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Assessment of NOx emissions over the San Joaquin Valley: Emission Inventory and Spatio-Temporal Variability

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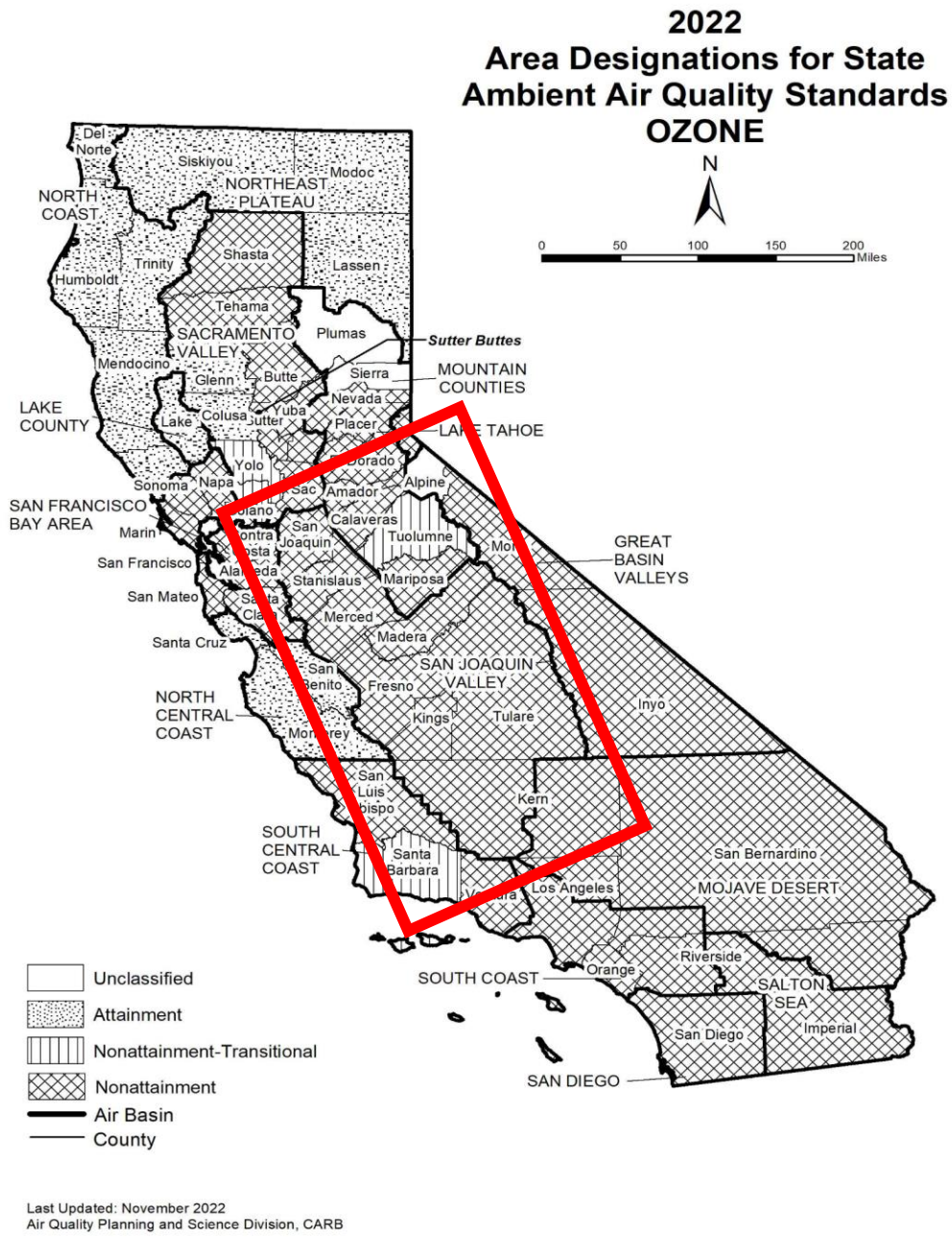
Background

- Nitrogen Oxides (NOx) are reactive gases that serve as precursor to tropospheric ozone formation and cause adverse health impacts.
- NOx sources are diverse and difficult to track:
  - Anthropogenic: Mobile sources, stationary sources, and biomass burning
  - Biogenic: Forest fires and soil microorganism nitrification and denitrification byproduct



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Re-Evaluating the Chemistry of Air Pollutants in California (RECAP) NOx Flux Field Campaign

- University of California Berkley in contract with the California Air Resources Board (Contract: 20RD003)
- Airborne eddy covariance NOx flux measurements over Los Angeles and the San Joaquin Valley in June 2021.
- Measured NOx Flux over a variety of land use types including highways, urban areas, and cropland.
- NOx flux was compared to air quality modeling conducted by the California Air Resources Board (CARB) .

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California Air Resources Board (CARB) Modeling Inventory Development

- Modeling inventory was generated for 2021 using:
  - **Area and Point Sources:** California Emissions Inventory Data Analysis and Reporting System (CEIDARS) and California Emissions Projection Analysis Model (CEPAM) 2022 Ozone State Implementation Plan Version 1.01
  - **On-Road:** Emission Factor (EmFAC) 2021 Version1.02 MPO11
  - **Biogenic:** Model of Emissions of Gases and Aerosols from Nature (MEGAN) Version 3.0

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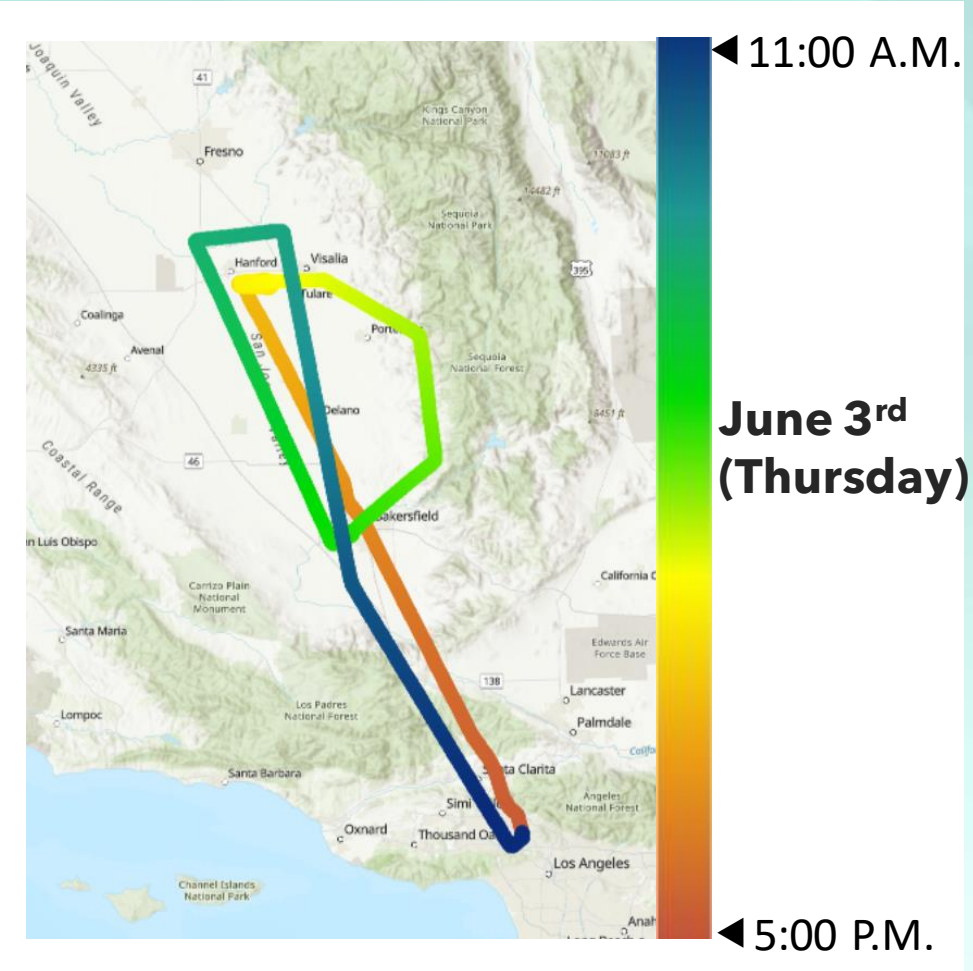
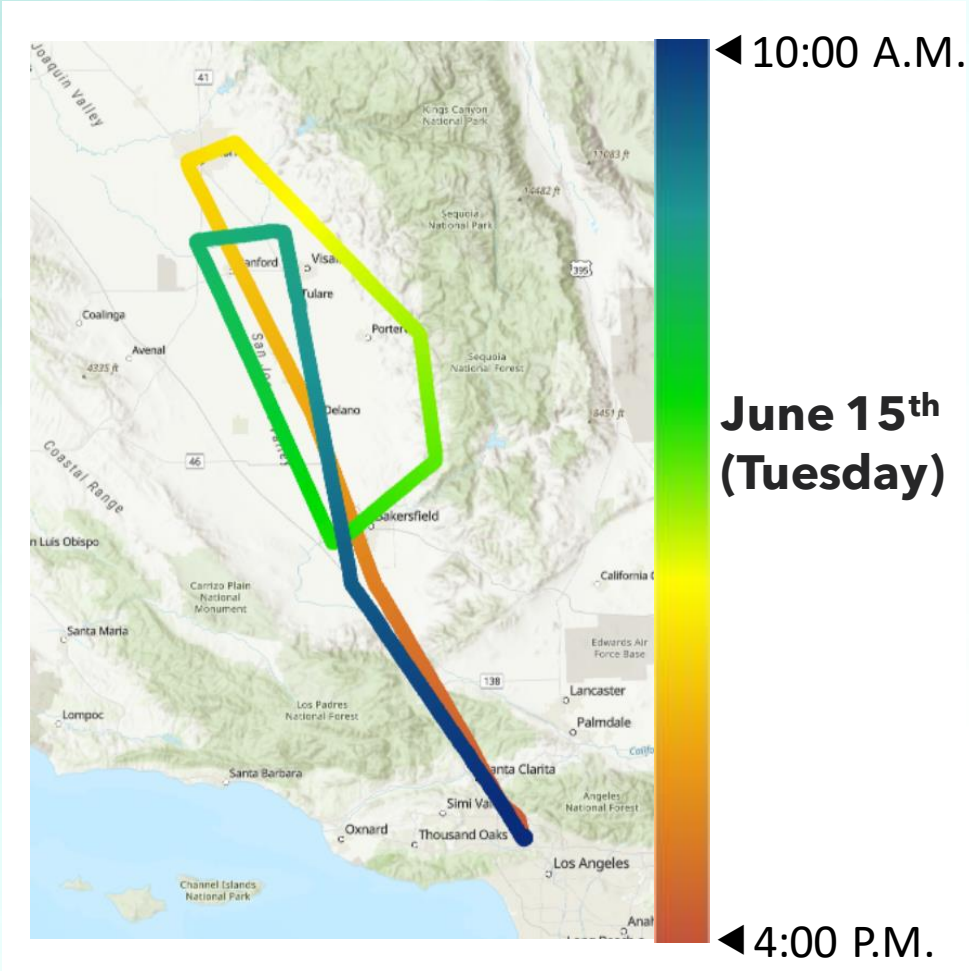
Re-Evaluating the Chemistry of Air Pollutants in California (RECAP) Flight Paths





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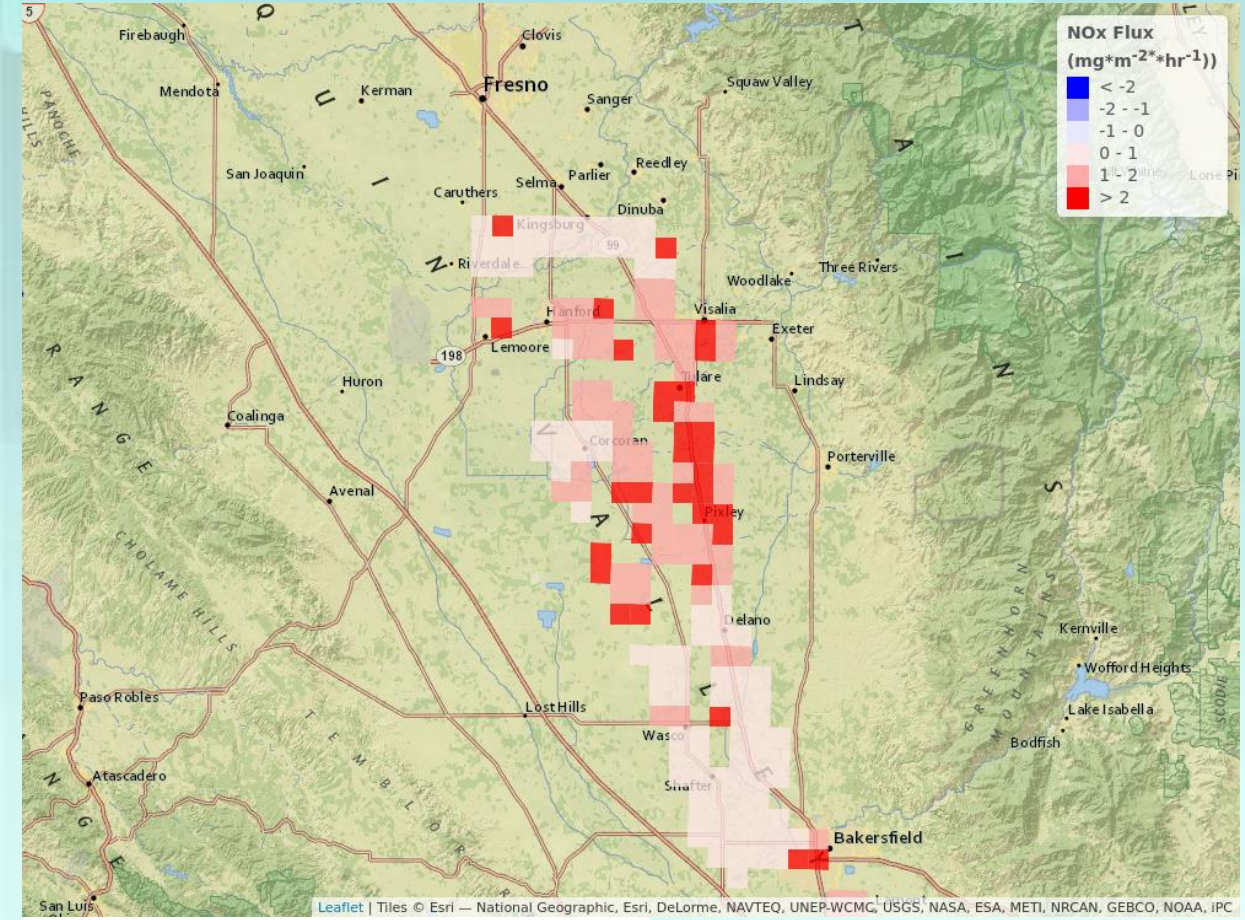
Re-Evaluating the Chemistry of Air Pollutants in California (RECAP) NOx Flux Measurements



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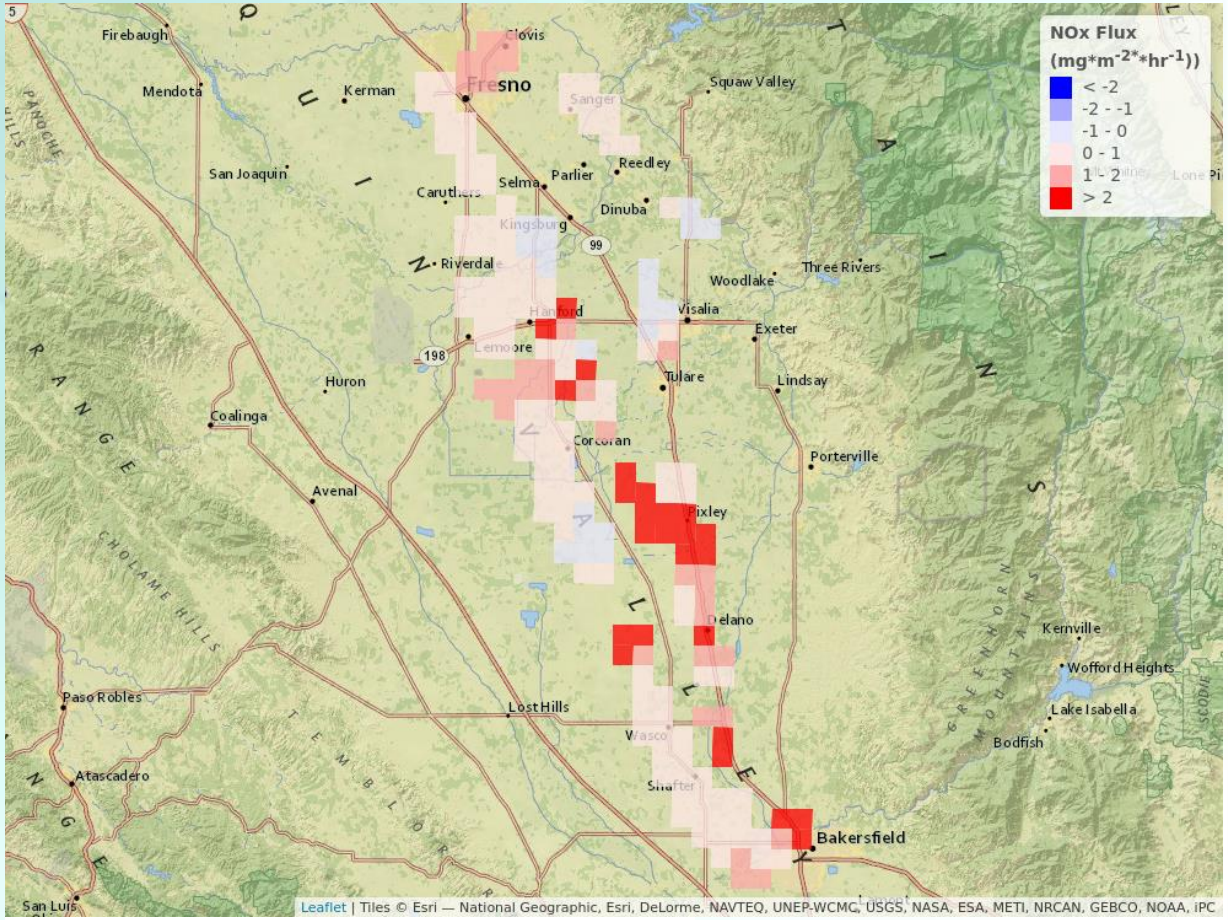

June 15th (Tuesday) 2021

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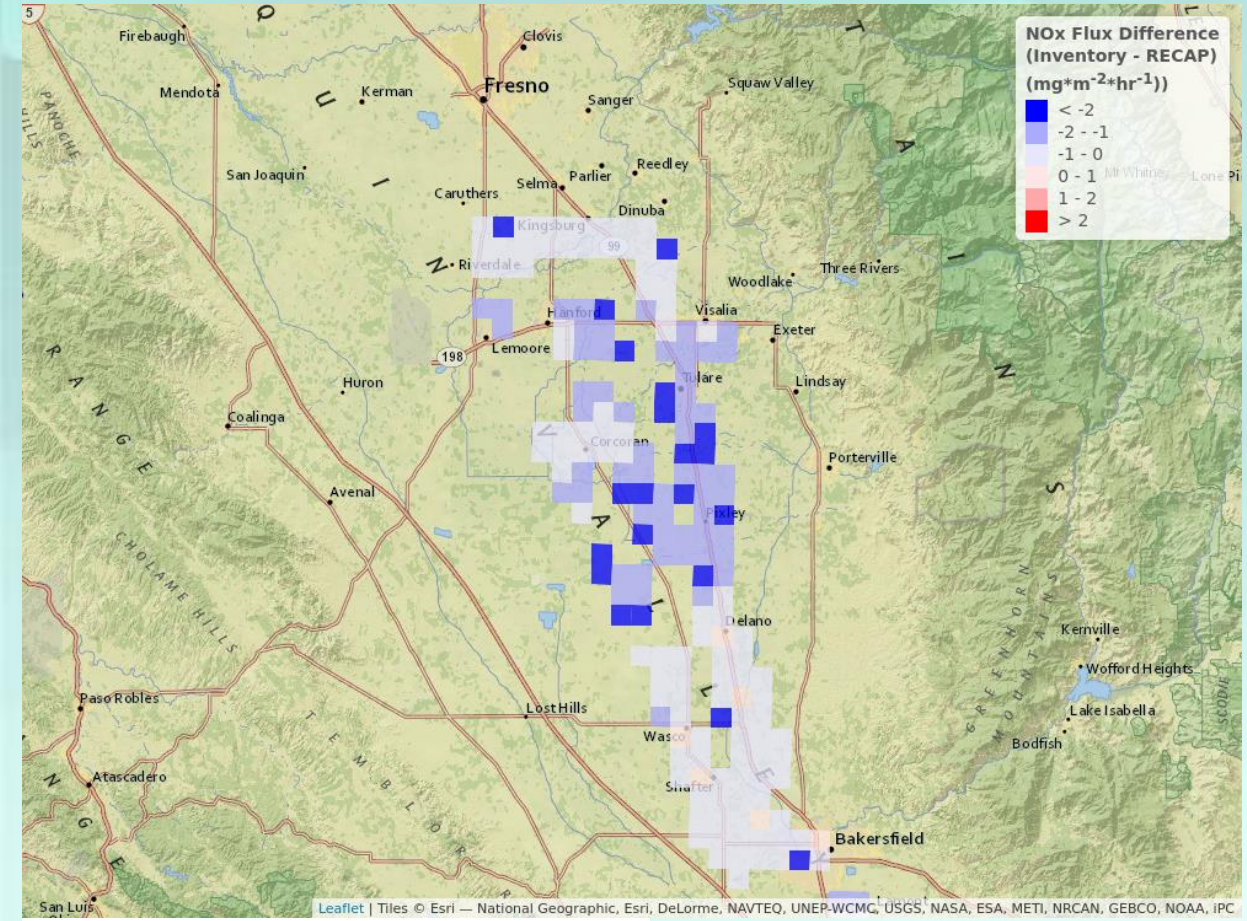
California Air Resources Board (CARB) NOx Flux Modeling Inventory Comparison



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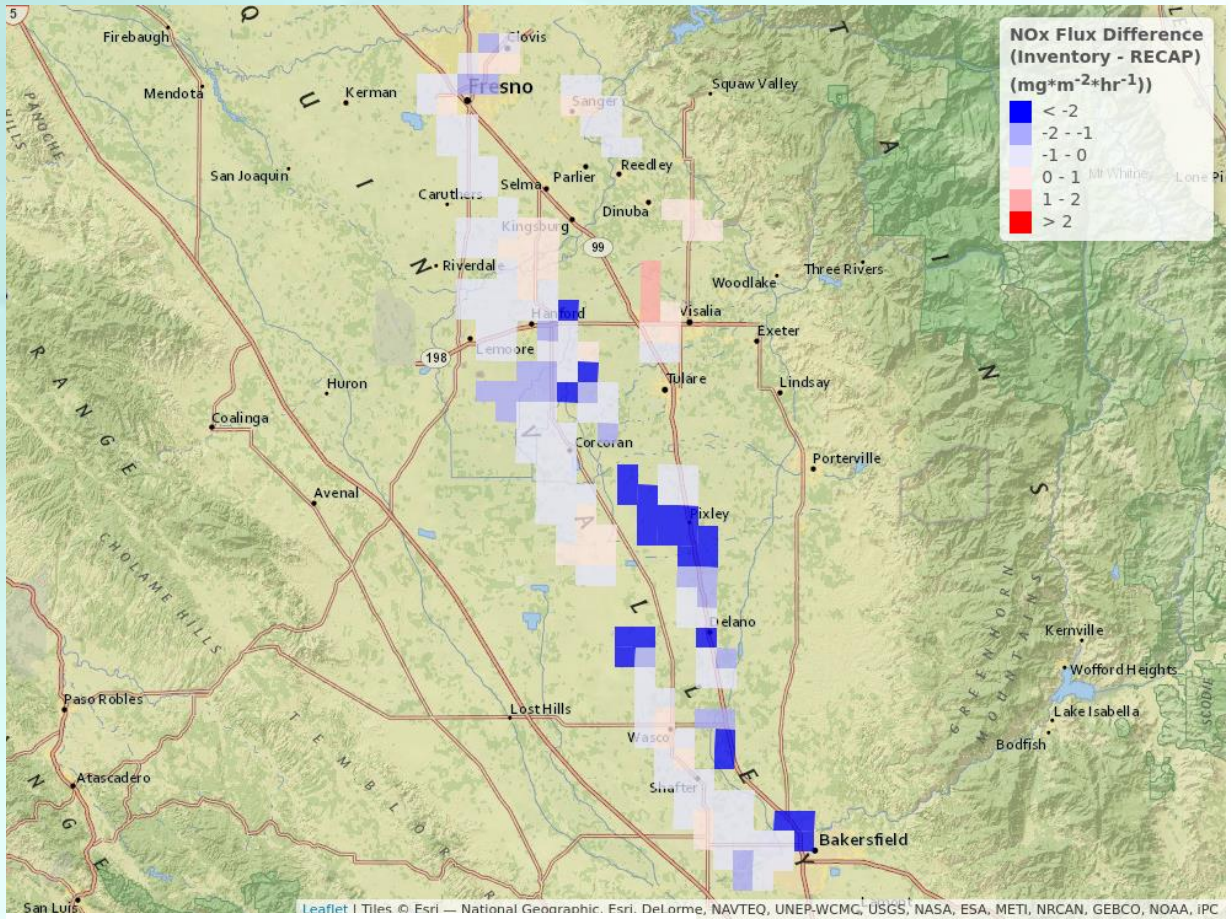

June 15th (Tuesday) 2021

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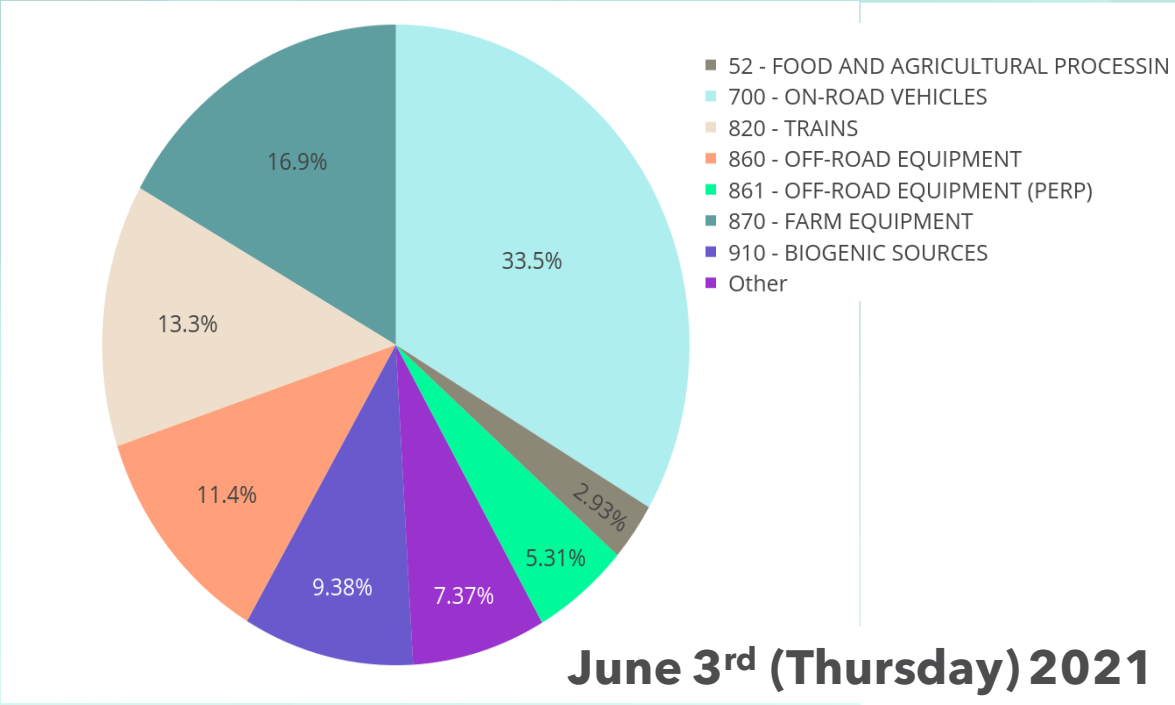
California Air Resources Board (CARB) NOx Flux Modeling Inventory Source Comparison June 3rd

| CARB Inventory – RECAP | < 1 mg*m^{-2}*hr^{-1}



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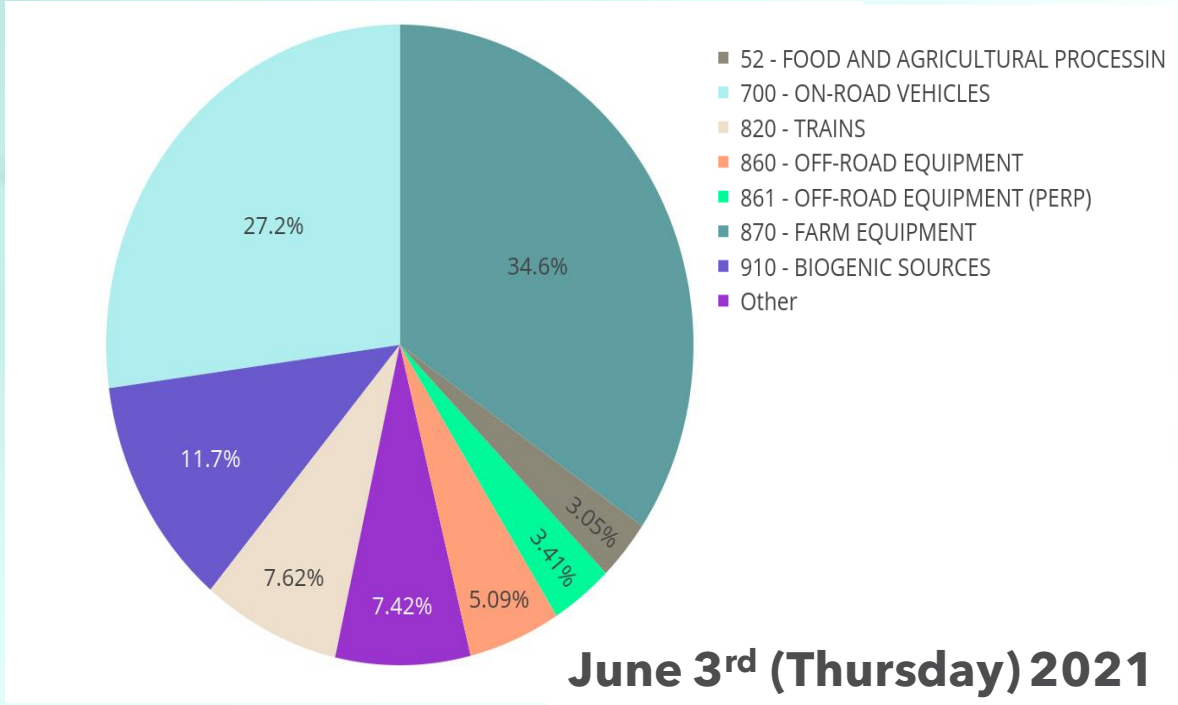
CARB Inventory – RECAP < -2 mg*m^{-2}*hr^{-1}

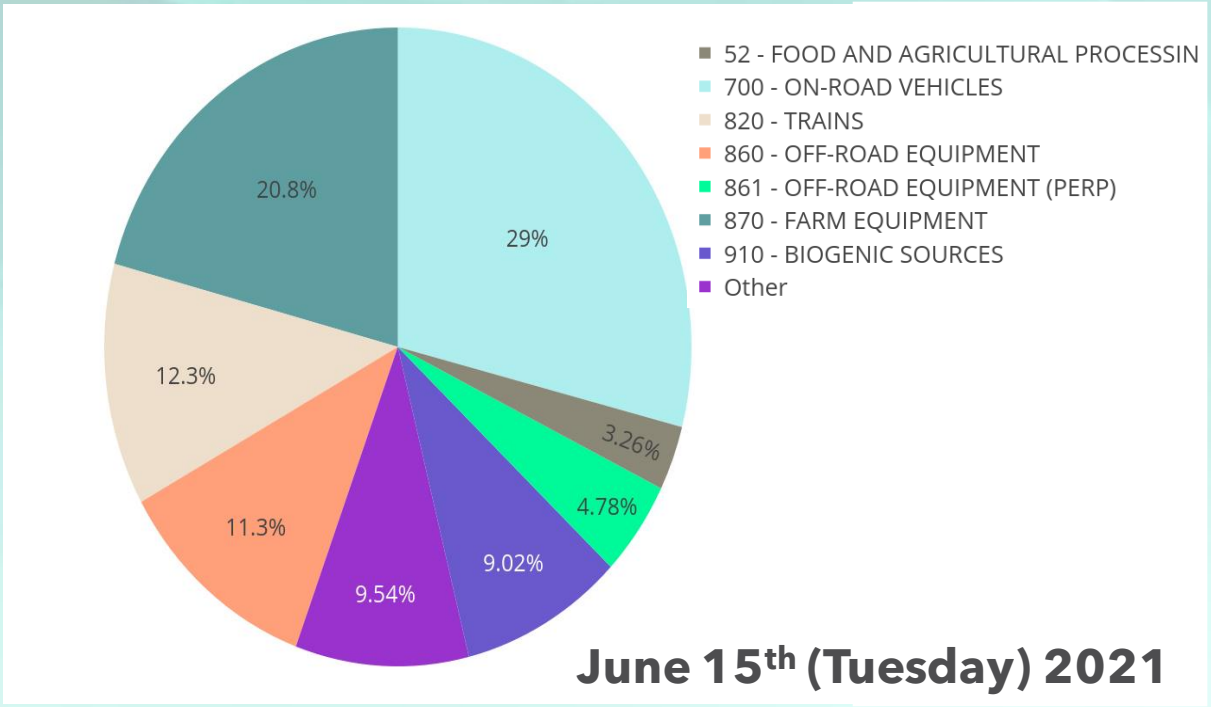


June 3rd (Thursday) 2021

CARB

California Air Resources Board (CARB) NOx Flux Modeling Inventory Source Comparison June 15th

| CARB Inventory – RECAP | < 1 $mg*m^{-2}*hr^{-1}$



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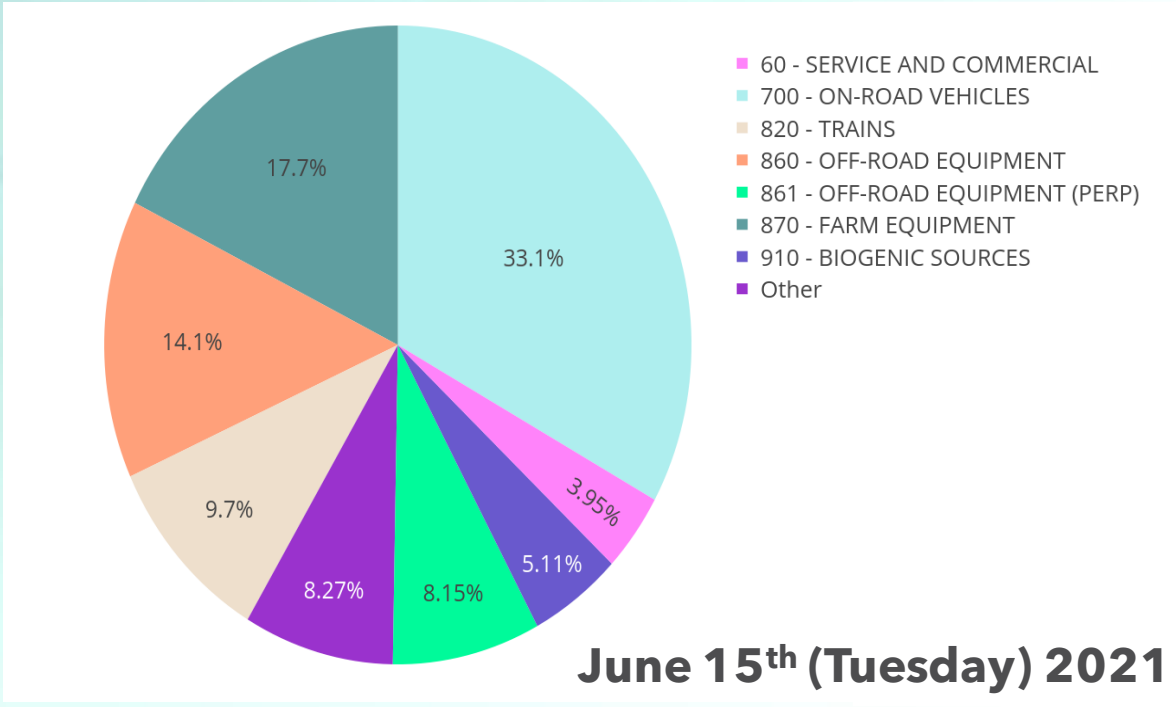

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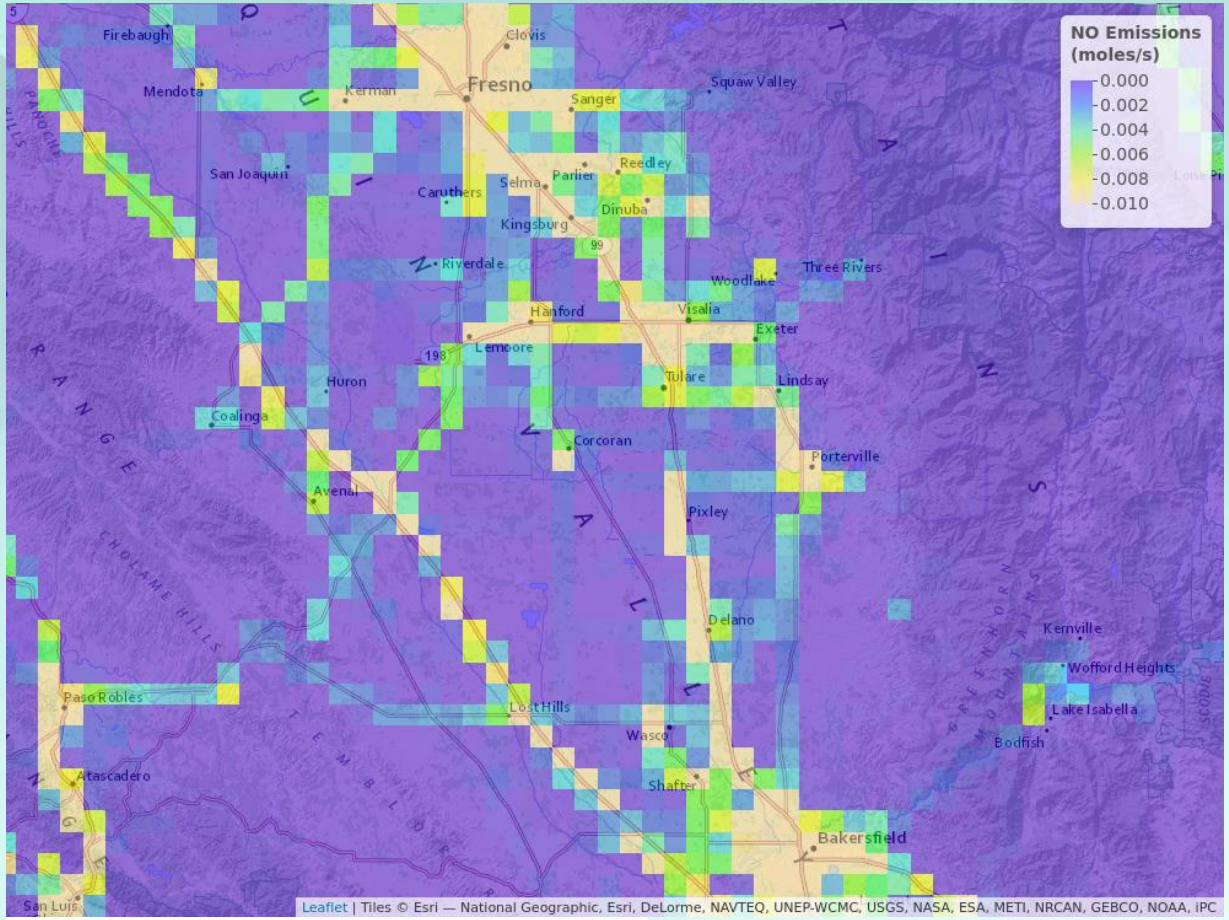
California Air Resources Board (CARB) Modeling Inventory On-Road Sources Spatial Distribution



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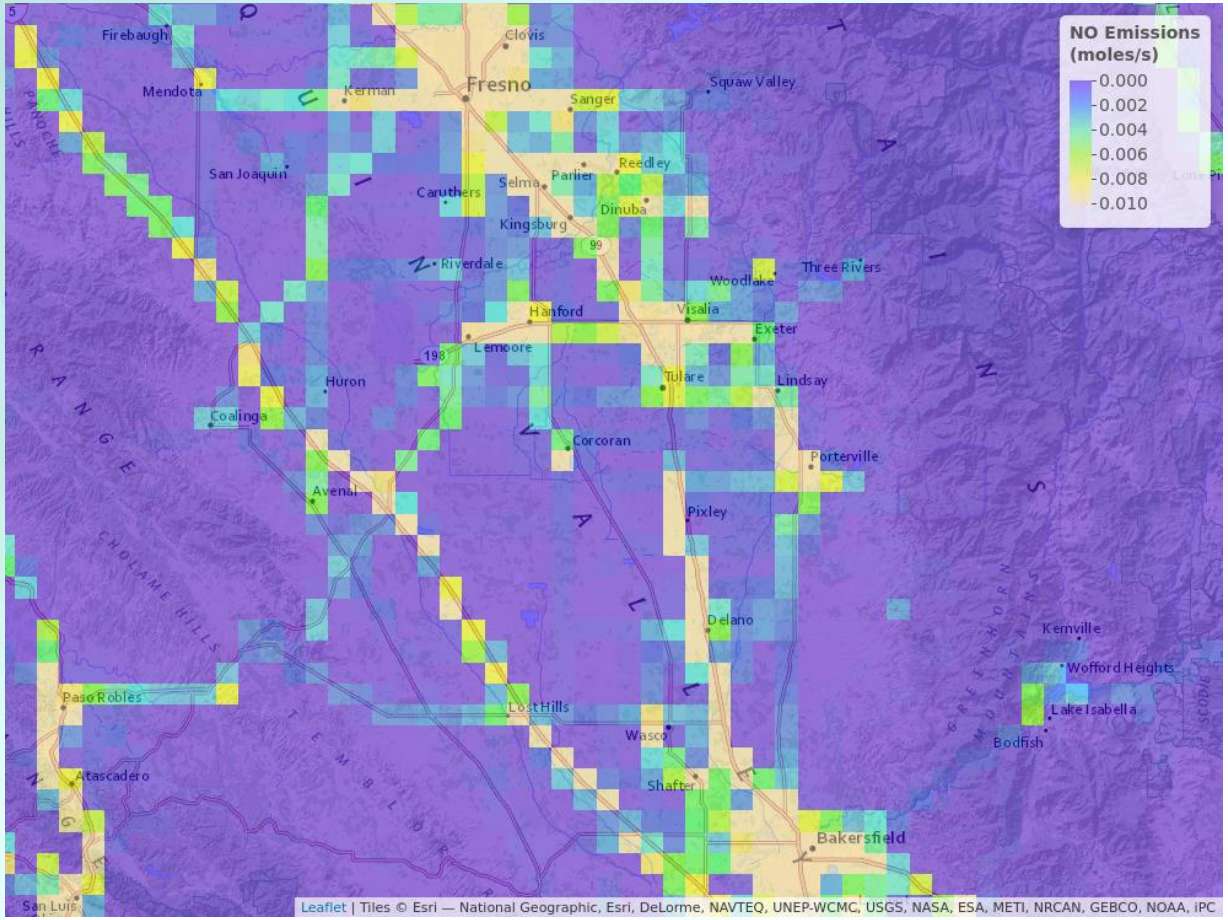

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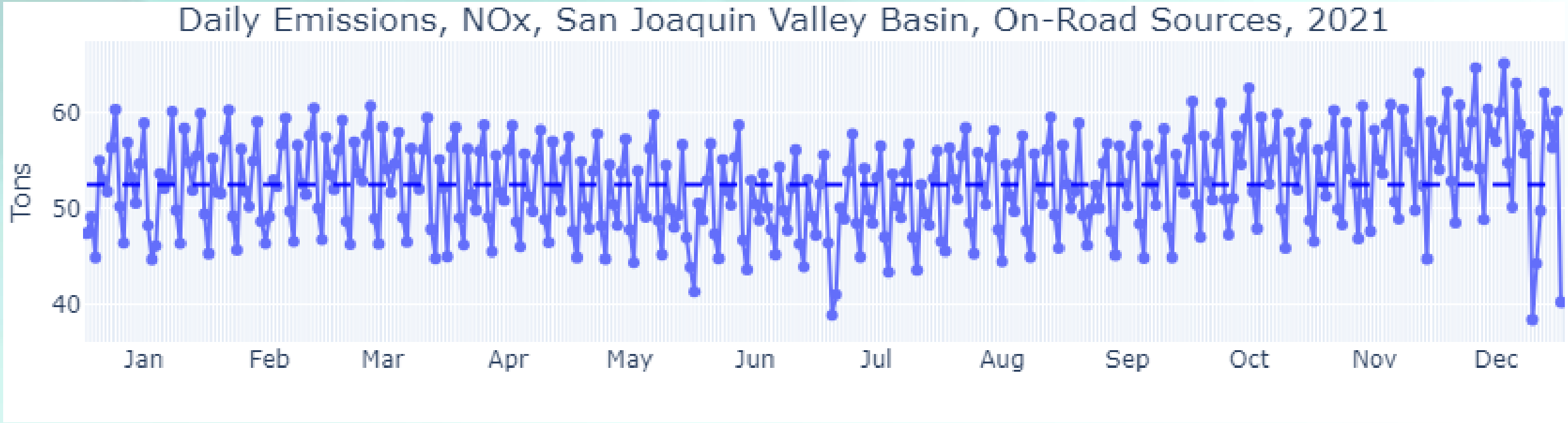

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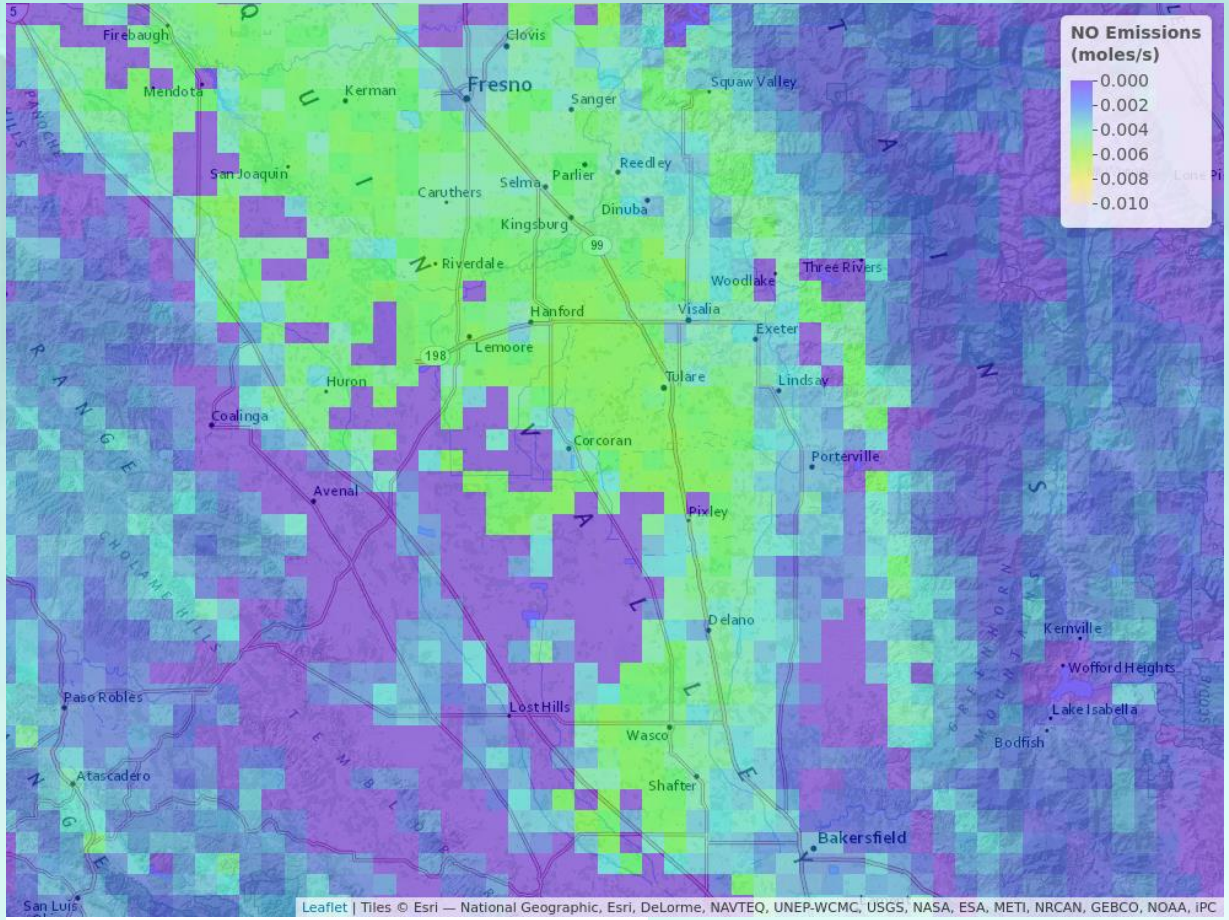
California Air Resources Board (CARB) Modeling Inventory Biogenic Sources Spatial Distribution



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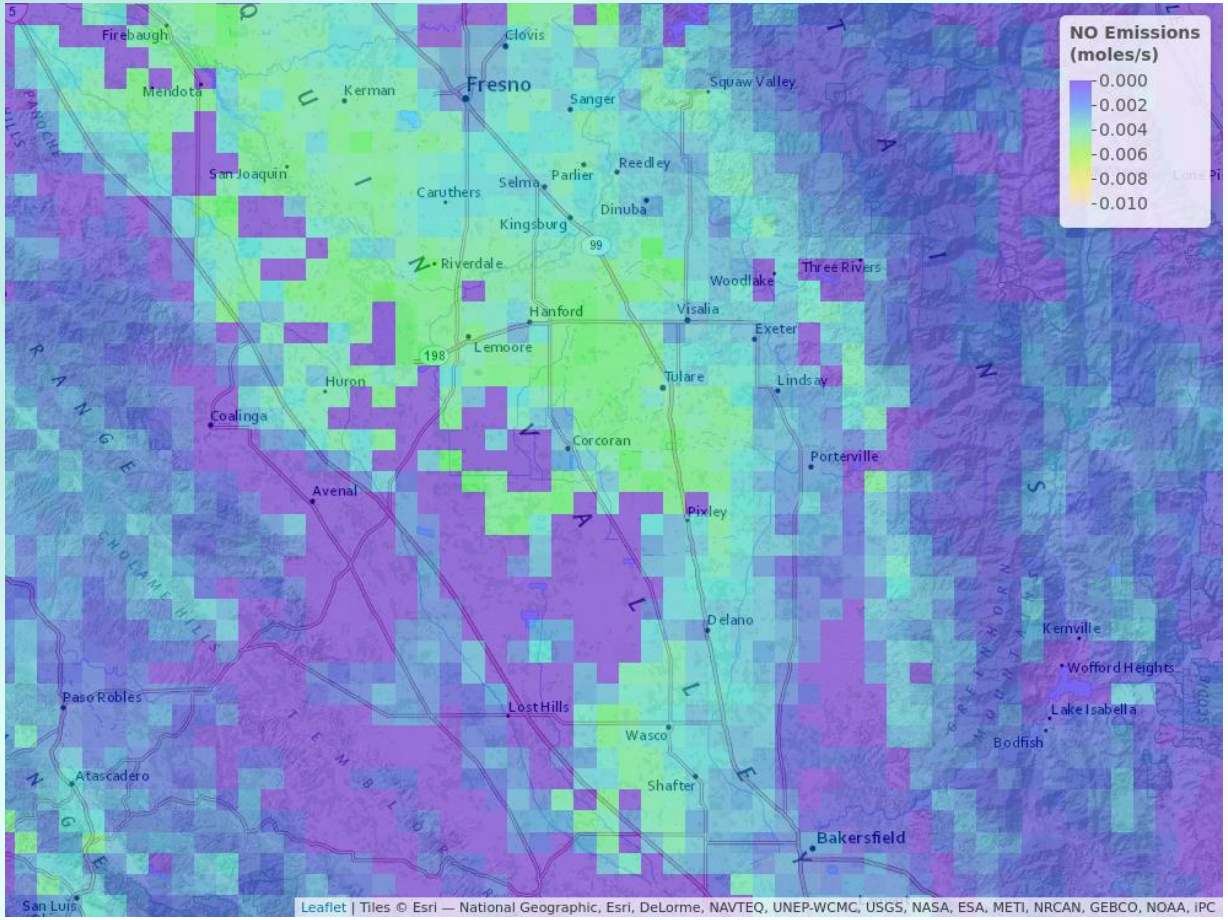

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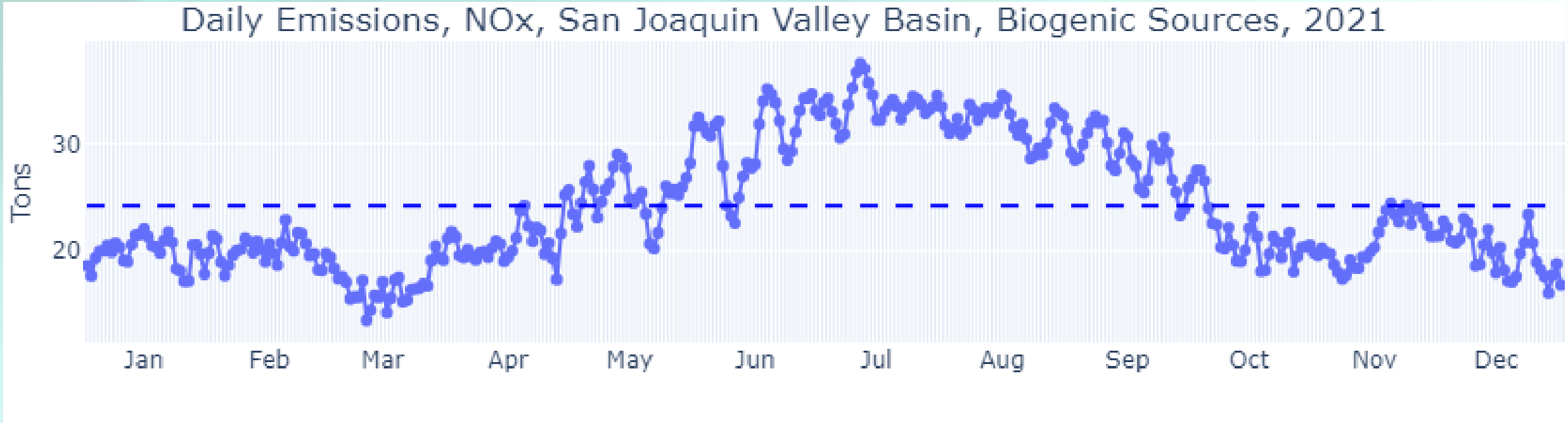
California Air Resources Board (CARB) Modeling Inventory Biogenic Sources Temporal Distribution



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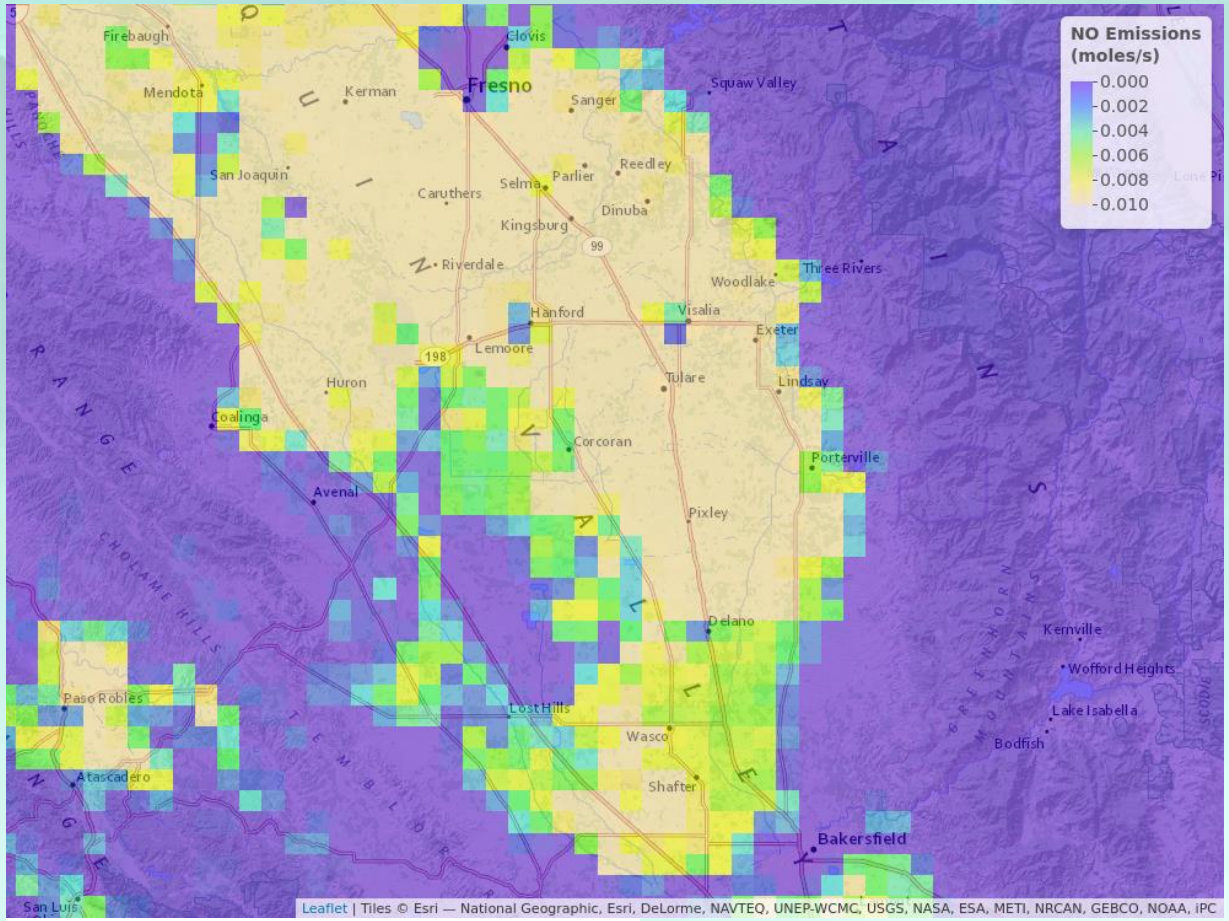
California Air Resources Board (CARB) Modeling Inventory Farm Equipment Spatial Distribution



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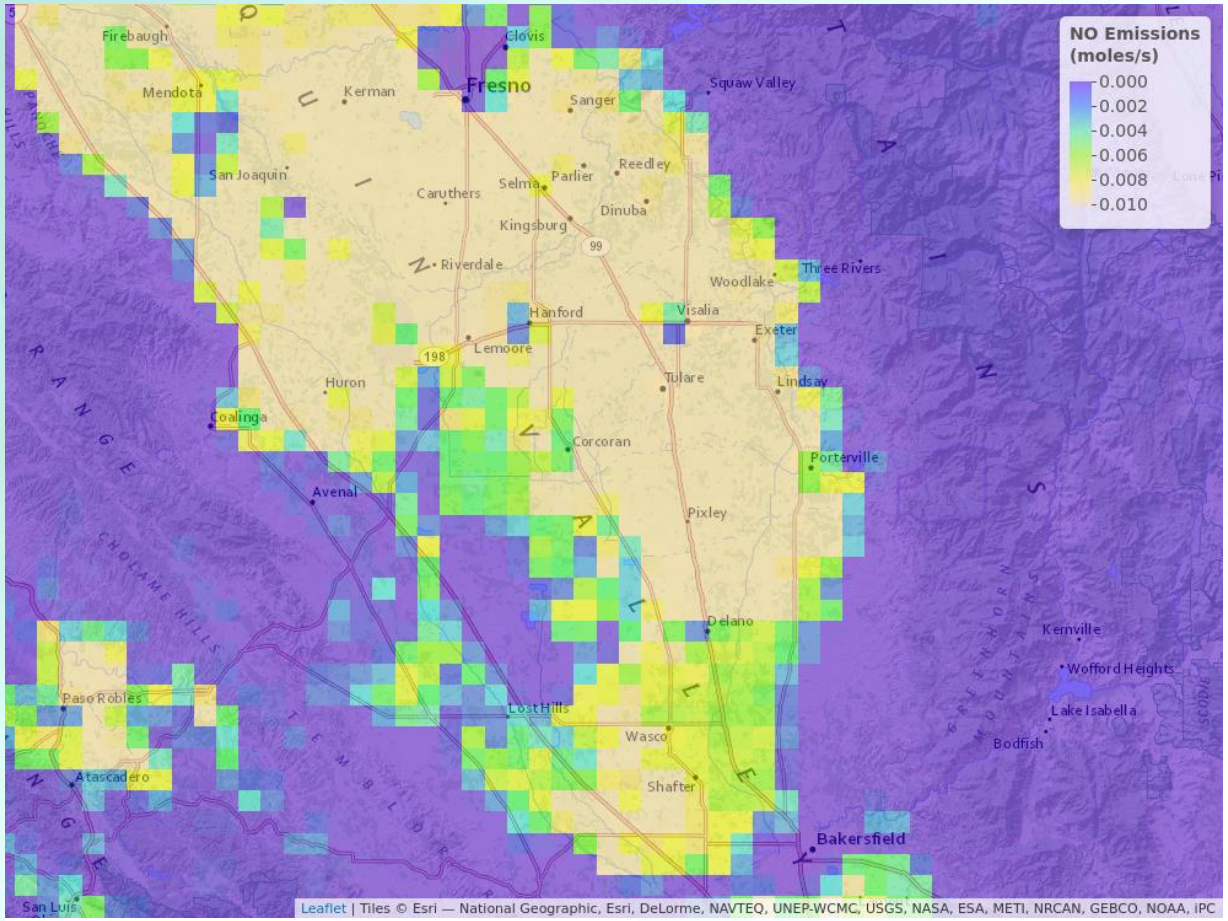

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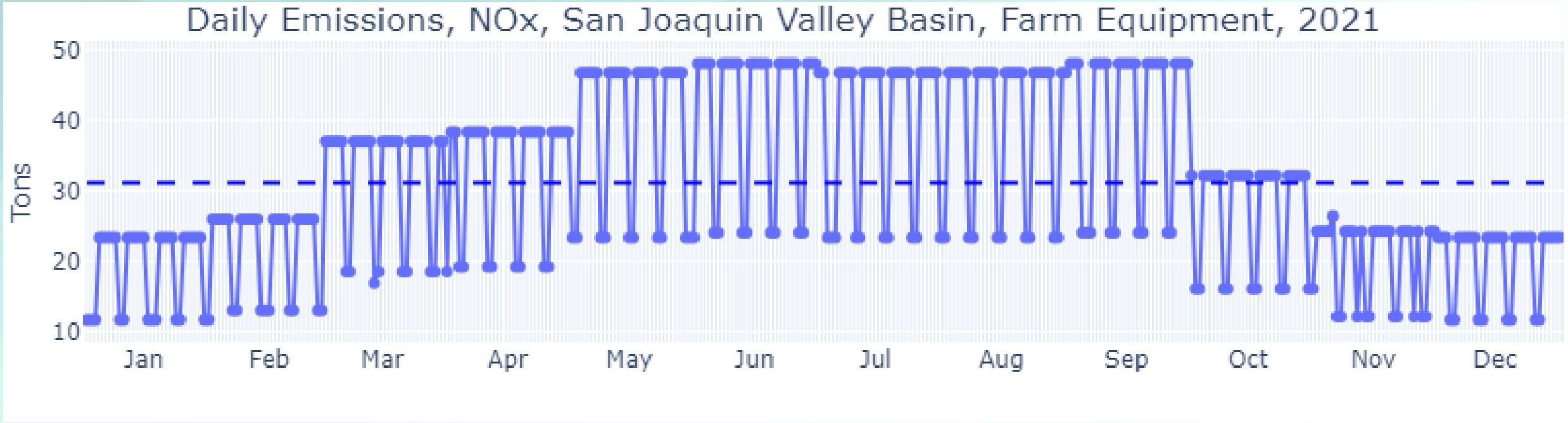
California Air Resources Board (CARB) Modeling Inventory Farm Equipment Distribution



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Conclusion

- Sources contributing to NOx are diverse and difficult to capture in an inventory
- Some differences from flux measurements in select areas of San Joaquin Valley
  - Sensitivity of footprint calculations and gridding resolution
  - Modeling resolution differences
  - Assumptions made in calculating inventory flux
- Continued review of major sectors in the modeling inventory

Acknowledgements

- Ron Cohen, Allen Goldstein and the UC Berkley research team for there efforts in collecting and analyzing the data in collaboration with CARB.
- Majiong Jiang, Dazhong Yin, and Chenxia Cai for their thorough comparisons and helpful collaboration in the review of these datasets.
- Melissa Venecek for her guidance and initiative to take on this analysis.

References

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Questions?