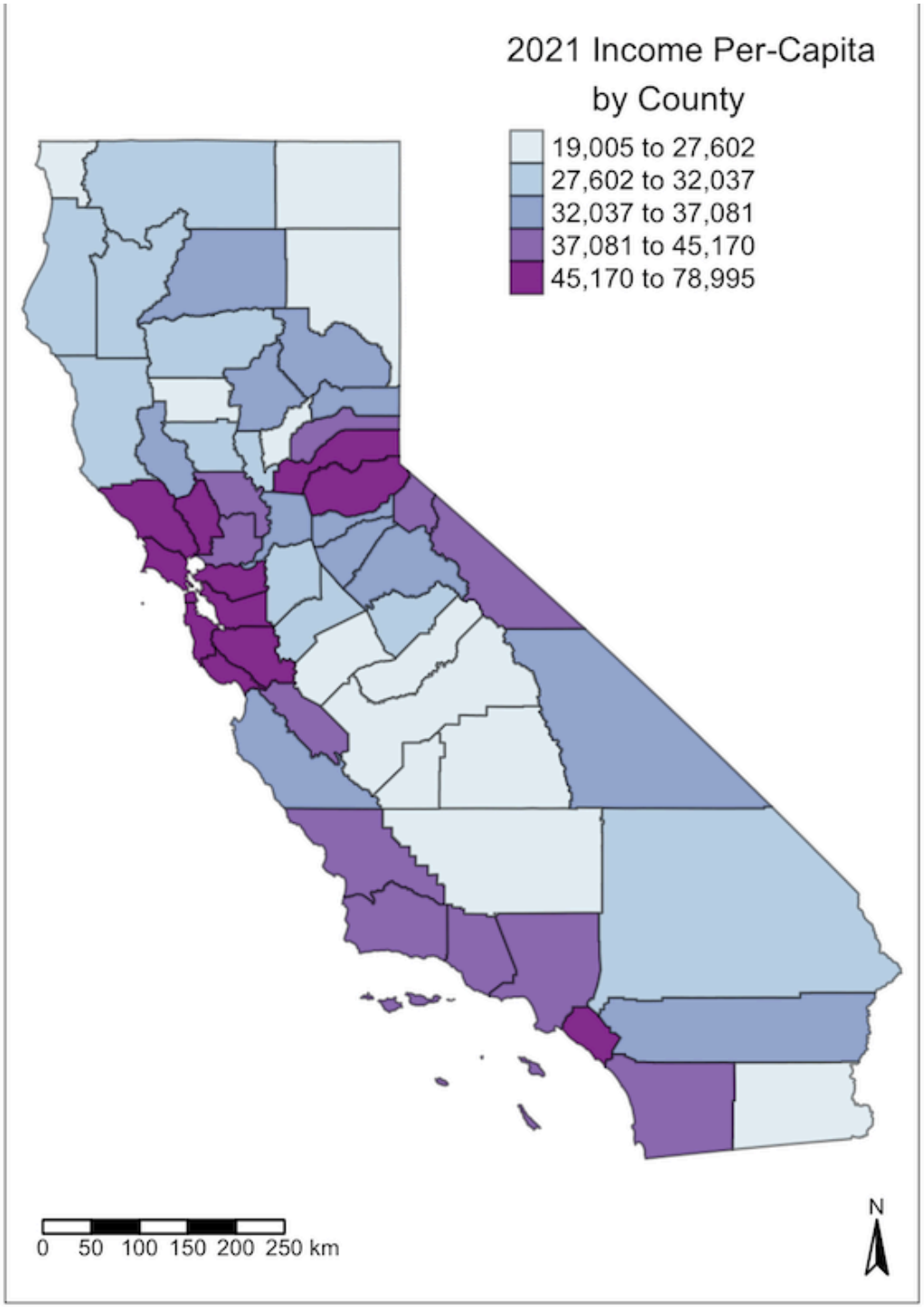
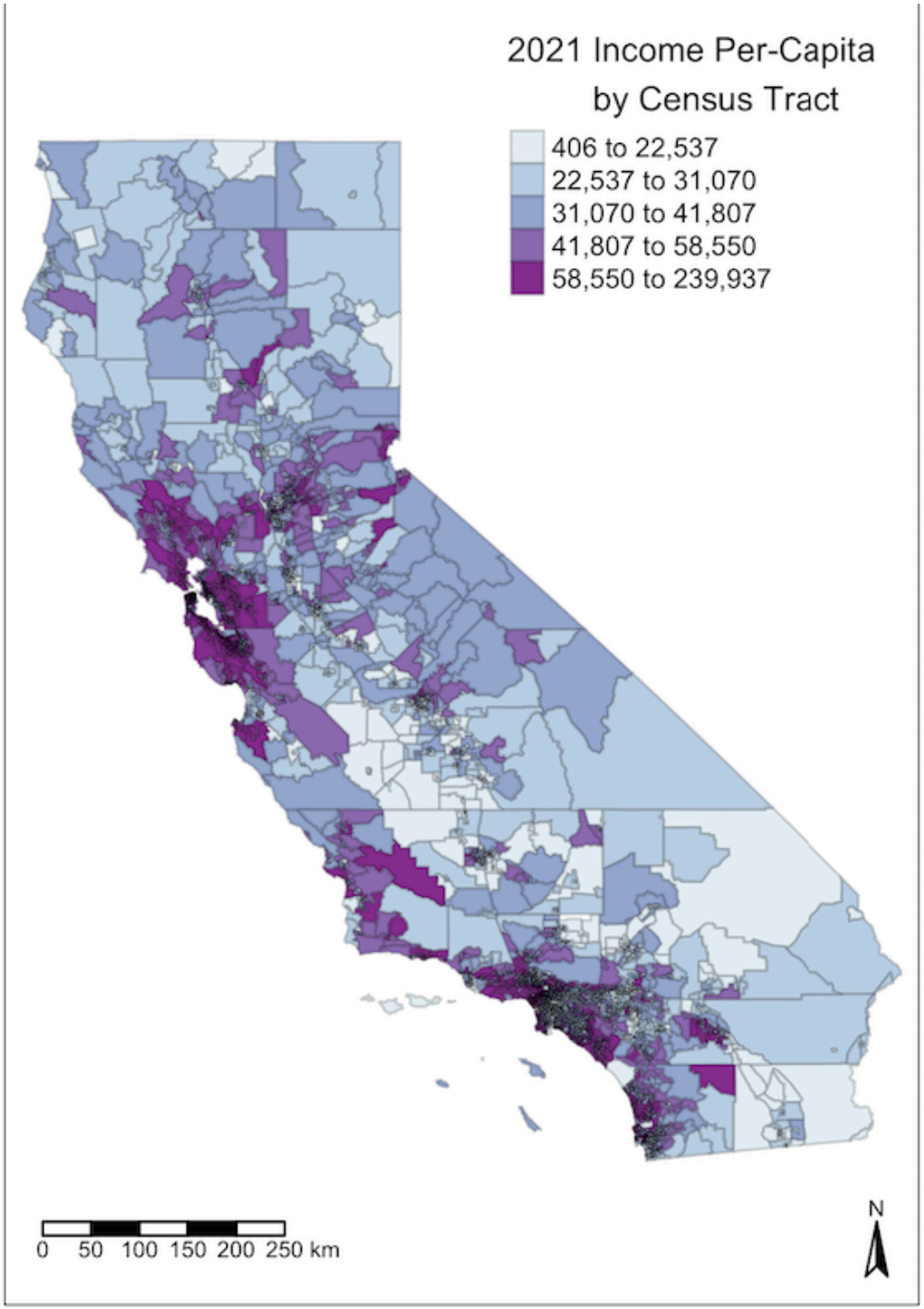

2021 Income Per-Capita
by County
19,005 to 27,602
27,602 to 32,037
32,037 to 37,081
37,081 to 45,170
45,170 to 78,995
0 50 100 150 200 250 km
N


2021 Income Per-Capita
by Census Tract
406 to 22,537
22,537 to 31,070
31,070 to 41,807
41,807 to 58,550
58,550 to 239,937
0 50 100 150 200 250 km
N

Sief Salameh
Assignment Two Write-Up
04/16/2023

First, I created my maps using data from the 2021 American Community Survey. I utilized a Census API key in R studio to extract the 1-year estimates for income per capita for all the counties and Census tracts that were available in the state of California. In addition to the 1-year income estimates, I included geographic boundaries in the API request so that the values for each county and tract have corresponding location coordinates that could be visualized on a choropleth map. I decided to use this metric because income per capita computes the total income divided by every known individual - including children and the elderly. This metric is more effective in my perspective because it accounts for population density, while median income measurements only compute incomes on a household level. California has a predominantly immigrant population base, which I correlate with a higher rate of multi-family and multi-generation households. Therefore, if we measure median incomes based on a household level, we will neglect and exclude the households that have a higher average of residents per dwelling compared to the standard 4 or 6-person household size. Thus, I decided to use the income per capita ratio instead because it computes incomes based on an individual level. The only risk we face, however, is that the income per capita is more susceptible to high or low-value outliers. So maintaining this awareness is crucial in the analysis.

Analyzing the maps, it is clear that the counties containing Los Angeles, San Francisco, Sacramento, and all the immediate nearby counties have the highest incomes per capita compared to the other counties in the state. On the county level, we could also see that Northern California seems to experience lower incomes per capita compared to the larger metropolitan areas near the cities. Additionally, we see that there is no income data available for the counties containing the Sierra Nevada parks and mountains - which is expected. On the Census tract level, there are two major interesting findings. First, even though LA county and the nearby counties near the ocean have the highest incomes per capita on the county level, the Census tract level shows that there are pockets where per capita incomes represent the highest quantile, but some of the bordering tracts represent the lowest income quantiles. On the county level, the high-income tracts overshadow and skew the income trends so that they appear in the highest income quantiles. Yet, the tract map shows that there are significant income disparities near the areas along the ocean. Specifically the nearby areas north of Los Angeles. The second interesting find is how densely populated the LA and San Francisco regions are. The Census tracts are meant to group approximately 5,000 to 8,000 individuals per block. In Northern California, the Census tracts are geographically larger compared to the hundreds of small tracts located throughout the LA and San Francisco areas. This made analyzing the data difficult because the scale for this assignment focused on the state level and not the community level.

When discussing the spatial scale, especially on the Census tract level, we can identify the spatial dependence that occurs in the tracts with cities that have significantly higher incomes per capita. Residents in those areas are dependent on the tech, entertainment, and finance

industries for high-paying jobs. Thus, these tracts become housing and employment hubs for competitive talent and labor markets - that in turn produce resources and economic conditions that are geographically exclusive and isolated. The spatial spillover then occurs in the nearby tracts and counties where they become more accessible to residents who were either priced out from the original housing markets in the exclusive areas, or to residents who want to serve the high-income residents by operating and maintaining restaurants, bars, and recreational facilities. This helps explain the income disparities experienced in the tracts containing LA and San Francisco cities and the areas that immediately surround them. As a consequence, the uneven distribution or concentration of high-paying jobs in the metro regions across California generated a spatial polarity where the Northern part of the state has the majority of low-income residents. Thus, these maps showcase the positive autocorrelation of the income distribution across the state of California and how the concentration of talented workforces and highly-competitive industries has produced areas with significantly higher incomes per capita vs. areas with very low incomes per capita in the Northern part of the state and in areas that serve the nearby high-income populations.

Assignment_Two_Salameh

Sief Salameh

4/16/2023

Part One: Load Libraries

```
setwd("~/Downloads/GIS/Assignment_Two")

library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.1 --
## v ggplot2 3.4.0     v purrr   0.3.4
## v tibble  3.1.7     v dplyr   1.0.9
## v tidyr   1.2.0     v stringr 1.4.0
## v readr   2.1.2     v forcats 0.5.1
## Warning: package 'ggplot2' was built under R version 4.1.2
## Warning: package 'tibble' was built under R version 4.1.2
## Warning: package 'tidyr' was built under R version 4.1.2
## Warning: package 'readr' was built under R version 4.1.2
## Warning: package 'dplyr' was built under R version 4.1.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(sf)
```

```
## Warning: package 'sf' was built under R version 4.1.2
## Linking to GEOS 3.10.2, GDAL 3.4.2, PROJ 8.2.1; sf_use_s2() is TRUE
```

```
library(tmap)
```

```
## Warning: package 'tmap' was built under R version 4.1.2
```

```
library(RColorBrewer)
```

```
## Warning: package 'RColorBrewer' was built under R version 4.1.2
```

```
library(tidycensus)
```

```
## Warning: package 'tidycensus' was built under R version 4.1.2
```

```
options(tigris_use_cache = TRUE)
```

Part Two: Census Data

```
ACS21var <- load_variables(2021, "acs5", cache = TRUE)

# view(ACS21var)

Cali_county_income <- get_acs(
  geography = "county",
  variables = c(per_capita_income = "B19301_001"),
  state = "CA",
  year = 2021
)
```

```
## Getting data from the 2017-2021 5-year ACS
```

```
Cali_county_sp <- get_acs(
  state = "CA",
  geography = "county",
  variables = c(per_capita_income = "B19301_001"),
  year = 2021,
  geometry = TRUE
)
```

```
## Getting data from the 2017-2021 5-year ACS
```

```
Cali_tracts_income <- get_acs(
  geography = "tract",
  variables = c(per_capita_income = "B19301_001"),
  state = "CA",
  year = 2021
)
```

```
## Getting data from the 2017-2021 5-year ACS
```

```
Cali_tracts_sp <- get_acs(
  state = "CA",
  geography = "tract",
  variables = c(per_capita_income = "B19301_001"),
  year = 2021,
  geometry = TRUE
)
```

```
## Getting data from the 2017-2021 5-year ACS
```

```
Cali_tracts_sp <- na.omit(Cali_tracts_sp)

Cali_county_sp <- na.omit(Cali_county_sp)
```

Part Three: Mapping

```
CA_counties <- tm_shape(Cali_county_sp) +
  tm_fill("estimate",
    n = 5, palette = "BuPu", style = "quantile",
    title = "2021 Income Per-Capita
         by County"
```

```
  ) +
  tm_borders(alpha = .5, col = "black") +
  tm_scale_bar(position = c("left", "bottom")) +
  tm_compass(text.size = 0.5, position = c("RIGHT")) +
  tm_layout(legend.text.size = .6, legend.title.size = .9, legend.position = c("right", "top"), frame =


CA_tracts <- tm_shape(Cali_tracts_sp) +
  tm_fill("estimate",
    n = 5, palette = "BuPu", style = "quantile",
    title = "2021 Income Per-Capita
         by Census Tract"
  ) +
  tm_borders(alpha = .2, col = "black") +
  tm_compass(text.size = 0.5, position = c("RIGHT")) +
  tm_scale_bar(position = c("left", "bottom")) +
  tm_layout(legend.text.size = .6, legend.title.size = .9, legend.position = c("right", "top"), frame =


# tmap_save(tmap_arrange(CA_counties, CA_tracts),
#  filename = "my_plot.png", width = 7, height = 5
# )
```

END