

# SocScape



## USER GUIDE

*April 2017*

# 1. INTRODUCTION

**SocScape (Social Landscape)** is a GeoWeb-based application designed to explore and download high resolution (30 m) demographic grids covering the entire conterminous United States. Demographic grids have been calculated from census blocks using dasymetric modeling technique with land cover as ancillary data.

Methodology to obtain demographic grids is described in:

- *A. Dmowska, T. F. Stepinski, P. Netzel (2017) Comprehensive framework for visualizing and analyzing spatio-temporal dynamics of racial diversity in the entire United States, PLoS ONE 12 (3): e0174993*  
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0174993>
- A. Dmowska and T. F. Stepinski (2017) A high resolution population grid for the conterminous United States: The 2010 edition. *Computers, Environment and Urban Systems* 61, pp. 13-23.

At present, SocScape includes two types of demographic grids: **population density** and **racial diversity**. These grids are available for **1990, 2000, 2010** as multi-year comparable datasets (called “myc”). For 2010 we also made available additional datasets, that used more detailed ancillary information, but cannot be used for change analysis.

SocScape has been developed in the Space Informatics Lab (sil.uc.edu) at the University of Cincinnati and is available at

[http://sil.uc.edu/webapps/socscape\\_usa/](http://sil.uc.edu/webapps/socscape_usa/)

In addition to GeoWeb application we made available website – **SocScape data**, which provide data for each county and 363 metropolitan areas as a zip archive. This website is available at

<http://sil.uc.edu/cms/index.php?id=socscape-data>

## 2. OPENING SCREEN

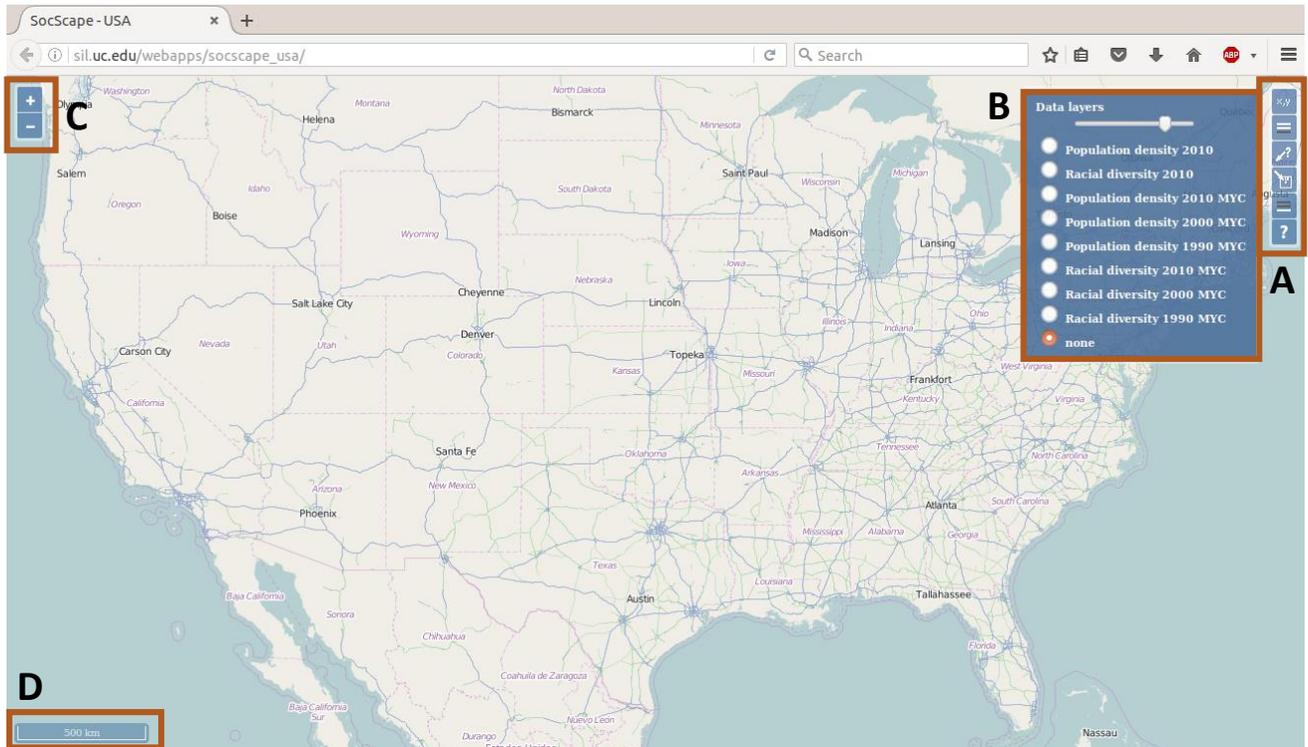


Fig. 1 SocScape opening screen.

A. Navigation panel, B. Data layers, C. Map navigation tools, D. Scale

Upon launching SocScape displays the zoomable map of the United States, the navigation panel (A) and the list of available demographic layers (B). By default only background layer (street map) is displayed.

## 2. OPENING SCREEN

### 2.1 DATA LAYER (label B)

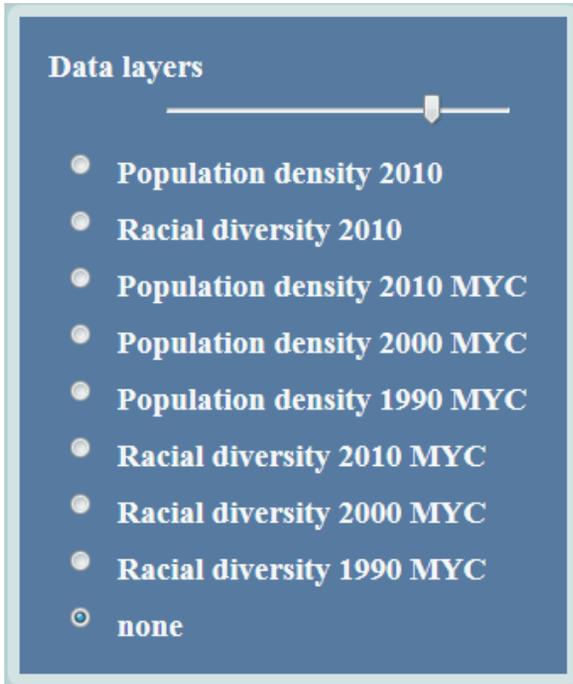


Fig. 2. Data layer menu

This panel shows all demographic layers available to SocScape.

It can be displayed one data layer at once. Default is a none option (only base map is displayed).

At the top part of data layer panel is located transparency slider.

#### Data layers

SocScape includes two types of population density and racial diversity grids. Datasets called **"MYC"** are comparable between 1990, 2000, 2010 and can be used to change analysis.

For 2010 we also made available additional datasets, that used more detailed ancillary information, but cannot be used for change analysis.

#### Transparency

Transparency slider acts on the selected demographic layer. Transparency is used for spatial reference with street or image map.

## 2. OPENING SCREEN

### 2.2 NAVIGATION PANEL (label A)

The navigation panel contains six tools accessible by clicking on the buttons (starting from the top): **coordinates**, **select data layers**, **query data layers**, **download data**, **select base layer**, and **info**. After selecting data layer additional button – **show legend** will be added to navigation panel.



#### **Coordinates tool**

shows coordinates for mouse cursor



#### **Select data layers**

opens list of available to display demographic grids.



#### **Query data layers tool**

displays value of each demographic grids in given point.



#### **Download data tool**

allows to download selected area of the map



#### **Base layer**

allows to select between different backgrounds maps



#### **Show legend**

displays legend for selected data layer (population or racial diversity).



#### **Info**

brings information about the authors of SocScape and provide link to SocScape data

## 2. OPENING SCREEN

### 2.3 MAP NAVIGATION TOOLS (label C and D)

**Map navigation** is provided by zooming icons (zoom in/zoom out) at the top-right part of the opening screen (label C).

Also mouse can be used for map navigation:

- ***pan the map*** - press the left mouse button and drag the map.
- ***zoom in/out*** - use mouse wheel
- ***zooming into a selected rectangle*** - press Shift button and use mouse to indicate an approximate area into which to zoom in.

**Scale** is showed at the bottom-right part of the screen.

### 3. USING SOCSCAPE

#### **SocScape can be useful for:**

Fast and intuitive exploration of population density and racial diversity in different scales  
(from the entire U.S. down to the street)

Detecting changes in spatial dynamics of population density and racial diversity

Downloading population and racial diversity data for future analysis in external GIS software.

# 3. USING SOCSCAPE

### Select data layer

one data layer can be displayed at once

Data layers

- Population density 2010
- Racial diversity 2010
- Population density 2010 MYC
- Population density 2000 MYC
- Population density 1990 MYC
- Racial diversity 2010 MYC
- Racial diversity 2000 MYC
- Racial diversity 1990 MYC
- none

Transparency can be set for displayed layer

### Select base layer

Base Layers

- OpenStreetMap
- MapQuest Open Aerial
- Bing - Road
- Bing - Aerial
- Bing - Aerial with labels

Bing - Aerial

Bing - Road

Bing - Aerial with labels

### Show legend

Racial diversity by

Non-Hispanic white diversity	Am. Indian diversity
High	Low
Med	Med
Low	High

Non-Hispanic black

High	Other race
Med	Low
Low	High

Asian

High	Hispanic
Med	Low
Low	High

High diversity

High	Low
Med	Med
Low	High

### Zoom in/out

Use Shift key + mouse to zoom part of the map

From entire US down to individual street

### Query data layer

Population density 2000

Click on map to see values

- Population density 1990
- Population density 2000
- Population density 2010
- Population density 1990
- Population density 2000
- Population density 2010

Show data value in a current displayed layer and for other layers

### Data download

Use mouse to select regions of the map. Size of the region is limited to 100000 km<sup>2</sup>

Population data for download:

- Population density 2010
- Comprehensive data:
  - Population density 2010
  - Racial diversity 2010
- Multi-year comparison:
  - Population density 2010
  - Population density 2000
  - Population density 1990
- Racial diversity 2010
- Racial diversity 2000
- Racial diversity 1990

Use mouse to select region of the map. Size of the region is limited to 100000 km<sup>2</sup>.

### Show coordinates for mouse cursor

# 3. USING SOCSCAPE

SocScape can be used for fast and intuitive exploration of population density and racial diversity at different scales (from the entire U.S down to individual street)

## 3.1 Examining racial diversity patterns in 2010

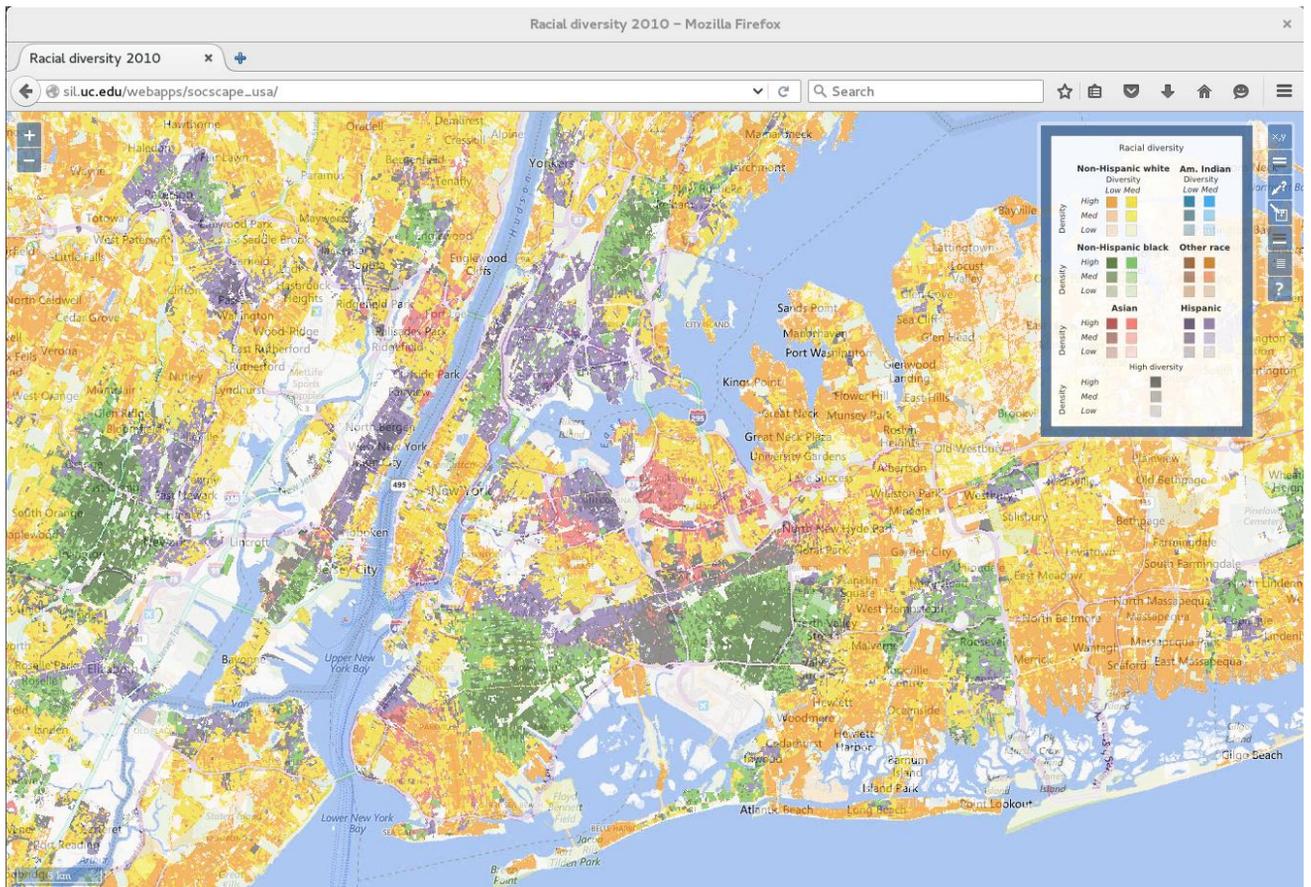


Fig. 3. Racial diversity of New York area in 2010

Using base map (street map or satellite image) navigate to the area of interest. From **data layers menu** select **Racial diversity 2010** map and set transparency level. Clicking on the **Show legend tool** in navigation menu (the second button from the bottom) and displays the legend for displayed map.

# 3. USING SOCSCAPE

## 3.2 Examining population density patterns in 2010

Here we present an example for New York.

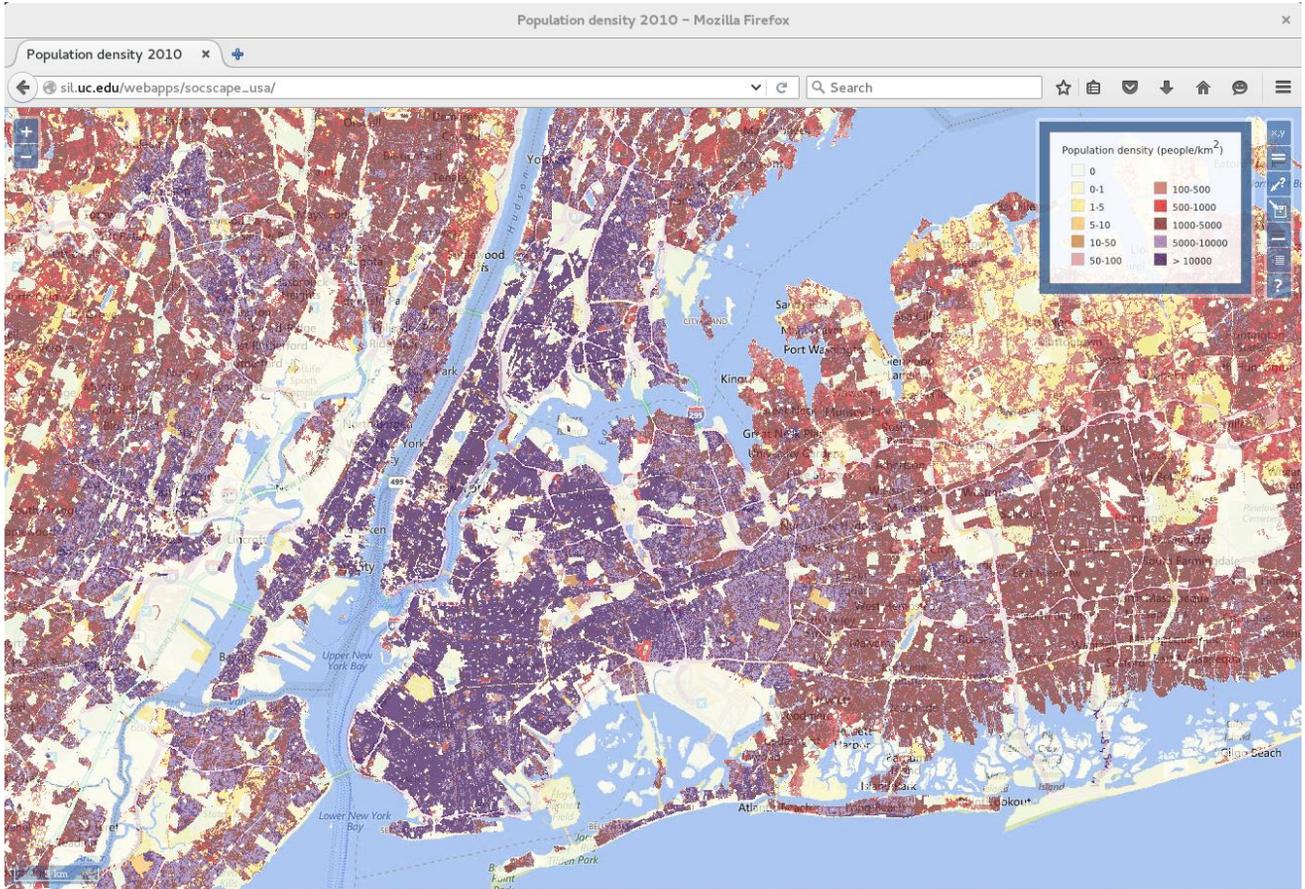


Fig. 4. Population density of New York area in 2010

Switch data layer into **"Population density 2010"** in **data layer menu**. Clicking on the **Show legend tool** in navigation menu (the second button from the bottom) and displays the legend for displayed map.

Use mouse wheel to zoom in and out. Zooming into a selected rectangle is accomplished by pressing Shift button and using mouse to indicate an approximate area into which to zoom in.

## 3. USING SOCSCAPE

### 3.3 Detecting changes in spatial dynamics of population density and racial diversity.

Using base map (street map or satellite image) navigate to the area of interest. Select first **“Racial diversity 1990 MYC ”** then **“Racial diversity 2000 MYC”** and **“Racial diversity 2010 MYC”**. Switch between these three layers to observe change in racial diversity patterns.

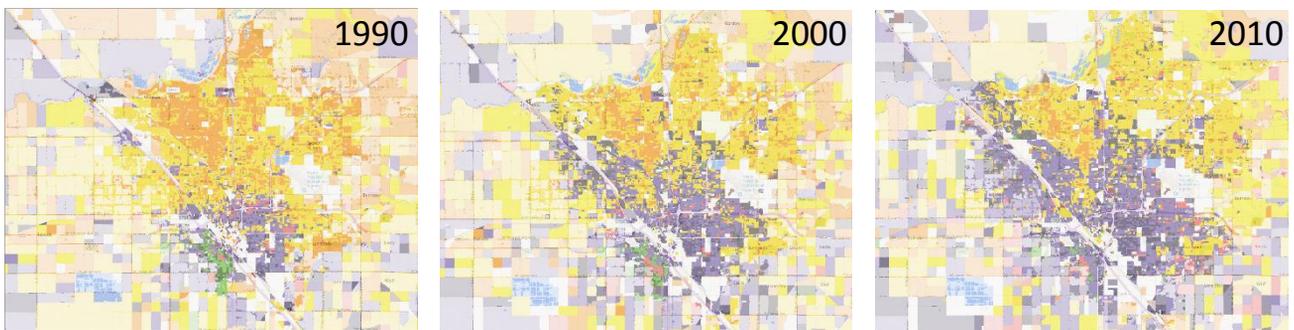


Fig. 5. Racial diversity maps of the Fresno, California area in 1990, 2000 and 2010.

Navigate to the area of interest and select first **“Population density 1990 MYC”** then **“Population density 2000 MYC”** and **“Population density 2010 MYC”**. Switch between these three layers to observe change in population density patterns.

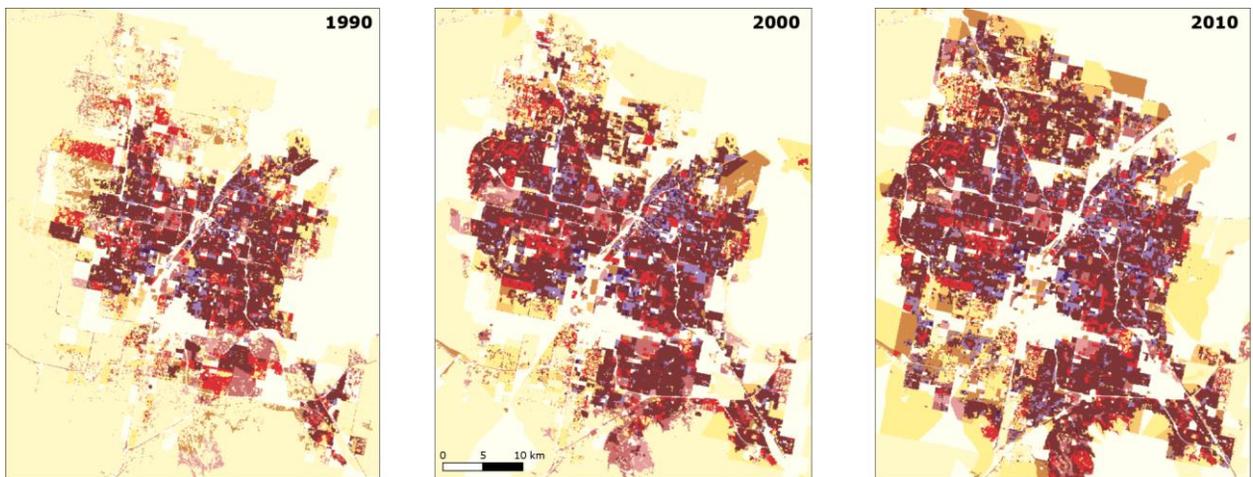


Fig. 6. Population density maps of Las Vegas, Nevada area in 1990, 2000 and 2010.

### 3. USING SOCSCAPE

#### 3.4 Detecting changes in spatial dynamics of population density and racial diversity using Data Query Tool.

Using base map (street map or satellite image) navigate to the area of interest. Select “**Racial diversity 1990 MYC**” map. Select **data query tool** from the navigation menu (third button from the top). Click on the map in the area of interest. Value of each map in this point can be shown. Examine a map detecting change in given point. Switch between maps to see racial diversity changes.

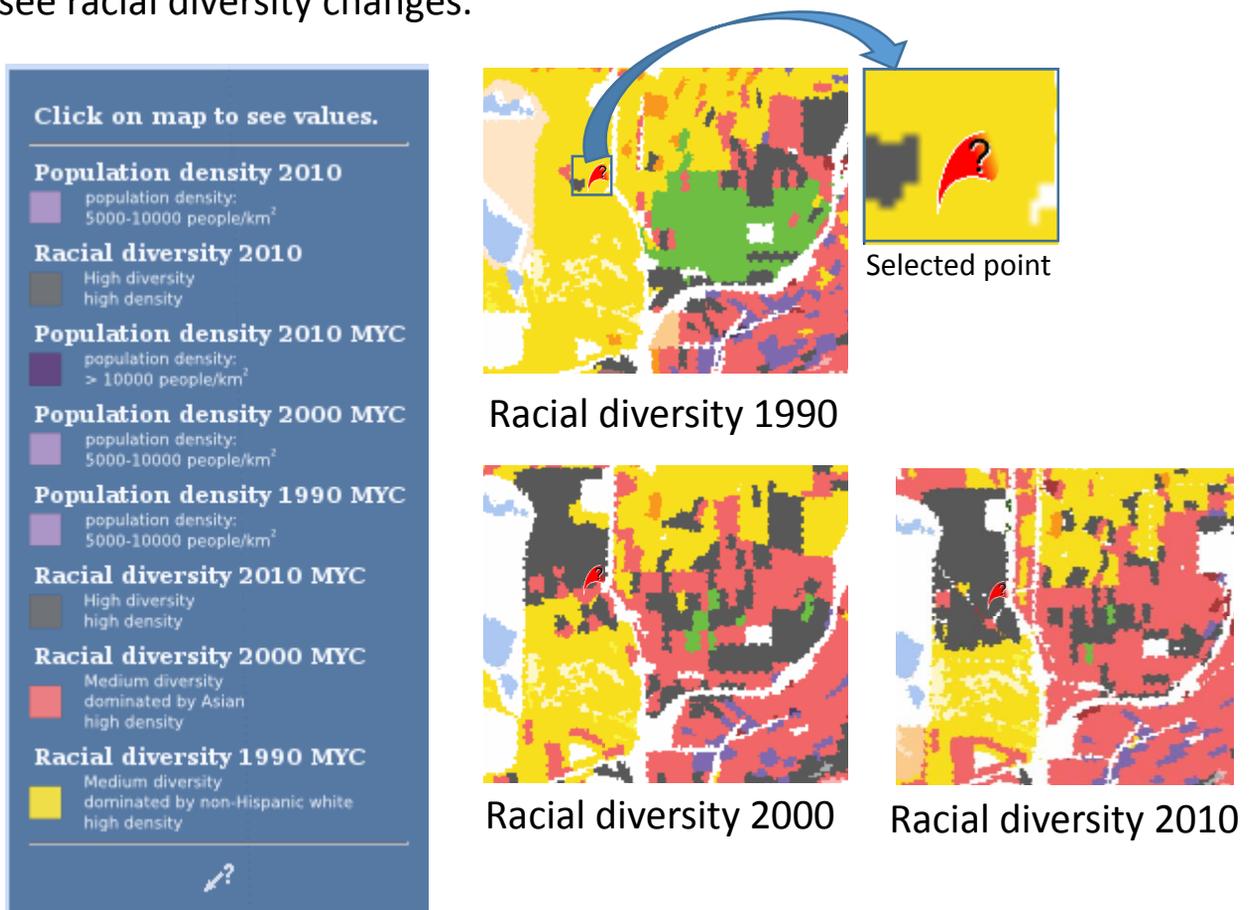


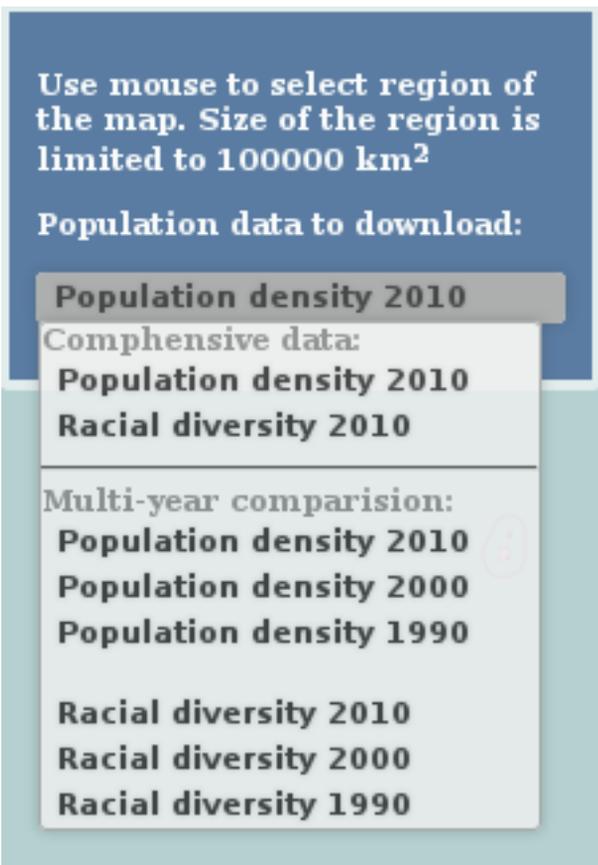
Fig. 7. Detecting changes in spatial dynamics of population density and racial diversity using Data Query Tool

## 3. USING SOCSCAPE

### 3.5 Downloading population and racial diversity data for future analysis in external GIS software.

SocScape provides tool for downloading data for the area of interest. Size of the selected region is limited to 100 000 km<sup>2</sup>. However, most of metropolitan area can be downloaded at once.

Download tool gives access to original, non-classified data (estimated person per 30 m grid cell). For racial diversity grids the same layer is displayed and downloaded (there is one of 40 classes of racial diversity classification). Racial diversity grids are downloaded with palette. Population and racial diversity grids are downloaded in WGS84/Pseudo Mercator projection (EPSG: 3857).



There are available are 2 groups of data:

- **Comprehensive data** include population density and racial diversity layer for 2010 year, that use additional ancillary data available only for 2010.
- **Multi-year comparison** data include population density and racial diversity data comparable between 1990, 2000 and 2010 year. Download these grids for change analysis.

Default option is *Population density 2010*.

Fig. 8. Download menu

## 3. USING SOCSCAPE

### 3.5 Downloading population and racial diversity data for future analysis in external GIS software.

Using base map (street map or satellite image) navigate to the area of interest. It could be displayed one layer and downloaded another one – there is no relation between displayed and downloaded data.

Click on **downloading icon** in navigation menu, use mouse to select region of the map (in this example there is an area covering Chicago) and select **"Racial diversity 2010"** layer from the list. Selecting region is displayed as red rectangle on the map.

Download extent can be displayed in Download menu. Click on **GeoTiff button** in download menu to download a data.

Select population density 2010 grids from the list, click again on GeoTiff button in download menu to download another data for the same extent.

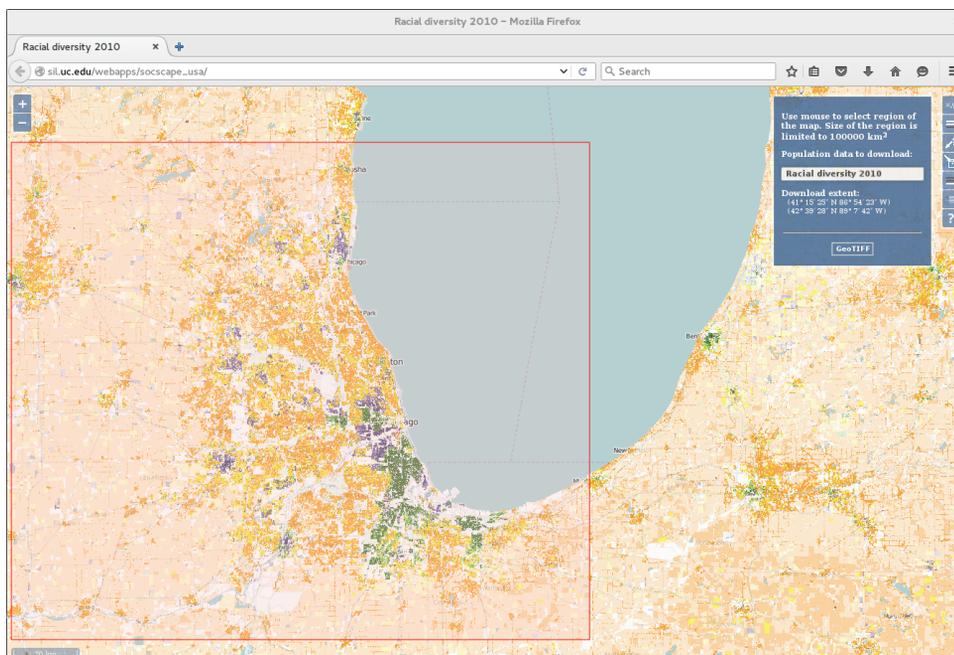


Fig. 9. Download data for Chicago area.

## 4. SOCSCAPE DATA

**SocScape data is a website**, which provide data for each county and 363 metropolitan areas as a zip archive. This website is available at <http://sil.uc.edu/cms/index.php?id=socscape-data>

This website made available high resolution demographic grids **for each county in the conterminous U.S. and for 363 MSA for 1990, 2000 and 2010**. Data are organized as zip archive.

Each archive contains 3 directories:

- population - contains population grids for each year (4 grids)
- diversity - contains racial diversity classification grids for each year (4 grids)
- race - contains separate grids for 7 race/ethnicity groups for each year (27 grids)

All data are provided in Albers Conical Equal Area projection (EPSG: 5070).

Additionally for urban areas within metropolitan areas we made available **racial diversity change map**, which shows temporal changes in racial diversity as a single map. This map is available as shapefile for 1990-2000, 2000-2010 and 1990-2010 comparison.

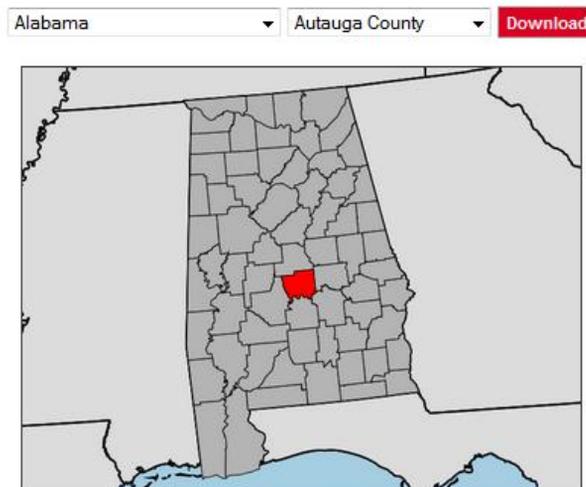


Fig. 10. Download SocScape data by county and MSA

## 4. SOCSCAPE DATA

### 4.1. Download high resolution grids for selected county.

From the dropdown menus select the **state name** (left menu) and next **county name** (right menu). There are listed only county names within a selected state. Selected county will be shown below the dropdown menu. Click on "**Download**" button to download zip archive.

Here is presented example for Hamilton county, Ohio.



Fig. 11. Download SocScape data for Hamilton county, OH.

Name of each zip archive contain 2-letters state code and county name. In this example file will be named *oh\_hamilton.zip*, which indicates Hamilton county in the state of Ohio.

## 4. SOCSCAPE DATA

### 4.2. Download high resolution grids for selected metropolitan area.

From the left dropdown menu select *metropolitan areas* (one before last position on the list) and next from the right menu select *name of MSA*. Selected metropolitan area will be shown below the dropdown menu. Click on "**Download**" button to download zip archive. Here example for Cincinnati, Ohio is presented.

Metropolitan areas ▼ Cincinnati, Middletown (OH) ▼ [Download](#)



Fig. 12. Download SocScape data for Cincinnati metropolitan area

Name of each zip archive contain prefix "msa", name of metropolitan area and 2-letters state. In this example file will be named *msa\_cincinnati\_oh.zip*, which indicates Cincinnati metropolitan area in the state of Ohio.

## 4. SOCSCAPE DATA

### 4.3. Download change map for selected metropolitan area.

From the left dropdown menu select the last position on the list - *metropolitan areas (change)* and next from the right menu select *name of MSA*.

Selected metropolitan area will be shown below the dropdown menu. Click on "**Download**" button to download zip archive. Here example for Cincinnati, Ohio is presented.

Metropolitan areas (change) ▼ Cincinnati, Middletown (OH) ▼ [Download](#)

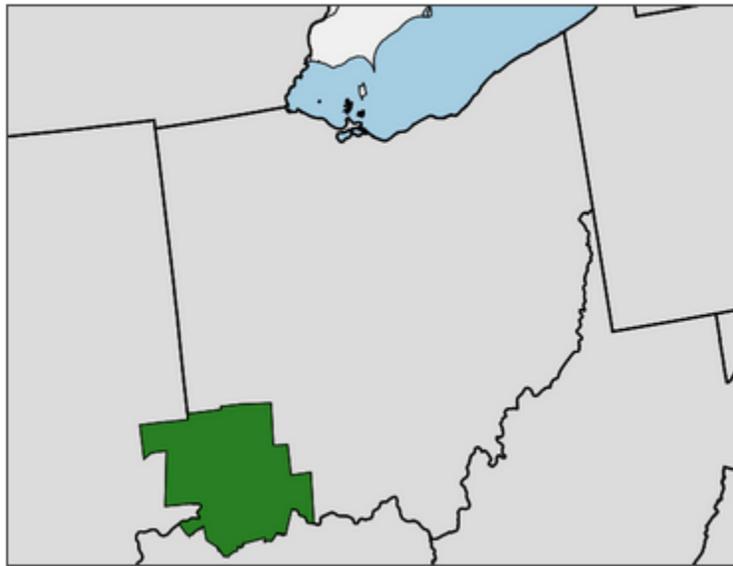


Fig. 13. Download changem map for Cincinnati metropolitan area

Name of each zip archive contains the prefix “msa\_change”, the name of metropolitan area and 2-letters state code. In this example there will be downloaded zip archive named `msa_change_cincinnati_oh.zip` Each archive contains data for analysis of racial diversity change and description file with detailed information about dataset.

## 5. DEMOGRAPHIC DATA LAYERS

The U.S. Census releases demographic data aggregated to areal units - irregular polygons delineated by streets, roads, creeks, or other manmade or natural boundaries. The smallest areal units of aggregation are census blocks. The area and population of a census block varies greatly.

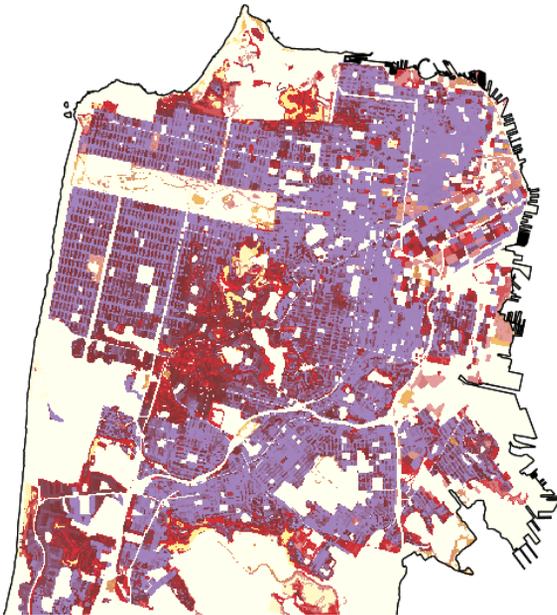
For a Web application such as SocScape it is advantageous to store demographic data in the form of a regular grid rather than irregular polygons. SocScape uses 30m size grids of population density and racial diversity. These grids have been calculated from census blocks using dasymetric modelling technique. Dasymetric modelling applied for creation of data layers in SocScape disaggregates population stored in census units into grid cells using land cover as ancillary variable. Specifically, SocScape uses 30m resolution National Land Cover Datasets or NLCD (<http://www.mrlc.gov/>).

For multiyear comparison datasets ("MYC") we used National Land Cover Datasets 2001 and 2011 reclassified into 3 classes (urban, vegetation, uninhabited) and NLCD 1992/2001 Retrofit Land Cover Change Product reclassified into 3 classes (urban, vegetation, uninhabited).

For 2010 grids ancillary data includes National Land Cover Datasets 2011 (NLCD 2011) (reclassified into 6 classes) and National Land Use Dataset 2010 (NLUD2010, Theobald 2014).

# 5. DEMOGRAPHIC DATA LAYERS

## 5.1 POPULATION DENSITY GRIDS



Population density (People/km<sup>2</sup>)

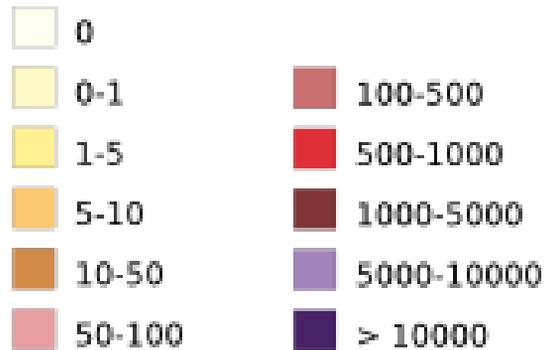


Fig. 14 Total population density in 2010, San Francisco, CA

The value of population density is assigned to each grid cell in units of people/km<sup>2</sup>. Note that this is NOT a population count - the number of people in a cell. Population density is a floating point number not an integer.

However, in order for SocScape to display the map of population density fast, the version of the map classified to only 11 bins is used. The bins are: 0, 0-1, 1-5, 5-10, 10-50, 50-100, 100-500, 500-1000, 1000-5000, 5000-10 000, more than 10 000 people/km<sup>2</sup>

Download tool gives access to original, non-classified data (estimated person per 30 m grid cell).

# 5. DEMOGRAPHIC DATA LAYERS

## 5.2 SUBPOPULATION (RACE/ETHNICITY) DENSITY GRIDS

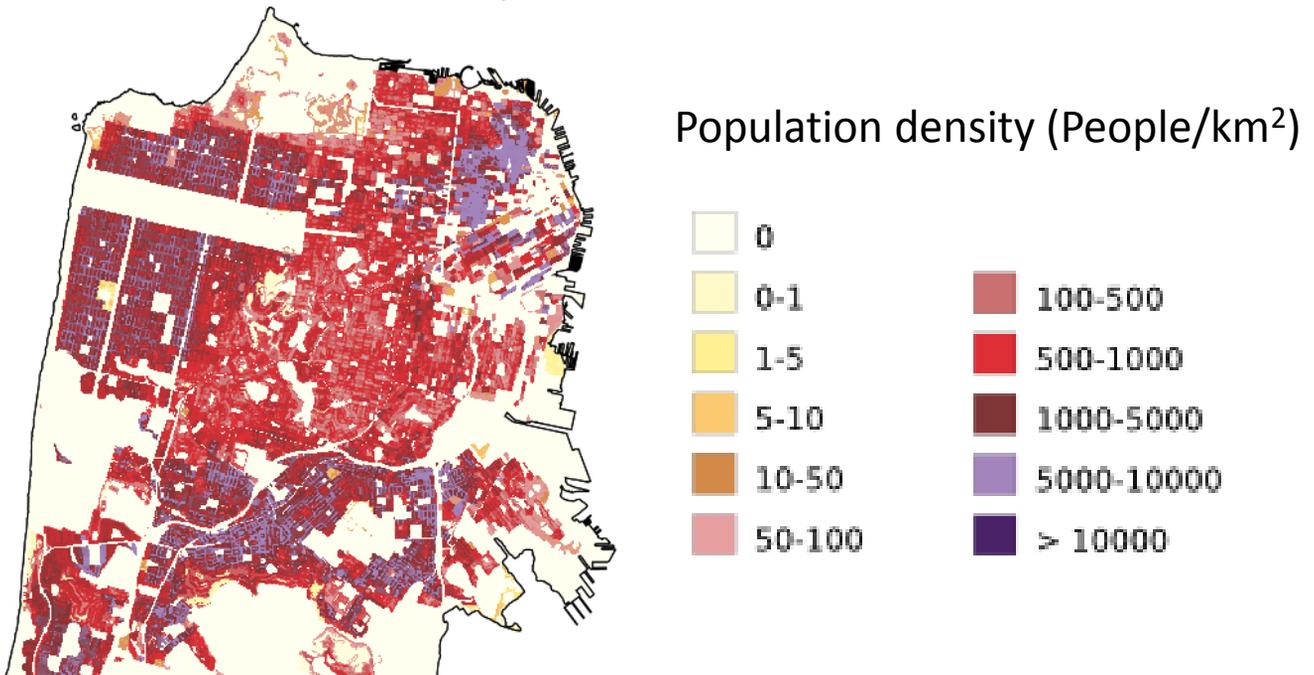


Fig. 15. Asians population density in 2010  
San Francisco, CA

We also used population-based dasymetric model to disaggregate race/ethnicity groups. Seven race/ethnicity hi-res grids are available: non-Hispanic white (nhb), non-Hispanic black (nhw), non-Hispanic Asian (nhas), non-Hispanic American Indian (nham), non-Hispanic Native Hawaiian and Other Pacific Islander (nhpi), non-Hispanic other race (nhother), Hispanic (hispanic).

Separate race/ethnicity groups are not available in GeoWeb application. These grids can be downloaded for county and metropolitan areas as a zip archive.

# 5. DEMOGRAPHIC DATA LAYERS

## 5.3 RACIAL DIVERSITY CLASSIFICATION GRIDS

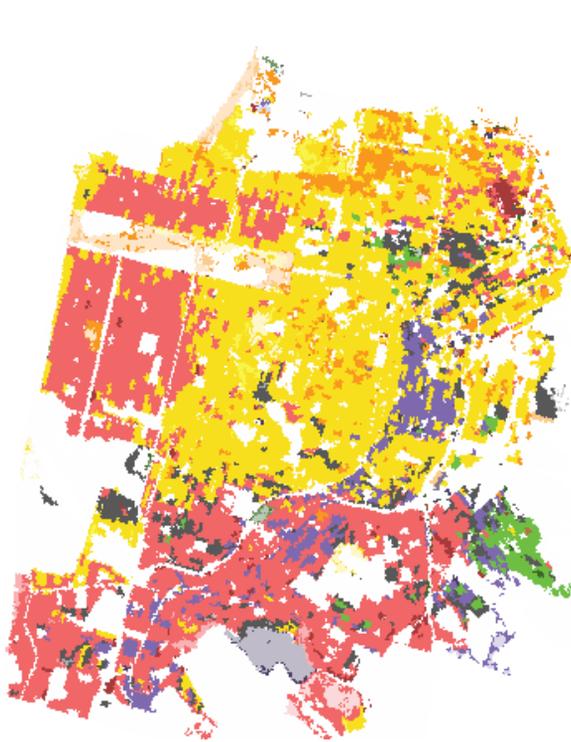


Fig. 16. Racial diversity in 2010  
San Francisco, CA

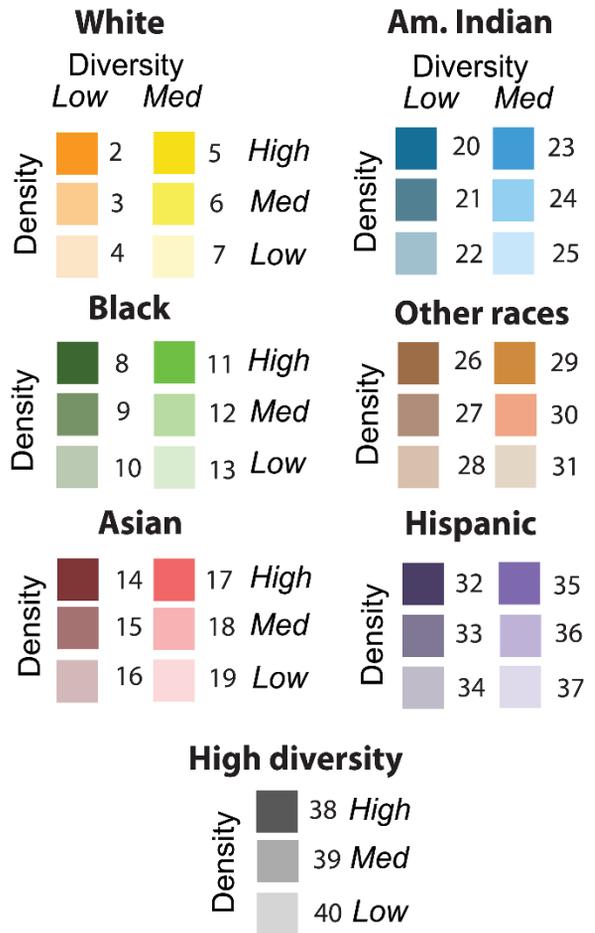


Fig. 17. Legend for racial diversity maps

Racial diversity map shows spatial character of racial diversity across the U.S. We use our population/race hi-res grids to prepare three-dimensional classification of grid cells based on racial diversity, dominant race, and population density. With exception of adding population density, the classification follows that in

*S. R. Holloway, R. Wright, and M. Ellis, "The Racially Fragmented City? Neighborhood Racial Segregation and Diversity Jointly Considered," The Professional Geographer, vol. 64, pp. 63–82, 2012.*

# 5. DEMOGRAPHIC DATA LAYERS

## 5.3 RACIAL DIVERSITY CLASSIFICATION GRIDS

Grid cells are classified based on:

**(1) racial diversity:** determined on the basis of standardized informational entropy (E):

- low diversity class ( $E < 0.37$  and dominant race more than 80%);
- high diversity class ( $E > 0.73$  and a dominant race less than 50% population);
- medium diversity otherwise.

**(2) dominant race:**

- non-Hispanic white,
- non-Hispanic black,
- non-Hispanic Asian,
- non-Hispanic Native American and Hawaiian,
- non-Hispanic other race,
- Hispanic.

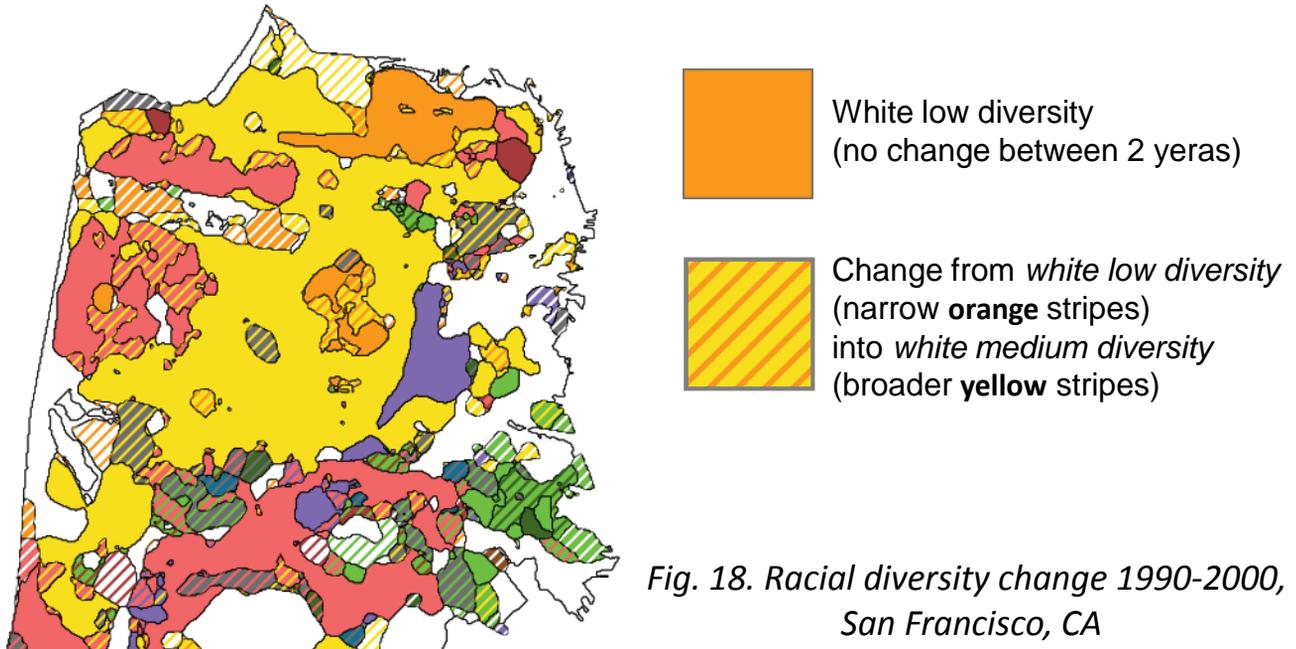
**(3) population density:**

- low density (less than 3 people/km<sup>2</sup>),
- medium density (3-30 people/km<sup>2</sup>),
- high density (equal or greater than 30 people/km<sup>2</sup>).

The result is a diversity–race–density classification of population cells into 40 categories (39 diversity–race–density and uninhabited class).

# 5. DEMOGRAPHIC DATA LAYERS

## 5.4 RACIAL DIVERSITY CHANGE MAP



**Racial diversity change map** (or change map) show temporal change in racial diversity in a single map. Change map is created in the basis of a high resolution (30m) two-dimensional classification of grid cells into 14 categories based on racial diversity level and dominant race. We use racial diversity map for 1990, 2000, 2010 years.

**Change map** show unchanged areas in original colors assigned to each of 14 diversity/dominant race classes. Changed areas are shown in stripes with the color of narrower stripes indicating the classes in first time point (i.e 1990 for 1990-2000 comparison) and broader stripes indicating the class in second point time (i.e 2000 for 1990-2000 comparison).

**Change map** is available as shapefile format for 351 metropolitan areas. Change map is limited to 2010-urban areas of main city in MSA.

# 5. DEMOGRAPHIC DATA LAYERS

## 5.4 RACIAL DIVERSITY CHANGE MAP

There are 14 categories indicating no change (solid color) and 182 categories indicating change (strips).

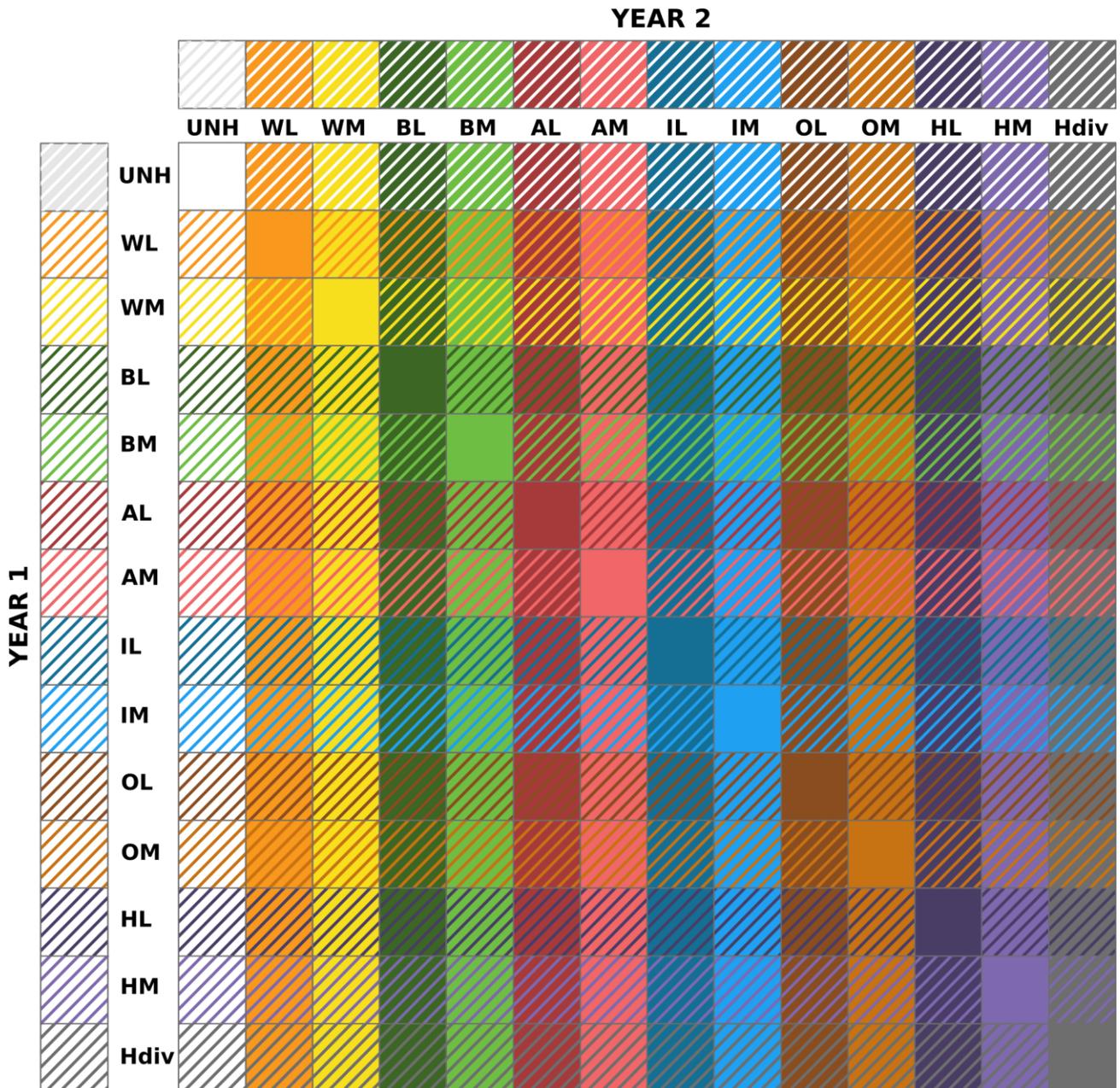


Fig. 19. Legend of racial diversity change map

## 6. SOCSCAPE DEVELOPMENT TEAM

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<http://sil.uc.edu>