Oil and Gas Extraction Hazard Assessment in Los Angeles County
(Map 1/9) - Oil Well Distribution Across the County

21,259 wells (37 fracking wells)

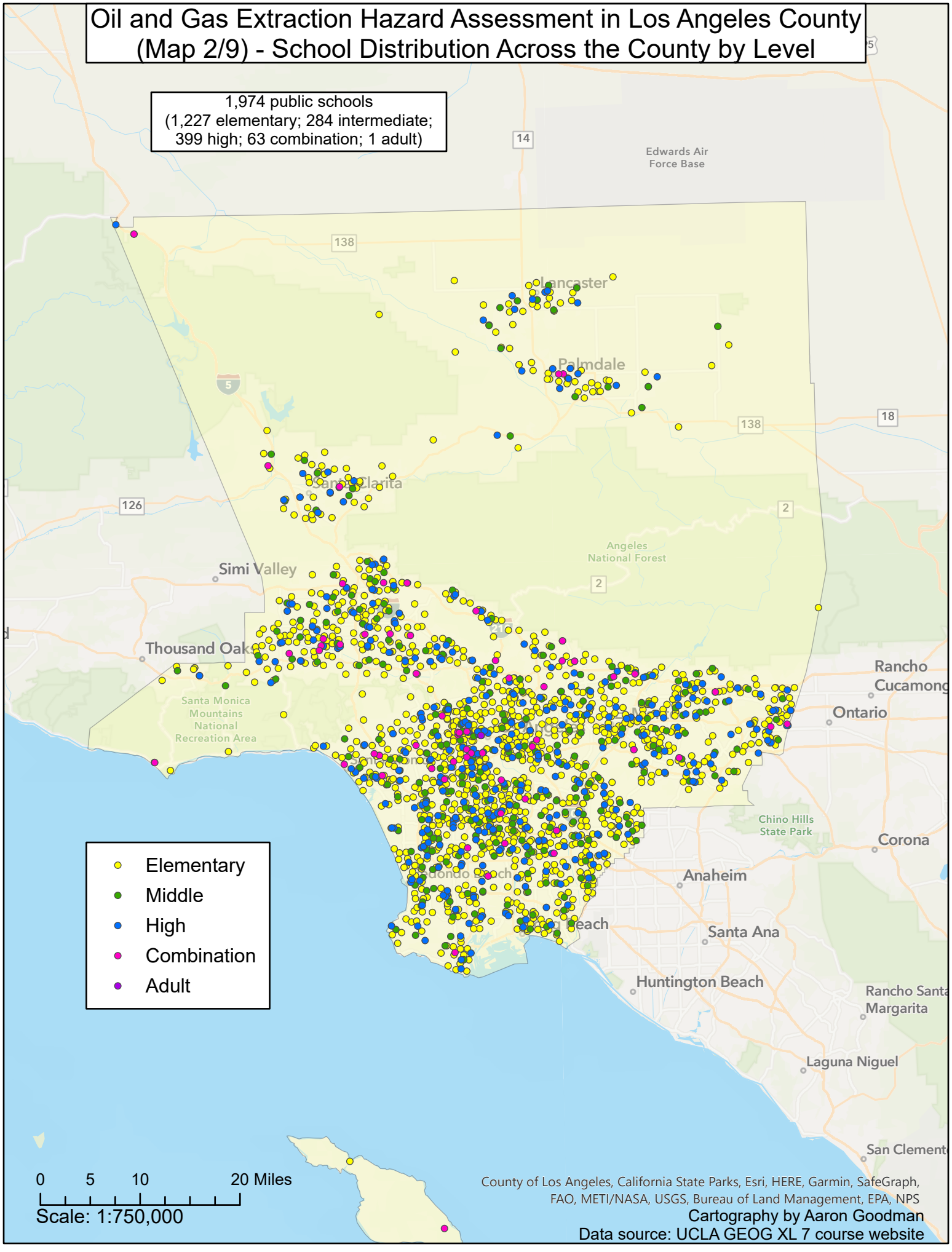
County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS

Cartography by Aaron Goodman

Data source: UCLA GEOG XL 7 course website

Oil and Gas Extraction Hazard Assessment in Los Angeles County (Map 2/9) - School Distribution Across the County by Level

1,974 public schools
(1,227 elementary; 284 intermediate;
399 high; 63 combination; 1 adult)



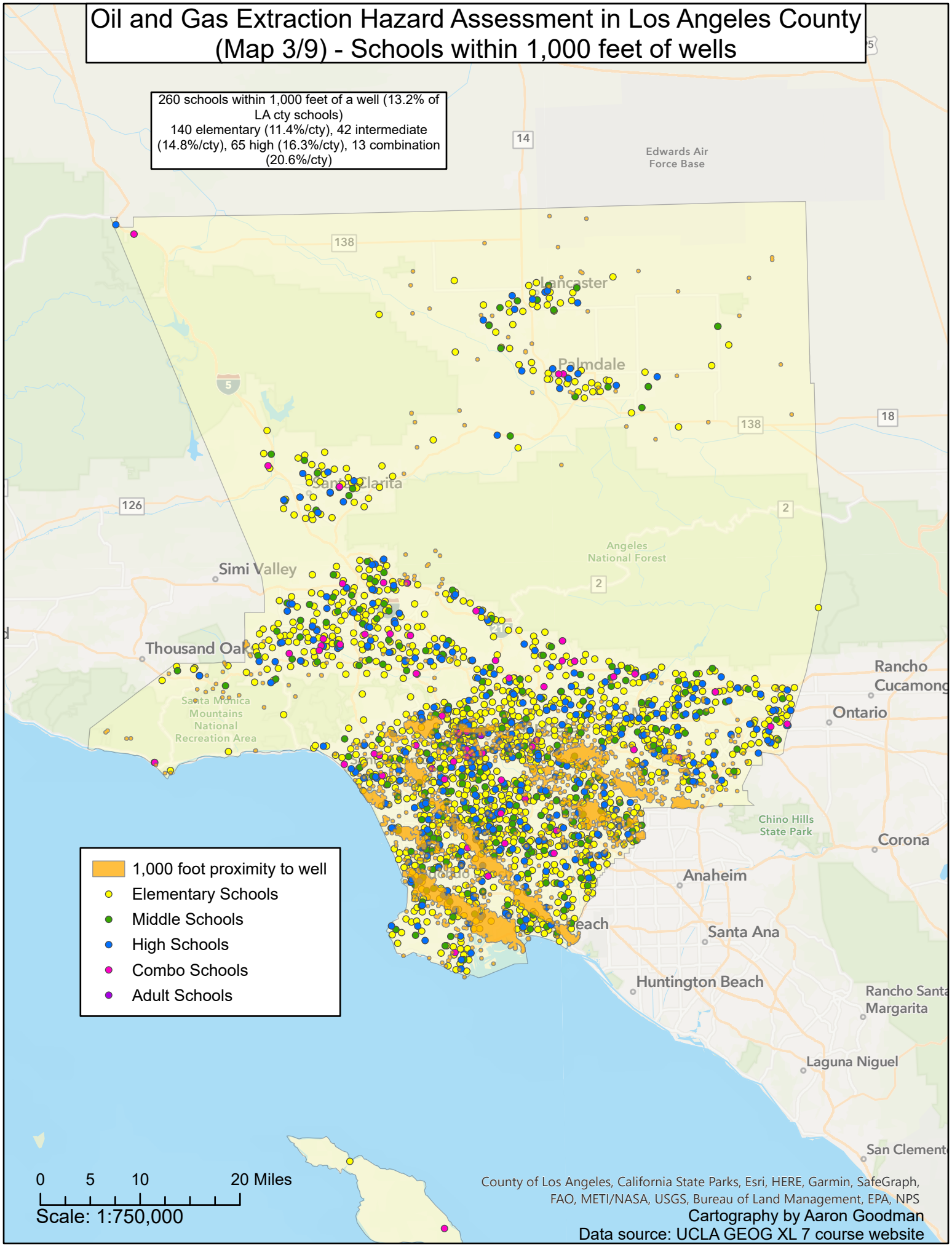
County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS

Cartography by Aaron Goodman

Data source: UCLA GEOG XL 7 course website

Oil and Gas Extraction Hazard Assessment in Los Angeles County (Map 3/9) - Schools within 1,000 feet of wells

260 schools within 1,000 feet of a well (13.2% of LA cty schools)
140 elementary (11.4%/cty), 42 intermediate (14.8%/cty), 65 high (16.3%/cty), 13 combination (20.6%/cty)



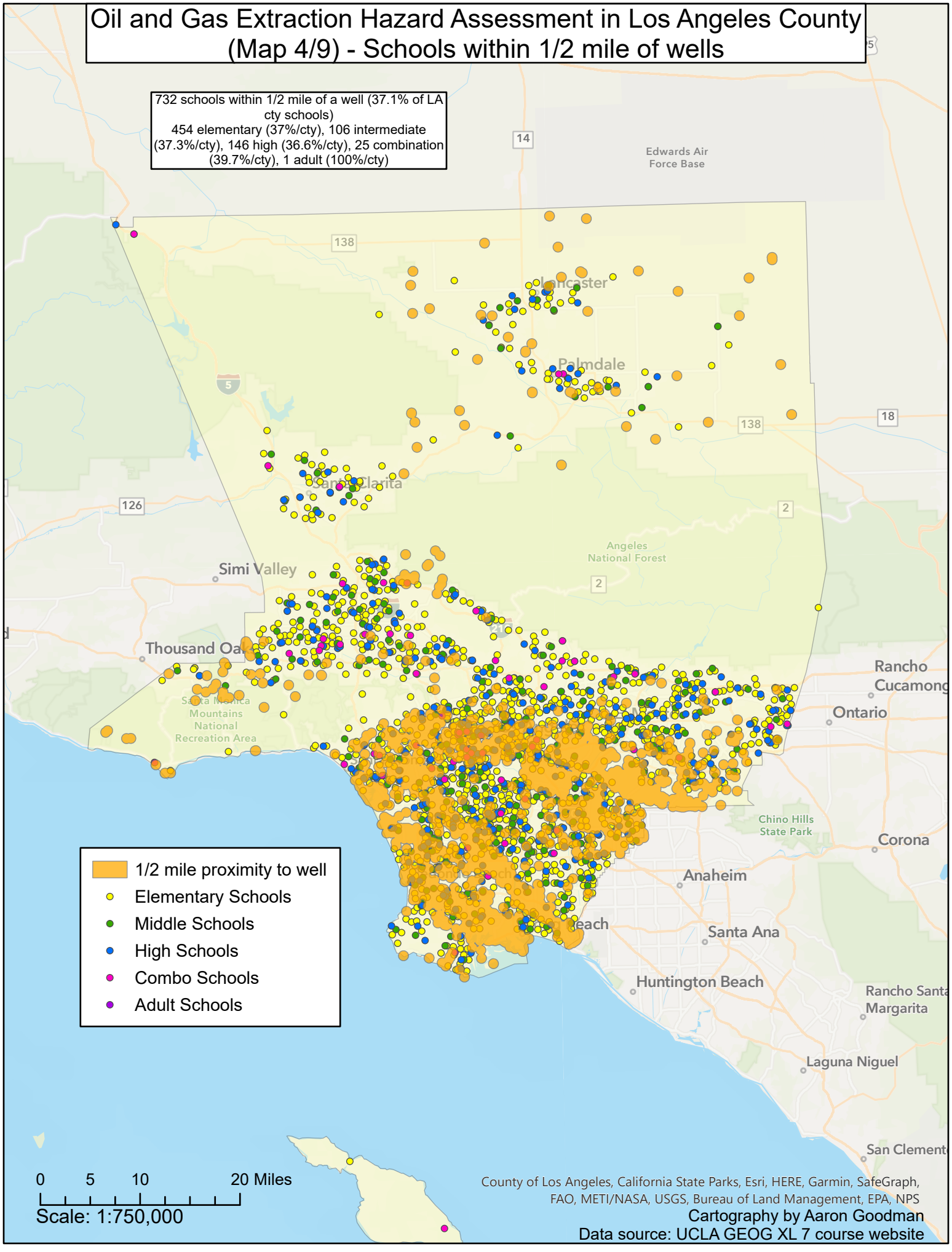
County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS

Cartography by Aaron Goodman

Data source: UCLA GEOG XL 7 course website

Oil and Gas Extraction Hazard Assessment in Los Angeles County
(Map 4/9) - Schools within 1/2 mile of wells

732 schools within 1/2 mile of a well (37.1% of LA cty schools)
454 elementary (37%/cty), 106 intermediate (37.3%/cty), 146 high (36.6%/cty), 25 combination (39.7%/cty), 1 adult (100%/cty)



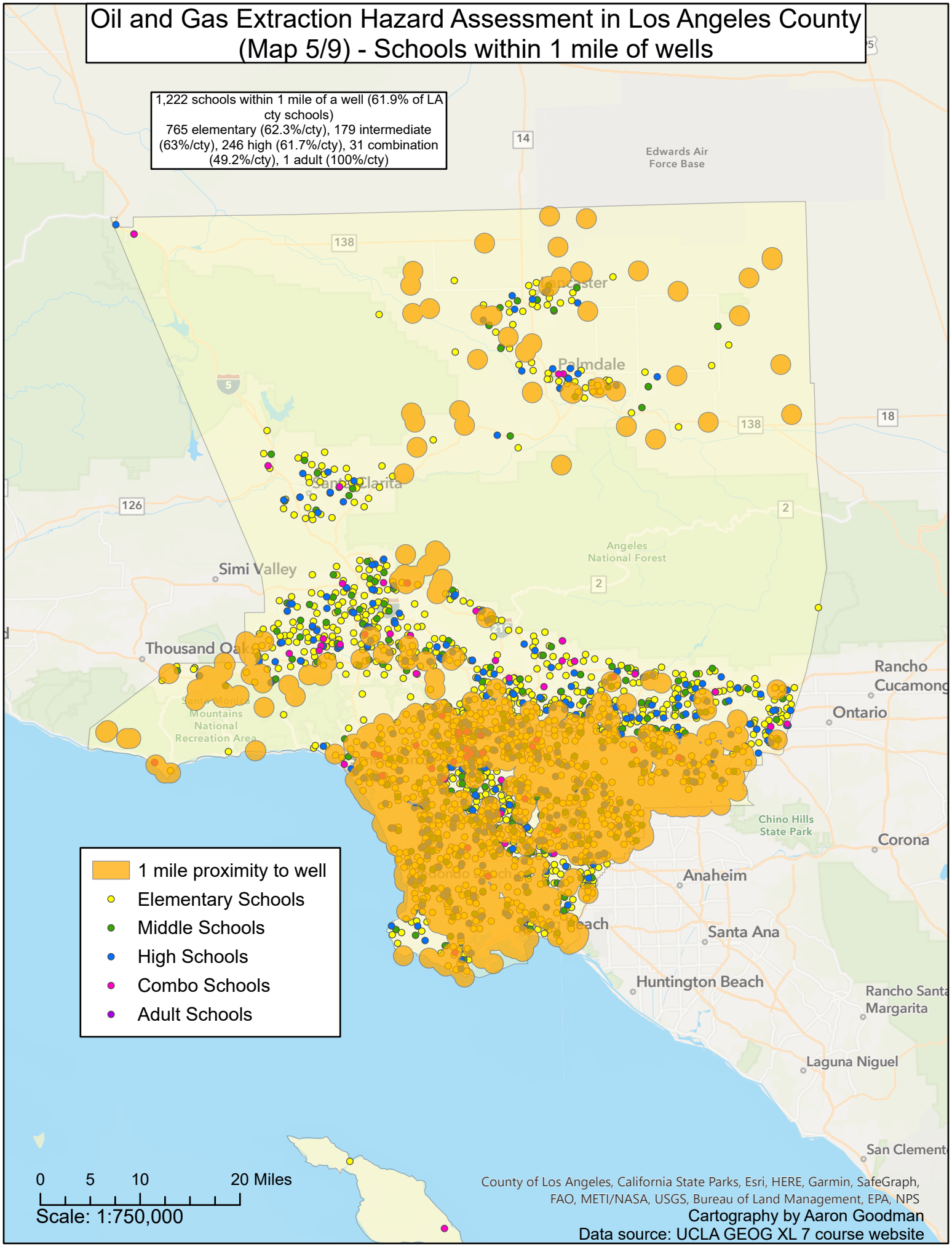
County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS

Cartography by Aaron Goodman

Data source: UCLA GEOG XL 7 course website

Oil and Gas Extraction Hazard Assessment in Los Angeles County (Map 5/9) - Schools within 1 mile of wells

1,222 schools within 1 mile of a well (61.9% of LA cty schools)
765 elementary (62.3%/cty), 179 intermediate (63%/cty), 246 high (61.7%/cty), 31 combination (49.2%/cty), 1 adult (100%/cty)



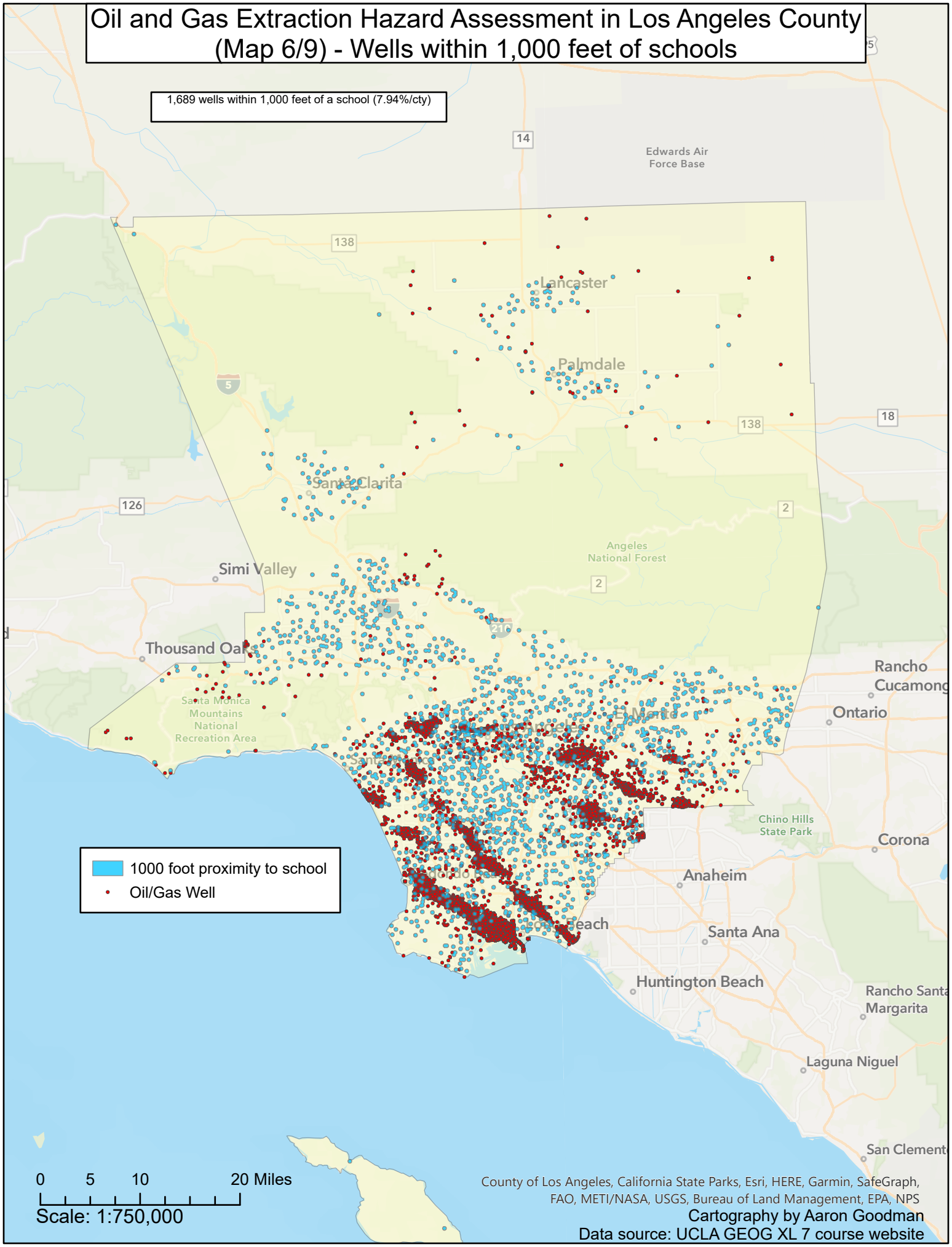
County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS

Cartography by Aaron Goodman

Data source: UCLA GEOG XL 7 course website

Oil and Gas Extraction Hazard Assessment in Los Angeles County (Map 6/9) - Wells within 1,000 feet of schools

1,689 wells within 1,000 feet of a school (7.94%/cty)



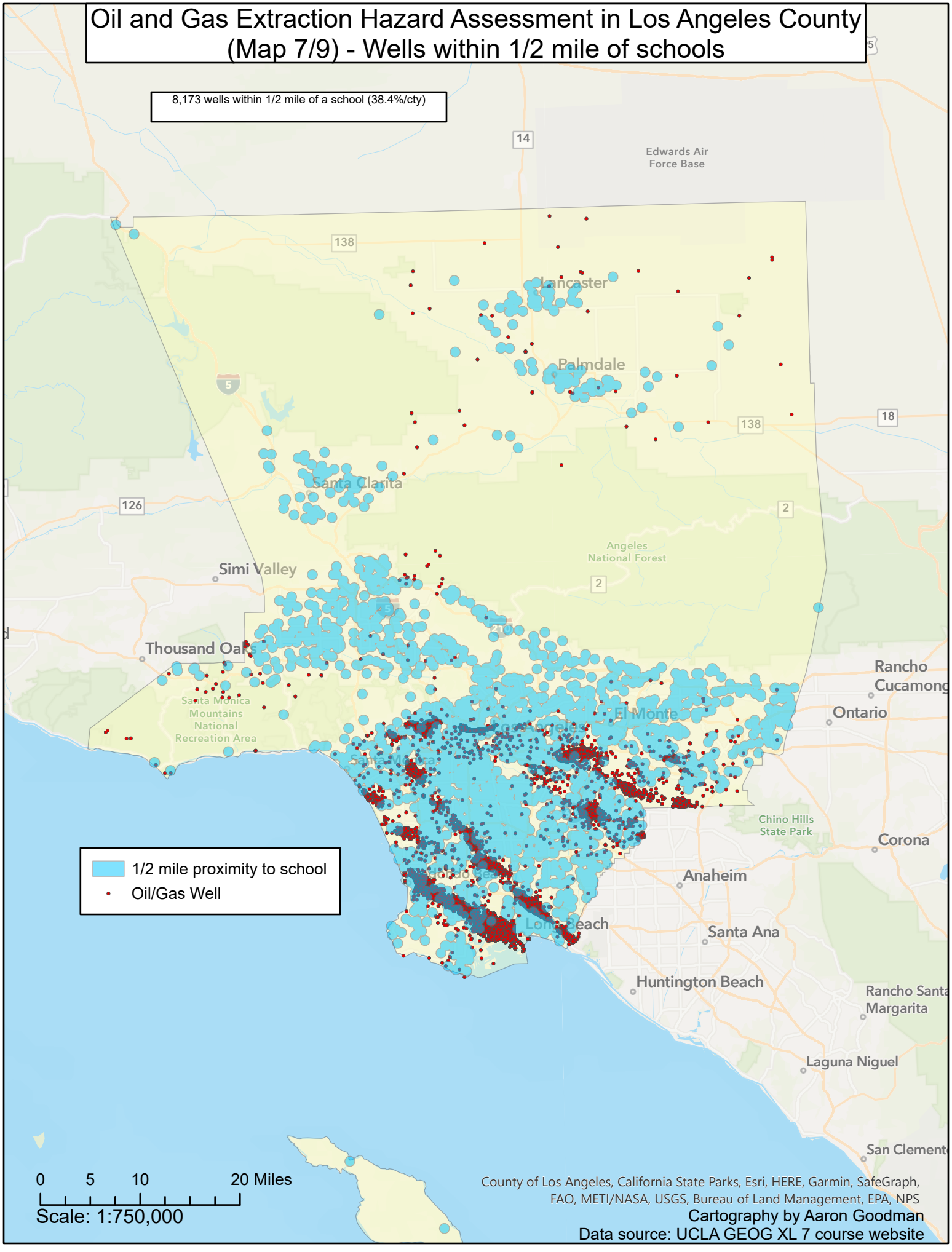
County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS

Cartography by Aaron Goodman

Data source: UCLA GEOG XL 7 course website

Oil and Gas Extraction Hazard Assessment in Los Angeles County
(Map 7/9) - Wells within 1/2 mile of schools

8,173 wells within 1/2 mile of a school (38.4%/cty)



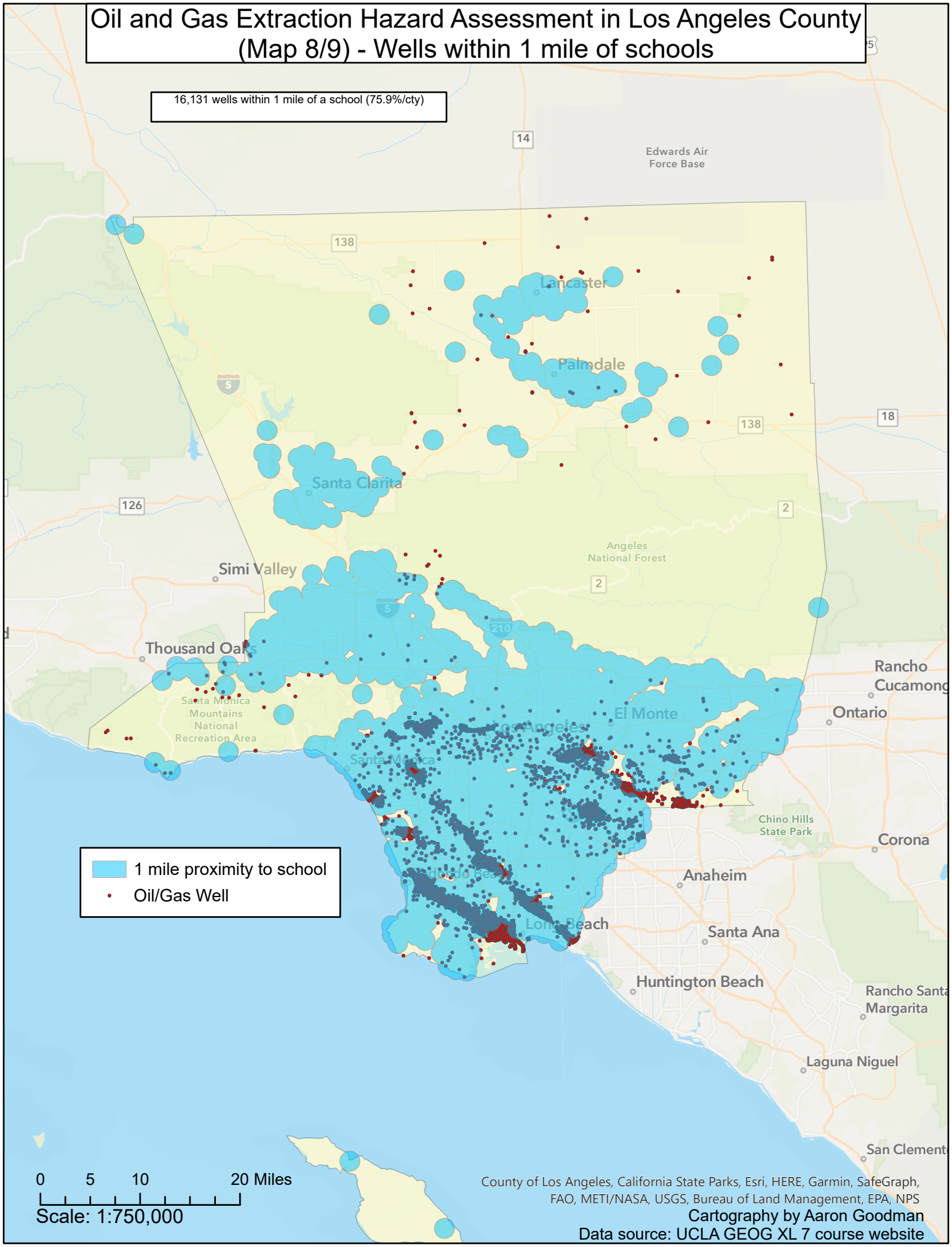
County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS

Cartography by Aaron Goodman

Data source: UCLA GEOG XL 7 course website

Oil and Gas Extraction Hazard Assessment in Los Angeles County (Map 8/9) - Wells within 1 mile of schools

16,131 wells within 1 mile of a school (75.9%/cty)



County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS

Cartography by Aaron Goodman

Data source: UCLA GEOG XL 7 course website

Oil and Gas Extraction Hazard Assessment in Los Angeles County (Map 9/9) - Schools within 1 mile of fracking wells

15 schools within 1 mile of a fracking well
9 elementary, 2 intermediate, 3 high, 1 combo
(see list)

NEARBY SCHOOLS

Los Angeles Unified School District

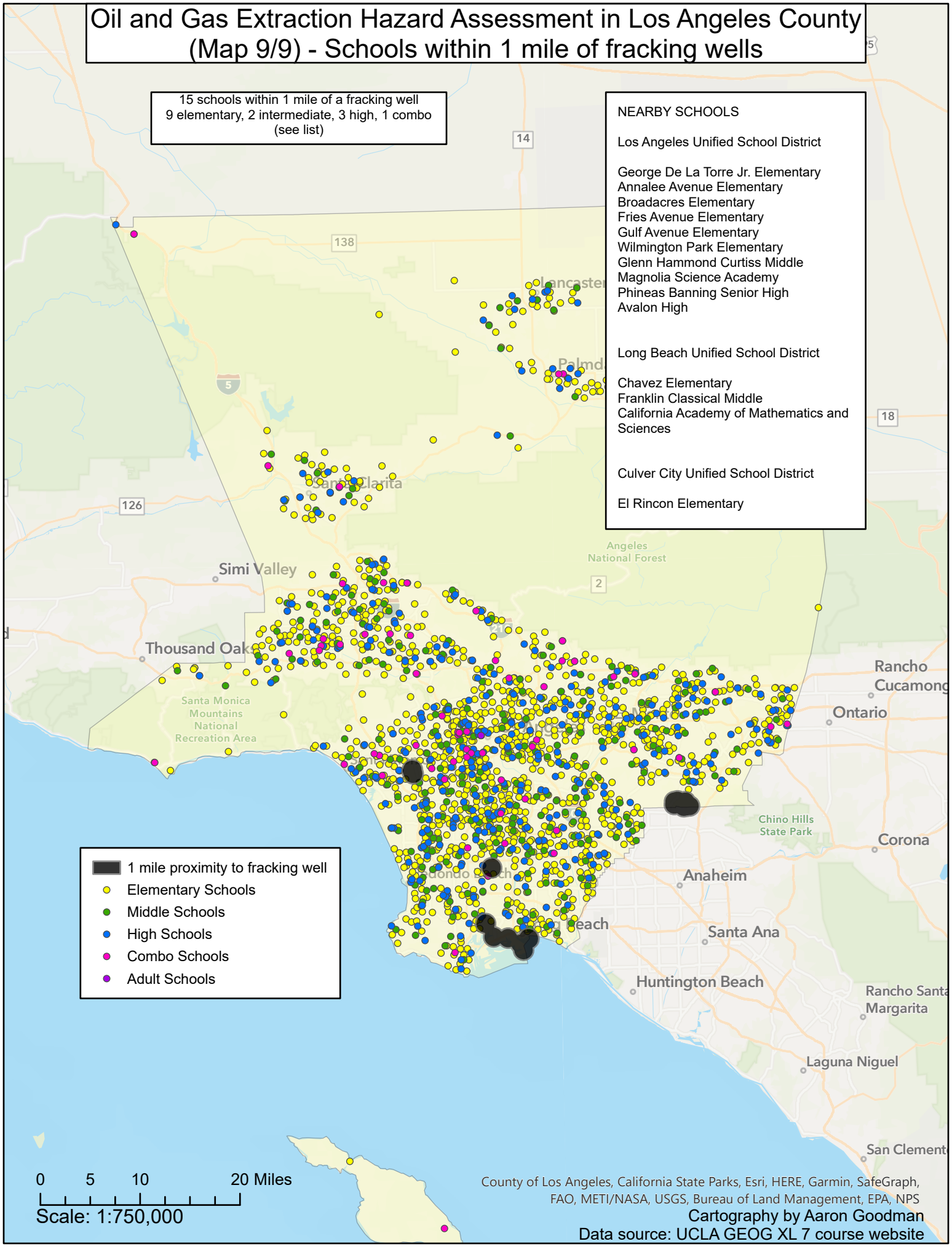
George De La Torre Jr. Elementary
Annalee Avenue Elementary
Broadacres Elementary
Fries Avenue Elementary
Gulf Avenue Elementary
Wilmington Park Elementary
Glenn Hammond Curtiss Middle
Magnolia Science Academy
Phineas Banning Senior High
Avalon High

Long Beach Unified School District

Chavez Elementary
Franklin Classical Middle
California Academy of Mathematics and Sciences

Culver City Unified School District

El Rincon Elementary



Cartography by Aaron Goodman
Data source: UCLA GEOG XL 7 course website

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Week 10 Oil/Gas Hazard Mapping in Los Angeles County

Only a handful of GIS techniques are necessary to produce a map of this type, which uses known locations of certain features (oil/gas wells and public schools) to assess hazard from proximity. The location data from the county, or from the course website in this case, come in the form of “points” and their associated attribute data. Informed manipulation of these points and their attributes allow the user to further disaggregate these grouped points; for example, the use of definition queries enables the separation and unique symbolization of fracking wells, or of different levels of schools. Knowledge of these often coded attribute fields is needed to correctly manipulate the data.

With well and school locations imported into a GIS and appropriately classified, geoprocessing tools can then be used to assess hazard based on proximity. The buffer tool or operation creates a new polygon surrounding the selected feature, be it a point, line, or polygon; the size of the buffer polygon is dependent upon the size of the initial feature, and more importantly, the buffer distance set by the user. These polygons represent areas that are within the buffer distance from the features, which are points in this case (oil wells). In the case of this project, there are tens of thousands of features (wells) that are used to draw the buffer, so the resulting polygon will be complex and made up of many small polygons. The dissolve tool enables the aggregation of these polygons into a single polygon, which reads more cleanly on a map of this complexity.

Multiple buffer distances can be calculated to create polygons with varying levels of proximity, or varying levels of risk. The spatial join geoprocessing tool is used to identify schools that are at risk, and does so by permanently making a copy of separate features (well buffers and schools, school buffers and wells) who share a spatial relationship—in this case, “intersection” was the employed spatial relationship, meaning that any school/well that even partially lies within the well/school buffer polygon will be included in the spatial join. The attribute table of the created feature contains a field which counts the number of features joined to the target feature; in other words, the spatial join allows the user to see how many school features fall within (are joined to) the oil buffers, or vice versa. This spatial join operation can be repeated for disaggregated parts of the original feature as well; this allowed me to find join counts for different levels of schools, as well as the entire school list.

The data engineering tool in ArcGIS Pro enables extensive statistical analysis on raw or spatially manipulated data. While there are a number of ways to easily calculate values like percentages, I completed this part of my mapping/analysis by myself. I used the attribute tables to find the appropriate totals for the features and calculated the percentages. For the school features disaggregated by level, I simply had to refer to multiple attribute tables.

The map of fracking buffers, which includes a list of affected schools, required minimal technical changes from the rest of the methodology used for the other maps. For the spatial join operation on this map, I enabled “one-to-many” joining to be able to view all attributes of all joined features. This allowed collection of school names and classification by district, whereas a “one-to-one” join would have only shown the number of schools.

Refinement of symbology is the final step in making the resulting map legible for general viewing. However, environmental knowledge or further research may be necessary to thoroughly assess risk for students within the proximity zones. Obviously, schools in closer proximity to wells are under greater risk. Contemporary studies in California suggest that even a 10km proximity to an oil extraction site can produce adverse birth effects for pregnant mothers (Tran et. al, 2020). Judith Lewis Mernit of *Yale Environment 360* journal, too, writes about the potential hazards, emphasizing that urban or suburban residents in California live closer to oil wells than do their counterparts in other states. Additionally, Mernit highlights the demographic make-up of these affected areas, which are largely Hispanic populations (2021). The benzene used in wells to pump out oil has been detected in neighboring residents’ urine, and is a known carcinogen.

References

Mernit, Judith Lewis. 2021. “The Oil Well Next Door: California’s Silent Health Hazard.” *Yale Environment 360.*

Tran, Kathy V. et al. 2020. “Residential Proximity to Oil and Gas Development and Birth Outcomes in California: A Retrospective Cohort Study of 2006-2015 Births.” *Environmental Health Perspectives* 128(6).