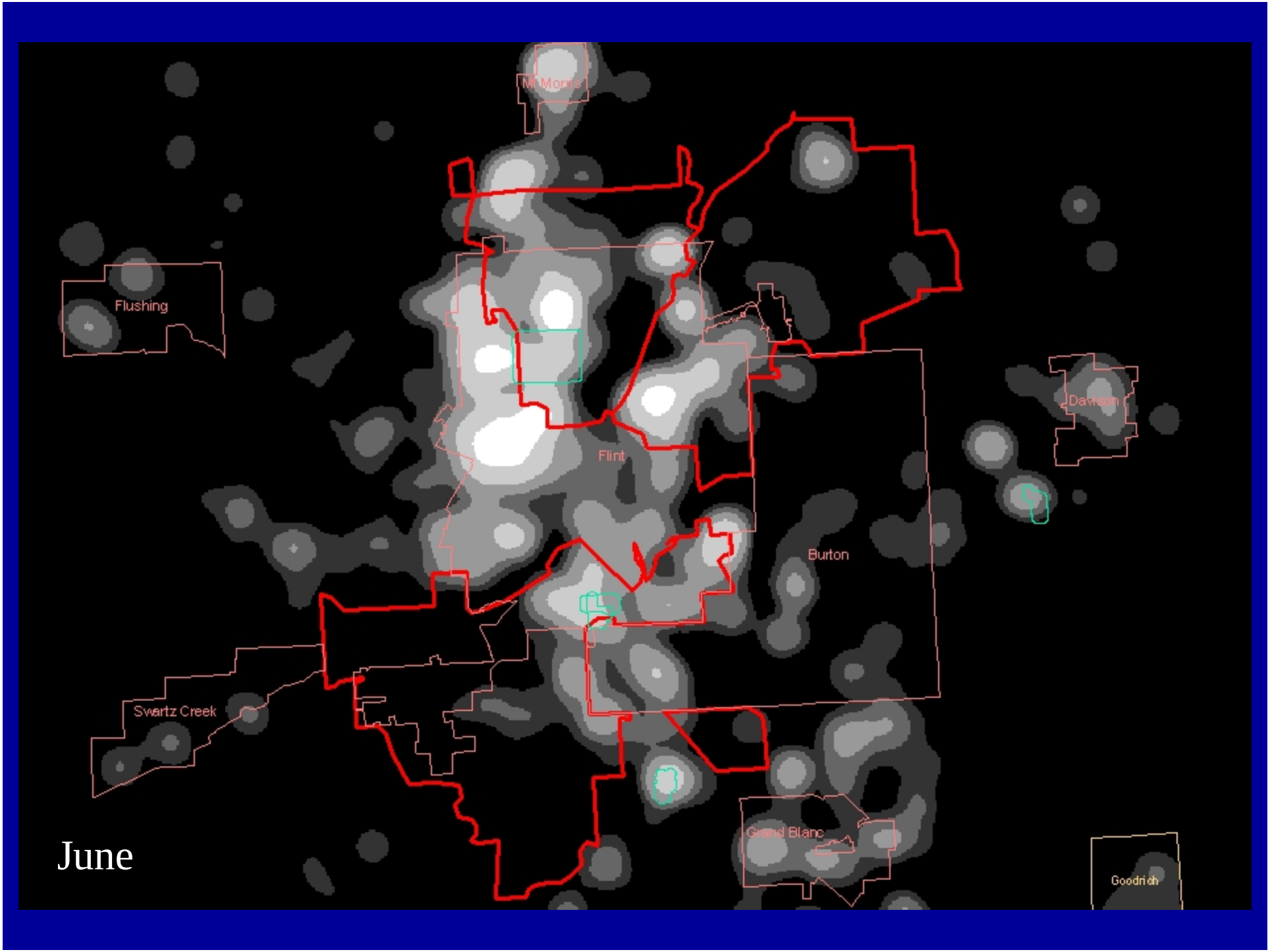

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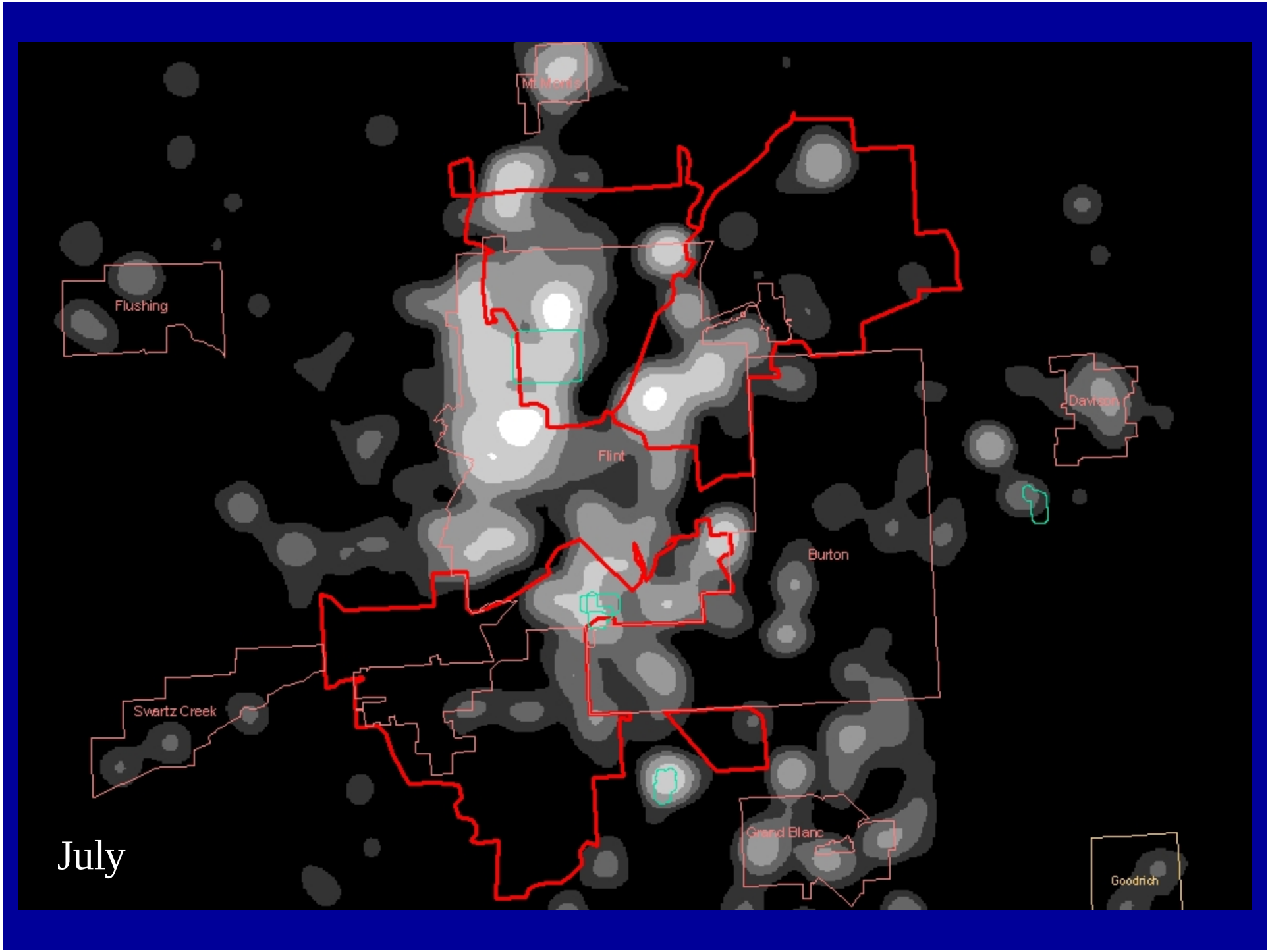

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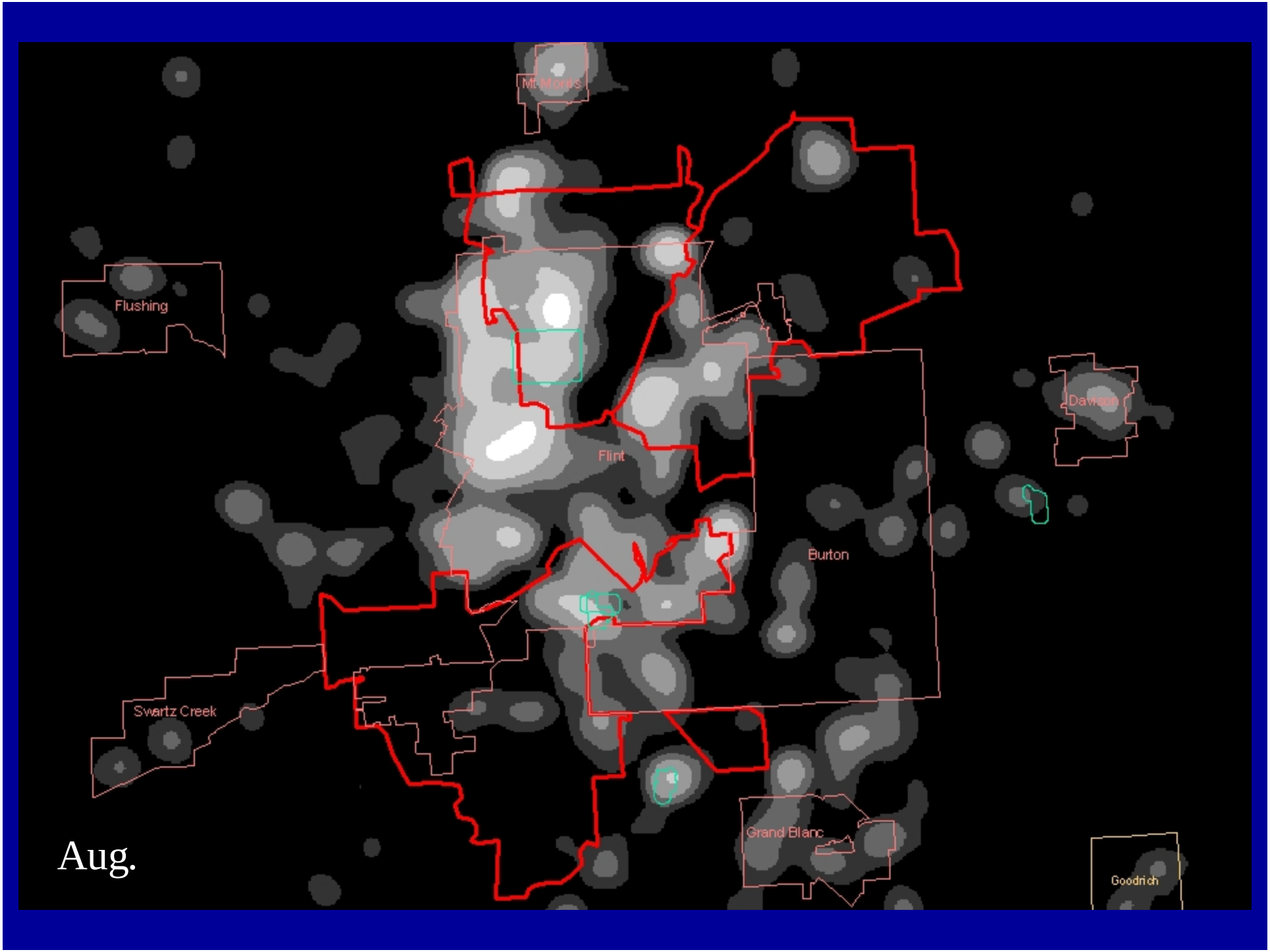

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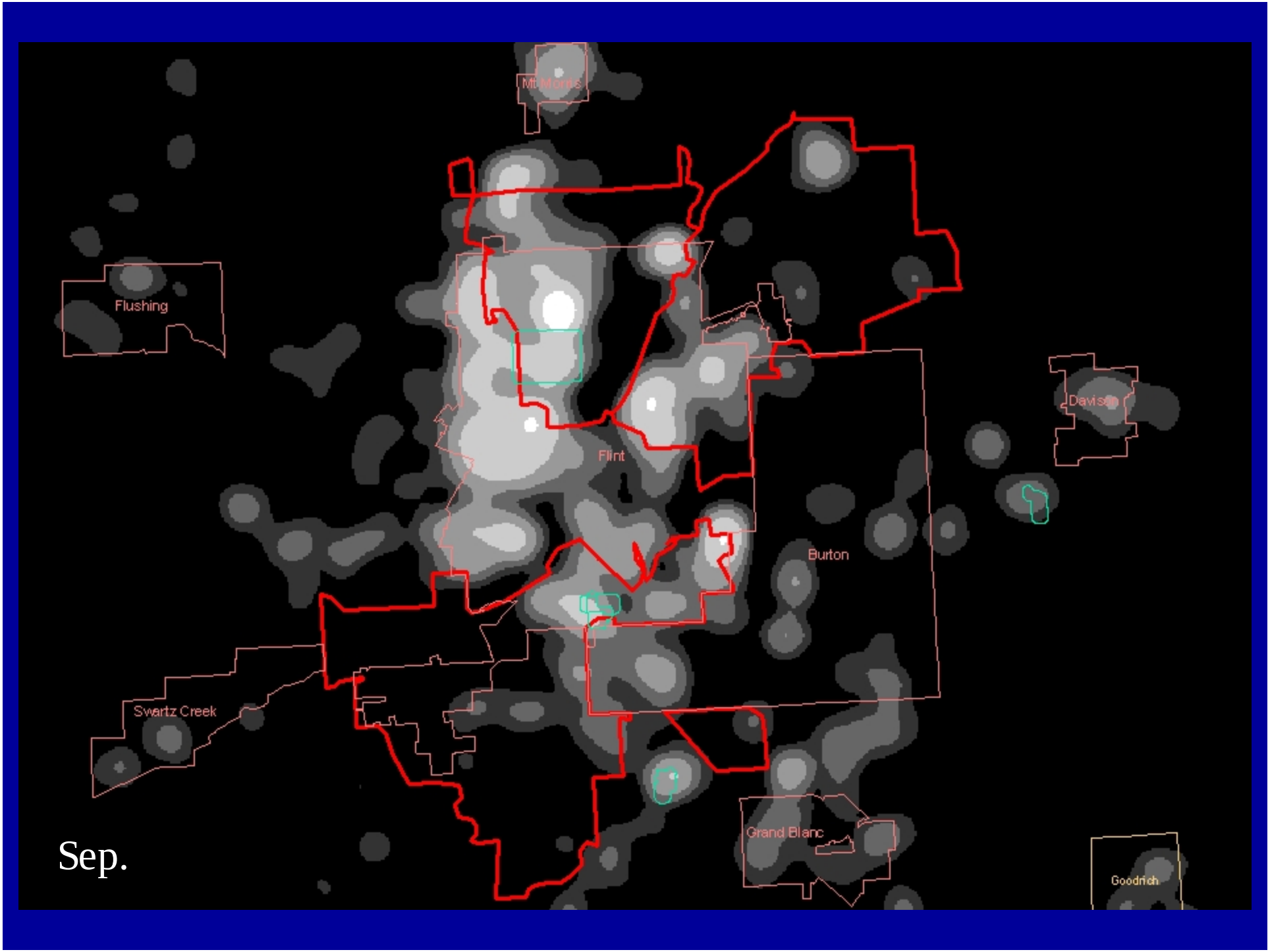

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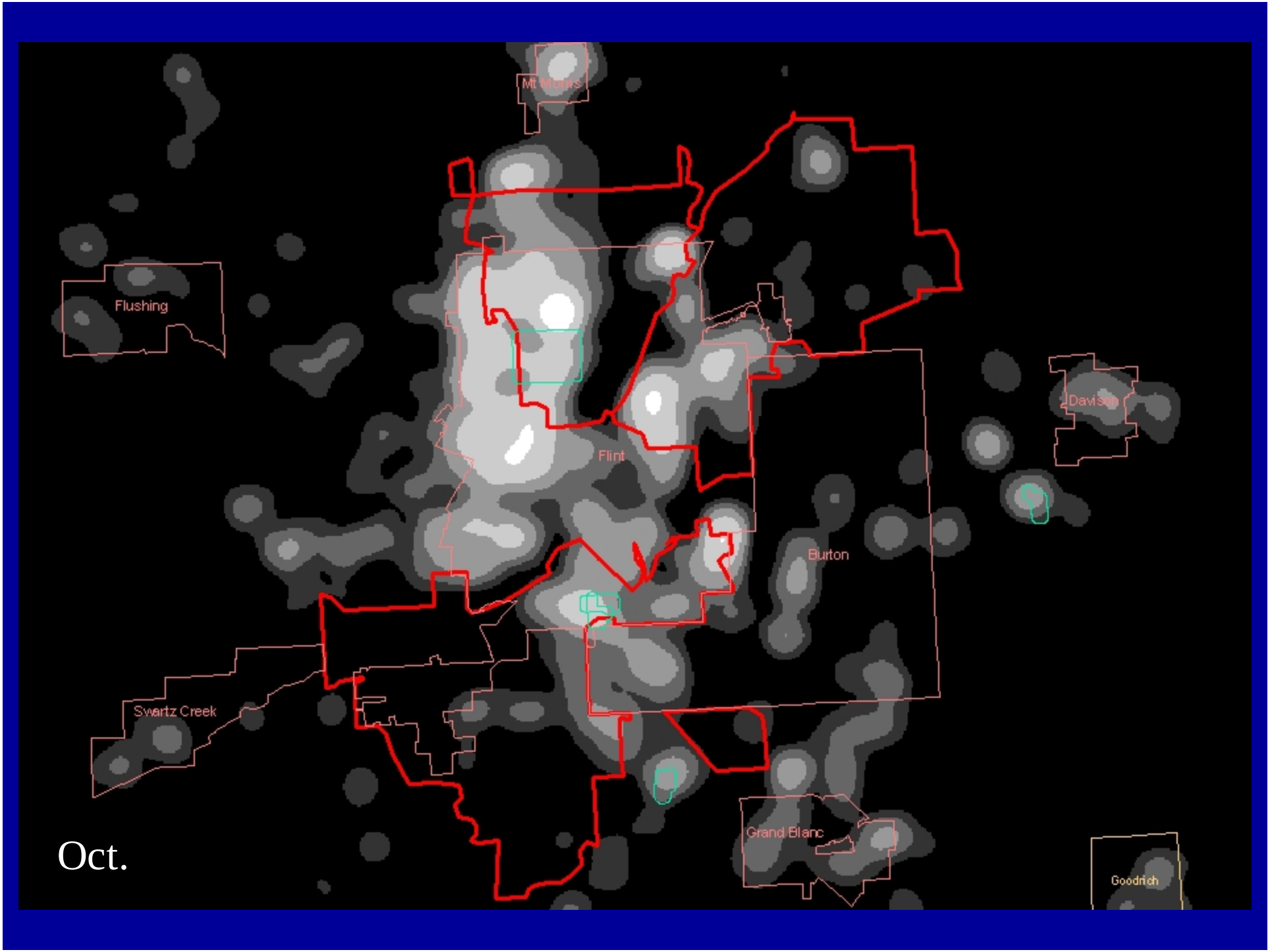

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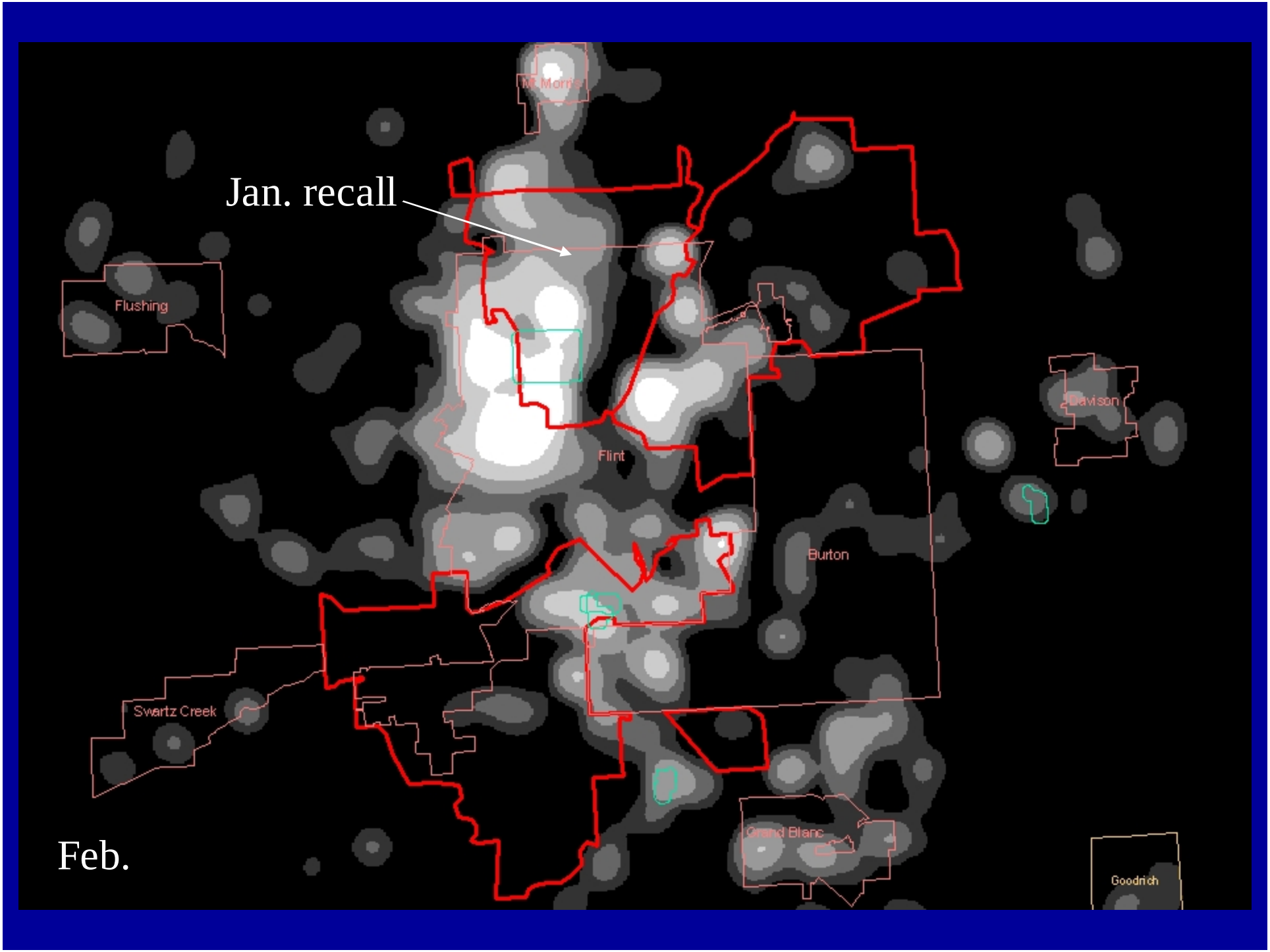

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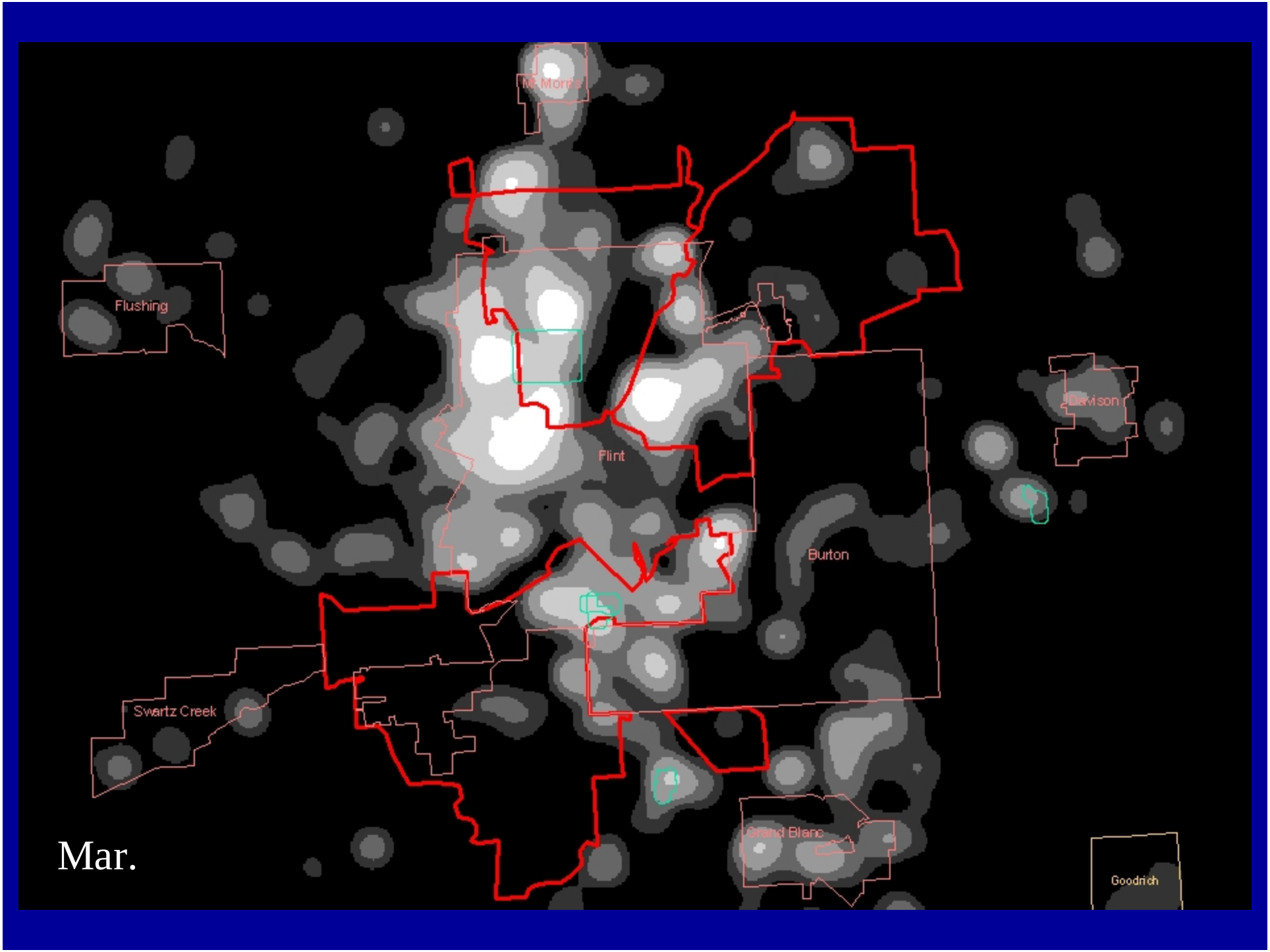

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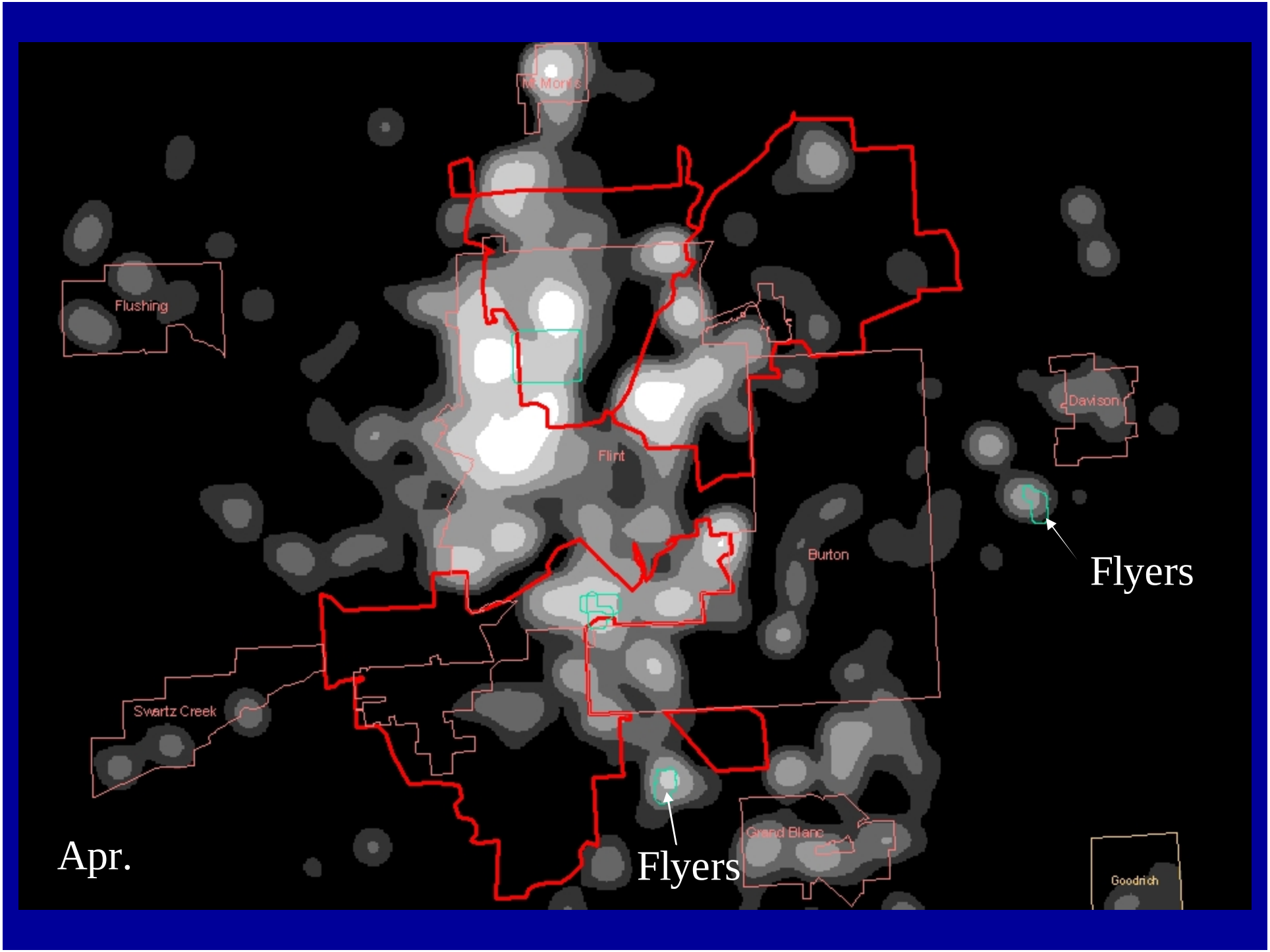

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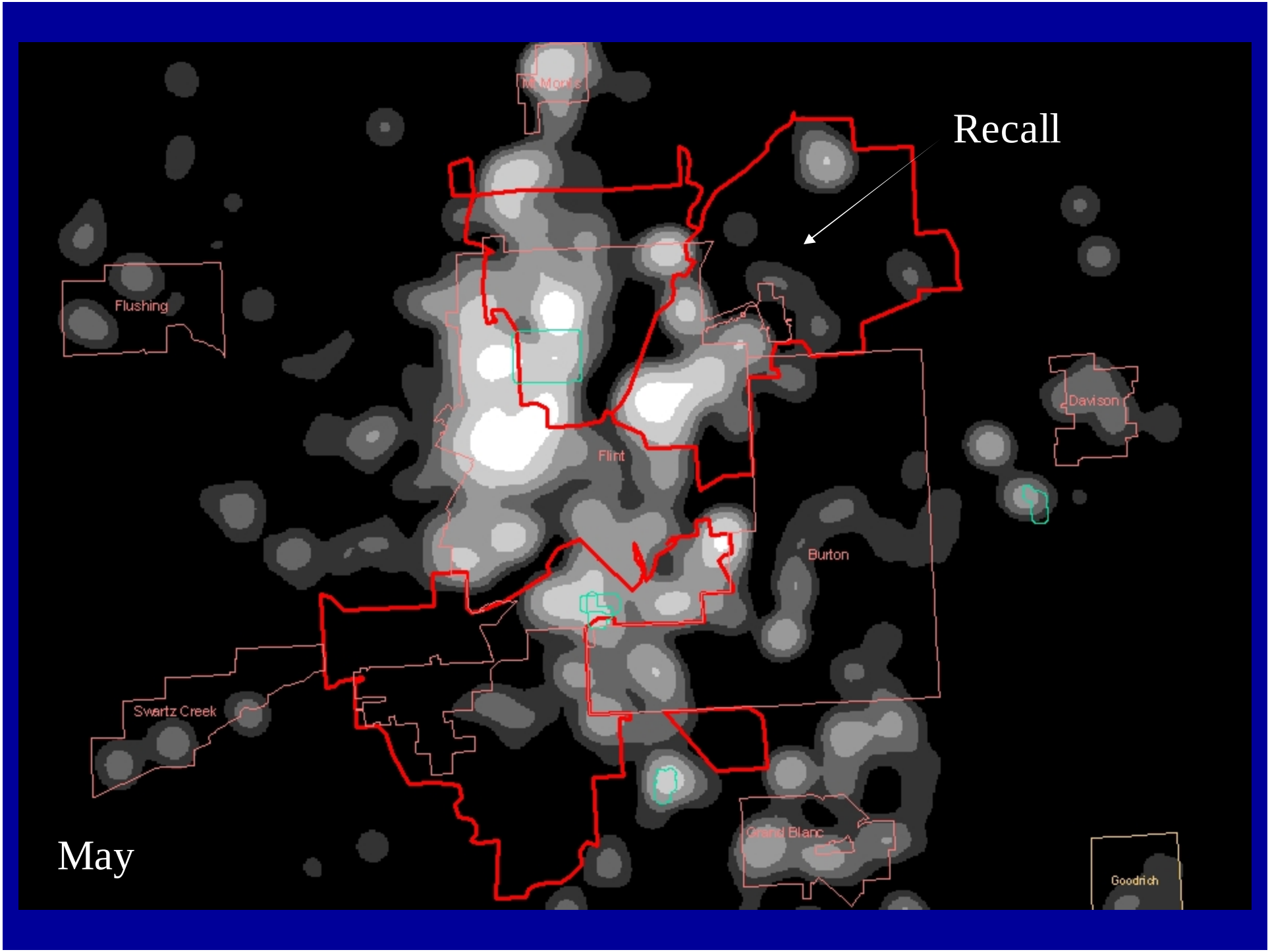

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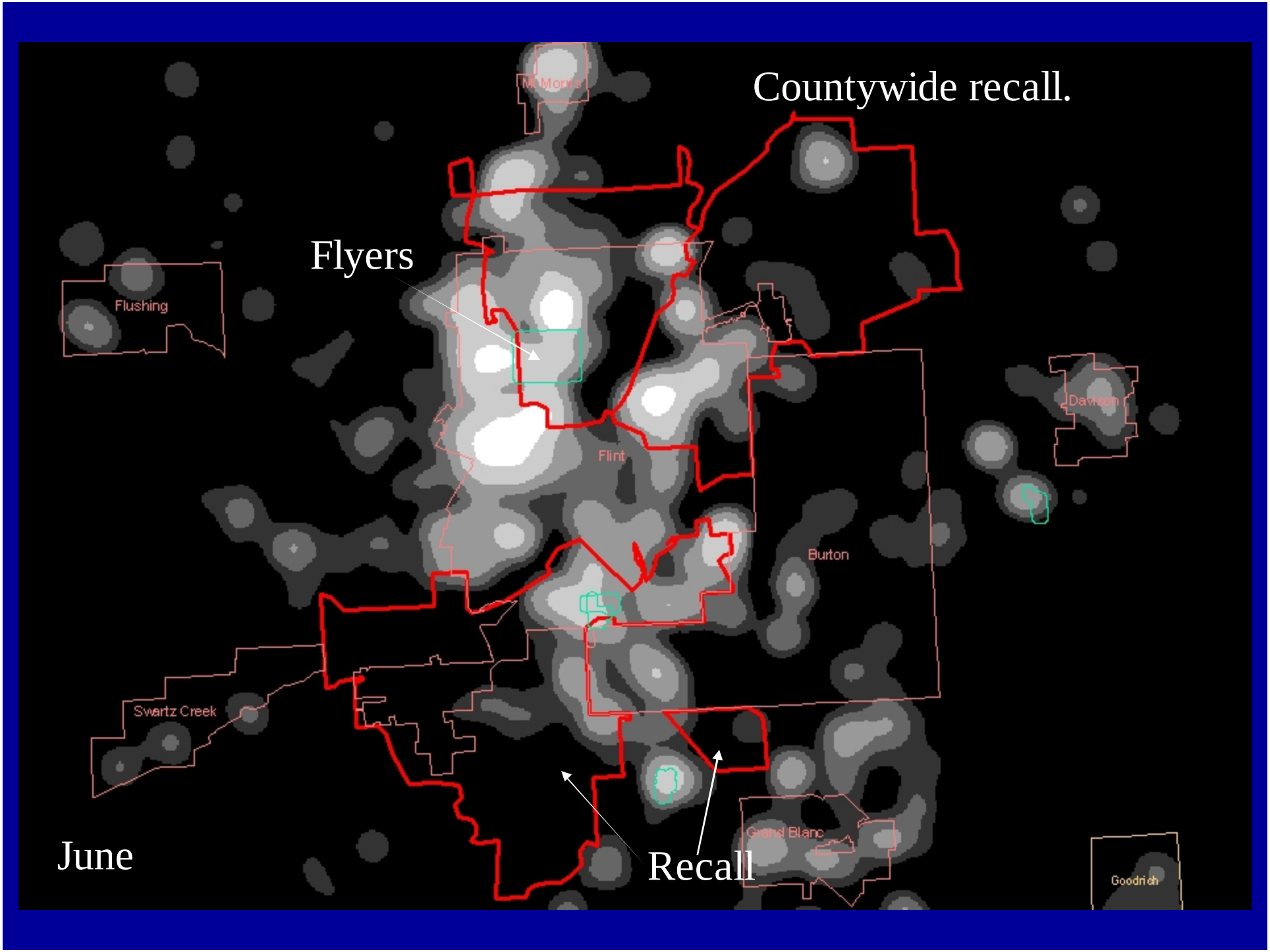

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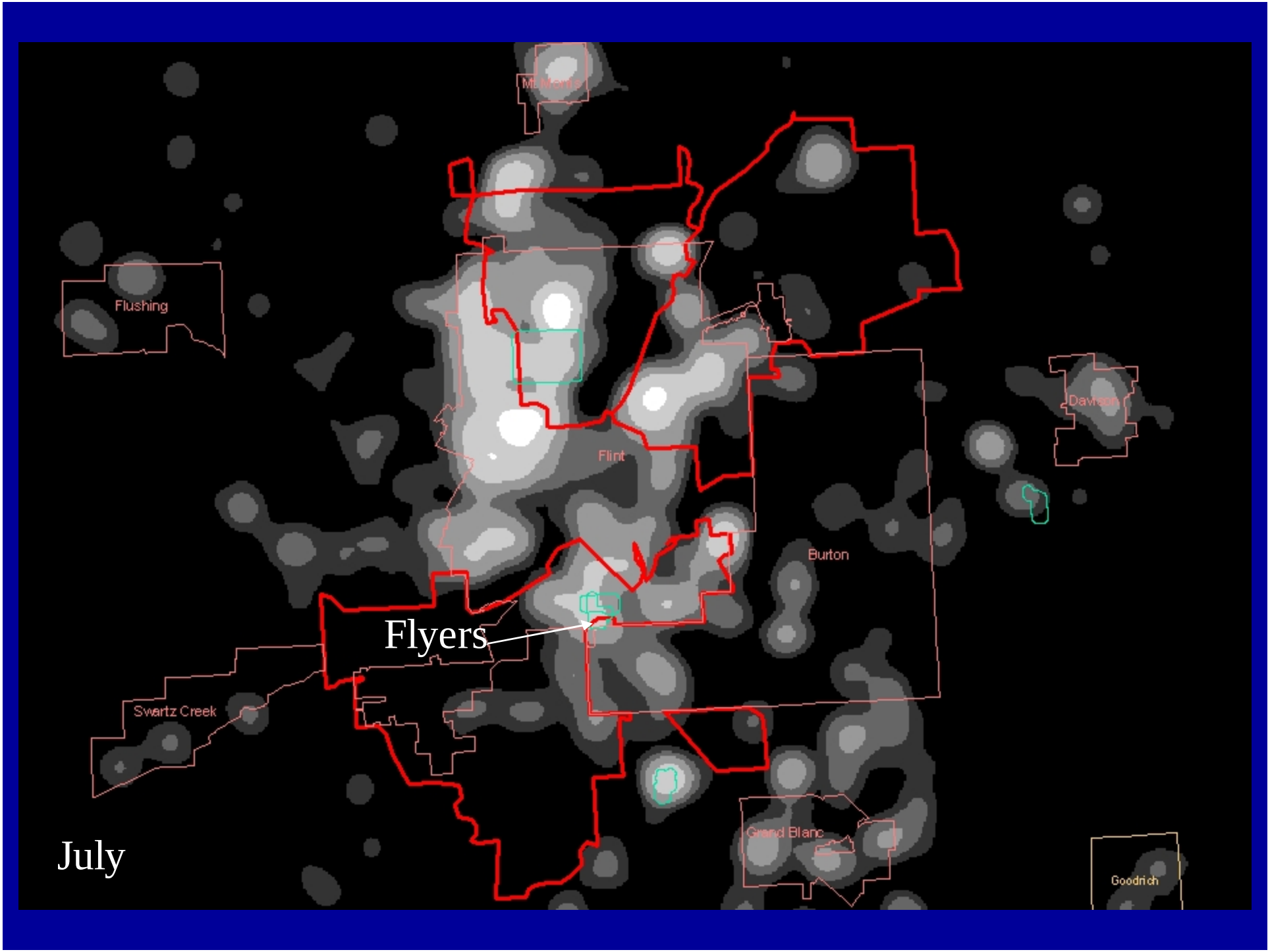

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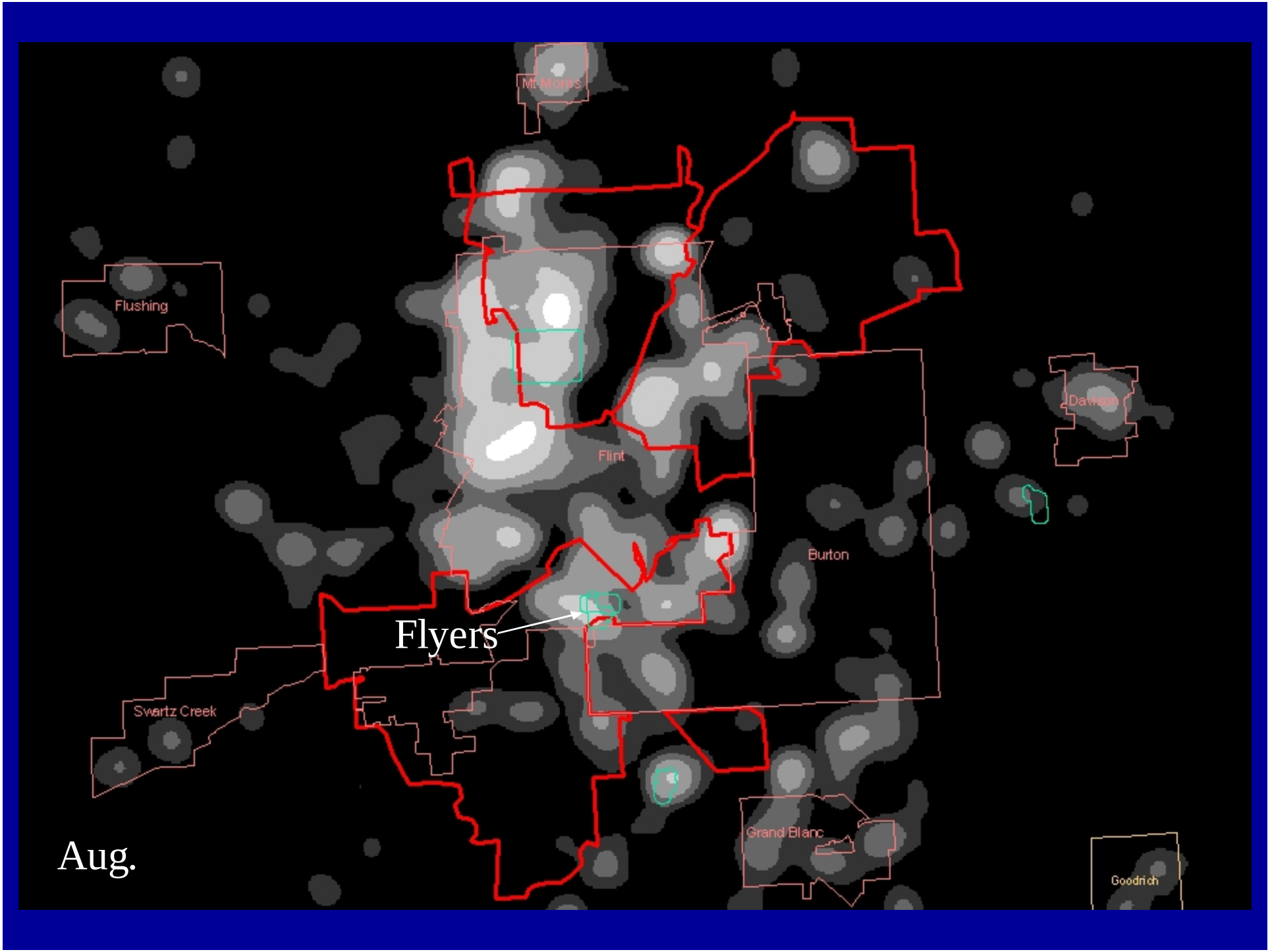

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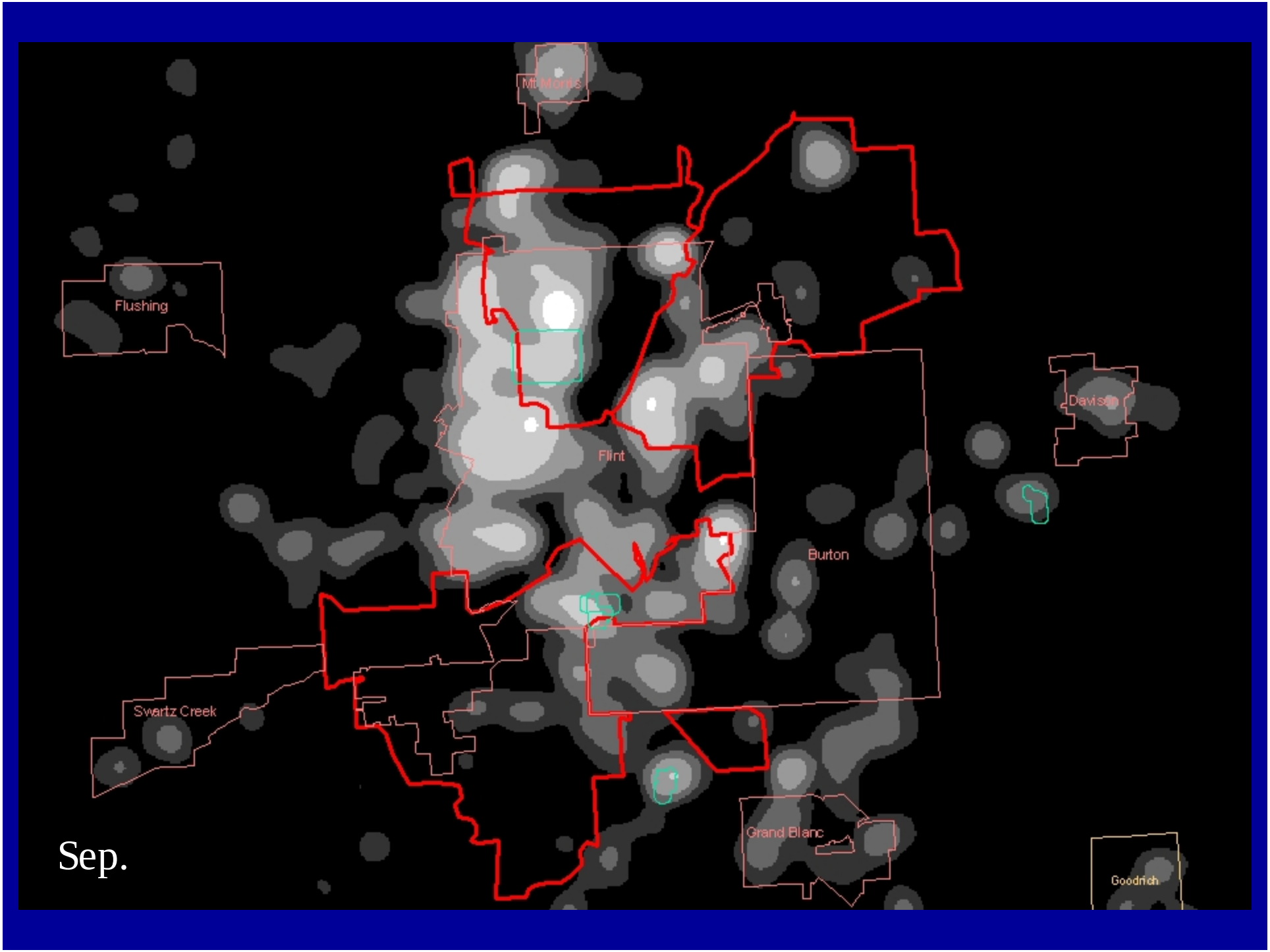

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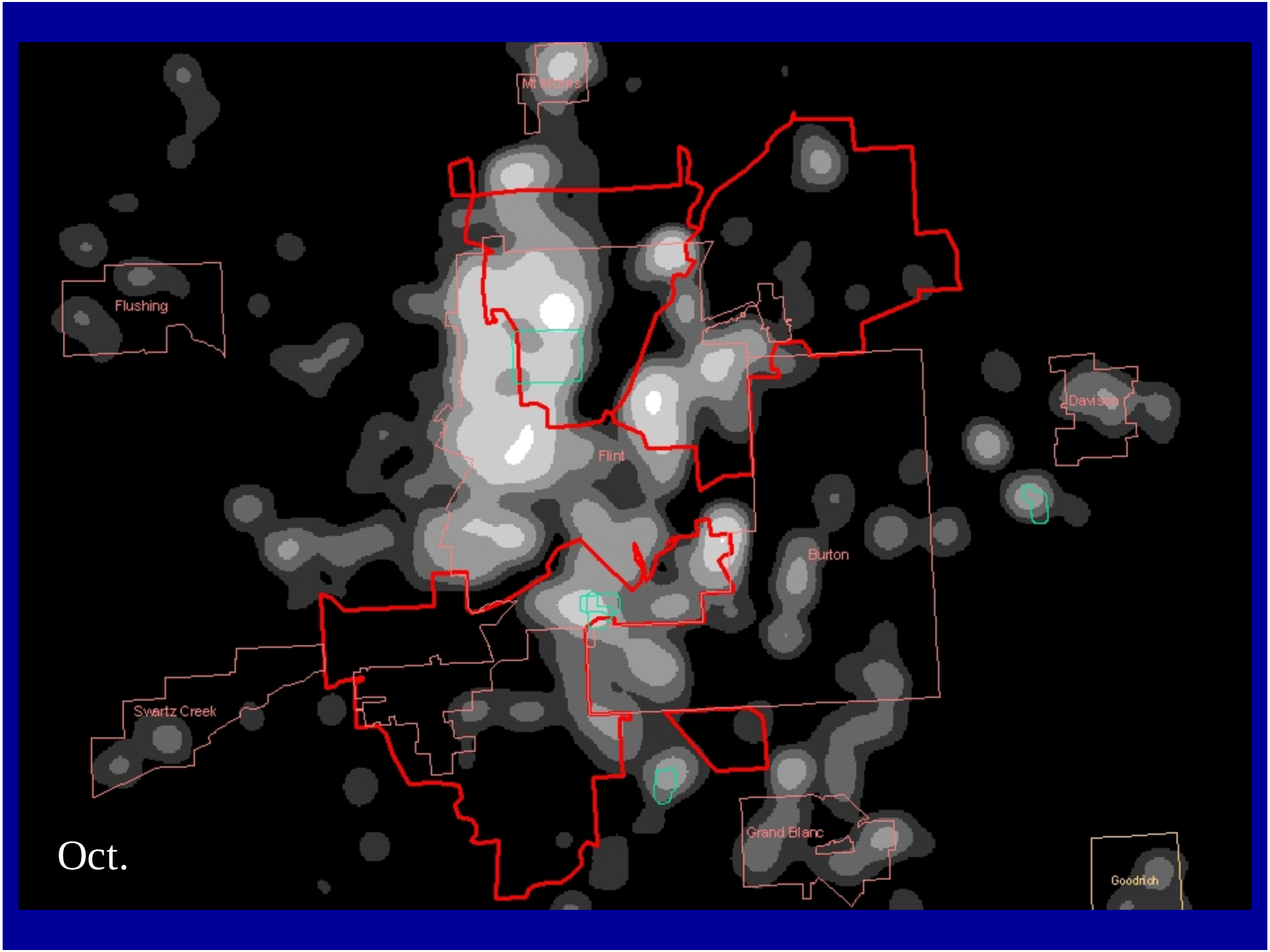

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This is nice, but…

- How can we actually use this?
- Many LHDs are short on time, resources, & personnel
- Need products that are easy for someone who doesn't know GIS

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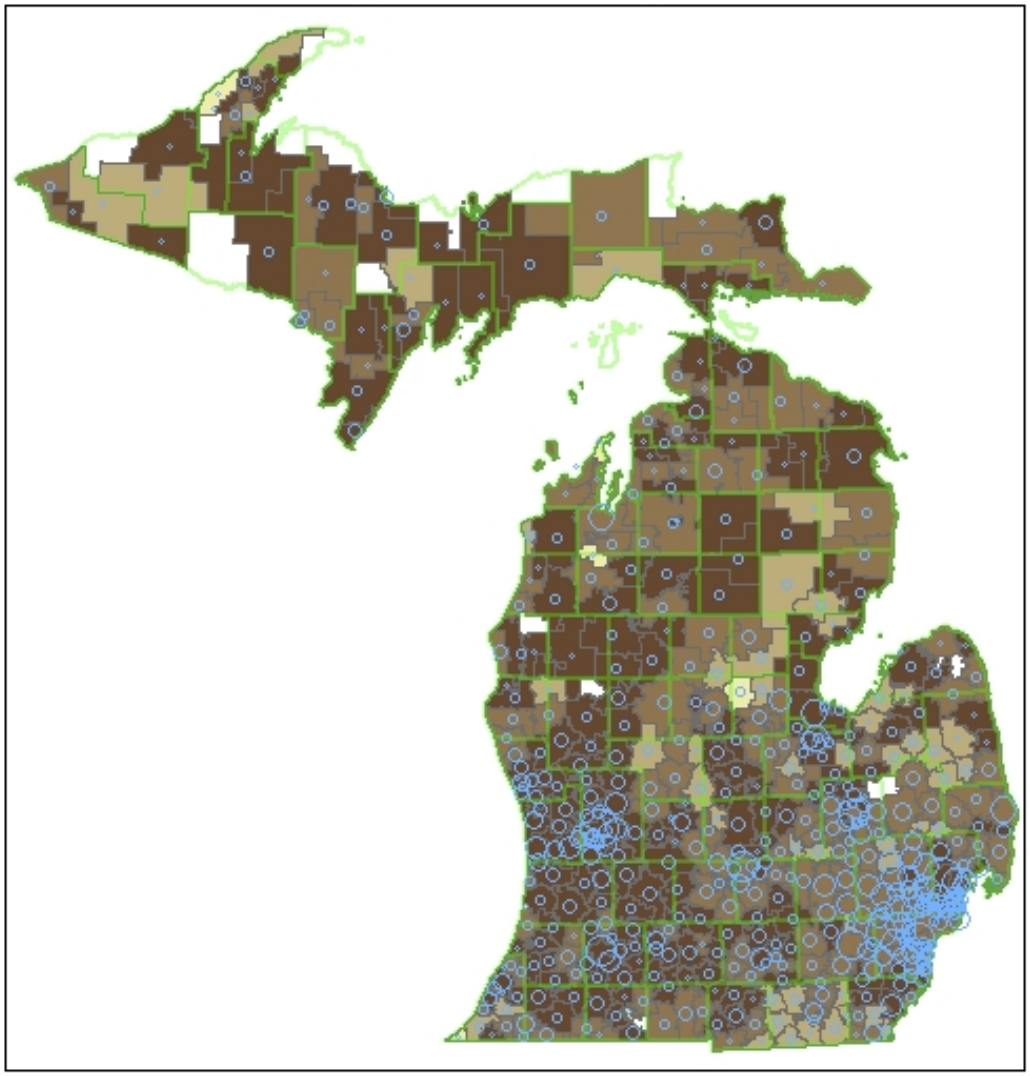
'Complete' (roughly 4 DTaP, 3 polio, 2 MMR, 3 hep. B, 1 varicella) immunization coverage for kindergartners, as reported by schools, Feb. 2007



Notes: These data are reported by schools and may contain errors. Also, districts/schools with low immunization coverage often have few students. White areas mean that no data are available. Schools/districts with > 5 students have no data shown. Completeness of < 30% is shown as 30%. Pie charts show immunization coverage of individual schools. A pie chart the size of the school symbol (which is circle) has about 15 students. Due to the large size of Detroit Public Schools, a blue circle corresponding to their # of students is not shown.

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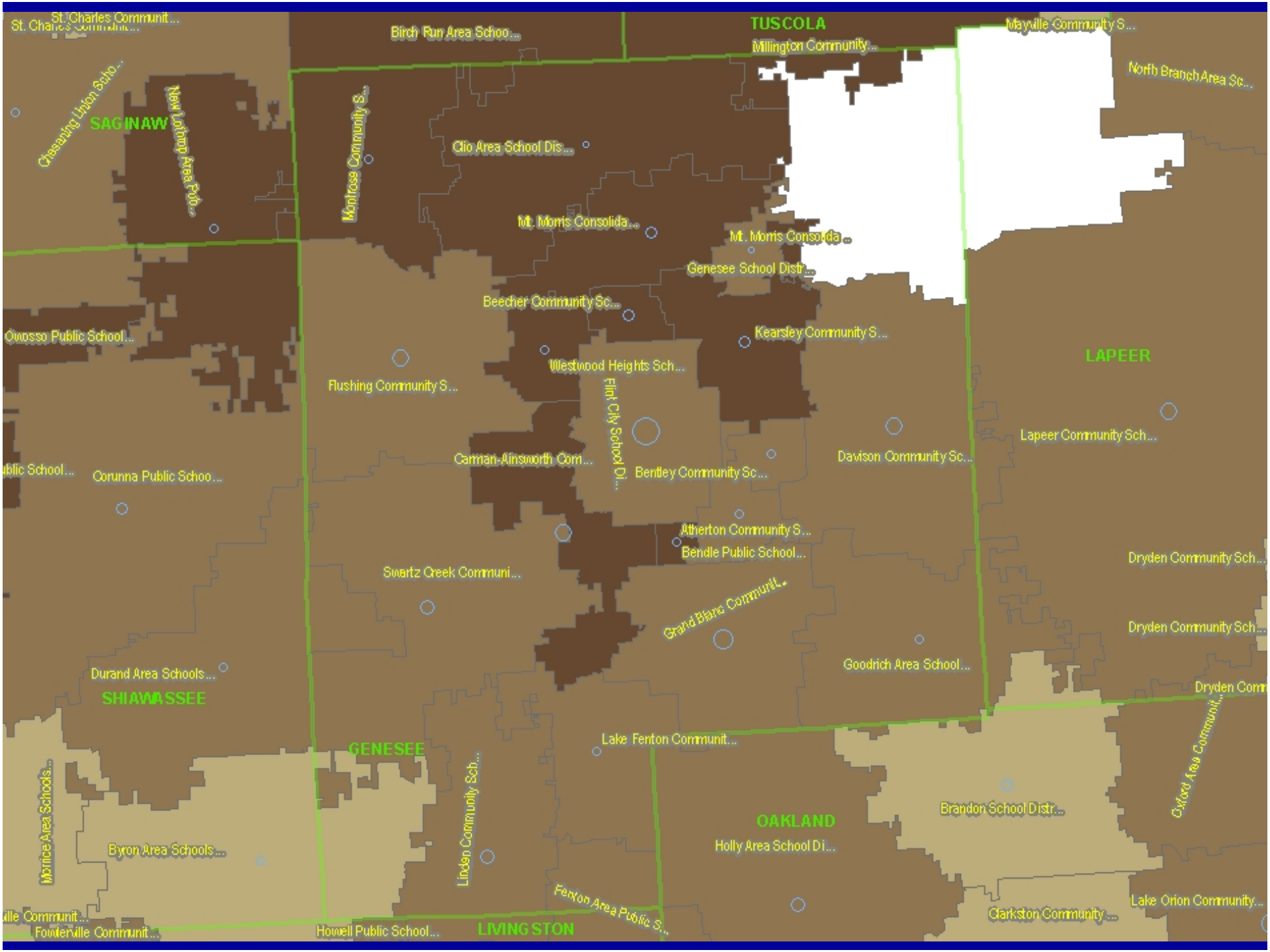

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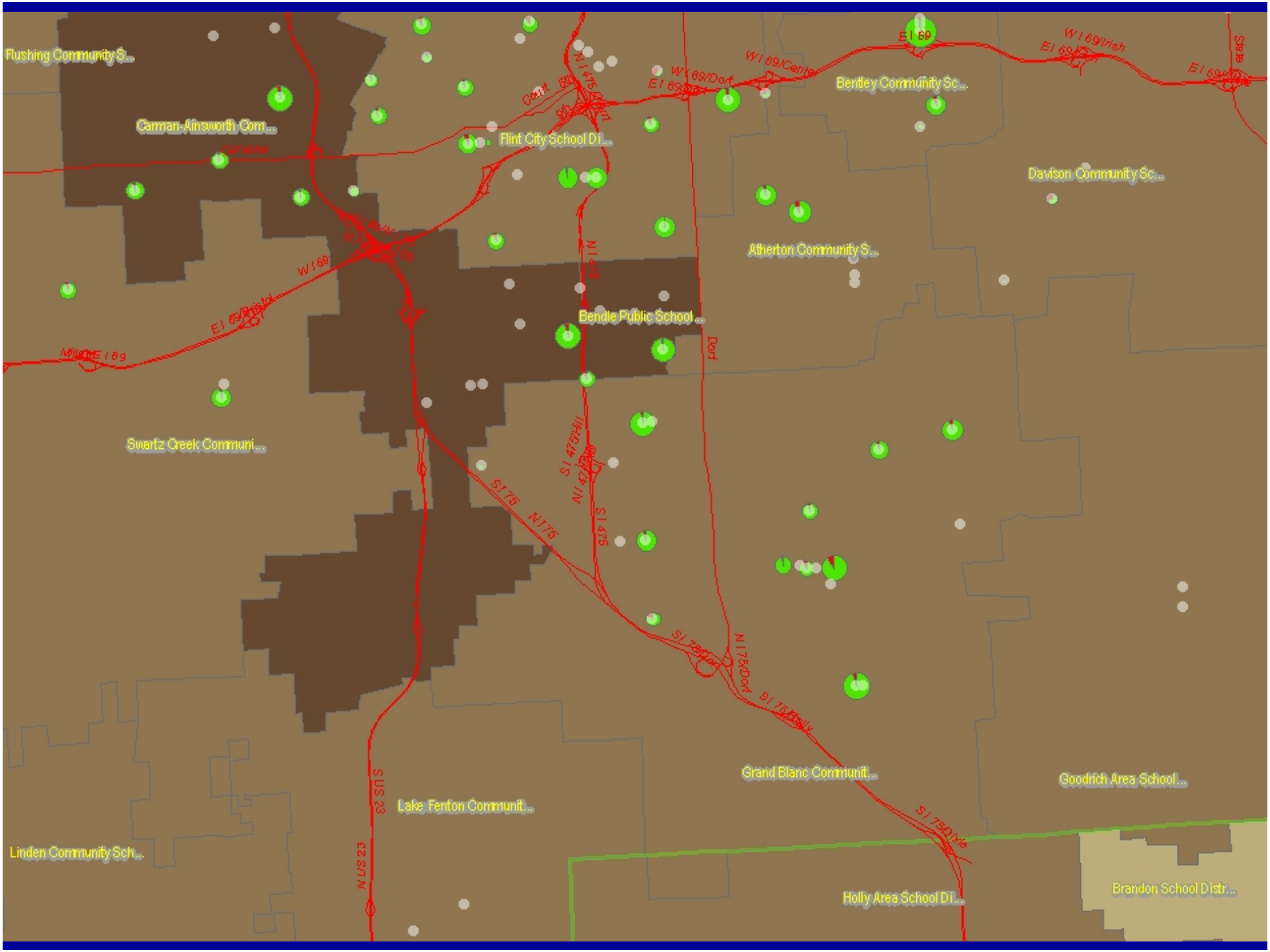

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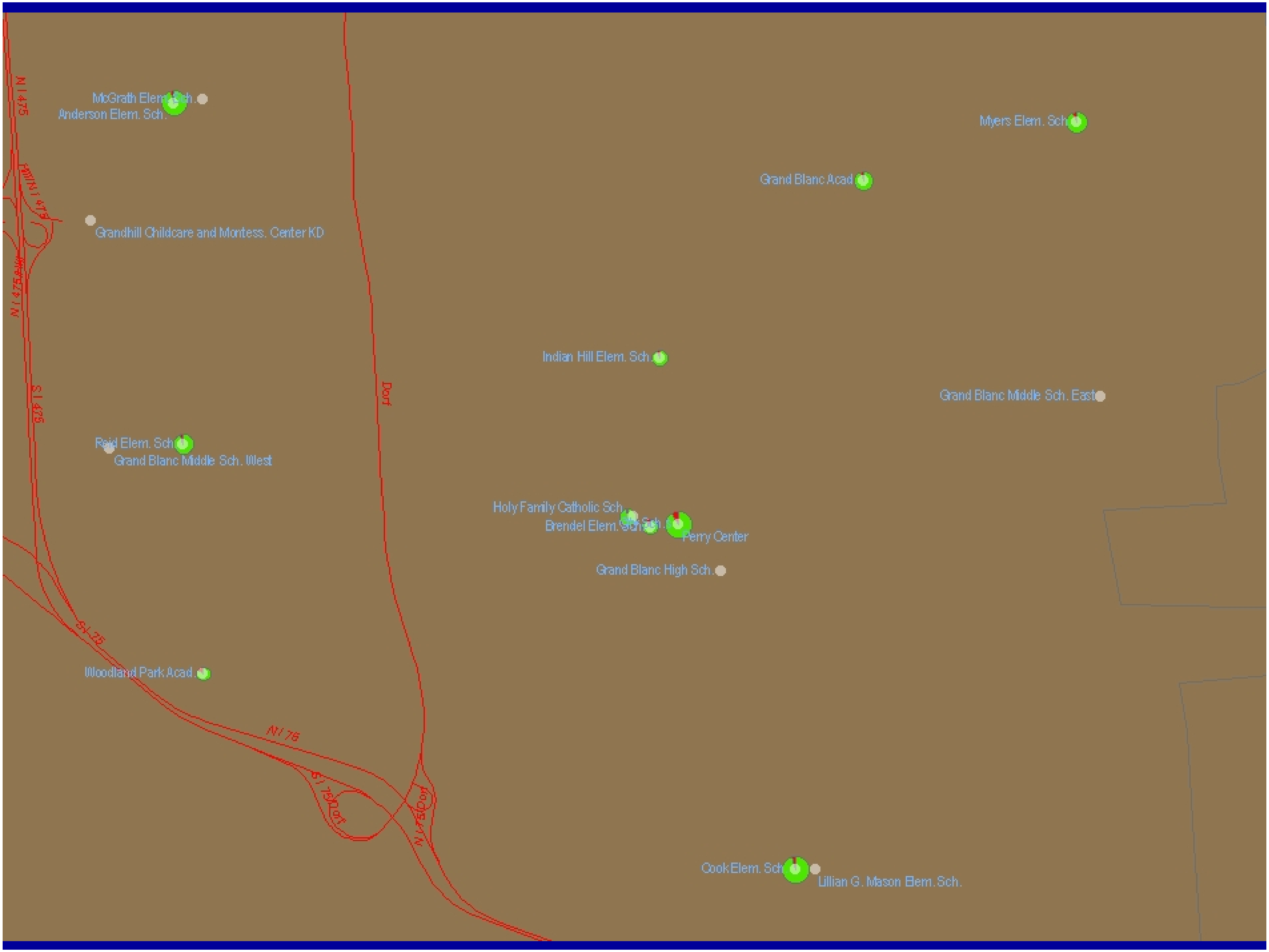

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Future plans

- The school district maps are helpful, but need more detail
- We are planning a web-based mapping application to allow creation of custom maps for the user's choice of:
  - vaccine(s)
  - age group
  - geographic area

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Acknowledgements

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Genesee County Health Dept.

Kevin Czubachowski, Mich. Dept. Comm. Health

Questions?

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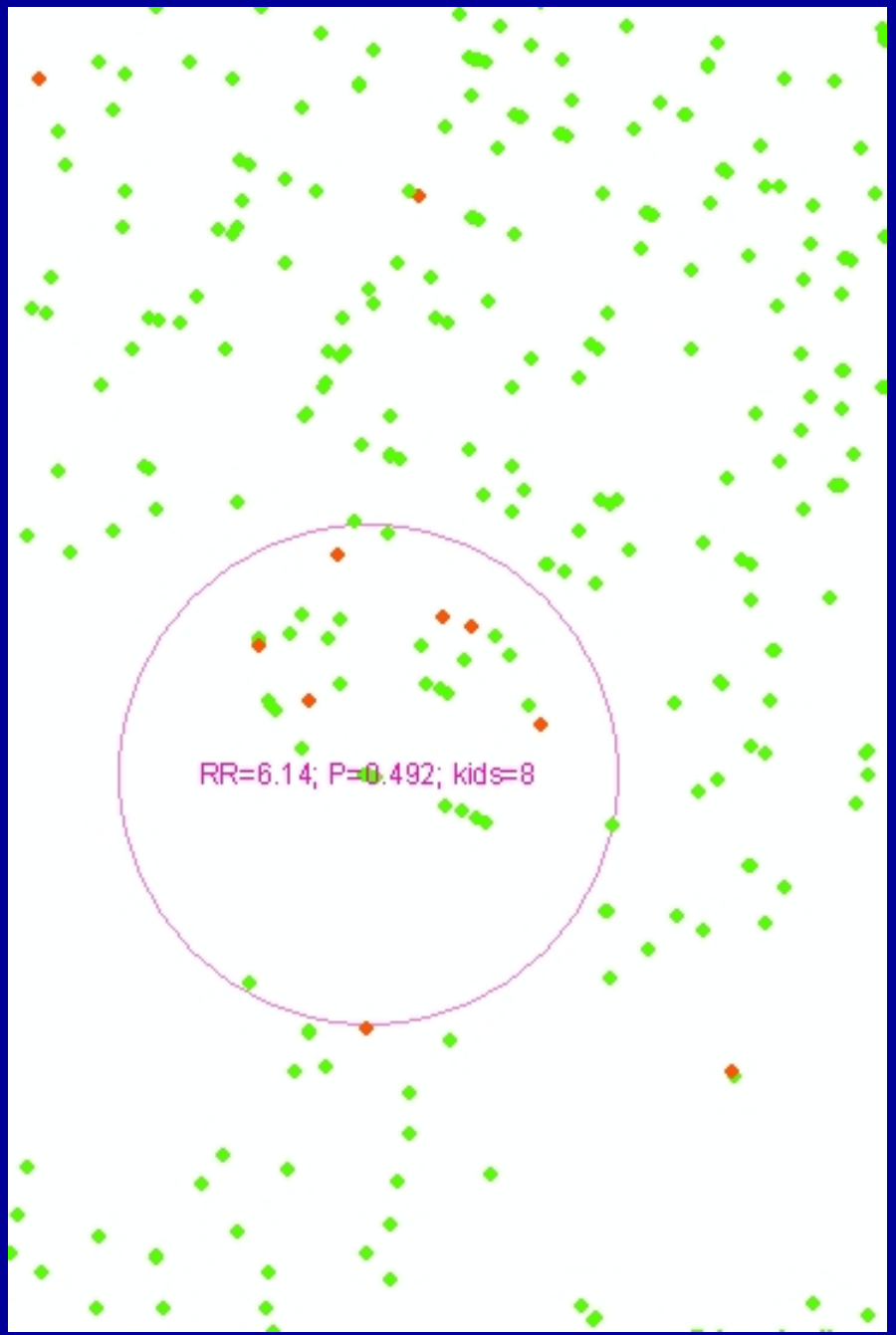
Methods: Cluster analysis

- Determines where a factor is more common than population would suggest
- Generates circular clusters; provides relative risk & P-value for each cluster
- SaTScan (free software)



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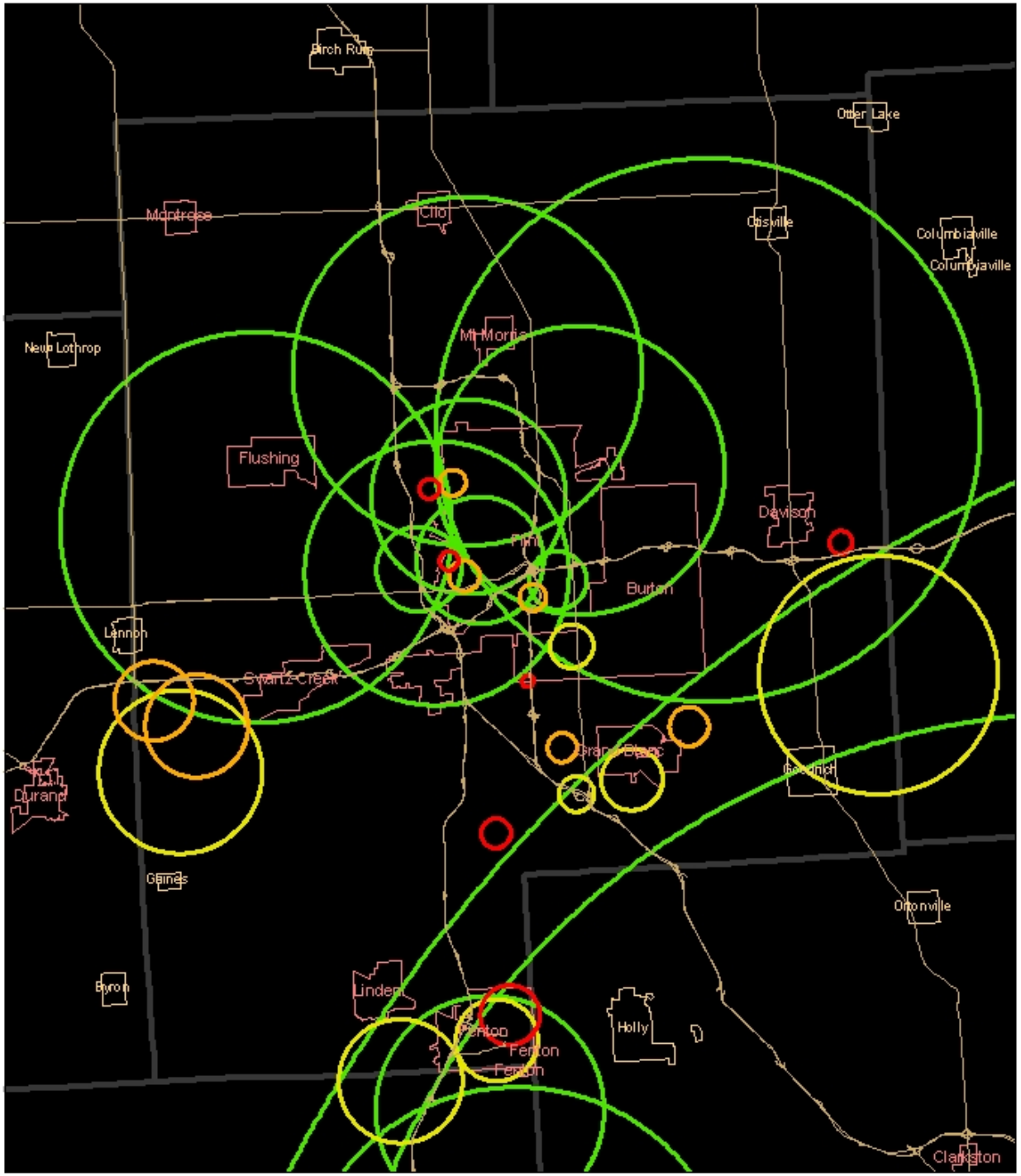

Clustering of
19-35 mo. olds on
28 Feb. 2007 who lack
DTaP iz.,
Genesee County

N

Miles
0 1.25 2.5 5 7.5 10

For illustration only. Cluster locations & sizes have been randomly changed.

stroads_miv6b
resultsFeb07newFuzzBuf
REL_RISK
1.18 - 2.00
2.01 - 3.00
3.01 - 4.00
4.01 - 7.23
village_miv6b_ds
city_miv6b
county_miv6b

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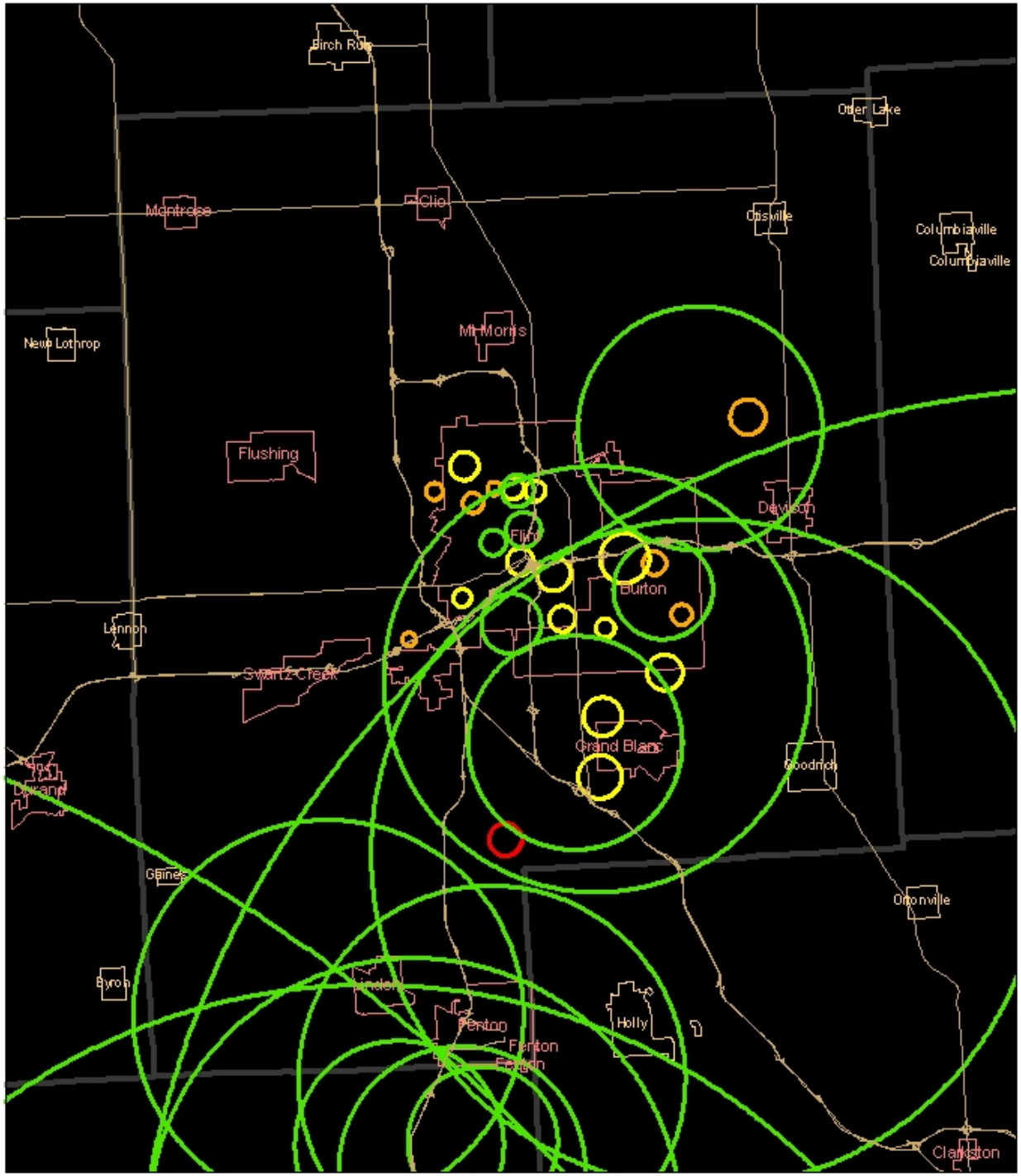

Clustering of
19-35 mo. olds on
28 Feb. 2007 who lack
PCV7 iz.,
Genesee County

N

Miles
0 1.25 2.5 5 7.5 10

For illustration only. Cluster locations & sizes have been randomly changed.

stroads_miv6b
resultsFeb07newBufFuzz
REL_RISK
1.15 - 2.00
2.01 - 3.00
3.01 - 4.00
4.01 - 4.66
village_miv6b_ds
city_miv6b
county_miv6b

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SaTScan settings

- Max cluster size: 50% of population
- Clusters of high RR only
- Bernoulli model (1/0)
  - (immunized/unimmunized)
- No pairs of centers both in each other's clusters

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Density map settings

- Density type: kernel
- Cell size: 50m
- Kernel radius: 1 km
- Output area units: kids/mile^2 or iz./mile^2
- Color steps: Factor of 1.67

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