FINAL REPORT

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Introduction

In 2016, Conservation Science Partners (CSP) and the Center for American Progress (CAP) concluded work on the Disappearing West Project, which measured the loss and fragmentation of natural lands in the western United States between 2001 and 2011. The principal product of that analysis was a map of intensity and extent of human modification (or 'HM'), a metric falling between 0 and 1 that describes the intensity of human land use on a per-pixel basis. Using the 2011 data, along with United States Census Bureau data, CSP conducted a follow-on analysis and found that HM was disproportionately high in communities of color and low income communities in the West. In 2019, CSP developed an update of HM for the conterminous U.S. for 2017. With these more recent and expanded data, the goal of this analysis was to determine if and to what extent low-income, underrepresented, and minority communities experience disproportionately high levels of HM throughout the conterminous United States.

Methods

Using the updated HM data for 2017, we calculated the mean, pixel-level HM value and the mean pixel-level value for HM attributable to energy development and infrastructure for every census tract in the conterminous U.S. HM attributable to energy comes from sources such as oil and gas wells, renewable energy, surface mines, and power lines (see also this report). We compared tract-level HM summaries against tract status group membership as determined by American Community Survey data (ca. 2013-2017) from the U.S. Census Bureau[1]. We determined whether each census tract fell into any of the following status groups:

By Race and Ethnic Group
- American Indian / Native Alaskan
- Asian American
- Black / African American
- Hispanic / Latinx
- Non-white
- White (non-Hispanic)

By Income
- High income
- Low income
- Moderate income

By Family Status
- With children < 18 [2]
- Without children < 18

We used a thresholding approach to determine whether a tract fell into a given status group. For racial or ethnic status groups, on a state-by-state basis, we calculated the proportion of each tract's population falling into the racial or ethnic group of interest. Tracts belonging to a given status group were defined as those with a proportion of the population falling in the racial or ethnic group of interest that was greater than or equal to the 75th percentile of proportions across all tracts in the state. In other words, these tracts were among the 25 percent of tracts in the state with the highest proportion of the population falling in the racial or ethnic group of interest. We used the same approach for family

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[1] Steven Manson, Jonathan Schroeder, David Van Riper, and Steven Ruggles. IPUMS National Historical Geographic Information System: Version 14.0 [Database]. Minneapolis, MN: IPUMS. 2019. http://doi.org/10.18128/D050.V14.0

[2] The "families with children under 18" group was additionally broken down by racial / ethnic group and poverty status, and the same percentile-based thresholding approach was used to determine tract status, e.g., hispanic families in poverty with children under 18.

status groups, but we calculated the proportion of families in each tract falling into the status group and compared that to the state-level 75th percentile. In general, inclusion in a racial, ethnic, or family status group does not necessarily mean that a majority of families or individuals in the tract fall into that group. Rather, it means that the tract has a high proportion of families or individuals in that group relative to the proportions typical of the state where the census tract lies.

We identified low income tracts as those with median household income less than or equal to the 10th percentile of median income at the tract level across their state. We identified high income tracts as those with median household income greater than or equal to the 90th percentile of median income at the tract level across their state. Finally, we identified moderate income tracts as those with median household income falling between the 10th and 90th percentile of median household income at the tract level across their state.

Once statuses were determined, we calculated the weighted mean tract-level HM (and HM attributable to energy development) for each status group nationally and for each state. We weighted by total tract population for racial, ethnic, and income-based groups, and by total number of families in the tract for family status groups. This enabled us to interpret the resulting mean HM values as the level typically faced by individuals (or families) in tracts rather than by the tracts themselves. We also calculated the mean HM experienced by the average family (Baseline [all families]; Tables 1 and 2) and individual (Baseline [all individuals]; Tables 1 and 2) regardless of status group. These measures are baselines against which to compare HM levels for the status groups described above. Finally, we calculated the proportion (nationally and at the state level) of individuals (or families) that experienced a higher HM value than their respective state medians conditional on status group membership (Table 3).

Results and Discussion

Results provided below are a subset of the results generated by this study. Our results indicate substantial differences in the degree of HM faced by different racial, ethnic, income, and family status groups. HM values for select status groups are shown in Table 1. HM values attributable to energy development for select status groups are shown in Table 2. Table 1, for example, shows that people who live in tracts with a relatively large white population experience 11.7% less HM than the national average. Conversely, people living in tracts with relatively large non-white populations experience 7.8% more HM than the national average. We additionally summarized the proportion of individuals (or families) experiencing a higher HM than their state-wide average conditional on status group (Table 3).

Table 1: Weighted national mean human modification (HM) for select status groups, percent difference from the appropriate national baseline (a negative value indicates less HM than average, positive indicates more HM than average), and standard deviation (SD) of mean HM, based on data for 2017. Note that these are national-level summaries, and values and patterns may be different for specific states. A higher standard deviation means that individuals (or families) in the status group experience a wider range of HM values. The percent difference is colored by value: less modified than would be expected by chance, more modified than would be expected by chance. This table shows, for example, that people in white-classified tracts experience 11.7% less human modification than the average person (regardless of status group membership), while people in non-white classified tracts experience 7.8% more human modification than the average person.

Status group	Mean HM	% difference from baseline[†]	SD
Baseline (all individuals)	0.806	0.0%	0.161
White (non-Hispanic)	0.712	-11.7%	0.197
Non-white	0.869	7.8%	0.108
Asian American	0.866	7.3%	0.085
Black / African American	0.861	6.8%	0.108
Hispanic / Latinx	0.856	6.1%	0.114
American Indian / Native Alaskan	0.788	-2.3%	0.183
High income	0.838	3.9%	0.103
Moderate income	0.797	-1.2%	0.168
Low income	0.856	6.1%	0.142
Low income and non-white	0.874	8.4%	0.117
Baseline (all families)	0.799	0.0%	0.164
Families without children < 18	0.732	-8.4%	0.211
Families with children < 18	0.851	6.6%	0.108
Non-white families with children < 18, in poverty	0.857	7.2%	0.122

[†]Percent difference from baseline was calculated using the exact, unrounded measurements of HM, the reported values may differ from what would be obtained using the rounded mean HM values provided in the table.

Table 2. Weighted national mean human modification (HM) **attributable only to energy development** for select status groups, percent difference from the appropriate national baseline (a negative value indicates less HM than average, positive indicates more HM than average), and standard deviation (SD) of mean HM, based on data for 2017. Note that these are *national*-level summaries, and values and patterns may be different for specific states. A higher standard deviation means that individuals (or families) in the status group experience a wider range of HM values. The percent difference is colored by value: less modified than would be expected by chance, more modified than would be expected by chance.

Status group	Mean HM	% difference from baseline[†]	SD
Baseline (all individuals)	0.027	0.0%	0.078
White (non-Hispanic)	0.035	29.6%	0.089
Non-white	0.022	-16.9%	0.071
Black / African American	0.020	-27.1%	0.066
Asian American	0.023	-14.3%	0.074
Hispanic / Latinx	0.023	-13.9%	0.071
American Indian / Native Alaskan	0.026	-1.9%	0.077
High income	0.022	-16.7%	0.073
Moderate income	0.028	3.3%	0.079
Low income	0.024	-9.7%	0.075
Low income and non-white	0.023	-15.5%	0.072
Baseline (all families)	0.027	0.0%	0.078
Families without children < 18	0.032	17.7%	0.086
Families with children < 18	0.022	-19.5%	0.068
Non-white families with children < 18, in poverty	0.022	-19.4%	0.069

[†]Percent difference from baseline was calculated using the exact, unrounded measurements of HM, the reported values may differ from what would be obtained using the rounded mean HM values provided in the table.

Evaluating results at the state level reveals additional patterns and disparities, particularly with respect to energy development, that are not apparent in the national-level summary. For example, in 12 states[3] out of the 48 (plus DC) analyzed, people in Native American-classified tracts experienced the most energy development out of all racial and ethnic groups. In 10 additional states[4], people in Native American-classified tracts experienced the 2nd most energy development out of all racial and ethnic groups. Tracts with a high proportion of Native Americans in Kansas in particular experience the highest degree of energy development of any status group in any state in the conterminous U.S. Additional

[3] Alabama, Arkansas, Florida, Georgia, Idaho, Kansas, Louisiana, Nebraska, New Hampshire, New Mexico, South Dakota, and Utah

[4] Delaware, Iowa, Maine, Michigan, Montana, Oregon, Tennessee, Texas, Wisconsin, and Wyoming

examples include Hispanic-classified tracts experiencing the most energy development in Colorado, and non-white classified tracts experienced the most energy development in California.

Table 3: Proportion of individuals (or families) experiencing higher HM than their state average by status group, based on data for 2017. We used the median because, at random, 50% of people (or families) would be expected to fall above and below this value. As such, 50% provides a reasonable baseline against which to compare the values provided in this table. A value greater than 50% indicates that a higher percentage experience greater HM than would be expected by chance. This table shows, for example, that people in non-white classified tracts are more than 3 times more likely than people in white-classified tracts to exerience an HM higher than the value typical for their state.

Status group	% with HM greater than median
White (non-Hispanic)	23.0%
Non-white	74.0%
Black / African American	68.2%
Hispanic / Latinx	67.0%
Asian American	66.9%
American Indian / Native Alaskan	48.2%
High income	51.9%
Moderate income	47.8%
Low income	69.7%
Low income and non-white	76.4%
Families without children < 18	35.8%
Families with children < 18	64.5%
Non-white families with children < 18, in poverty	71.2%

In addition to national- and state-level tabular summaries of HM, we generated a shapefile containing information on status group membership for each tract and the associated HM values. Figure 1 shows Hispanic-classified tracts overlaid on a map of tract-level mean HM. Figures 2-5 shows the 'intersection' of the relative proportion of non-white individuals in each tract with the tract-level mean HM. These maps support visual identification of tracts with both high minority populations and high mean HM.
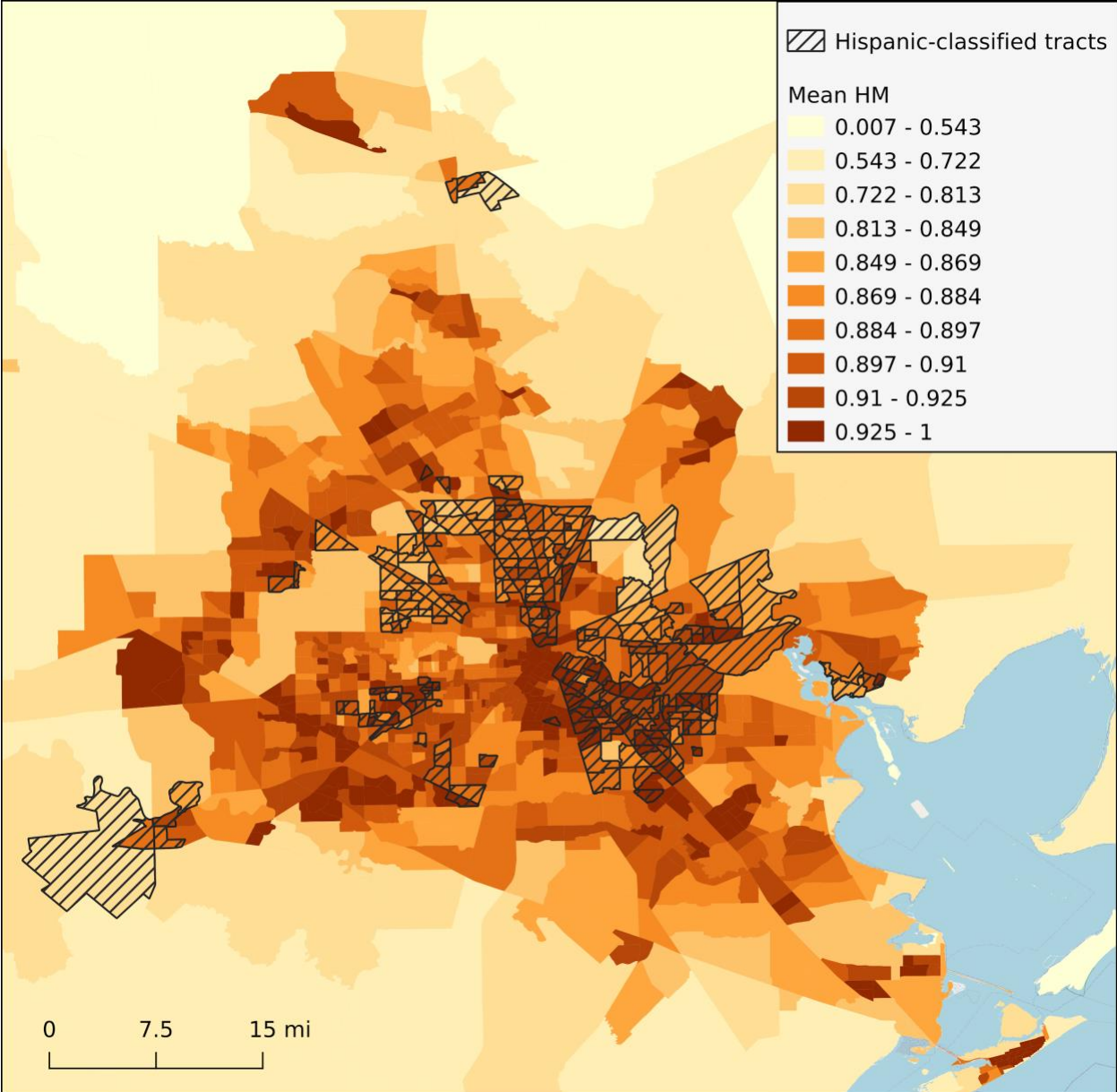
Figure 1: A map of tract-level mean human modification (HM) in Houston, Texas, with Hispanic-classified tracks overlaid. Based on data for 2017.

Florida natural lands (in-)equality

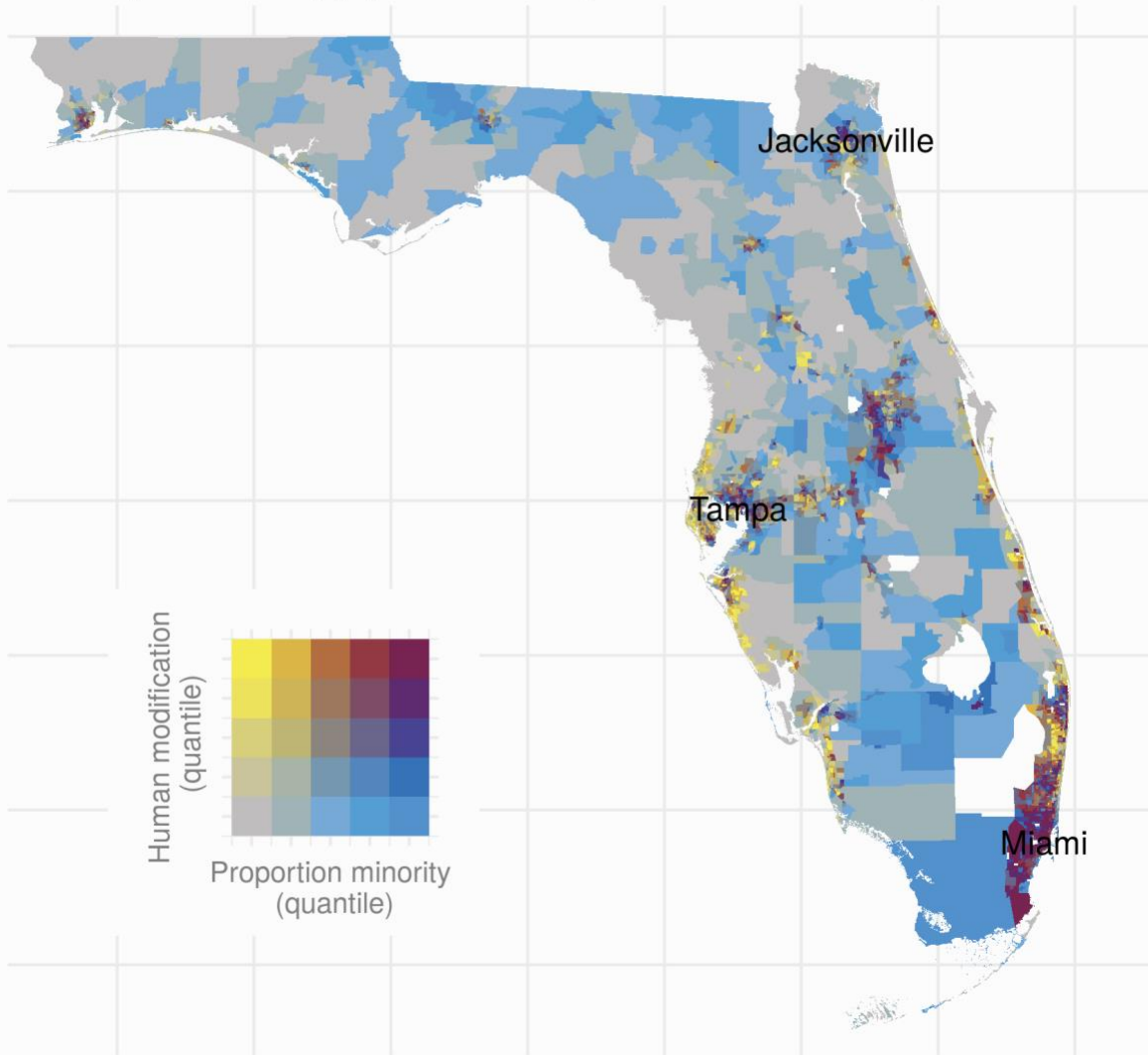Proportion minority populations and degree of human modification, 2013-2017

Figure 2: Bivariate choropleth map showing the 'intersection' of the relative proportion of non-white individuals in each tract with the mean degree of human modification (HM) in each tract for Florida. Each of these two quantities was divided into five quantiles, and each color symbolizes a unique pair of these quantiles. Tracts symbolized with deep purple (upper right-hand corner of the legend) are those with non-white proportions of the population in the top 20% in Florida *and* mean HM values in the top 20% in Florida. Based on data for 2017.
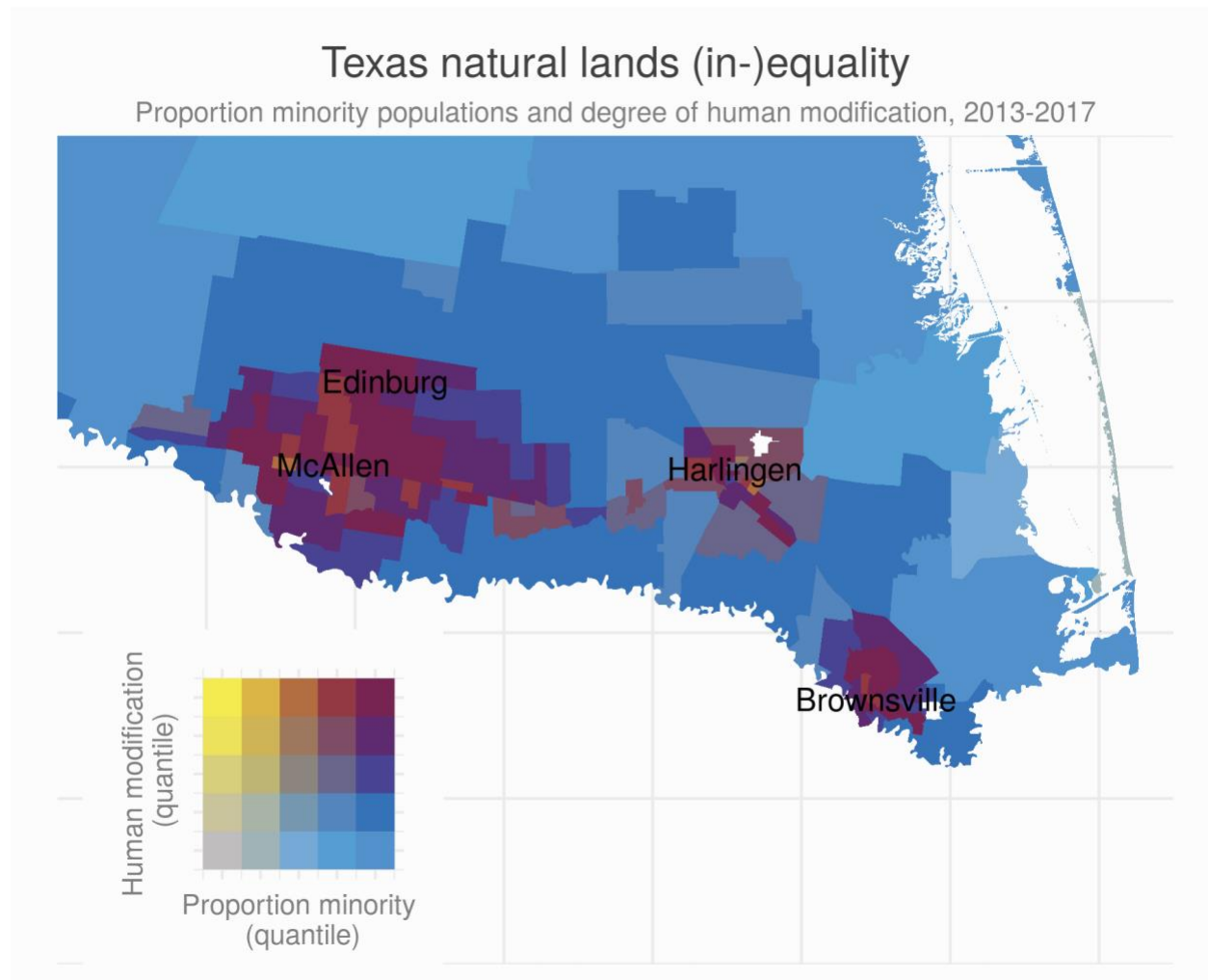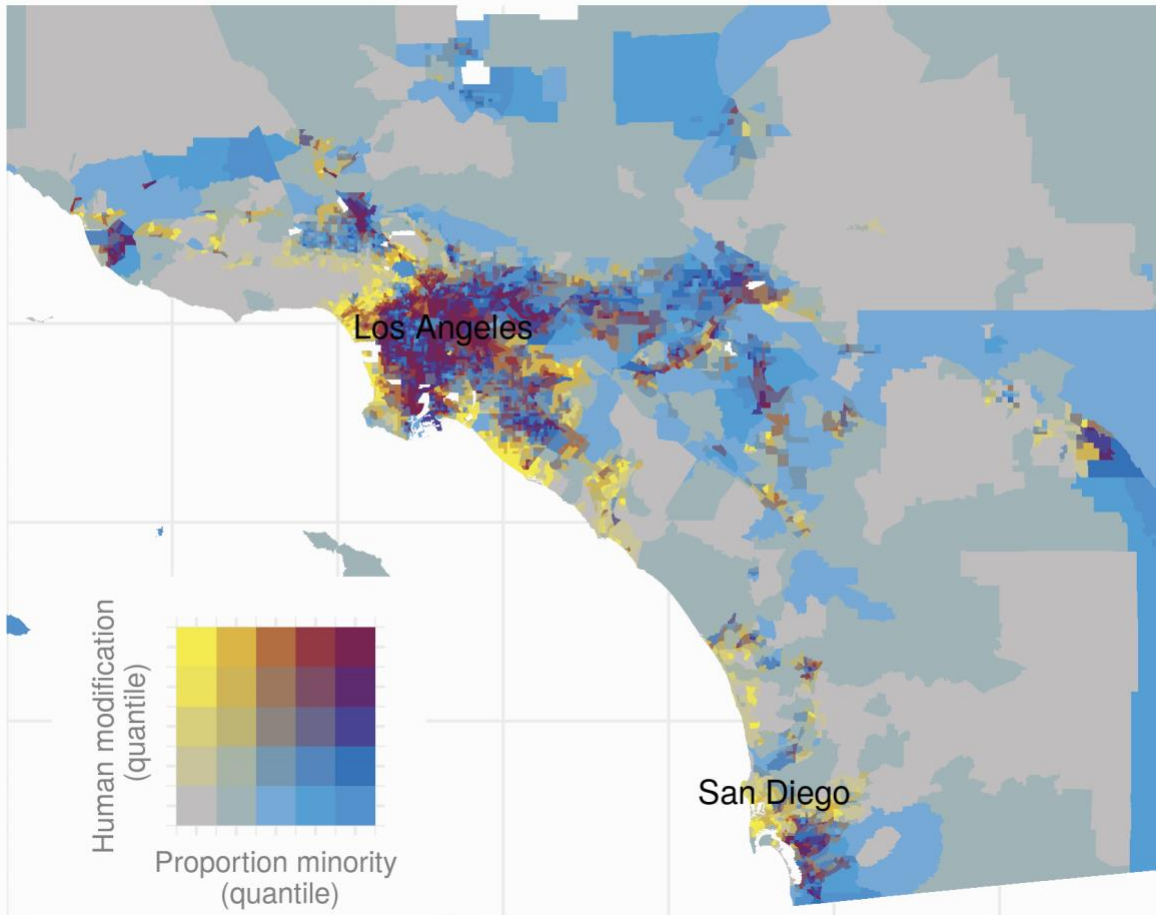
Figure 3: Bivariate choropleth map showing the 'intersection' of the relative proportion of non-white individuals in each tract with the mean degree of human modification (HM) in each tract in the southern tip of Texas. Each of these two quantities was divided into five quantiles, and each color symbolizes a unique pair of these quantiles. Tracts symbolized with deep purple (upper right-hand corner of the legend) are those with non-white proportions of the population in the top 20% in Texas *and* mean HM values in the top 20% in Texas. Based on data for 2017.

Figure 4: Bivariate choropleth map showing the 'intersection' of the relative proportion of non-white individuals in each tract with the mean degree of human modification (HM) in each tract in the southern California. Each of these two quantities was divided into five quantiles, and each color symbolizes a unique pair of these quantiles. Tracts symbolized with deep purple (upper right-hand corner of the legend) are those with non-white proportions of the population in the top 20% in California *and* mean HM values in the top 20% in California. Based on data for 2017.
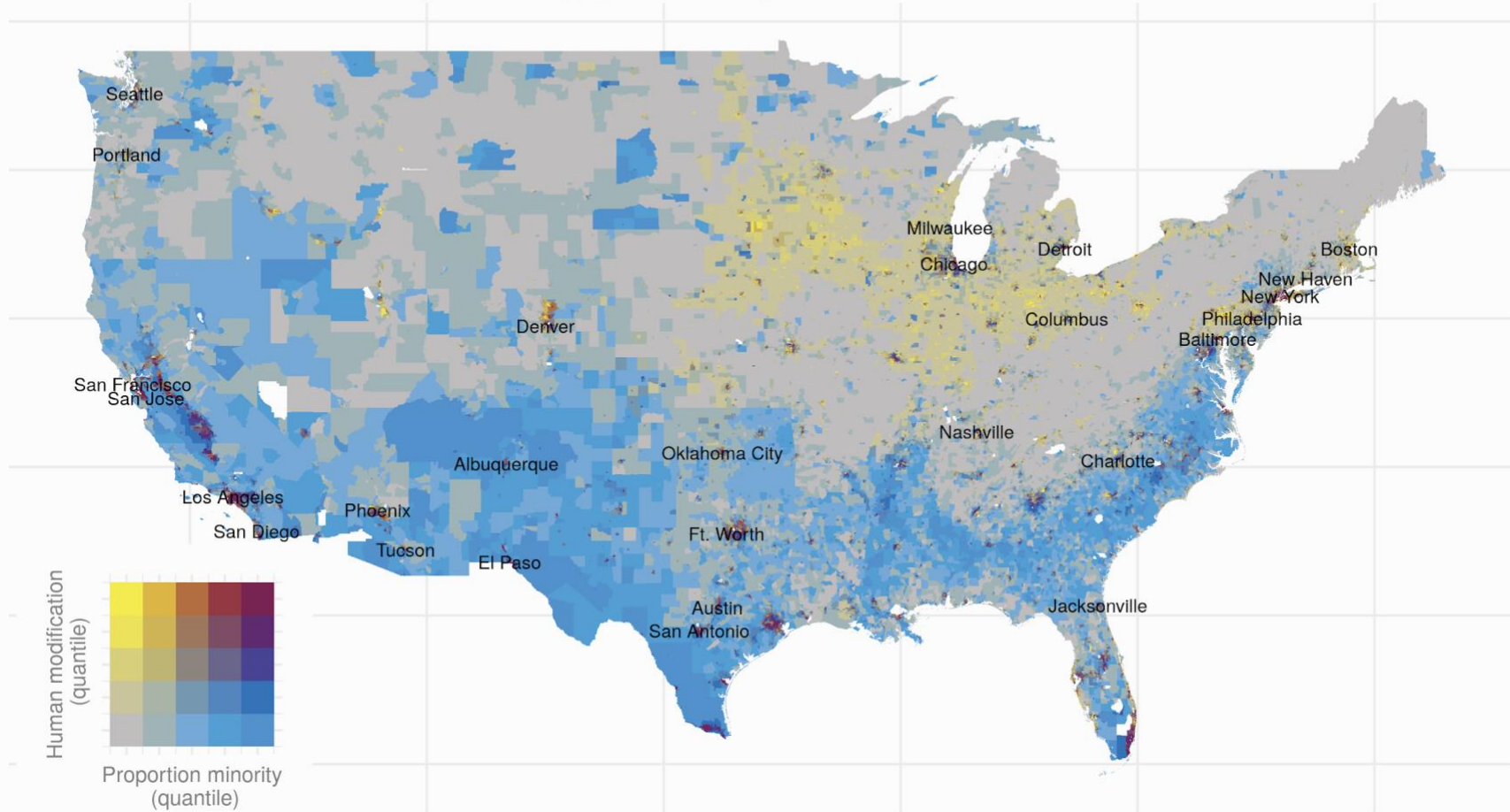
Figure 5: Bivariate choropleth map showing the 'intersection' of the relative proportion of non-white individuals in each tract with the mean degree of human modification (HM) in each tract. Each of these two quantities was divided into five quantiles, and each color symbolizes a unique pair of these quantiles. Tracts symbolized with deep purple (upper right-hand corner of the legend) are those with non-white proportions of the population in the top 20% nationally *and* mean HM values in the top 20% nationally. Based on data for 2017.