Week 13 - K-means Clustering

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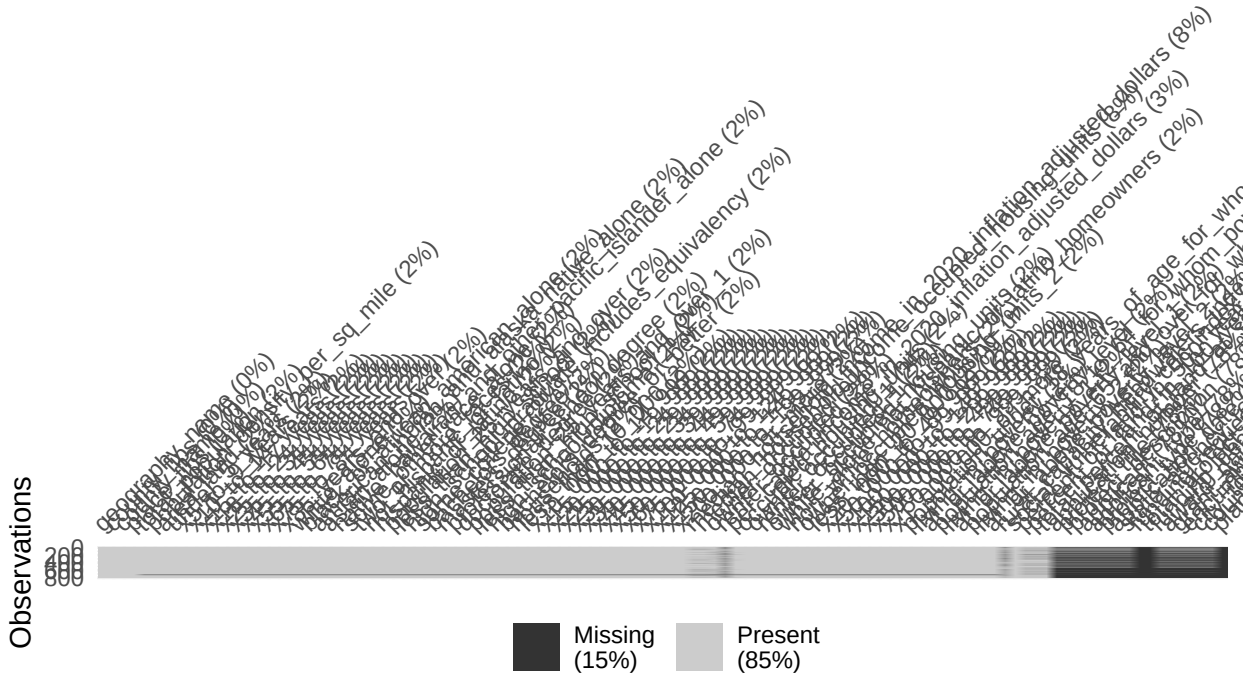
```
knitr::opts_chunk$set(root.dir='Users/devinwilson/Documents/EDF/Flood_Analysis_PLCY_698') # change for y
```

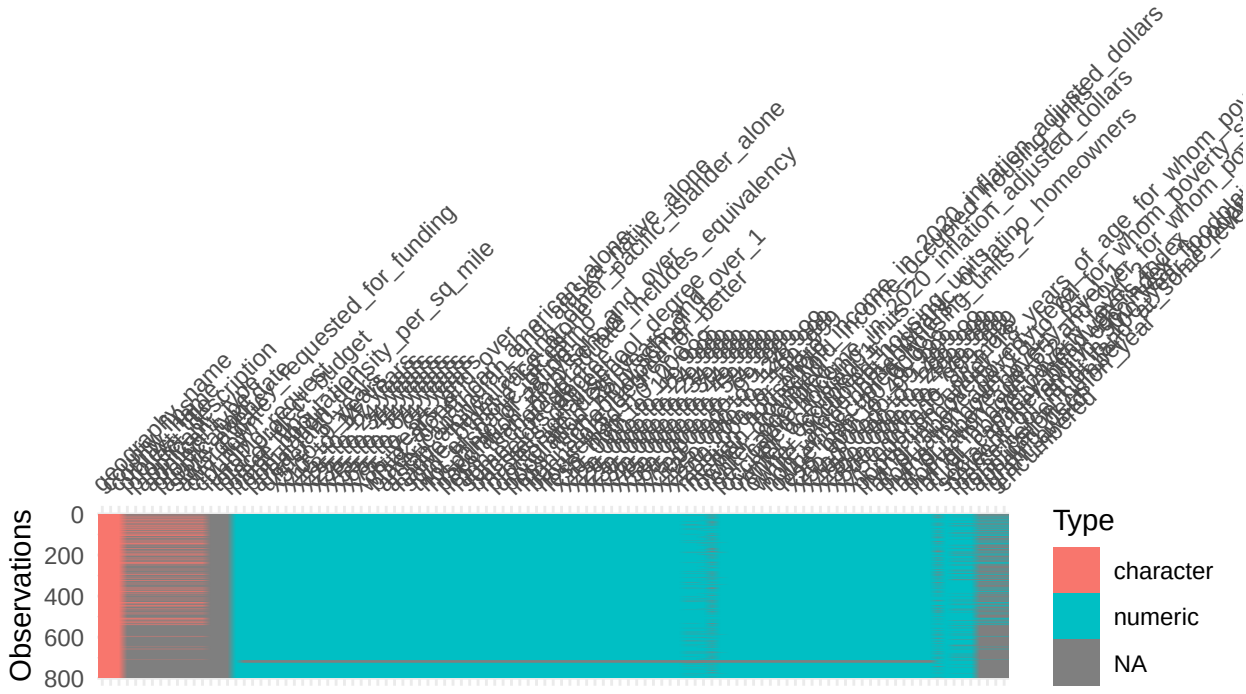
#Running Libraries and Reading in the Data

EDA

```
#install Packages
library(visdat)
library(naniar)

# visualize missingness
vis_miss(data)
```




```
vis_dat(data)
```




```
data %>% summarise(across(everything(), ~ mean(is.na(.))))
```

```
## # A tibble: 1 x 109
##   geography_name count~1 count~2 place~3 total~4 popul~5 area_~6 under~7 x5_to~8
##            <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>   <dbl>
## 1              0       0       0       0  0.0163  0.0163  0.0163  0.0163  0.0163
## # ... with 100 more variables: x10_to_14_years <dbl>, x15_to_17_years <dbl>,
## #   x18_to_24_years <dbl>, x25_to_34_years <dbl>, x35_to_44_years <dbl>,
## #   x45_to_54_years <dbl>, x55_to_64_years <dbl>, x65_to_74_years <dbl>,
## #   x75_to_84_years <dbl>, x85_years_and_over <dbl>, white_alone <dbl>,
## #   black_or_african_american_alone <dbl>,
## #   american_indian_and_alaska_native_alone <dbl>, asian_alone <dbl>,
## #   native_hawaiian_and_other_pacific_islander_alone <dbl>, ...
```

```
#Looking at summary statistics
glimpse(data)
```

```
## Rows: 796
## Columns: 109
## $ geography_name                                                    <chr> ~
## $ county_fips                                                       <chr> ~
## $ county_name                                                       <chr> ~
## $ place_fips                                                        <dbl> ~
## $ total_population                                                  <dbl> ~
## $ population_density_per_sq_mile                                    <dbl> ~
## $ area_land                                                         <dbl> ~
## $ under_5_years                                                     <dbl> ~
## $ x5_to_9_years                                                     <dbl> ~
## $ x10_to_14_years                                                   <dbl> ~
## $ x15_to_17_years                                                   <dbl> ~
## $ x18_to_24_years                                                   <dbl> ~
## $ x25_to_34_years                                                   <dbl> ~
## $ x35_to_44_years                                                   <dbl> ~
```

```
## $ x45_to_54_years                                                    <dbl> ~
## $ x55_to_64_years                                                    <dbl> ~
## $ x65_to_74_years                                                    <dbl> ~
## $ x75_to_84_years                                                    <dbl> ~
## $ x85_years_and_over                                                 <dbl> ~
## $ white_alone                                                        <dbl> ~
## $ black_or_african_american_alone                                    <dbl> ~
## $ american_indian_and_alaska_native_alone                            <dbl> ~
## $ asian_alone                                                        <dbl> ~
## $ native_hawaiian_and_other_pacific_islander_alone                   <dbl> ~
## $ some_other_race_alone                                              <dbl> ~
## $ two_or_more_races                                                  <dbl> ~
## $ not_hispanic_or_latino                                             <dbl> ~
## $ hispanic_or_latino                                                 <dbl> ~
## $ population_25_years_and_over                                       <dbl> ~
## $ less_than_high_school                                              <dbl> ~
## $ high_school_graduate_includes_equivalency                          <dbl> ~
## $ some_college                                                       <dbl> ~
## $ bachelors_degree                                                   <dbl> ~
## $ masters_degree                                                     <dbl> ~
## $ professional_school_degree                                         <dbl> ~
## $ doctorate_degree                                                   <dbl> ~
## $ population_25_years_and_over_1                                     <dbl> ~
## $ less_than_high_school_1                                            <dbl> ~
## $ high_school_diploma                                                <dbl> ~
## $ bachelors_degree_or_better                                         <dbl> ~
## $ households                                                         <dbl> ~
## $ less_than_10_000                                                   <dbl> ~
## $ x10_000_to_14_999                                                  <dbl> ~
## $ x15_000_to_19_999                                                  <dbl> ~
## $ x20_000_to_24_999                                                  <dbl> ~
## $ x25_000_to_29_999                                                  <dbl> ~
## $ x30_000_to_34_999                                                  <dbl> ~
## $ x35_000_to_39_999                                                  <dbl> ~
## $ x40_000_to_44_999                                                  <dbl> ~
## $ x45_000_to_49_999                                                  <dbl> ~
## $ x50_000_to_59_999                                                  <dbl> ~
## $ x60_000_to_74_999                                                  <dbl> ~
## $ x75_000_to_99_999                                                  <dbl> ~
## $ x100_000_to_124_999                                                <dbl> ~
## $ x125_000_to_149_999                                                <dbl> ~
## $ x150_000_to_199_999                                                <dbl> ~
## $ x200_000_or_more                                                   <dbl> ~
## $ median_household_income_in_2020_inflation_adjusted_dollars         <dbl> ~
## $ median_household_income_occupied_housing_units                     <dbl> ~
## $ owner_occupied                                                     <dbl> ~
## $ renter_occupied                                                    <dbl> ~
## $ per_capita_income_in_2020_inflation_adjusted_dollars               <dbl> ~
## $ occupied_housing_units                                             <dbl> ~
## $ owner_occupied_1                                                   <dbl> ~
## $ renter_occupied_1                                                  <dbl> ~
## $ owner_occupied_housing_units                                       <dbl> ~
## $ white_alone_not_hispanic_or_latino_homeowners                      <dbl> ~
## $ non_white_homeowners                                               <dbl> ~
```

```
## $ owner_occupied_housing_units_2                                        <dbl> ~
## $ less_than_20_000                                                      <dbl> ~
## $ x20_000_to_49_999                                                     <dbl> ~
## $ x50_000_to_99_999                                                     <dbl> ~
## $ x100_000_to_149_999                                                   <dbl> ~
## $ x150_000_to_299_999                                                   <dbl> ~
## $ x300_000_to_499_999                                                   <dbl> ~
## $ x500_000_to_749_999                                                   <dbl> ~
## $ x750_000_to_999_999                                                   <dbl> ~
## $ x1_000_000_or_more                                                    <dbl> ~
## $ population_under_18_years_of_age_for_whom_poverty_status_is_determined <dbl> ~
## $ living_in_poverty                                                     <dbl> ~
## $ at_or_above_poverty_level                                             <dbl> ~
## $ population_age_18_to_64_for_whom_poverty_status_is_determined         <dbl> ~
## $ living_in_poverty_1                                                   <dbl> ~
## $ at_or_above_poverty_level_1                                           <dbl> ~
## $ population_age_65_and_over_for_whom_poverty_status_is_determined      <dbl> ~
## $ living_in_poverty_2                                                   <dbl> ~
## $ at_or_above_poverty_level_2                                           <dbl> ~
## $ rural_capacity_headwaters_index                                       <dbl> ~
## $ social_vulnerability_cdc_index                                        <dbl> ~
## $ percent_of_land_in_500_year_floodplain                                <dbl> ~
## $ percent_of_land_in_100_year_floodplain                                <dbl> ~
## $ total_percent_of_land_at_some_level_of_flood_risk                     <dbl> ~
## $ application_number                                                    <dbl> ~
## $ project_title                                                         <chr> ~
## $ project_description                                                   <chr> ~
## $ applicant                                                             <chr> ~
## $ applicant_type                                                        <chr> ~
## $ project_type                                                          <chr> ~
## $ application_date                                                      <chr> ~
## $ state_agency_requested_for_funding                                    <chr> ~
## $ funding_request                                                       <lgl> ~
## $ total_project_budget                                                  <lgl> ~
## $ funding_decision_year                                                 <dbl> ~
## $ award_date                                                            <chr> ~
## $ grant_award                                                           <dbl> ~
## $ encumbered                                                            <dbl> ~
## $ city_town                                                             <chr> ~
## $ county                                                                <chr> ~
## $ place_id                                                              <lgl> ~
```

```
summary(data)
```

```
##  geography_name     county_fips        county_name          place_fips
##  Length:796         Length:796         Length:796         Min.   :3700160
##  Class :character   Class :character   Class :character   1st Qu.:3718315
##  Mode  :character   Mode  :character   Mode  :character   Median :3736910
##                                                           Mean   :3737286
##                                                           3rd Qu.:3757005
##                                                           Max.   :3776220
##
##  total_population population_density_per_sq_mile   area_land
##  Min.   :     0   Min.   :   0.0                 Min.   :  0.11
##  1st Qu.:   535   1st Qu.: 319.9                 1st Qu.:  1.27
```

```
##  Median :  1451   Median : 674.8                Median :  2.76
##  Mean   :  8212   Mean   : 797.7                Mean   :  6.51
##  3rd Qu.:  4102   3rd Qu.:1131.5                3rd Qu.:  6.15
##  Max.   :873570   Max.   :5240.2                Max.   :308.29
##  NA's   :13       NA's   :13                    NA's   :13
##  under_5_years     x5_to_9_years     x10_to_14_years   x15_to_17_years
##  Min.   :    0.0   Min.   :    0.0   Min.   :    0.0   Min.   :    0.0
##  1st Qu.:   18.0   1st Qu.:   21.0   1st Qu.:   21.5   1st Qu.:   14.0
##  Median :   72.0   Median :   82.0   Median :   91.0   Median :   51.0
##  Mean   :  505.7   Mean   :  510.8   Mean   :  525.5   Mean   :  309.9
##  3rd Qu.:  229.5   3rd Qu.:  239.0   3rd Qu.:  249.0   3rd Qu.:  158.0
##  Max.   :58918.0   Max.   :56624.0   Max.   :56281.0   Max.   :32565.0
##  NA's   :13        NA's   :13        NA's   :13        NA's   :13
##  x18_to_24_years   x25_to_34_years  x35_to_44_years  x45_to_54_years
##  Min.   :    0.0   Min.   :     0   Min.   :     0   Min.   :     0
##  1st Qu.:   31.0   1st Qu.:    55   1st Qu.:    49   1st Qu.:    63
##  Median :   99.0   Median :   170   Median :   163   Median :   196
##  Mean   :  888.9   Mean   :  1203   Mean   :  1058   Mean   :  1034
##  3rd Qu.:  342.0   3rd Qu.:   495   3rd Qu.:   502   3rd Qu.:   519
##  Max.   :82299.0   Max.   :159567   Max.   :129349   Max.   :112992
##  NA's   :13        NA's   :13       NA's   :13       NA's   :13
##  x55_to_64_years   x65_to_74_years   x75_to_84_years   x85_years_and_over
##  Min.   :    0.0   Min.   :    0.0   Min.   :    0.0   Min.   :    0.0
##  1st Qu.:   69.5   1st Qu.:   56.0   1st Qu.:   27.0   1st Qu.:    6.0
##  Median :  200.0   Median :  182.0   Median :   86.0   Median :   30.0
##  Mean   :  950.9   Mean   :  716.8   Mean   :  352.7   Mean   :  155.1
##  3rd Qu.:  556.0   3rd Qu.:  492.0   3rd Qu.:  254.0   3rd Qu.:  101.0
##  Max.   :94216.0   Max.   :56165.0   Max.   :24004.0   Max.   :10590.0
##  NA's   :13        NA's   :13        NA's   :13        NA's   :13
##   white_alone       black_or_african_american_alone
##  Min.   :     0.0   Min.   :     0
##  1st Qu.:   309.5   1st Qu.:    17
##  Median :  1091.0   Median :   161
##  Mean   :  5017.5   Mean   :  2175
##  3rd Qu.:  3132.5   3rd Qu.:   708
##  Max.   :407684.0   Max.   :309837
##  NA's   :13         NA's   :13
##  american_indian_and_alaska_native_alone  asian_alone
##  Min.   :   0.00                         Min.   :    0.0
##  1st Qu.:   0.00                         1st Qu.:    0.0
##  Median :   0.00                         Median :    0.0
##  Mean   :  57.69                         Mean   :  339.4
##  3rd Qu.:  23.00                         3rd Qu.:   38.0
##  Max.   :3468.00                         Max.   :57889.0
##  NA's   :13                              NA's   :13
##  native_hawaiian_and_other_pacific_islander_alone some_other_race_alone
##  Min.   :   0.000                                 Min.   :    0.0
##  1st Qu.:   0.000                                 1st Qu.:    0.0
##  Median :   0.000                                 Median :    8.0
##  Mean   :   6.146                                 Mean   :  286.5
##  3rd Qu.:   0.000                                 3rd Qu.:   81.0
##  Max.   :1014.000                                 Max.   :58164.0
##  NA's   :13                                       NA's   :13
##  two_or_more_races not_hispanic_or_latino hispanic_or_latino
```

```
##  Min.   :    0.0   Min.   :     0.0       Min.   :     0.0
##  1st Qu.:    1.0   1st Qu.:   495.5       1st Qu.:     7.0
##  Median :   29.0   Median :  1361.0       Median :    65.0
##  Mean   :  329.3   Mean   :  7353.2       Mean   :   858.5
##  3rd Qu.:  148.0   3rd Qu.:  3780.0       3rd Qu.:   315.0
##  Max.   :36179.0   Max.   :746265.0       Max.   :127305.0
##  NA's   :13        NA's   :13             NA's   :13
##  population_25_years_and_over less_than_high_school
##  Min.   :     0               Min.   :    0.0
##  1st Qu.:   393               1st Qu.:   40.5
##  Median :  1031               Median :  125.0
##  Mean   :  5471               Mean   :  571.5
##  3rd Qu.:  2968               3rd Qu.:  342.5
##  Max.   :586883               Max.   :62042.0
##  NA's   :13                   NA's   :13
##  high_school_graduate_includes_equivalency  some_college
##  Min.   :    0                              Min.   :     0.0
##  1st Qu.:  115                              1st Qu.:   117.5
##  Median :  308                              Median :   339.0
##  Mean   : 1204                              Mean   :  1621.7
##  3rd Qu.:  774                              3rd Qu.:   961.5
##  Max.   :98608                              Max.   :163444.0
##  NA's   :13                                 NA's   :13
##  bachelors_degree   masters_degree    professional_school_degree
##  Min.   :     0.0   Min.   :    0.0   Min.   :    0.0
##  1st Qu.:    33.5   1st Qu.:    9.0   1st Qu.:    0.0
##  Median :   139.0   Median :   47.0   Median :    5.0
##  Mean   :  1299.9   Mean   :  552.9   Mean   :  128.6
##  3rd Qu.:   505.5   3rd Qu.:  197.5   3rd Qu.:   40.0
##  Max.   :171566.0   Max.   :68365.0   Max.   :16246.0
##  NA's   :13         NA's   :13        NA's   :13
##  doctorate_degree  population_25_years_and_over_1 less_than_high_school_1
##  Min.   :   0.00   Min.   :     0                 Min.   :    0.0
##  1st Qu.:   0.00   1st Qu.:   393                 1st Qu.:   40.5
##  Median :   3.00   Median :  1031                 Median :  125.0
##  Mean   :  92.14   Mean   :  5471                 Mean   :  571.5
##  3rd Qu.:  26.50   3rd Qu.:  2968                 3rd Qu.:  342.5
##  Max.   :8701.00   Max.   :586883                 Max.   :62042.0
##  NA's   :13        NA's   :13                     NA's   :13
##  high_school_diploma bachelors_degree_or_better   households
##  Min.   :     0.0    Min.   :     0.0           Min.   :     0
##  1st Qu.:   243.5    1st Qu.:    51.5           1st Qu.:   214
##  Median :   641.0    Median :   207.0           Median :   609
##  Mean   :  2825.8    Mean   :  2073.5           Mean   :  3198
##  3rd Qu.:  1708.5    3rd Qu.:   821.0           3rd Qu.:  1572
##  Max.   :262052.0    Max.   :262789.0           Max.   :338985
##  NA's   :13          NA's   :13                 NA's   :13
##  less_than_10_000  x10_000_to_14_999 x15_000_to_19_999 x20_000_to_24_999
##  Min.   :    0.0   Min.   :    0.0   Min.   :    0.0   Min.   :    0.0
##  1st Qu.:    8.0   1st Qu.:    7.0   1st Qu.:    8.0   1st Qu.:    8.0
##  Median :   39.0   Median :   29.0   Median :   32.0   Median :   28.0
##  Mean   :  212.1   Mean   :  153.2   Mean   :  148.7   Mean   :  155.5
##  3rd Qu.:  111.0   3rd Qu.:   90.5   3rd Qu.:   89.0   3rd Qu.:   85.0
##  Max.   :16173.0   Max.   :11650.0   Max.   :11812.0   Max.   :12715.0
```

```
##  NA's   :13        NA's   :13        NA's   :13        NA's   :13
##  x25_000_to_29_999 x30_000_to_34_999 x35_000_to_39_999 x40_000_to_44_999
##  Min.   :    0.0   Min.   :    0.0   Min.   :    0.0   Min.   :    0.0
##  1st Qu.:    8.0   1st Qu.:    7.0   1st Qu.:    6.0   1st Qu.:    4.5
##  Median :   29.0   Median :   28.0   Median :   25.0   Median :   22.0
##  Mean   :  153.3   Mean   :  159.8   Mean   :  150.9   Mean   :  147.6
##  3rd Qu.:   83.5   3rd Qu.:   79.0   3rd Qu.:   74.0   3rd Qu.:   76.5
##  Max.   :13865.0   Max.   :16902.0   Max.   :15431.0   Max.   :16143.0
##  NA's   :13        NA's   :13        NA's   :13        NA's   :13
##  x45_000_to_49_999 x50_000_to_59_999 x60_000_to_74_999 x75_000_to_99_999
##  Min.   :    0.0   Min.   :    0.0   Min.   :    0.0   Min.   :    0.0
##  1st Qu.:    4.0   1st Qu.:   14.0   1st Qu.:   17.0   1st Qu.:   19.0
##  Median :   20.0   Median :   46.0   Median :   60.0   Median :   64.0
##  Mean   :  128.7   Mean   :  252.6   Mean   :  307.9   Mean   :  391.2
##  3rd Qu.:   60.5   3rd Qu.:  132.0   3rd Qu.:  165.0   3rd Qu.:  202.5
##  Max.   :13134.0   Max.   :28467.0   Max.   :33903.0   Max.   :43066.0
##  NA's   :13        NA's   :13        NA's   :13        NA's   :13
##  x100_000_to_124_999 x125_000_to_149_999 x150_000_to_199_999 x200_000_or_more
##  Min.   :    0.0     Min.   :    0.0     Min.   :    0.0     Min.   :    0.0
##  1st Qu.:    8.0     1st Qu.:    1.5     1st Qu.:    0.0     1st Qu.:    0.0
##  Median :   37.0     Median :   17.0     Median :   13.0     Median :   10.0
##  Mean   :  267.3     Mean   :  167.8     Mean   :  184.1     Mean   :  217.9
##  3rd Qu.:  145.5     3rd Qu.:   76.5     3rd Qu.:   70.0     3rd Qu.:   55.5
##  Max.   :30997.0     Max.   :19679.0     Max.   :22236.0     Max.   :32812.0
##  NA's   :13          NA's   :13          NA's   :13          NA's   :13
##  median_household_income_in_2020_inflation_adjusted_dollars
##  Min.   : 13889
##  1st Qu.: 36613
##  Median : 47432
##  Mean   : 53432
##  3rd Qu.: 64125
##  Max.   :209950
##  NA's   :63
##  median_household_income_occupied_housing_units owner_occupied
##  Min.   : 13889                                 Min.   : 13492
##  1st Qu.: 36613                                 1st Qu.: 47586
##  Median : 47432                                 Median : 59315
##  Mean   : 53432                                 Mean   : 64139
##  3rd Qu.: 64125                                 3rd Qu.: 74802
##  Max.   :209950                                 Max.   :210515
##  NA's   :63                                     NA's   :68
##  renter_occupied  per_capita_income_in_2020_inflation_adjusted_dollars
##  Min.   :  2499   Min.   :  5987
##  1st Qu.: 22372   1st Qu.: 20402
##  Median : 30803   Median : 25050
##  Mean   : 35482   Mean   : 28081
##  3rd Qu.: 41898   3rd Qu.: 33086
##  Max.   :250001   Max.   :145777
##  NA's   :225      NA's   :21
##  occupied_housing_units owner_occupied_1   renter_occupied_1
##  Min.   :     0         Min.   :     0.0   Min.   :     0.0
##  1st Qu.:   214         1st Qu.:   145.5   1st Qu.:    50.5
##  Median :   609         Median :   393.0   Median :   168.0
##  Mean   :  3198         Mean   :  1839.7   Mean   :  1358.8
```

```
##  3rd Qu.:  1572         3rd Qu.:  1119.5   3rd Qu.:   504.0
##  Max.   :338985         Max.   :179054.0   Max.   :159931.0
##  NA's   :13             NA's   :13         NA's   :13
##  owner_occupied_housing_units white_alone_not_hispanic_or_latino_homeowners
##  Min.   :     0.0             Min.   :     0
##  1st Qu.:   145.5             1st Qu.:    98
##  Median :   393.0             Median :   290
##  Mean   :  1839.7             Mean   :  1315
##  3rd Qu.:  1119.5             3rd Qu.:   923
##  Max.   :179054.0             Max.   :102643
##  NA's   :13                   NA's   :13
##  non_white_homeowners owner_occupied_housing_units_2 less_than_20_000
##  Min.   :    0        Min.   :     0.0               Min.   :   0.00
##  1st Qu.:   12        1st Qu.:   145.5               1st Qu.:   0.00
##  Median :   66        Median :   393.0               Median :   9.00
##  Mean   :  525        Mean   :  1839.7               Mean   :  39.57
##  3rd Qu.:  196        3rd Qu.:  1119.5               3rd Qu.:  33.50
##  Max.   :76411        Max.   :179054.0               Max.   :2388.00
##  NA's   :13           NA's   :13                     NA's   :13
##  x20_000_to_49_999 x50_000_to_99_999 x100_000_to_149_999 x150_000_to_299_999
##  Min.   :   0.0    Min.   :    0.0   Min.   :    0.0     Min.   :    0.0
##  1st Qu.:   1.0    1st Qu.:   19.0   1st Qu.:   17.5     1st Qu.:   24.0
##  Median :  13.0    Median :   60.0   Median :   60.0     Median :  101.0
##  Mean   :  45.4    Mean   :  215.3   Mean   :  293.4     Mean   :  715.3
##  3rd Qu.:  39.0    3rd Qu.:  147.0   3rd Qu.:  182.0     3rd Qu.:  425.0
##  Max.   :2026.0    Max.   :12628.0   Max.   :25722.0     Max.   :71187.0
##  NA's   :13        NA's   :13        NA's   :13          NA's   :13
##  x300_000_to_499_999 x500_000_to_749_999 x750_000_to_999_999 x1_000_000_or_more
##  Min.   :    0.0     Min.   :    0.0     Min.   :   0.0      Min.   :   0.00
##  1st Qu.:    0.0     1st Qu.:    0.0     1st Qu.:   0.0      1st Qu.:   0.00
##  Median :   19.0     Median :    0.0     Median :   0.0      Median :   0.00
##  Mean   :  362.8     Mean   :  104.9     Mean   :  35.9      Mean   :  27.09
##  3rd Qu.:  125.0     3rd Qu.:   22.0     3rd Qu.:   3.0      3rd Qu.:   3.00
##  Max.   :37736.0     Max.   :14767.0     Max.   :6588.0      Max.   :6444.00
##  NA's   :13          NA's   :13          NA's   :13          NA's   :13
##  population_under_18_years_of_age_for_whom_poverty_status_is_determined
##  Min.   :     0.0
##  1st Qu.:    92.0
##  Median :   291.0
##  Mean   :  1821.1
##  3rd Qu.:   847.5
##  Max.   :200673.0
##  NA's   :13
##  living_in_poverty at_or_above_poverty_level
##  Min.   :    0.0   Min.   :     0.0
##  1st Qu.:    6.0   1st Qu.:    63.5
##  Median :   53.0   Median :   206.0
##  Mean   :  378.7   Mean   :  1442.5
##  3rd Qu.:  191.0   3rd Qu.:   678.0
##  Max.   :36185.0   Max.   :164488.0
##  NA's   :13        NA's   :13
##  population_age_18_to_64_for_whom_poverty_status_is_determined
##  Min.   :     0.0
##  1st Qu.:   299.5
```

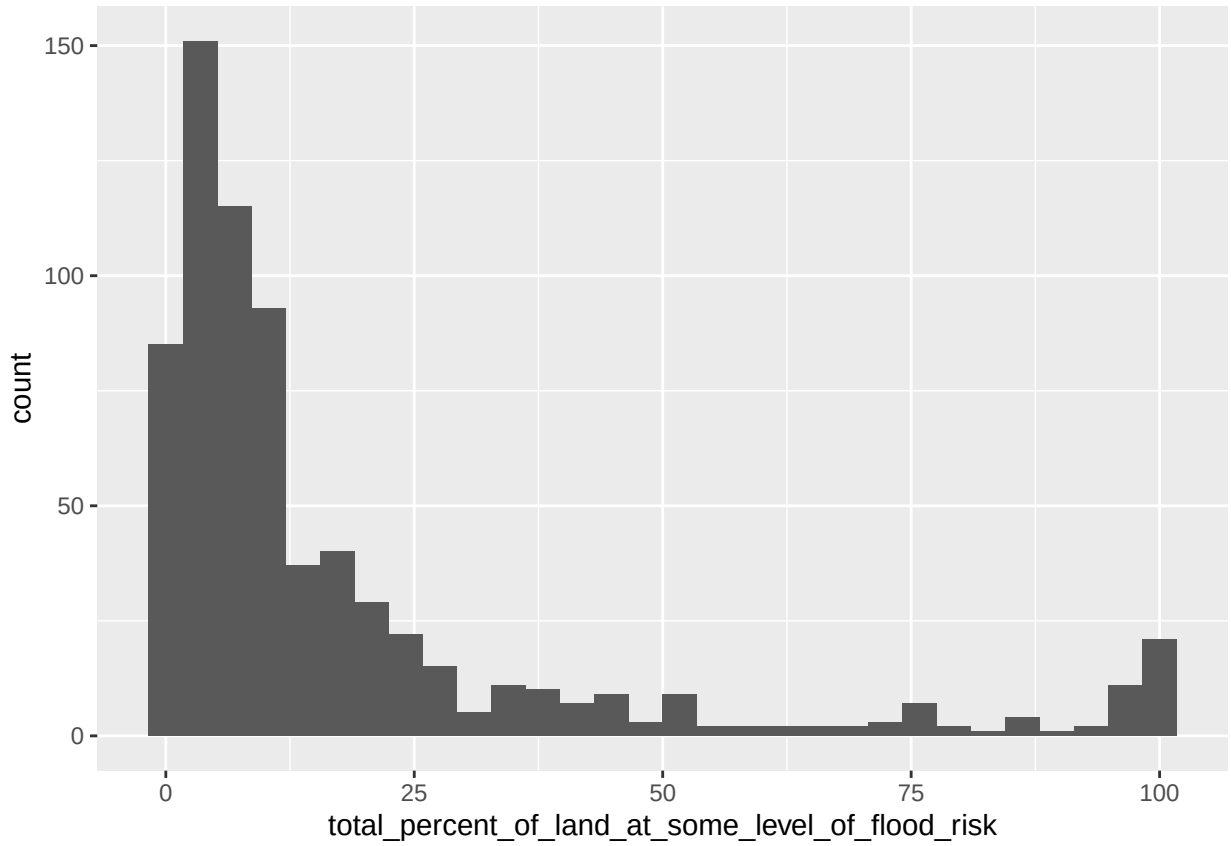
```
##  Median :   814.0
##  Mean   :  4901.4
##  3rd Qu.:  2256.0
##  Max.   :569328.0
##  NA's   :13
##  living_in_poverty_1 at_or_above_poverty_level_1
##  Min.   :    0.0     Min.   :     0
##  1st Qu.:   34.0     1st Qu.:   240
##  Median :  116.0     Median :   692
##  Mean   :  668.3     Mean   :  4233
##  3rd Qu.:  329.0     3rd Qu.:  1950
##  Max.   :58906.0     Max.   :510422
##  NA's   :13          NA's   :13
##  population_age_65_and_over_for_whom_poverty_status_is_determined
##  Min.   :    0.0
##  1st Qu.:   98.5
##  Median :  302.0
##  Mean   : 1180.9
##  3rd Qu.:  785.5
##  Max.   :89182.0
##  NA's   :13
##  living_in_poverty_2 at_or_above_poverty_level_2
##  Min.   :   0.0      Min.   :    0.0
##  1st Qu.:   5.0      1st Qu.:   83.0
##  Median :  24.0      Median :  270.0
##  Mean   : 110.9      Mean   : 1070.0
##  3rd Qu.:  72.0      3rd Qu.:  694.5
##  Max.   :7530.0      Max.   :81652.0
##  NA's   :13          NA's   :13
##  rural_capacity_headwaters_index social_vulnerability_cdc_index
##  Min.   : 4.00                   Min.   :0.0100
##  1st Qu.:53.00                   1st Qu.:0.3500
##  Median :58.00                   Median :0.6000
##  Mean   :57.78                   Mean   :0.5595
##  3rd Qu.:69.00                   3rd Qu.:0.7500
##  Max.   :95.00                   Max.   :0.9800
##  NA's   :195
##  percent_of_land_in_500_year_floodplain percent_of_land_in_100_year_floodplain
##  Min.   : 0.000                         Min.   :  0.00
##  1st Qu.: 0.000                         1st Qu.:  3.38
##  Median : 0.510                         Median :  7.66
##  Mean   : 2.311                         Mean   : 15.74
##  3rd Qu.: 1.860                         3rd Qu.: 17.00
##  Max.   :48.430                         Max.   :100.00
##  NA's   :93                             NA's   :93
##  total_percent_of_land_at_some_level_of_flood_risk application_number
##  Min.   :  0.000                                   Min.   : 1.00
##  1st Qu.:  3.655                                   1st Qu.: 8.00
##  Median :  8.690                                   Median :13.00
##  Mean   : 18.047                                   Mean   :13.09
##  3rd Qu.: 19.455                                   3rd Qu.:20.00
##  Max.   :100.000                                   Max.   :24.00
##  NA's   :93                                        NA's   :620
##  project_title      project_description  applicant         applicant_type
```

```
##  Length:796         Length:796          Length:796         Length:796
##  Class :character   Class :character    Class :character   Class :character
##  Mode  :character   Mode  :character    Mode  :character   Mode  :character
##
##
##
##
##  project_type       application_date   state_agency_requested_for_funding
##  Length:796         Length:796         Length:796
##  Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  funding_request total_project_budget funding_decision_year  award_date
##  Mode:logical    Mode:logical         Min.   :2022          Length:796
##  NA's:796        NA's:796             1st Qu.:2022          Class :character
##                                       Median :2022          Mode  :character
##                                       Mean   :2022
##                                       3rd Qu.:2022
##                                       Max.   :2022
##                                       NA's   :620
##   grant_award       encumbered      city_town            county
##  Min.   : 90000   Min.   : 90000   Length:796         Length:796
##  1st Qu.:175000   1st Qu.:175000   Class :character   Class :character
##  Median :249880   Median :249880   Mode  :character   Mode  :character
##  Mean   :216198   Mean   :216198
##  3rd Qu.:250000   3rd Qu.:250000
##  Max.   :250000   Max.   :250000
##  NA's   :620      NA's   :620
##  place_id
##  Mode:logical
##  NA's:796
##
##
##
##
##
```

```
#Exploring the Data through some plots
  #Histogram
  ggplot(data, aes(x=total_percent_of_land_at_some_level_of_flood_risk)) +
  geom_histogram()
```

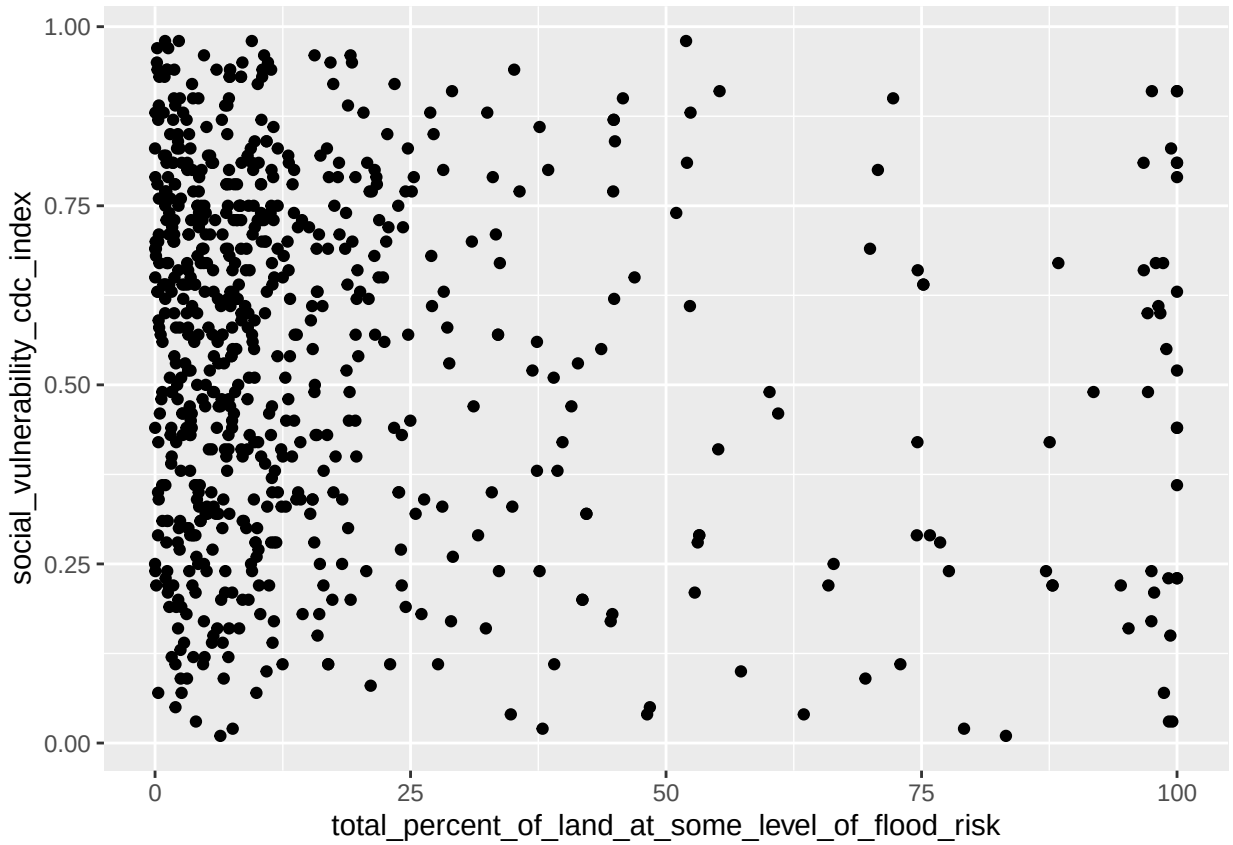
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 93 rows containing non-finite values (`stat_bin()`).
```




```
#Scatterplot
ggplot(data, aes(x=total_percent_of_land_at_some_level_of_flood_risk, y=social_vulnerability_cdc_inde
geom_point()
```

```
## Warning: Removed 93 rows containing missing values (`geom_point()`).
```



Interpretation of missingness: There a large amount of missingnes in this data at 15% of the data missing. Variables which were missing over 70% of their data include: Place ID, County, City/Town, Encumbered ($), Grant Award (4), Award Date, Funding Decision Year, Total Project Budget, Funding Request, StateEgency REquested for Funding, Application Date, Application Number, Project Title, Projcet Description, Applicant, Applicant Type, Project Type. The missing variables came from the grant data that was provided by the Golden Leaf Foundation.

Interpretation of Plots: The total percent of land at some level of flood risk is right skewed and also does not seem to be correlated with the CDC social vulnerability index. I chose to do some plots with this variable because I feel like it offers the most insight into the level of flooding in each community.

RQ1: What communities have completed and submitted applications for funding?

- Within these applicants, what communities received funding?
- What are their characteristics?
- What type of funding did these communities receive?
- Who are key people to their application?
- What organizational infrastructure do they have to support the deployment of funding?

```
counties1_withdata <- data %>% na.omit()
```

RQ2: How is funding distributed by grant administrators?

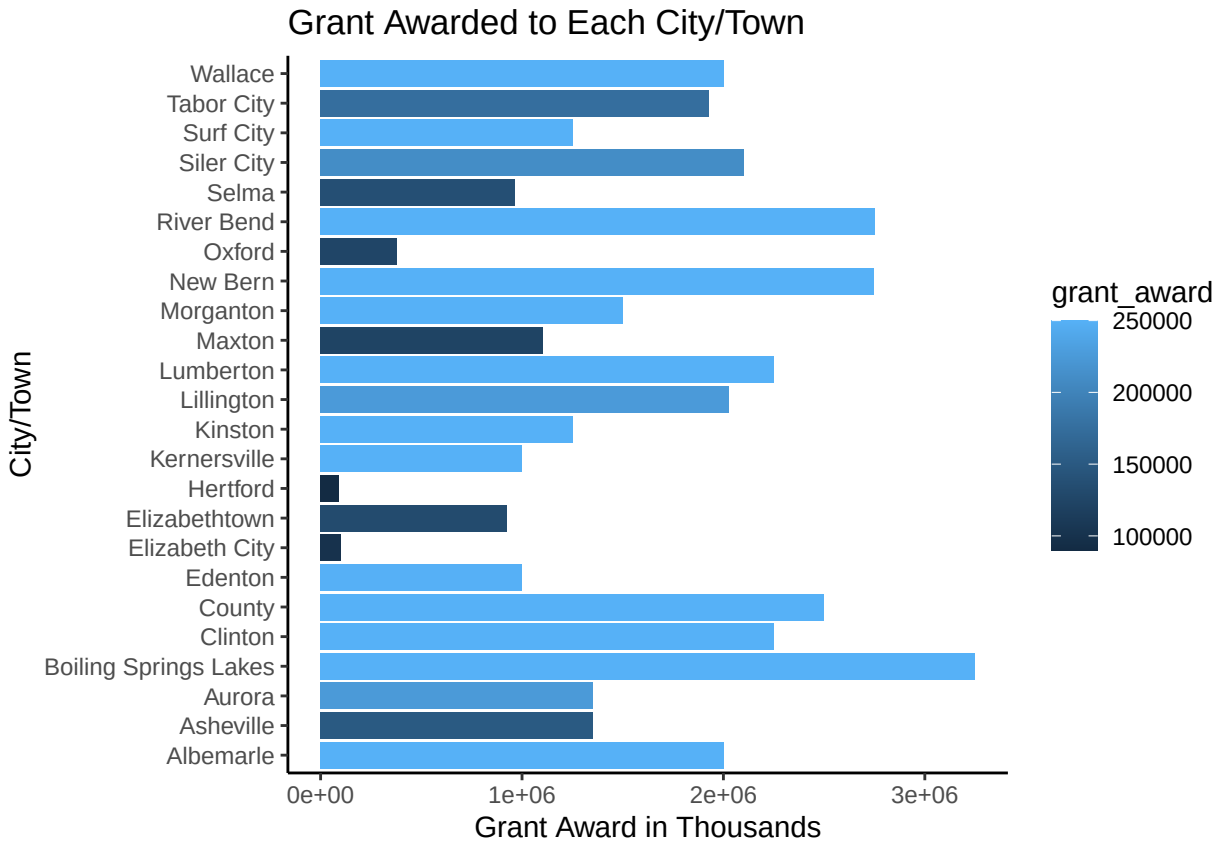
- Is there a correlation between communities funded and the wealth of the community and funding?

RQ3: What trends exist in the data?

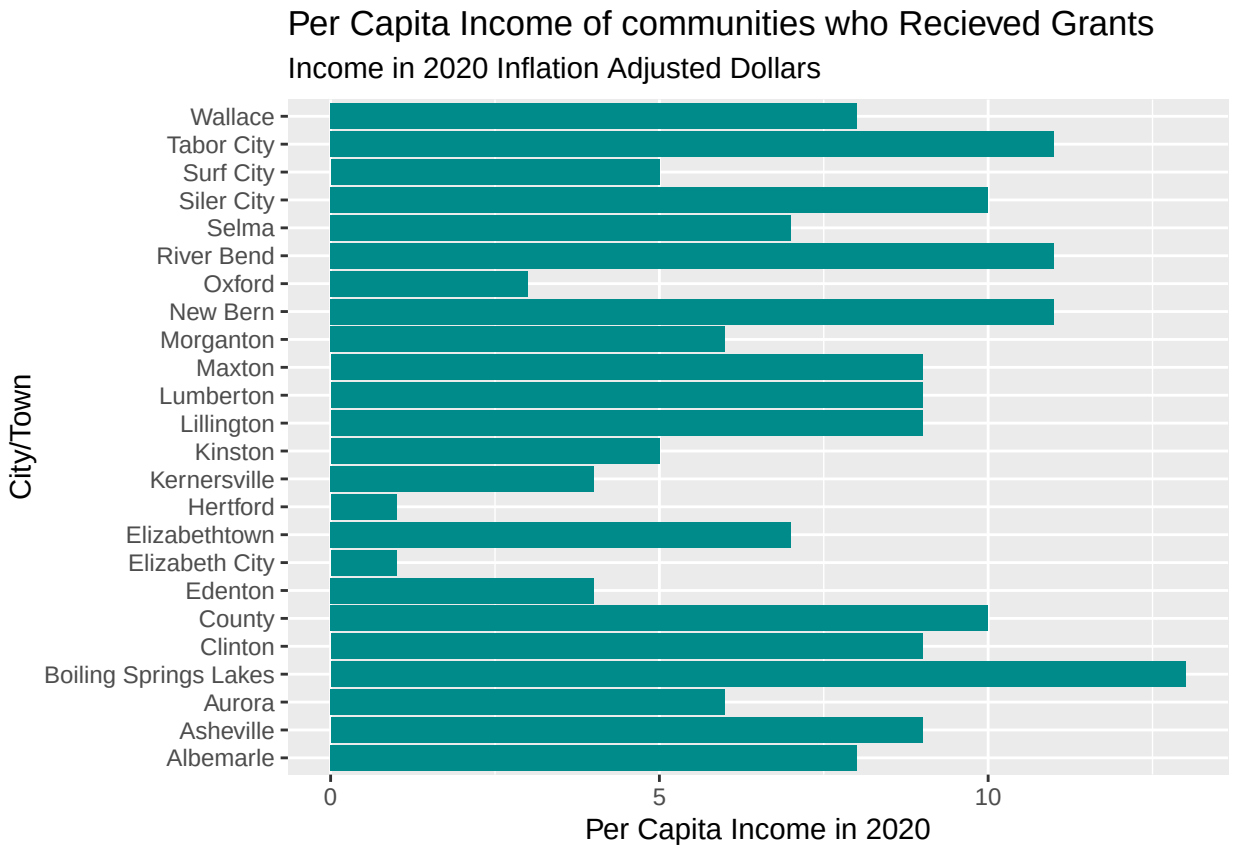
- What variables influence whether an organization receives funding?
- To what extent is there equitable distribution of funds?

- How does flood risk correlate with the amount of funds received if any?

```
#Bar Plot visualizing which communties recieved grants and how much they received.
data %>%
  filter(!is.na(city_town)) %>%
  filter(!is.na(grant_award)) %>%
  ggplot(aes(y=city_town, x=grant_award, fill = grant_award)) + labs(y = "City/Town", x = "Grant Award
```




```
#Bar Plot visualizing the Per Capita Income of communities who Recieved Grants
  data %>%
  filter(!is.na(city_town)) %>%
  filter(!is.na(grant_award)) %>%
  ggplot(aes(y=city_town, fill=per_capita_income_in_2020_inflation_adjusted_dollars)) + labs(y = "City/
```



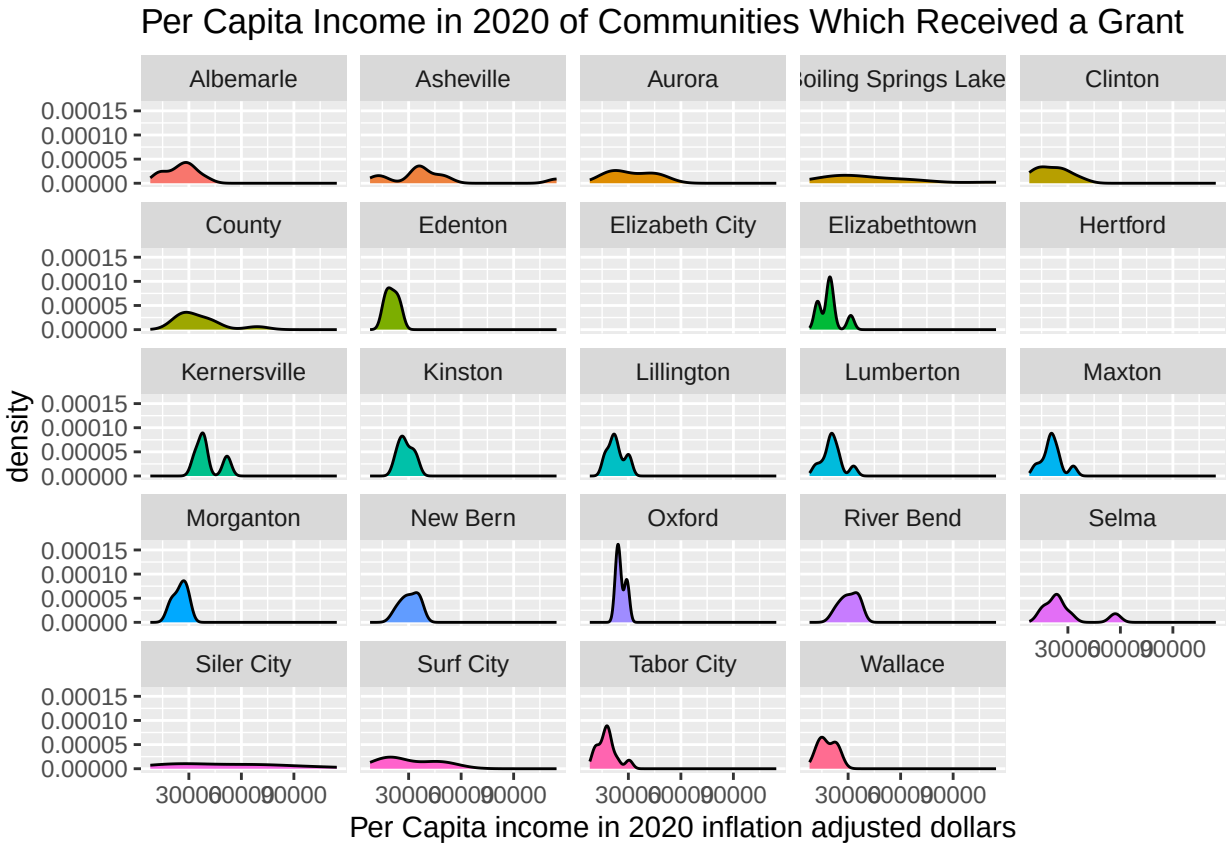

```
#Histograms visualizing the Per Capita income in 2020 of the communities which received funding
  data %>%
  filter(!is.na(city_town)) %>%
  filter(!is.na(grant_award)) %>%
  ggplot(aes(x=per_capita_income_in_2020_inflation_adjusted_dollars, fill=city_town), show.legend = FALS
```

```
## Warning: Removed 3 rows containing non-finite values (`stat_density()`).
```

```
## Warning: Groups with fewer than two data points have been dropped.
## Groups with fewer than two data points have been dropped.
```

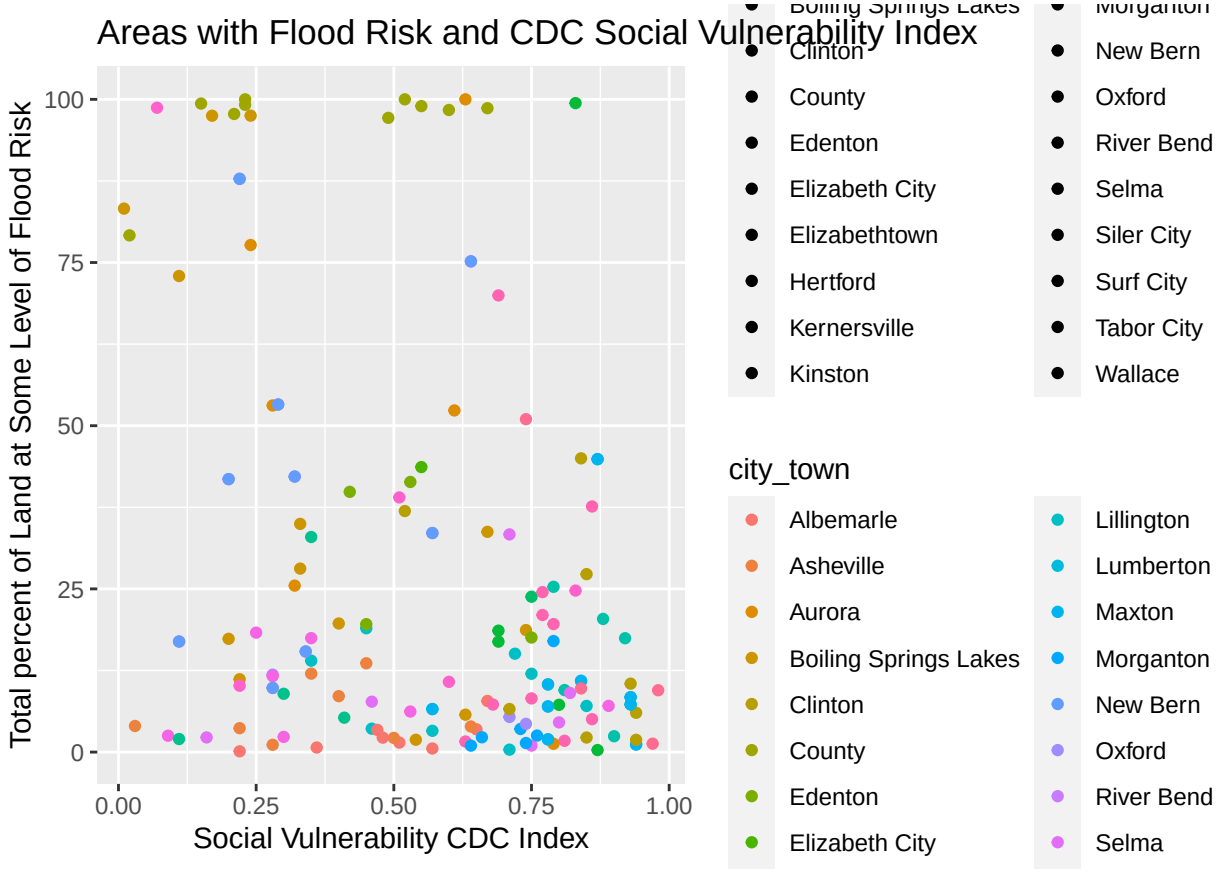
```
## Warning in max(ids, na.rm = TRUE): no non-missing arguments to max; returning
## -Inf
```

```
## Warning in max(ids, na.rm = TRUE): no non-missing arguments to max; returning
## -Inf
```



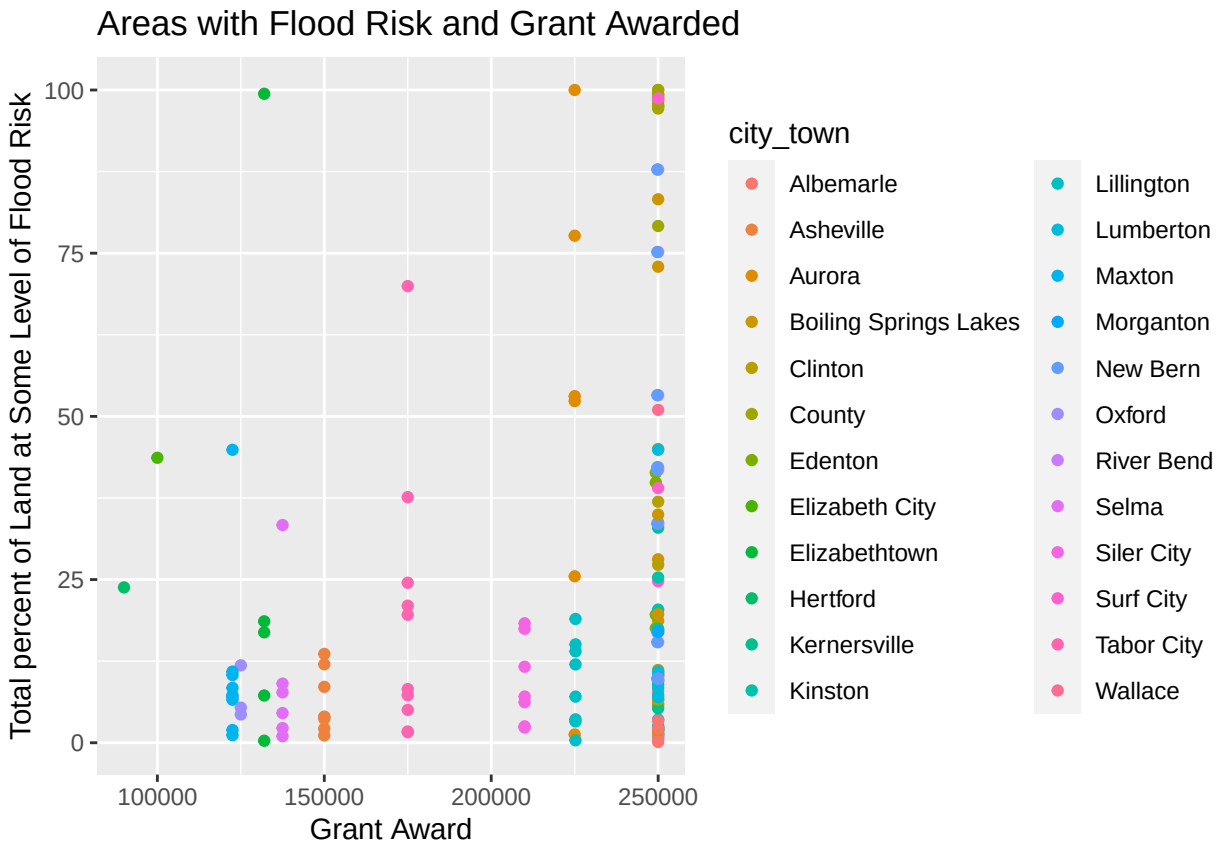

```
#Scatterplot visualizing the relationship between social vulnerability index and percent of area floode
  data %>%
  filter(!is.na(city_town)) %>%
  filter(!is.na(grant_award)) %>%
  ggplot(aes(x=social_vulnerability_cdc_index, y=total_percent_of_land_at_some_level_of_flood_risk, fil
```

```
## Warning: Removed 18 rows containing missing values (`geom_point()`).
```




```
#Scatterplot visualizing the relationship between grant awarded and percent of area flooded
  data %>%
  filter(!is.na(city_town)) %>%
  filter(!is.na(grant_award)) %>%
  ggplot(aes(x=grant_award, y=total_percent_of_land_at_some_level_of_flood_risk, fill=city_town, color=
```

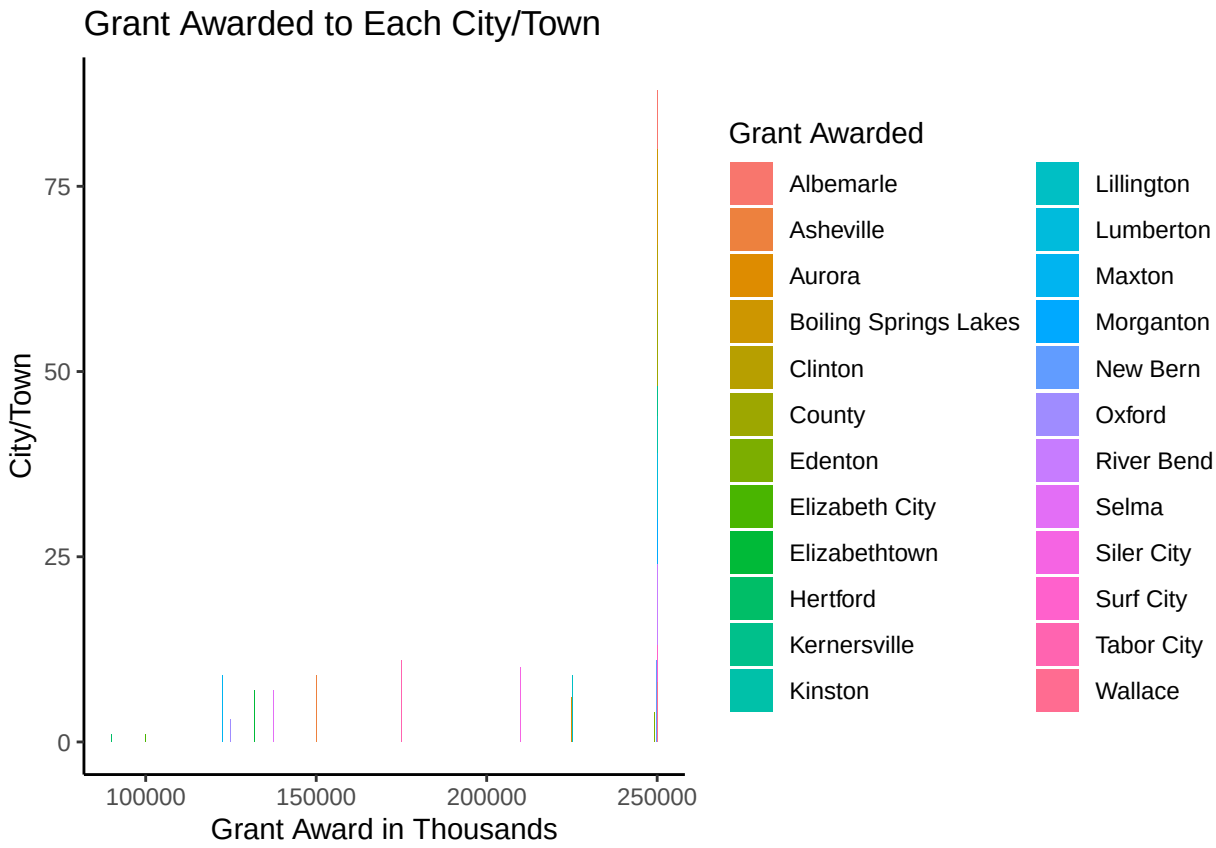
```
## Warning: Removed 18 rows containing missing values (`geom_point()`).
```



RQ4: Is there a correlation between the size of the town and the amount of funds awarded?

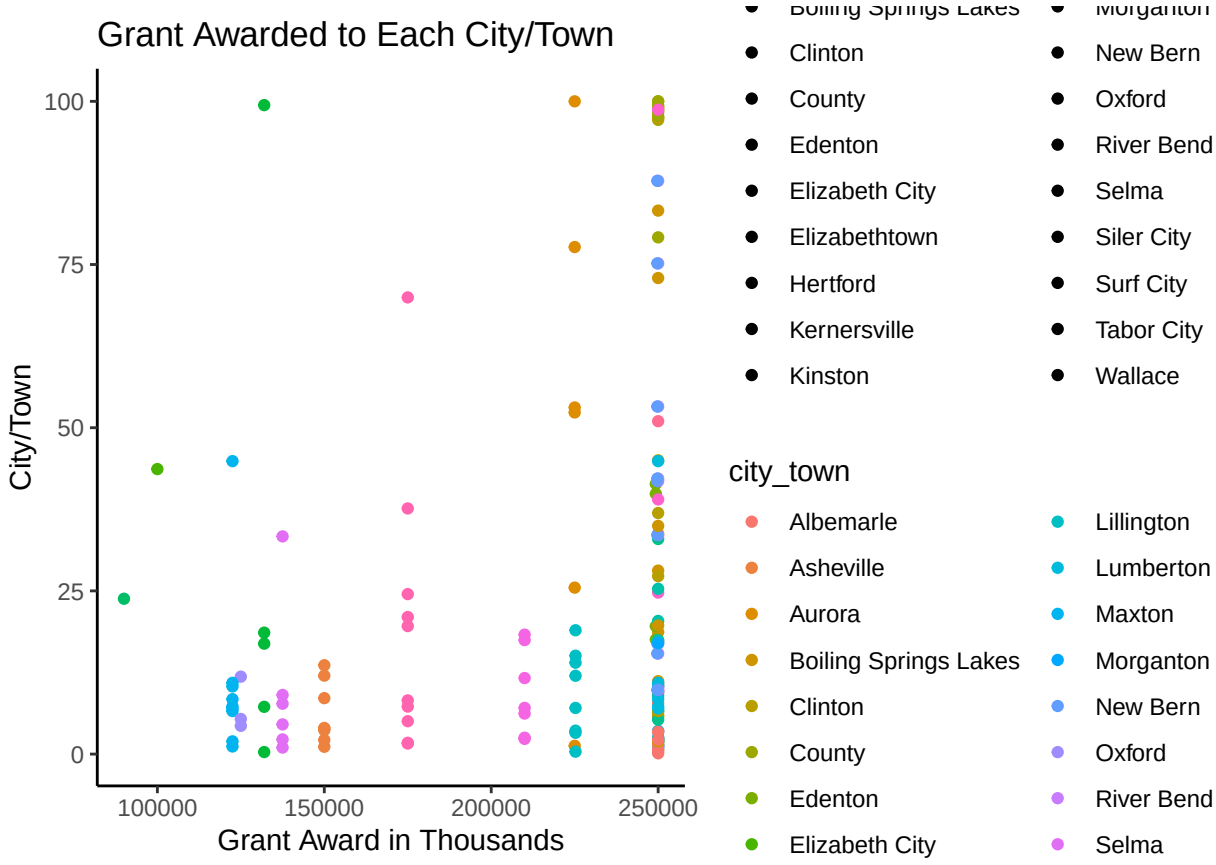
```
p1 <-
  data %>%
  filter(!is.na(city_town)) %>%
  filter(!is.na(grant_award)) %>%
  ggplot(aes(fill=total_percent_of_land_at_some_level_of_flood_risk, y=city_town, color=city_town)) + la

p2 <- data %>%
  filter(!is.na(city_town)) %>%
  filter(!is.na(grant_award)) %>%
  ggplot(aes(y=city_town, fill=grant_award)) + labs(y = "City/Town", x = "Grant Award in Thousands", ti
```

```
data %>%
  filter(!is.na(city_town)) %>%
  filter(!is.na(grant_award)) %>%
  ggplot(aes(x=grant_award, fill=city_town)) + labs(y = "City/Town", x = "Grant Award in Thousands", ti
```



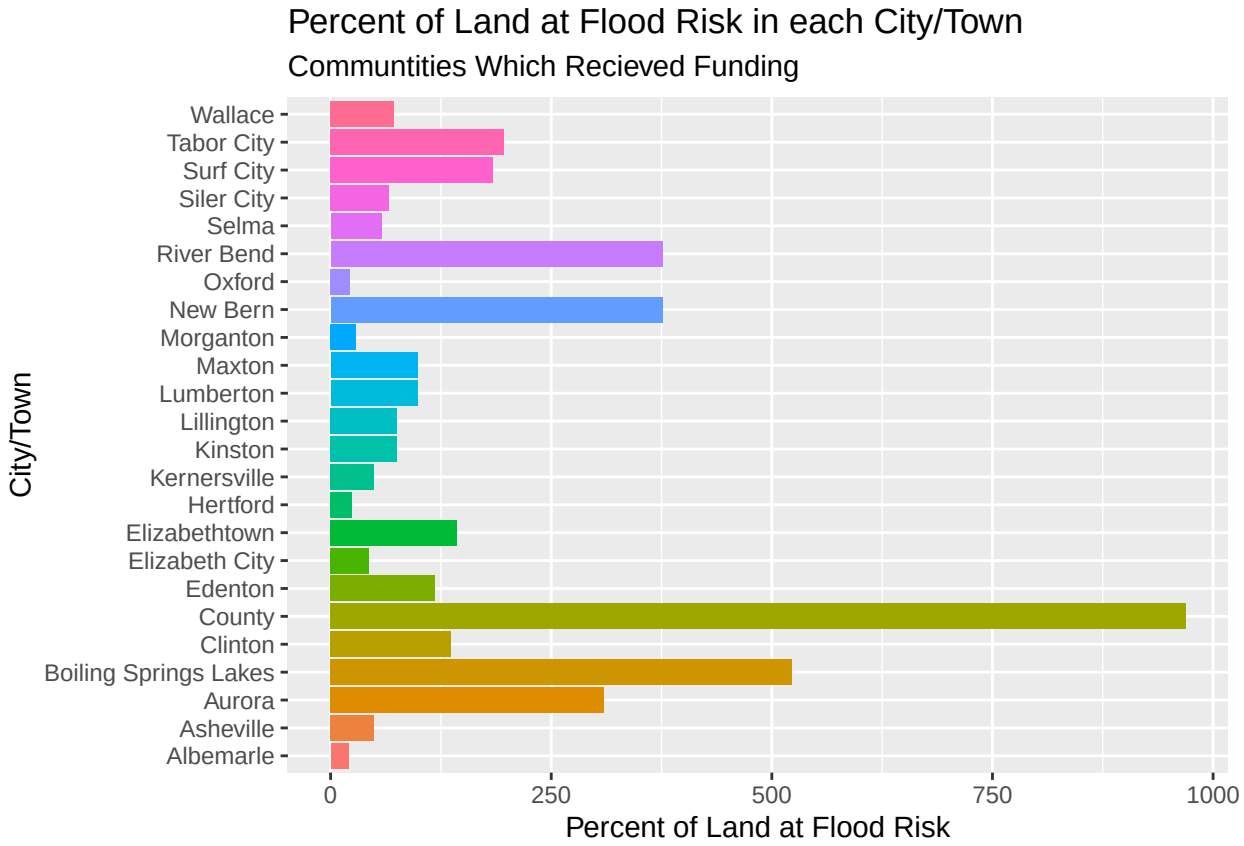

```
data %>%
  filter(!is.na(city_town)) %>%
  filter(!is.na(grant_award)) %>%
  ggplot(aes(y=total_percent_of_land_at_some_level_of_flood_risk, x=grant_award, fill=city_town, color=
```

```
## Warning: Removed 18 rows containing missing values (`geom_point()`).
```




```
data %>%
  filter(!is.na(city_town)) %>%
  filter(!is.na(grant_award)) %>%
  select(-c('county')) %>%
  ggplot(aes(x=total_percent_of_land_at_some_level_of_flood_risk, y=city_town, fill=city_town)) + labs(
```

```
## Warning: Removed 18 rows containing missing values (`position_stack()`).
```




```
read_csv("golden_leaf.csv")
```

```
## Warning: One or more parsing issues, call `problems()` on your data frame for details,
## e.g.:
##   dat <- vroom(...)
##   problems(dat)
```

```
## Rows: 176 Columns: 35
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (11): county_fips, place_fips, project_description, applicant, applicant...
## dbl (22): geography_name, county_name, total_population, population_density_...
## lgl  (2): total_project_budget, funding_decision_year
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
## # A tibble: 176 x 35
##    geography_n~1 count~2 count~3 place~4 total~5 popul~6 area_~7 livin~8 at_or~9
##            <dbl> <chr>     <dbl> <chr>     <dbl>   <dbl>   <dbl>   <dbl>   <dbl>
##  1             1 Albema~     167 Stanly  3700680   16073    921.    17.5     1264
##  2             2 Anders~      85 Harnett 3701340   14899    764.    19.5     1153
##  3             3 Angier~      85 Harnett 3701400    5748   1797.     3.2      206
##  4             4 Aquada~     167 Stanly  3701560     413    127.     3.26       0
##  5             5 Archer~     101 Johnst~ 3701760    5037    556.     9.07     522
##  6             6 Arrowh~      41 Chowan  3701972     799   1306.     0.61       0
##  7             7 Ashevi~      21 Buncom~ 3702140   92328   2030.    45.5     2766
##  8             8 Atkins~     141 Pender  3702460     351    355.     0.99      16
```

```
##  9             9 Aurora~      13 Beaufo~ 3702620     772    832.    0.93      92
## 10            10 Autryv~     163 Sampson 3702700     192    368.    0.52       0
## # ... with 166 more rows, 26 more variables:
## #   population_age_18_to_64_for_whom_poverty_status_is_determined <dbl>,
## #   living_in_poverty_1 <dbl>, at_or_above_poverty_level_1 <dbl>,
## #   population_age_65_and_over_for_whom_poverty_status_is_determined <dbl>,
## #   living_in_poverty_2 <dbl>, at_or_above_poverty_level_2 <dbl>,
## #   rural_capacity_headwaters_index <dbl>,
## #   social_vulnerability_cdc_index <dbl>, ...
```

```
#This is where I did a subset of the merged dataset and created a smaller dataset called "golden_leaf".
#golden_leaf <- golden_leaf %>% clean_names() %>% filter(!is.na(city_town)) %>%
 # filter(!is.na(grant_award))

#this is where I exported the file to a new .csv file
#write.table(golden_leaf, file="golden_leaf.csv", sep=",")
```

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

```
#This is where I created a plot of each NC County and their percent of flood risk.
#golden_leaf %>% ggplot(aes(x=total_percent_of_land_at_some_level_of_flood_risk, y=county_name)) + xlim
```

```
#This is where I created a plot of each NC County and the grant they were awarded. The x-axis goes up t
#golden_leaf %>% ggplot(aes(y=county_name, x=grant_award)) + xlim(0, 300000)+ labs(y = "County", x = "G

#This is where I created a new variable grant/per population
#golden_leaf2 <- golden_leaf %>%
  #mutate(grant_per_person = grant_award/ total_population)

#This is where I created a new variable grant/per amount of communtiy at flood risk
#golden_leaf2 <- golden_leaf2 %>%
  #mutate(grant_per_percent_of_land_at_some_level_of_flood_risk = grant_award/ total_percent_of_land_at

#This is where I exported the data with the new variables
#write.table(golden_leaf2, file="golden_leaf2.csv", sep=",")
```