mapping_R Markup

Setup

The following are packages useful for working with GIS data in R. They only nee to be installed once!

```
install.packages(c("acs","choroplethr","choroplethrMaps","maptools","rgeos","mapproj","RColorBrewer","ma
```

We start with a simple example plotting a cloropleth map using data from the American Community Survey (ACS), yearly census data collected by the U.S. Census Bureau. To access and plot this we need to load the following libraries:

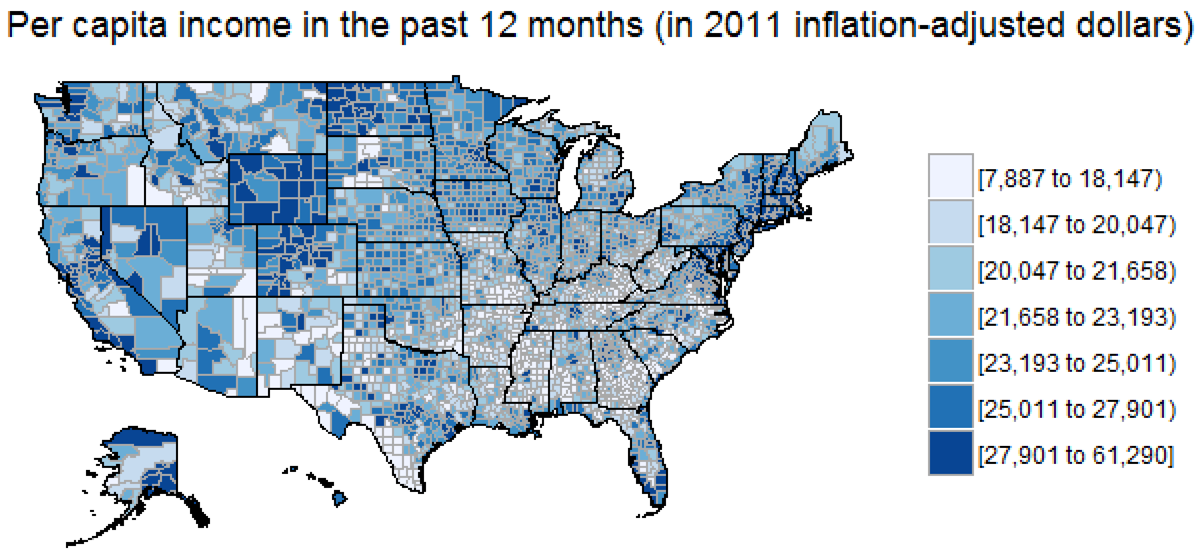
```
library(acs)
library(choroplethr)
```

We need an api key to access the ACS data. Visit http://api.census.gov/data/key_signup.html, request a key, and paste it into the line below:

```
api.key.install("e3dd607b83adce3268ef2bb723da22c68001e6f0")
```

Great, now we have access to the census data. Table B19301 contains per capita income for the year of 2011. Lets plot it!

```
county_choropleth_acs(tableId="B19301")
```



To see the description of a function and its arguments in R, place a "?" before its name:

```
?county_choropleth_acs
```

Reading in Shapefiles

Load `maptools`, a library for reading and manipulating geographic data, including ESRI shapefiles.

```
library(maptools)
```

The following prompts you to select the provided county census shapefiles at the path . . . county_census/Count_2010Census_DP
Note: You will have to unzip the folder county_census first!

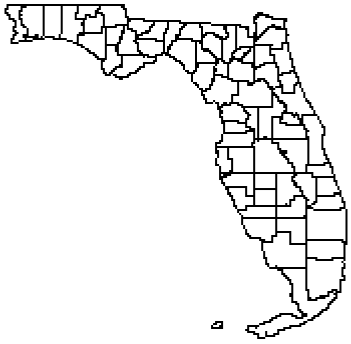
```
counties <- readShapeSpatial(file.choose(),proj4string=CRS("+proj=longlat +datum=WGS84"))
```

Let's inspect the first few rows of the counties data to get a feel for its structure:

```
head(counties@data)
```

Census data assigns codes to counties using the Federal Information Processing Standard (FIPS). A FIPS code starts with two digits representing the state, and is followed by three digits representing the county. For example, Florida is 12 and Clay County Florida is 12019. So to select all the counties in Florida, we can use a regular expression matching all codes that start with "12":

```
florida <- counties[substring(counties$GEOID10,1,2)=="12",]
plot(florida)
```



You can look up other state and county codes using the U.S. Census Bureau site: https://www.census.gov/geo/reference/codes/cou.html

Projection and Layering

Next we'll work with library `rgdal`, a package for working with projection and transformation of geospatial data. We want to find a projection appropriate for Florida. Make the EPSG data frame of projections (use `?make_EPSG()` to find out more about this table):

```
library(rgdal)
EPSG <- make_EPSG()
```

We can use regular expressions to search the note field of `EPSG` for any that refer to Florida:

```
EPSG[grep("florida", EPSG$note, ignore.case=TRUE), 1:2]
```

code	note
2236	# NAD83 / Florida East (ftUS)

code	note
2237	# NAD83 / Florida West (ftUS)
2238	# NAD83 / Florida North (ftUS)
2777	# NAD83(HARN) / Florida East
2778	# NAD83(HARN) / Florida West
2779	# NAD83(HARN) / Florida North
2881	# NAD83(HARN) / Florida East (ftUS)
2882	# NAD83(HARN) / Florida West (ftUS)
2883	# NAD83(HARN) / Florida North (ftUS)
3086	# NAD83 / Florida GDL Albers
3087	# NAD83(HARN) / Florida GDL Albers
3511	# NAD83(NSRS2007) / Florida East
3512	# NAD83(NSRS2007) / Florida East (ftUS)
3513	# NAD83(NSRS2007) / Florida GDL Albers
3514	# NAD83(NSRS2007) / Florida North

Let's use Florida GDL Albers. Using the code from the inspected dataframe, we can store the `prj4` variable, a string containing all the relevant information about our chosen projection:

```
subset(EPSG, code==3087)
prjstring <- subset(EPSG, code==3087)$prj4
```

Inspect our `prjstring` variable if you want to see the format of the `prj4` variable.

select cultural shapefile in cultural_centers

Next we'll overlay Florida cultural centers. The following prompts you to select the desired input shape file. Select ...cultural_centers/gc_culturecenter_oct15.shp.

```
cultural <- readShapeSpatial(file.choose(),proj4string=CRS(prjstring))
```

Notice that we're using the projection that we chose in the previous section. Next we want to... WHAT IS THIS TRANSFORM DOING?

```
cultural_proj <- spTransform(cultural, CRS("+proj=longlat +datum=WGS84"))

plot(florida)
points(cultural_proj)
```

join polygon data to points

```
county_data <- over(cultural_proj,florida)
cultural_proj$pop <- county_data$DP0010001
```

set colors

```
library(RColorBrewer)

brks <- c(.5,1,1.5,2) * 1000000
cols <- brewer.pal(5,"Greens")
```

```
mapcols <- cols[findInterval(cultural_proj$pop, vec=brks)]
plot(cultural_proj,col=mapcols,pch=20)
```

base R instructions for choropleth

```
brks <- c(25,30,35,40,45,50,55,60,65)
cols <- brewer.pal(8,"Purples")

mapcols <- cols[findInterval(florida$DP0020001, vec=brks)]
plot(florida,col=mapcols,border="white")

legend("bottomleft", legend = levels(cut(florida$DP0020001, brks)), fill = cols, title = "Median Age")
```

using ggplot2

```
library(ggplot2)

fl_shapes <- fortify(florida,region="GEOID10")

ggplot() + geom_map(data=as.data.frame(florida),aes(map_id = GEOID10,fill=DP0020001), map=fl_shapes) +
```

networky type example

```
library(maps)
library(geosphere)
library(reshape)
```

select - state_shapes/tl_2014_us_state.shp

```
state <- readShapeSpatial(file.choose())
```

select - /state_migrations_2014.csv

```
migration <- read.csv(file.choose())

centrs <- data.frame(as.character(state@data$NAME),coordinates(state))
colnames(centrs) <- c("name","long","lat")


migration <- migration[c(1,6:56)]
long_mig <- melt(migration,id.vars="from_state")

map("state")
```

define draw_from_state function

```
draw_from_state <- function(centrs, migrations, state_name, color=rgb(0,0,0,alpha=0.5)) {
    migrations$variable <- sub(".", " ",migrations$variable,fixed=TRUE)
    migrations <- migrations[migrations$variable==state_name & migrations$from_state != state_name,]
    for(i in 1:nrow(migrations)){
        if (nrow(centrs[centrs$name==as.character(migrations[i,]$from_state),]) > 0){
            from_long <- centrs[centrs$name==as.character(migrations[i,]$from_state),]$long
            from_lat <- centrs[centrs$name==as.character(migrations[i,]$from_state),]$lat
            to_long <- centrs[centrs$name==as.character(migrations[i,]$variable),]$long
            to_lat <- centrs[centrs$name==as.character(migrations[i,]$variable),]$lat
            number <- migrations[i,]$value
            lines(gcIntermediate(c(from_long, from_lat), c(to_long, to_lat), n=50, addStartEnd=TRUE),lwd
        }
    }
}
```

```
draw_from_state(centrs, long_mig, "Florida", rgb(0,0,1,0.5))
```

```
xlim <- c(-171.738281, -56.601563)
ylim <- c(12.039321, 71.856229)
map("world", col="#f2f2f2", fill=TRUE, bg="white", lwd=0.05, xlim=xlim, ylim=ylim)

draw_from_state(centrs, long_mig, "Wyoming", rgb(1,0,0,.5))
```