Lab 3 - Linking R to the Web

GIS III Spring 2020 - Erin Abbott

Contents

Submission due on 4/26

Loading required packages

```
library(ggmap)
```

```
## Loading required package: ggplot2
```

```
## Google's Terms of Service: https://cloud.google.com/maps-platform/terms/.
```

```
## Please cite ggmap if you use it! See citation("ggmap") for details.
```

```
library(sf)
```

```
## Warning: package 'sf' was built under R version 3.6.2
```

```
## Linking to GEOS 3.7.2, GDAL 2.4.2, PROJ 5.2.0
```

```
library(rgdal)
```

```
## Loading required package: sp
```

```
## rgdal: version: 1.4-8, (SVN revision 845)
##  Geospatial Data Abstraction Library extensions to R successfully loaded
##  Loaded GDAL runtime: GDAL 2.4.2, released 2019/06/28
##  Path to GDAL shared files: /Library/Frameworks/R.framework/Versions/3.6/Resources/library/rgdal/gdal
##  GDAL binary built with GEOS: FALSE
##  Loaded PROJ.4 runtime: Rel. 5.2.0, September 15th, 2018, [PJ_VERSION: 520]
##  Path to PROJ.4 shared files: /Library/Frameworks/R.framework/Versions/3.6/Resources/library/rgdal/pr
##  Linking to sp version: 1.3-2
```

```r
library(sp)
library(tidyr)
library(RColorBrewer)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
library(ggsn)
```

```
## Loading required package: grid
```

```r
library(ggplot2)
```

Reading a CSV from the web

```r
# read the data
senegal <- read.csv("https://data.humdata.org/dataset/c0137f69-bf61-4991-8ed6-50bf603beed5/resource/f1d
head(senegal)
```

```
##           X        Y     osm_id osm_type completeness is_in_health_zone
## 1 -17.46187 14.73957 4956827011     node           10                NA
## 2 -17.40614 14.75308 4485784101     node           13                NA
## 3 -17.44679 14.72700 4077886878     node           10                NA
## 4 -17.33861 14.79265 4747601124     node           13                NA
## 5 -17.47721 14.71174 5184731521     node           10                NA
## 6 -17.47216 14.73618 4956870873     node           10                NA
##    amenity speciality addr_full operator water_source changeset_id insurance
## 1 pharmacy                                                50109006
## 2   clinic                                                71224078
## 3 pharmacy                                                38059112
## 4 pharmacy                                                48590663
## 5   clinic                                                80449307
## 6  doctors                                                50109741
##   staff_doctors contact_number                              uuid electricity
## 1            NA               515ebe3d0fff496398d03eccd68a2dbd          NA
## 2            NA               0a59daa1c8be4bcdbc01dd4aef5592b3          NA
## 3            NA               570e5e92eb10473b9c7423c6bec5b8cf          NA
## 4            NA               2c386b7012c14c9486b9e06a4f02ce61          NA
## 5            NA               1b978769f881488faf403b7c7116ff6c          NA
## 6            NA               95aa54084a6042968b1b6a525bf52704          NA
```

```
##       opening_hours operational_status source is_in_health_area
## 1                                                            NA
## 2                                                            NA
## 3                                                            NA
## 4 Mo-Su 08:00-21:00                                          NA
## 5                                                            NA
## 6                                                            NA
##   health_amenity_type changeset_version emergency changeset_timestamp
## 1                                   1           2017/07/07 13:31:22
## 2                                   2           2019/06/13 16:06:45
## 3                                   1           2016/03/25 10:03:23
## 4                                   2           2017/05/11 12:23:51
## 5                                   2           2020/02/03 00:19:30
## 6                                   1           2017/07/07 14:04:13
##                                 name staff_nurses  changeset_user
## 1                 Pharmacie Maodo Malick           NA Jacques Cartier
## 2 CLinique Docteur Ngagne Mbaye Pediatre           NA        mapman44
## 3               PHARMACIE FRONT DE TERRE           NA         Ray1998
## 4                      Pharmacie Malika           NA  babacar_ndiaye
## 5                                Rahma           NA    daganzdaanda
## 6                  Cabinet médical Dawa           NA Jacques Cartier
##   wheelchair beds url dispensing healthcare operator_type
## 1              NA
## 2              NA                     clinic
## 3              NA
## 4              NA
## 5              NA
## 6              NA
```

```
str(senegal)
```

```
## 'data.frame':    1288 obs. of  34 variables:
##  $ X                  : num  -17.5 -17.4 -17.4 -17.3 -17.5 ...
##  $ Y                  : num  14.7 14.8 14.7 14.8 14.7 ...
##  $ osm_id             : num  4.96e+09 4.49e+09 4.08e+09 4.75e+09 5.18e+09 ...
##  $ osm_type           : Factor w/ 2 levels "node","way": 1 1 1 1 1 1 2 1 1 1 ...
##  $ completeness       : int  10 13 10 13 10 10 10 10 6 13 ...
##  $ is_in_health_zone  : logi  NA NA NA NA NA NA ...
##  $ amenity            : Factor w/ 6 levels "","clinic","dentist",..: 6 2 6 6 2 4 2 4 3 2 ...
##  $ speciality         : Factor w/ 13 levels "","cardiology",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ addr_full          : Factor w/ 89 levels "","263, route de la corniche BP 226, Saint-Louis",..: 1
##  $ operator           : Factor w/ 79 levels "","Adji Seynabou Sow",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ water_source       : Factor w/ 5 levels "","groundwater",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ changeset_id       : int  50109006 71224078 38059112 48590663 80449307 50109741 49895632 68404087
##  $ insurance          : Factor w/ 7 levels "","no","private",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ staff_doctors      : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ contact_number     : Factor w/ 61 levels "","+221 339 611082",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ uuid               : Factor w/ 1274 levels "006a4d73a6dd42f2a4c06ca0c8cf8604",..: 418 47 445 231 1
##  $ electricity        : logi  NA NA NA NA NA NA ...
##  $ opening_hours      : Factor w/ 59 levels "","06:00-18:00",..: 1 1 1 56 1 1 1 1 1 55 ...
##  $ operational_status : Factor w/ 5 levels "","non_operational",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ source             : Factor w/ 35 levels "","bing","Bing",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ is_in_health_area  : logi  NA NA NA NA NA NA ...
##  $ health_amenity_type: Factor w/ 15 levels "","emergency_department",..: 1 1 1 1 1 1 1 1 1 1 ...
```

```
##  $ changeset_version  : int  1 2 1 2 2 1 1 2 1 1 ...
##  $ emergency          : Factor w/ 5 levels "","False","no",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ changeset_timestamp: Factor w/ 771 levels "","2009/11/04 09:19:21",..: 433 694 244 389 760 437 413
##  $ name               : Factor w/ 1071 levels "","4","Abou Houreyra",..: 737 224 659 723 1011 60 282
##  $ staff_nurses       : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ changeset_user     : Factor w/ 287 levels "","A F Bousso",..: 129 179 242 34 66 129 221 131 76 24
##  $ wheelchair         : Factor w/ 6 levels "","False","limited",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ beds               : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ url                : Factor w/ 5 levels "","Http://ugb.sn",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ dispensing         : Factor w/ 8 levels "","CHEIKH MASSAMBA MBACKE",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ healthcare         : Factor w/ 28 levels "","alternative",..: 1 7 1 1 1 1 1 1 1 1 ...
##  $ operator_type      : Factor w/ 8 levels "","combination",..: 1 1 1 1 1 1 1 1 1 1 ...
```

```
# remove observations with NA amenity or lat/long values
senegal1 <- senegal %>% drop_na(amenity) %>% drop_na(X)

# remove observations with a blank amenity value.
senegal2 <- senegal1 %>% filter(amenity!="")
str(senegal2)
```

```
## 'data.frame':    986 obs. of  34 variables:
##  $ X                  : num  -17.5 -17.4 -17.4 -17.3 -17.5 ...
##  $ Y                  : num  14.7 14.8 14.7 14.8 14.7 ...
##  $ osm_id             : num  4.96e+09 4.49e+09 4.08e+09 4.75e+09 5.18e+09 ...
##  $ osm_type           : Factor w/ 2 levels "node","way": 1 1 1 1 1 1 1 1 1 1 ...
##  $ completeness       : int  10 13 10 13 10 10 10 6 13 10 ...
##  $ is_in_health_zone  : logi  NA NA NA NA NA NA ...
##  $ amenity            : Factor w/ 6 levels "","clinic","dentist",..: 6 2 6 6 2 4 4 3 2 6 ...
##  $ speciality         : Factor w/ 13 levels "","cardiology",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ addr_full          : Factor w/ 89 levels "","263, route de la corniche BP 226, Saint-Louis",..: 1
##  $ operator           : Factor w/ 79 levels "","Adji Seynabou Sow",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ water_source       : Factor w/ 5 levels "","groundwater",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ changeset_id       : int  50109006 71224078 38059112 48590663 80449307 50109741 68404087 29777880
##  $ insurance          : Factor w/ 7 levels "","no","private",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ staff_doctors      : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ contact_number     : Factor w/ 61 levels "","+221 339 611082",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ uuid               : Factor w/ 1274 levels "006a4d73a6dd42f2a4c06ca0c8cf8604",..: 418 47 445 231
##  $ electricity        : logi  NA NA NA NA NA NA ...
##  $ opening_hours      : Factor w/ 59 levels "","06:00-18:00",..: 1 1 1 56 1 1 1 1 55 1 ...
##  $ operational_status : Factor w/ 5 levels "","non_operational",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ source             : Factor w/ 35 levels "","bing","Bing",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ is_in_health_area  : logi  NA NA NA NA NA NA ...
##  $ health_amenity_type: Factor w/ 15 levels "","emergency_department",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ changeset_version  : int  1 2 1 2 2 1 2 1 1 1 ...
##  $ emergency          : Factor w/ 5 levels "","False","no",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ changeset_timestamp: Factor w/ 771 levels "","2009/11/04 09:19:21",..: 433 694 244 389 760 437 655
##  $ name               : Factor w/ 1071 levels "","4","Abou Houreyra",..: 737 224 659 723 1011 60 967
##  $ staff_nurses       : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ changeset_user     : Factor w/ 287 levels "","A F Bousso",..: 129 179 242 34 66 129 131 76 24 242
##  $ wheelchair         : Factor w/ 6 levels "","False","limited",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ beds               : int  NA NA NA NA NA NA NA NA NA NA ...
##  $ url                : Factor w/ 5 levels "","Http://ugb.sn",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ dispensing         : Factor w/ 8 levels "","CHEIKH MASSAMBA MBACKE",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ healthcare         : Factor w/ 28 levels "","alternative",..: 1 7 1 1 1 1 1 1 1 1 ...
```

```
##  $ operator_type      : Factor w/ 8 levels "","combination",..: 1 1 1 1 1 1 1 1 1 ...
```

Preparing basemap

```
# making Senegal base map
coords <- c(lon=-14.45, lat=14.49)
basemap <- get_map(coords,zoom=7,maptype = "terrain", alpha = 0.5)
```

```
## Source : https://maps.googleapis.com/maps/api/staticmap?center=14.49,-14.45&zoom=7&size=640x640&scal
```

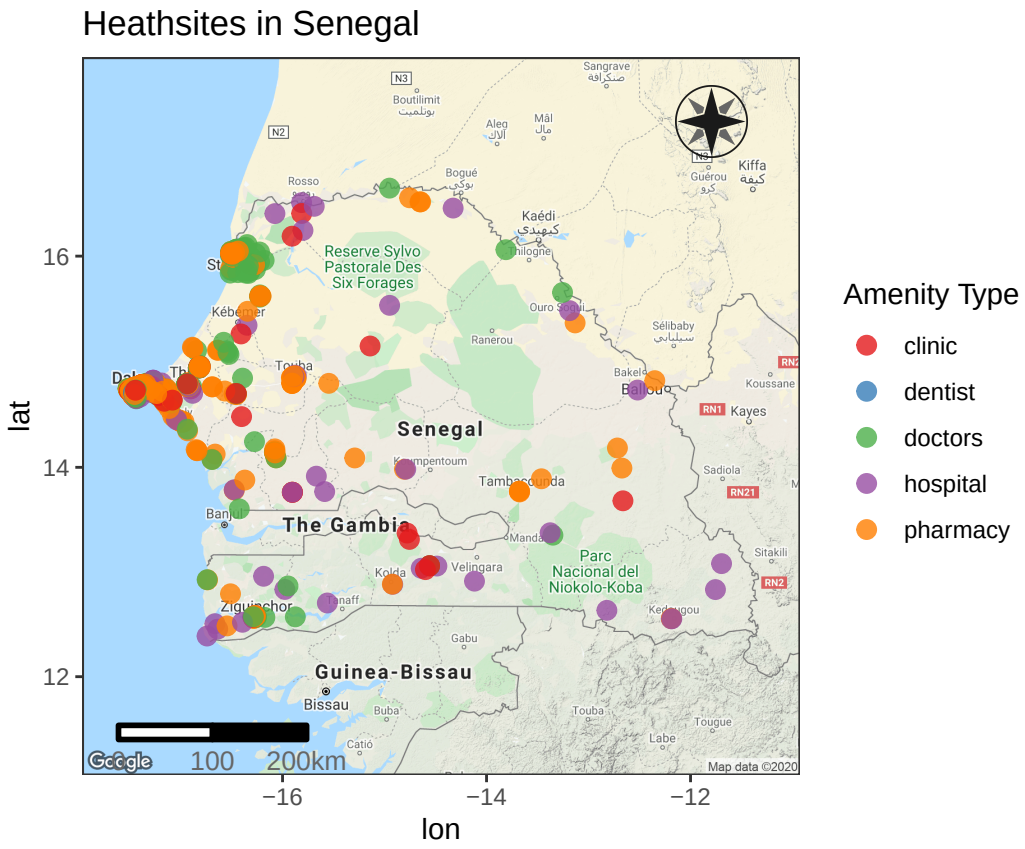
```
base <- ggmap(basemap)

#bounding box for scalebar:
bb<- attr(basemap, "bb")
bb2 <- data.frame(long=unlist(bb[c(2,4)]), lat= unlist(bb[c(1,3)]))
bb2
```

```
##             long      lat
## ll.lon -17.96013 11.05659
## ur.lon -10.92888 17.86061
```

Plotting heathsites in Senegal by type

```
map<- base + geom_point(data=senegal2, aes(x=X, y=Y, colour=amenity), size=3, alpha=0.8) + scale_colour_
north2(map, y=0.85, symbol=14)
```



- Data source: Global Healthsites Mapping Project, found on the Humanitarian Data Exchange - https://data.humdata.org/dataset/senegal-healthsites