Using R for GIS analysis:

More complex geo-processing

Textbook: Chapter 5

https://ceiba.ntu.edu.tw/1092Geog2017_

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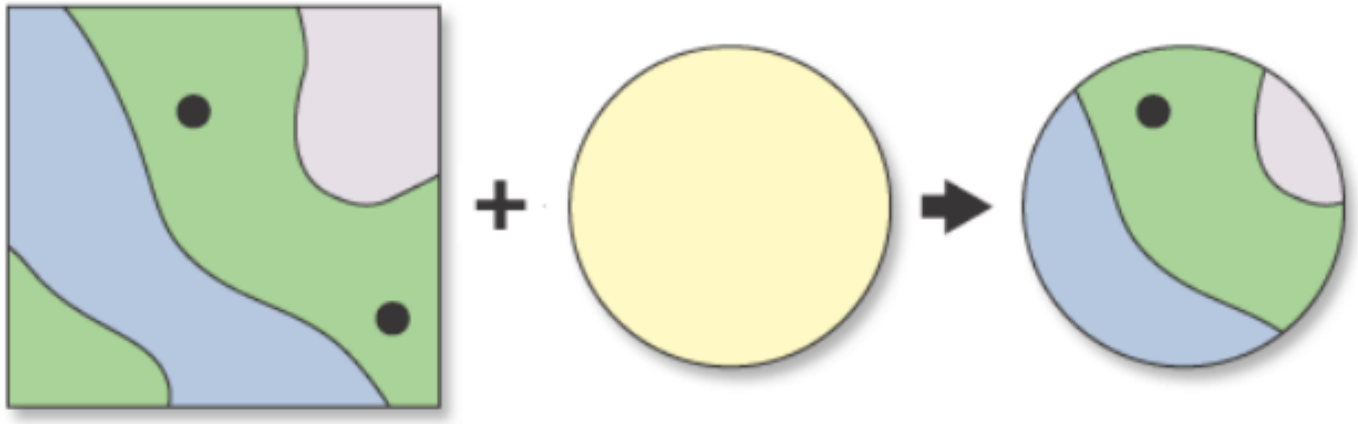
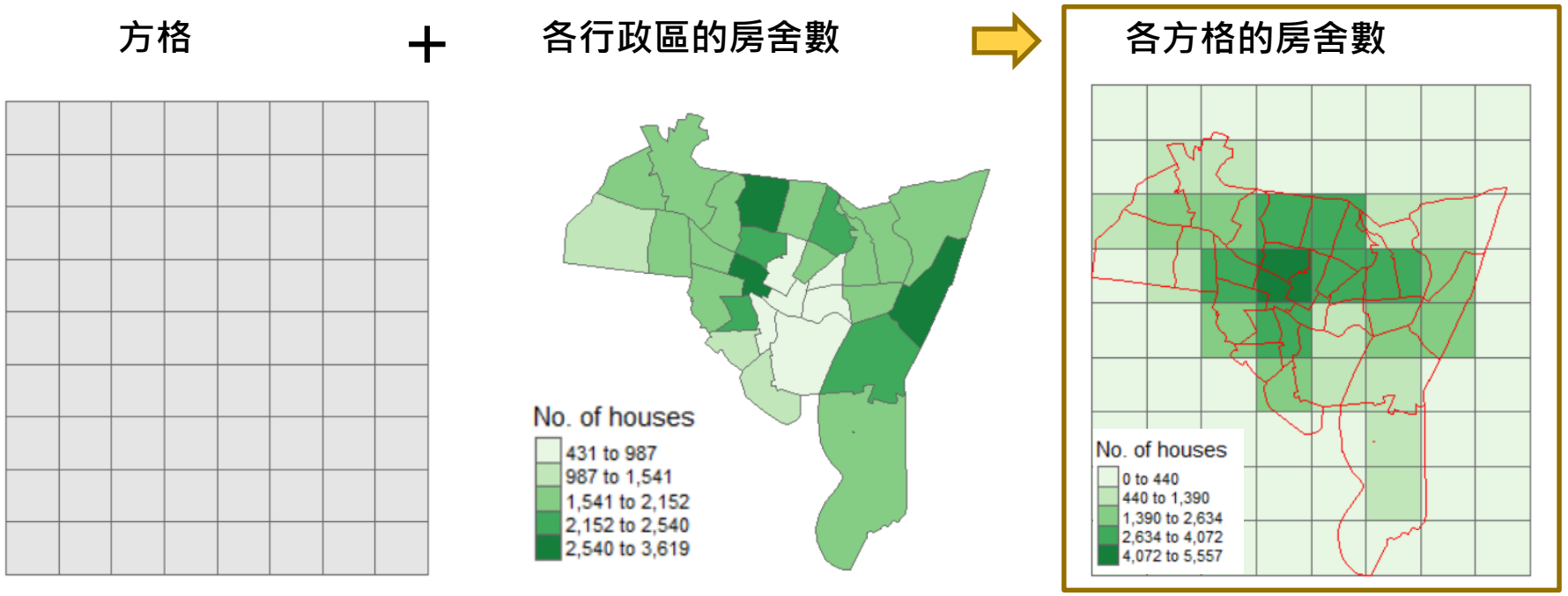
Contents

- Chapter 5: Using R as a GIS (2)
  - Spatial intersection of multiple polygon layers



Spatial intersection of multiple polygon layers

- Spatial Intersection: st_intersection()



R Functions and Procedures

- Step 1. Fishnet: st_make_grid()
- Step 2. Spatial intersection: st_intersection()
- Step 3. Field calculation
- Step 4. Grouping data: summarise()
- Step 5. Spatial mapping: tm_shape() + tm_polygons

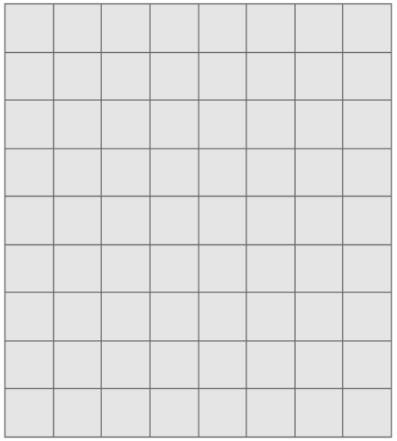
Step 1: Fishnet: st_make_grid()

Description

Create a square or hexagonal grid covering the bounding box of the geometry of an sf or sfc object

Usage

```
st_make_grid(
  x,
  cellsize = c(diff(st_bbox(x)[c(1, 3)]), diff(st_bbox(x)[c(2, 4)]))/n,
  offset = st_bbox(x)[c("xmin", "ymin")],
  n = c(10, 10),
  crs = if (missing(x)) NA_crs_ else st_crs(x),
  what = "polygons",
  square = TRUE,
  flat_topped = FALSE
```



Step 1: *sfc* format

```
grid <- st_make_grid(tracts_sf, 5000,
                     crs = st_crs(tracts_sf),
                     what = "polygons", square = TRUE)
```

grid	List of 72

```
> class(grid)
[1] "sfc_POLYGON" "sfc"
```

sfc: a list column of containing the geometries

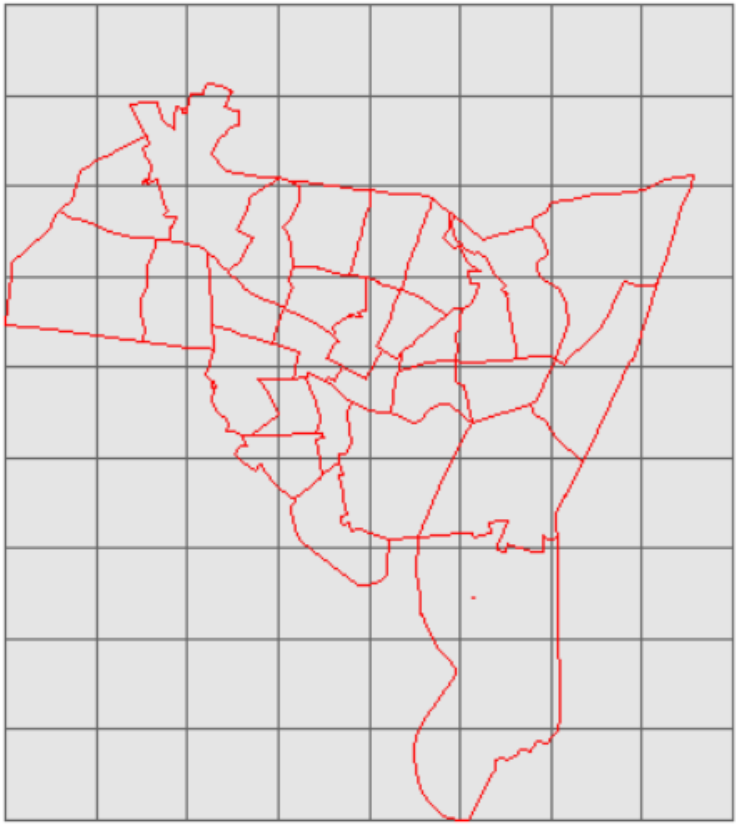
st_sf (): converting *sfc* to *sf* format

```
> n <- length(lengths(grid))
> n
[1] 72
```

```
> grid_sf <- st_sf(index = 1:n, grid)
> head(grid_sf)
Simple feature collection with 6 features and 1 field
geometry type:  POLYGON
dimension:      XY
bbox:           xmin: 531731.9 ymin: 147854 xmax: 561731.9
CRS:             +proj=lcc +datum=NAD27 +lon_0=-72d45 +lat_
57607315 +y_0=0 +units=us-ft +no_defs +ellps=clrk66 +nadgri
  index                             grid
1     1 POLYGON ((531731.9 147854, ...
2     2 POLYGON ((536731.9 147854, ...
3     3 POLYGON ((541731.9 147854, ...
4     4 POLYGON ((546731.9 147854, ...
5     5 POLYGON ((551731.9 147854, ...
6     6 POLYGON ((556731.9 147854, ...
```

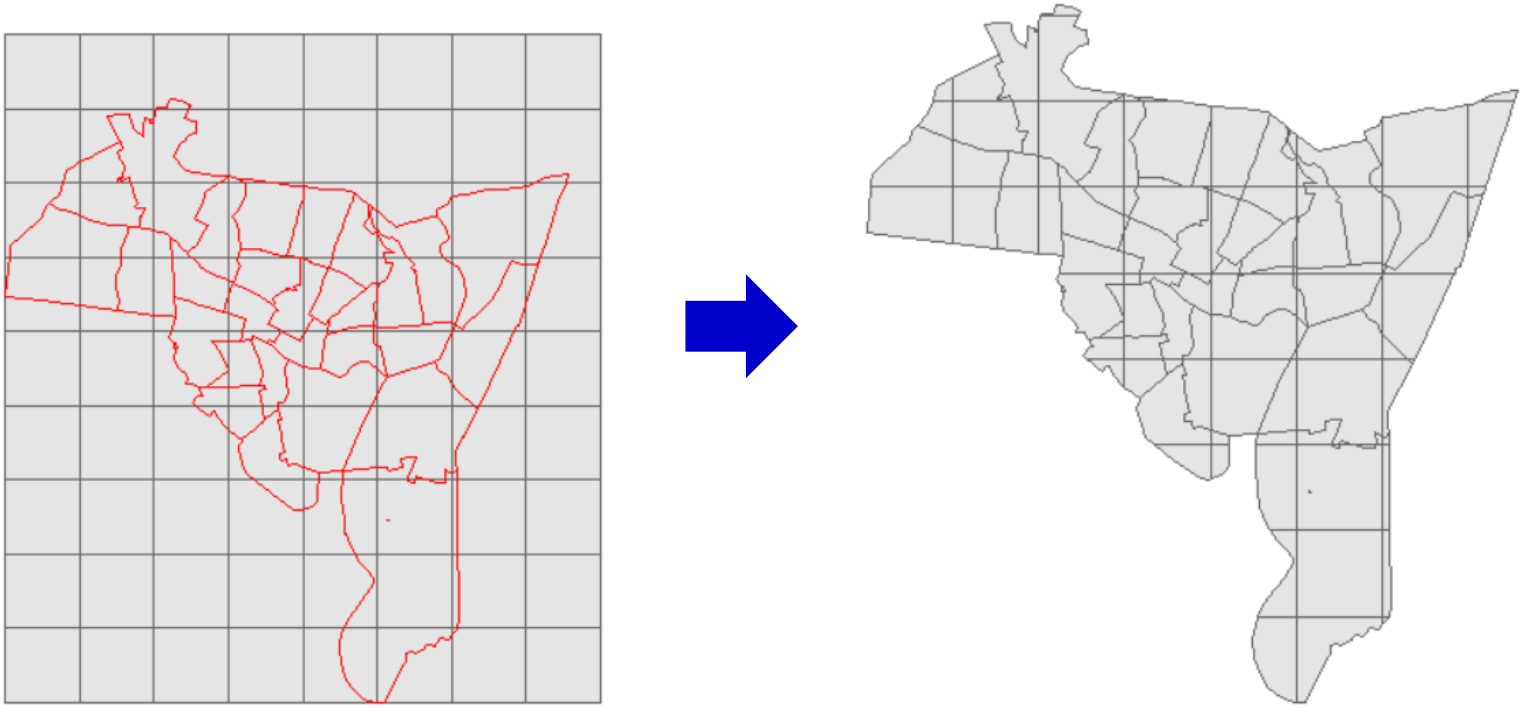
Step 1: Building fishnet

```
> grd_bg <- tm_shape(grid_sf) + tm_polygons("grey90")
> tracts <- tm_shape(tracts_sf) + tm_borders(col = "red")
> grd_bg + tracts
```



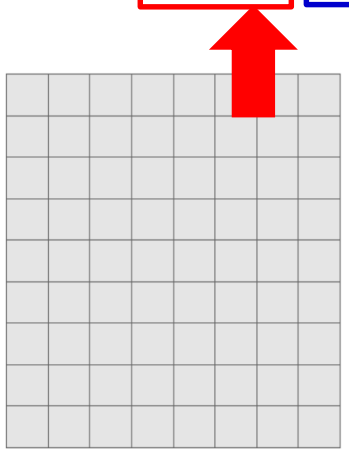
Step 2: Spatial intersection: st_intersection()

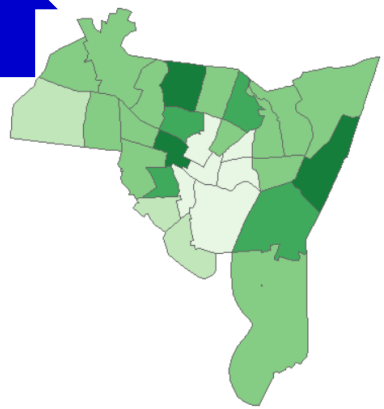
```
new_sf <- st_intersection(grid_sf, tracts_sf)
new_lyr <- tm_shape(new_sf) + tm_polygons("grey90")
new_lyr
```

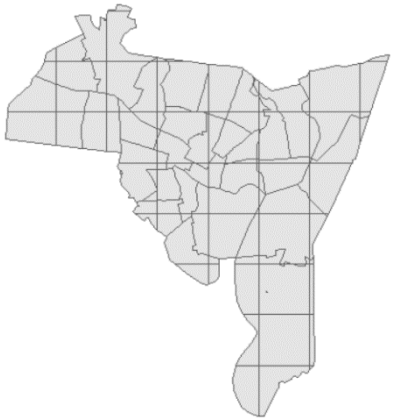


Checking the attributes of new *sf* data

```
> head(new_sf)
Simple feature collection with 6 features and 78 fields
geometry type:  POLYGON
dimension:      XY
bbox:           xmin: 538629.8 ymin: 178187.5 xmax: 546803.4
CRS:             +proj=lcc +datum=NAD27 +lon_0=-72d45 +lat_1=
57607315 +y_0=0 +units=us-ft +no_defs +ellps=clrk66 +nadgrids
   grd_id     AREA PERIMETER T009075H_ T009075H_I ARCINFOFPS
50     50 38821430  39255.55          2         554  090091413
51     51 38821430  39255.55          2         554  090091413
58     58 38821430  39255.55          2         554  090091413
59     59 38821430  39255.55          2         554  090091413
60     60 38821430  39255.55          2         554  090091413
67     67 38821430  39255.55          2         554  090091413
```







Step 3: Field calculation

```
head(new_sf)
new_sf$new_area<-st_area(new_sf)
new_sf$houses<- (new_sf$new_area / new_sf$AREA) * new_sf$HSE_UNITS
```

```
   PERS_UNIT SPLIT                                grid                                 new_area
50      2.42     0 POLYGON ((540203.5 182854, ... 3405836.375 [US_survey_foot^2]
51      2.42     0 POLYGON ((541731.9 179671.7... 12860440.706 [US_survey_foot^2]
58      2.42     0 POLYGON ((541731.9 187318.2... 9759082.762 [US_survey_foot^2]
59      2.42     0 POLYGON ((546106.7 182854, ... 11981191.015 [US_survey_foot^2]
60      2.42     0 POLYGON ((546731.9 183238.1...    1848.794 [US_survey_foot^2]
67      2.42     0 POLYGON ((544065.5 187854, ... 813052.833 [US_survey_foot^2]
                                houses
50 175.19847263 [US_survey_foot^2]
51 661.54956400 [US_survey_foot^2]
58 502.01366295 [US_survey_foot^2]
59 616.32037917 [US_survey_foot^2]
60   0.09510318 [US_survey_foot^2]
67  41.82397472 [US_survey_foot^2]
```

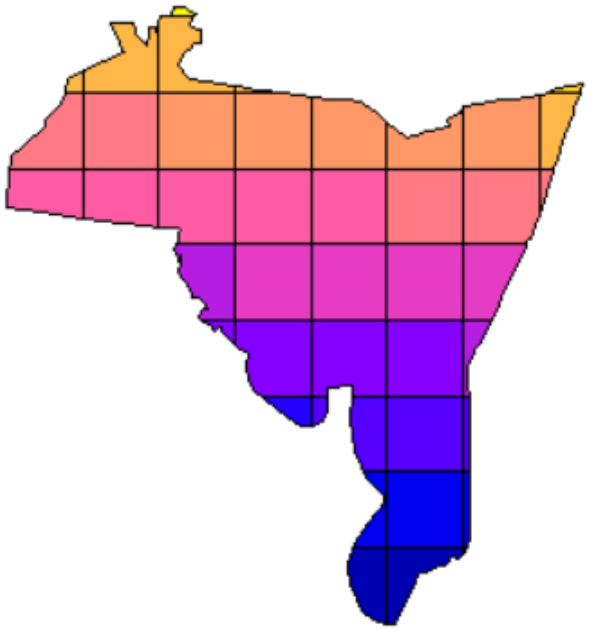
Step 4: Grouping data: summarise()

```
library(tidyverse)
new_sf <- summarise(group_by(new_sf, grd_id), count = sum(houses))

head(new_sf)
```

```
> head(new_sf)
Simple feature collection
geometry type:  POLYGON
dimension:      XY
bbox:           xmin: 5541
CRS:             +proj=lcc
57607315 +y_0=0 +units=us-
# A tibble: 6 x 3
```

	grd_id <int>	count [US_survey_foot^
1	5	224.70602
2	6	243.68082
3	7	2.08143
4	13	115.92200
5	14	536.60648
6	15	47.44232



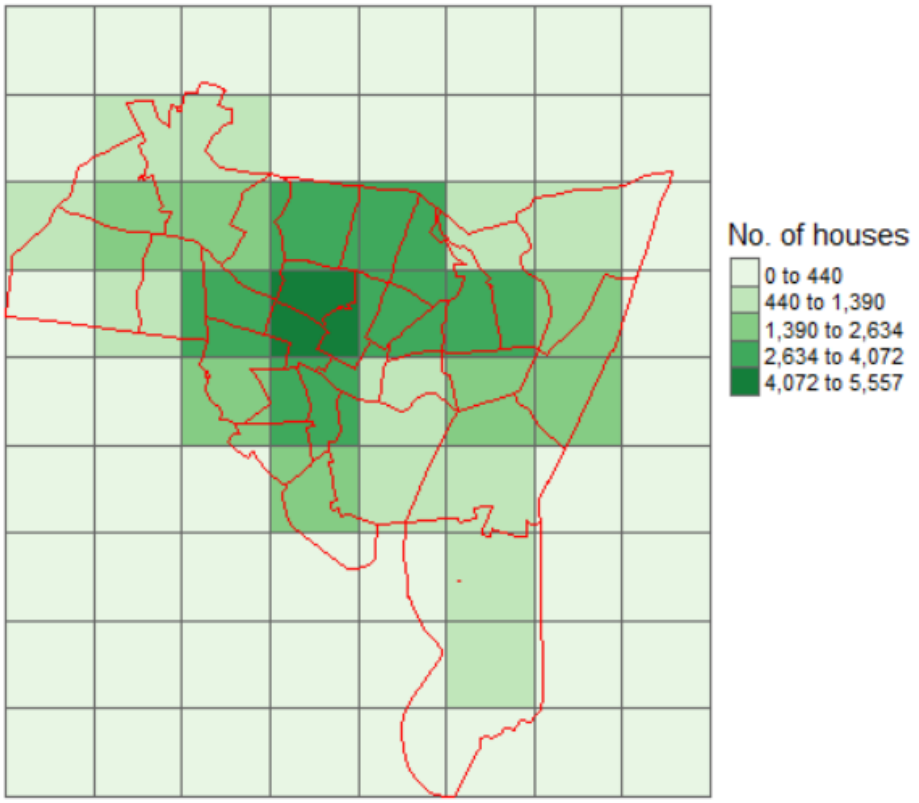
Link to *grid_sf* data

```
grid_sf$houses <- 0
grid_sf$houses[new_sf$grd_id] <- new_sf$count  # using [grd_id] as the index
```

```
> head(grid_sf)
Simple feature collection with 6 features and 2 fields
geometry type:  POLYGON
dimension:      XY
bbox:           xmin: 531731.9 ymin: 147854 xmax: 56173
CRS:             +proj=lcc +datum=NAD27 +lon_0=-72d45 +
57607315 +y_0=0 +units=us-ft +no_defs +ellps=clrk66 +na
  grd_id                              grid   houses
1      1 POLYGON ((531731.9 147854, ...   0.0000
2      2 POLYGON ((536731.9 147854, ...   0.0000
3      3 POLYGON ((541731.9 147854, ...   0.0000
4      4 POLYGON ((546731.9 147854, ...   0.0000
5      5 POLYGON ((551731.9 147854, ... 224.7060
6      6 POLYGON ((556731.9 147854, ... 243.6808
```

Step 5: Spatial mapping

```
tm_shape(grid_sf) +
  tm_polygons("houses", palette = "Greens", style = "jenks", title = "No. of houses") +
  tm_layout(frame = F, legend.position = c(1,0.5)) +
  tm_shape(tracts_sf) + tm_borders(col = "red")
```

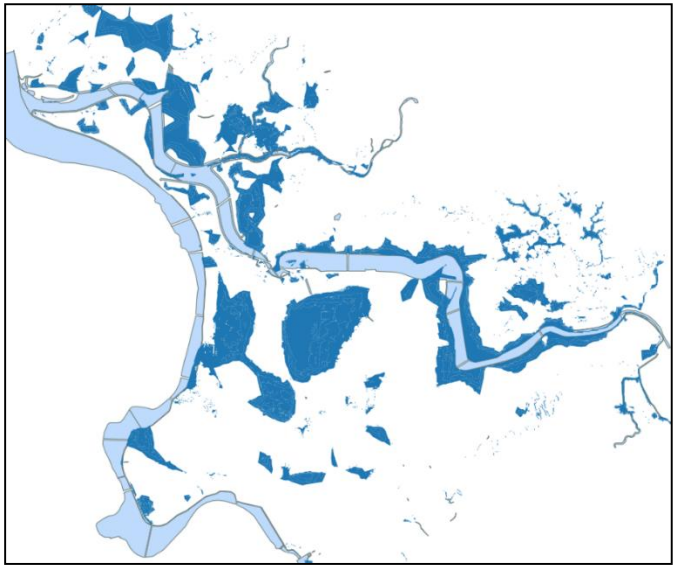


本週實習

繳交期限：下週一（4/5）晚上11:59

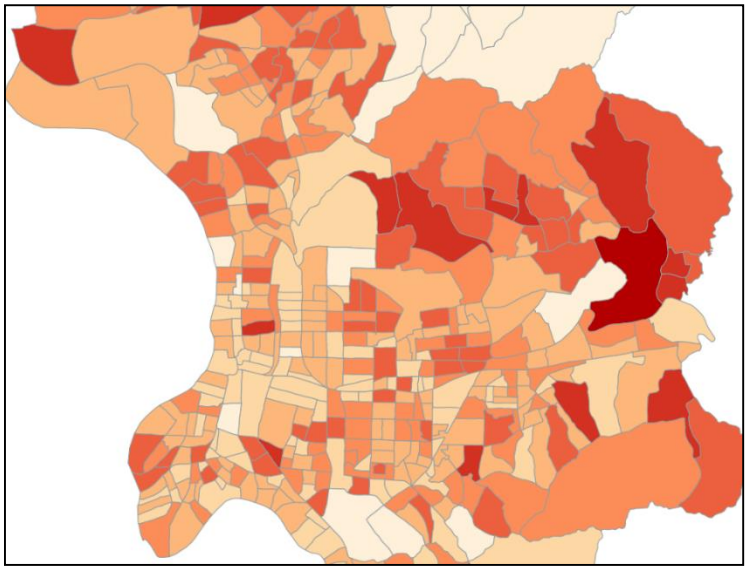
Flood50.shp

淡水河流域 洪災範圍



Taipei_Vill.shp

台北市村里人口數 (census欄位)



（1）利用村里淹水面積比例計算，估計**洪災影響人數**。

（2）依照「行政區（大安區、中正區、…）」彙總統計，

列表**各行政區**的洪災影響人數。

本週作業

繳交期限：下次上課（4/12）下午2:00

- 第一次期中考題（RMarkdown的html格式繳交）

- 影片觀看心得（PDF格式繳交）

Using Spatial Statistics to do More: Simple Approaches（1:14:17）

https://www.youtube.com/watch?v=3d_8nQpSCgE

心得需包括以下部分：

1. 簡述印象較深刻的空間分析方法（至少3個）
2. 針對前述的分析方法，可如何應用於在你目前就讀的科系領域？