

Combining Raster and Vector Data

HES 505 Fall 2022: Session 13

Matt Williamson



Today's Plan

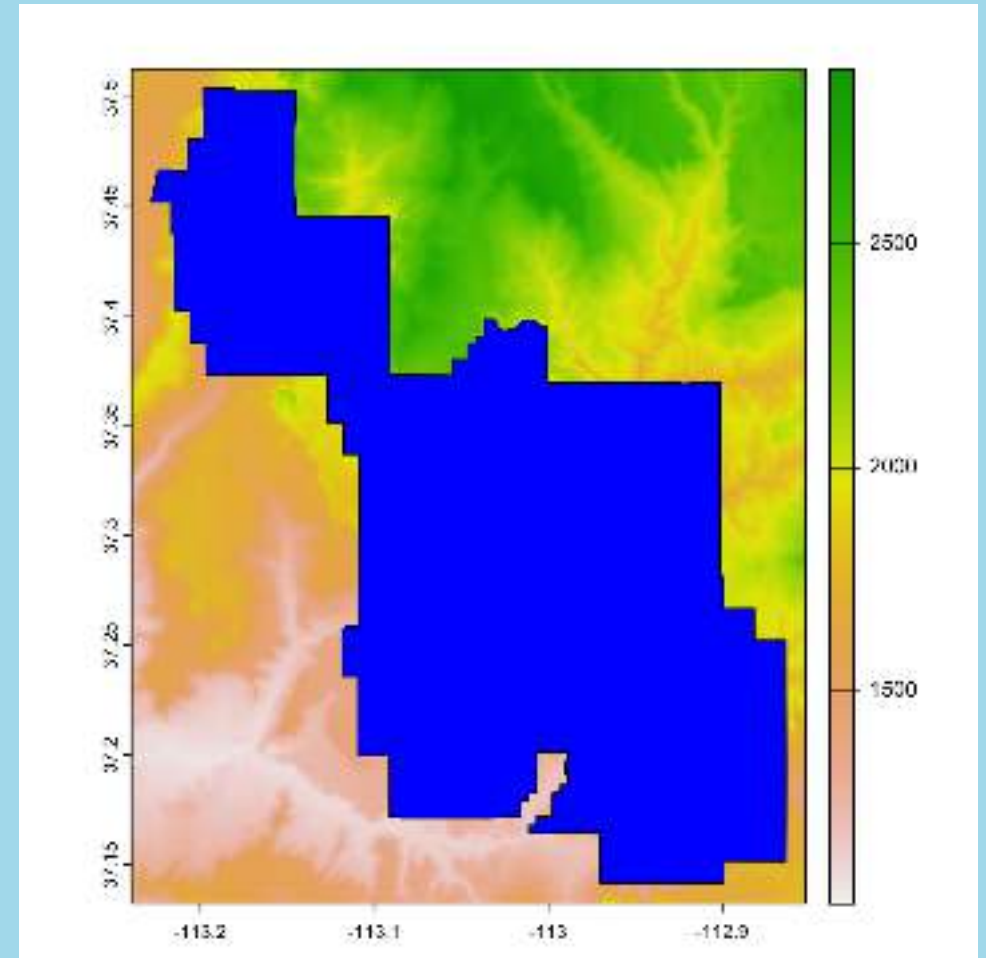
Objectives

- By the end of today, you should be able to:
 - Clip, crop, or extend vector and raster data so that extents align
 - Convert between raster and vector datasets
 - Generate new rasters describing the spatial arrangement of vector data
 - Extract raster values as attributes of vector data

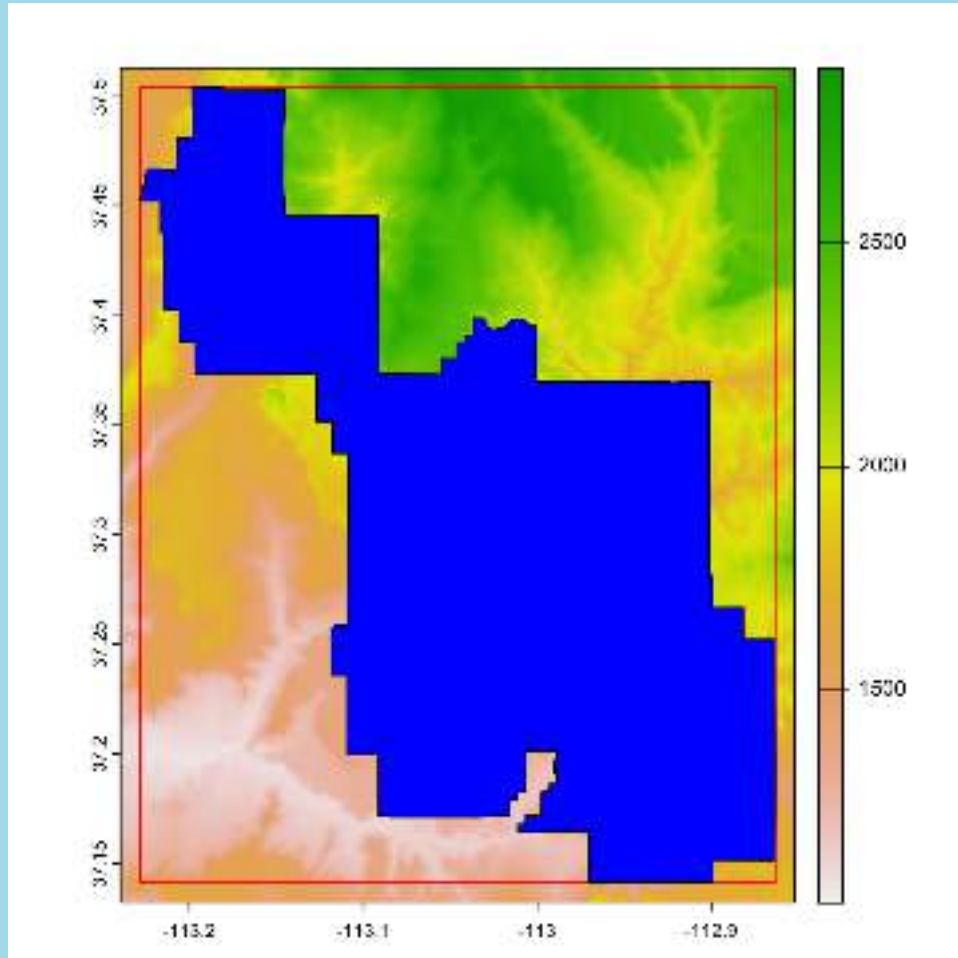
Modifying the Extent

Dealing with Different Extents

- Raster extents often larger than our analysis
- Reducing memory and computational resources
- Making attractive maps



Using `terra::crop()`



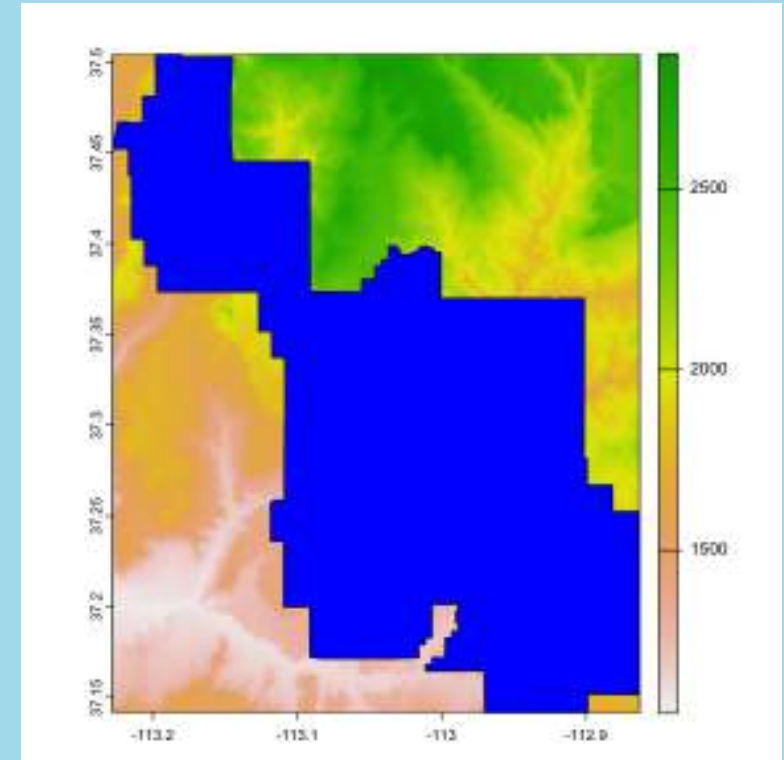
- Coordinate Reference System must be the same for both objects
- Crop is based on the (converted) **SpatExtent** of the 2nd object
- **snap** describes how **y** will be aligned to the raster
- Returns all data within the extent

Using `terra::crop()`

```
1 library(sf)
2 library(terra)
3 library(spDataLarge)
4 srtm = rast(system.file("raster/srtm.tif", package = "spDataLarge"))
5 zion = read_sf(system.file("vector/zion.gpkg", package = "spDataLarge"))
6 zion = st_transform(zion, crs(srtm))
7
8 crs(srtm) == crs(zion)
```

```
[1] TRUE
```

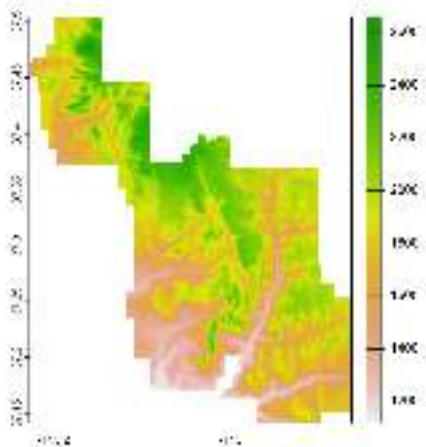
```
1 srtm.crop <- crop(x=srtm, y=zion, snap="near")
```



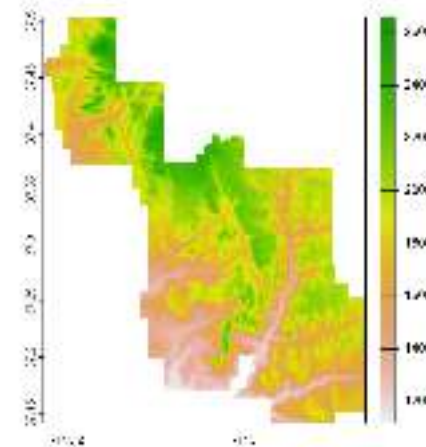
Using `mask()`

- Often want to get rid of all values outside of vector
- Can set `mask=TRUE` in `crop()` (`y` must be `SpatVector`)
- Or use `mask()`

```
1 srtm.crop.msk <- crop(x=srtm, y=ve  
2 plot(srtm.crop.msk)
```



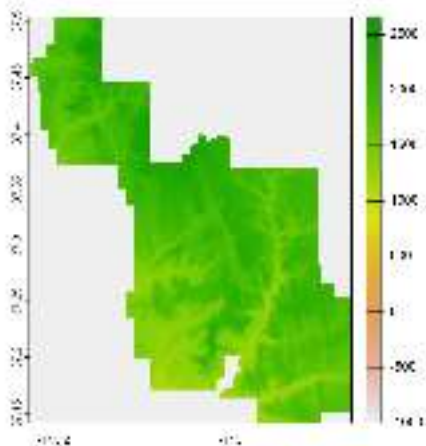
```
1 srtm.msk <- mask(srtm.crop, vect(z  
2 plot(srtm.msk)
```



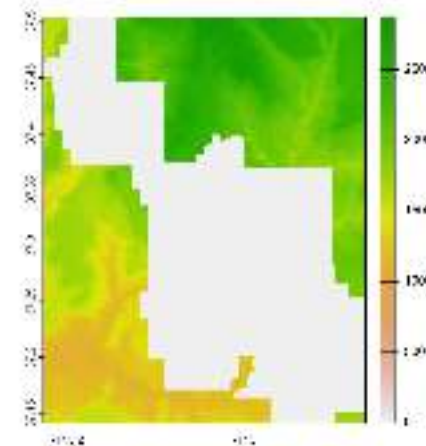
Using `mask()`

- Allows more control over what the mask does
- Can set `maskvalues` and `updatevalues` to change the resulting raster
- Can also use `inverse` to mask out the vector

```
1 srtm.msk <- mask(srtm.crop, vect(z  
2 plot(srtm.msk)
```



```
1 srtm.msk <- mask(srtm.crop, vect(z  
2 plot(srtm.msk)
```



Extending boundaries

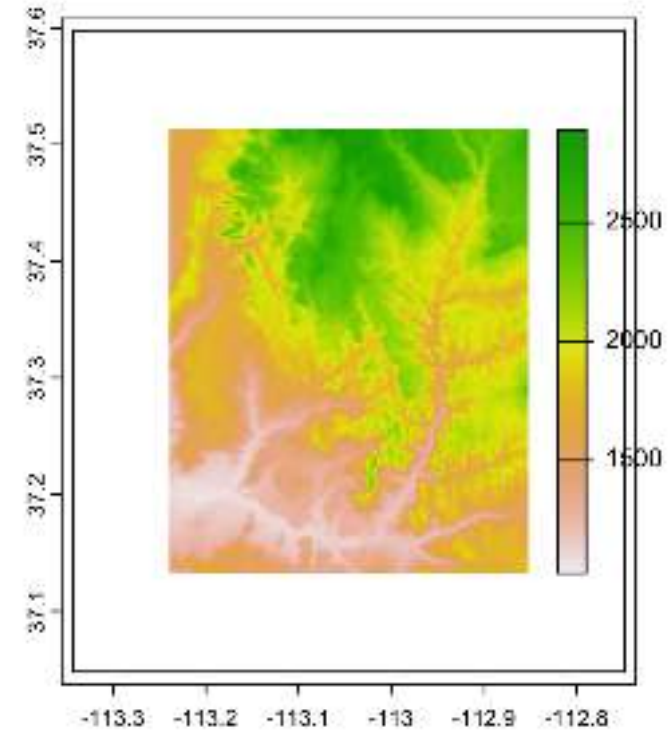
- Vector slightly larger than raster
- Especially when using buffered datasets
- Can use **extend**
- Not exact; depends on **snap()**

```
1 zion.buff <- zion %>%  
2   st_buffer(., 10000)  
3 srtm.ext <- extend(srtm, vect(zion  
4 ext(srtm.ext)
```

```
SpatExtent : -113.343749879444,  
-112.74791654615, 37.0479167631968,  
37.5979167631601 (xmin, xmax, ymin,  
ymax)
```

```
1 ext(vect(zion.buff))
```

```
SpatExtent : -113.343652923976,  
-112.747986193365, 37.0477357596604,  
37.5977812137969 (xmin, xmax, ymin,  
ymax)
```



Converting Between Formats

Converting Between Formats

- Using coercion (`as`, `rast`, `vect`) can change `class`, but not data model
- Sometimes we need to actually change the data model

Converting Vectors to Rasters

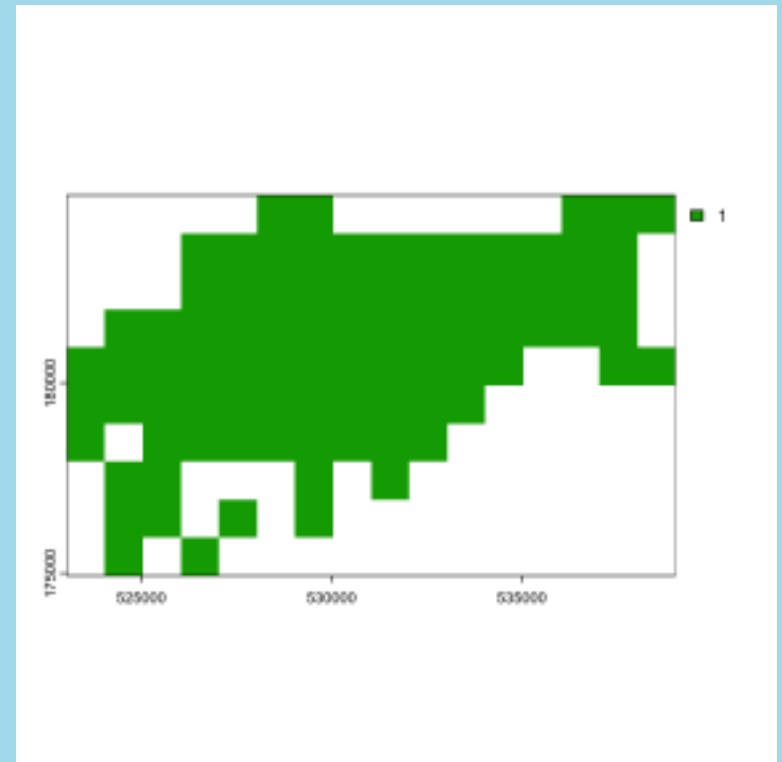
Using **rasterize**

- A special kind of data aggregation
- **x** is your **SpatVector** object
- **y** is a template raster with the appropriate CRS, resolution, and extent
- **fun** allows you to specify the value of the resulting raster

Using rasterize

- Presence/Absence
- **field** specifies which value should be returned to non-empty cells

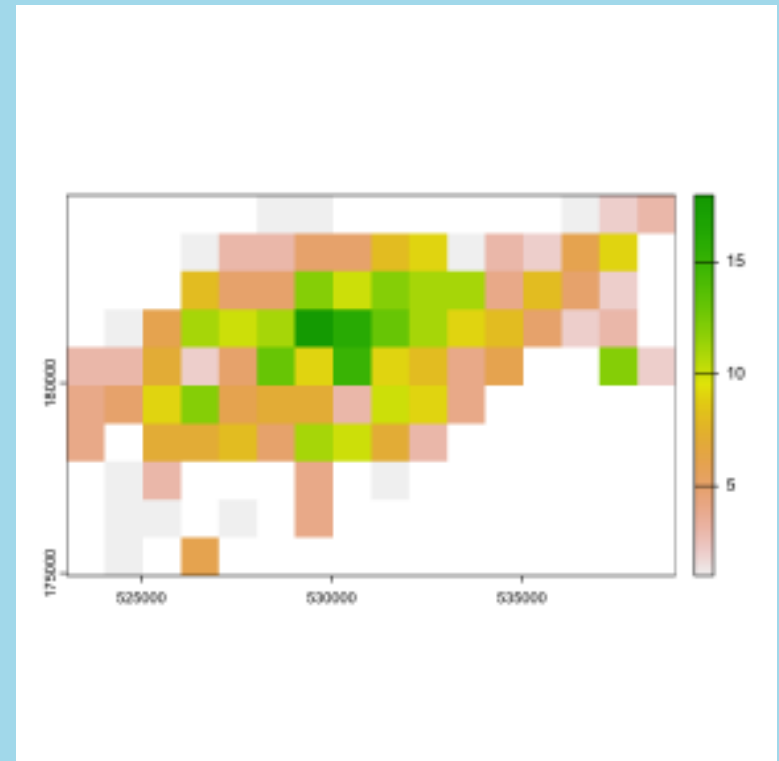
```
1 cycle_hire_osm = spData::cycle_hire_osm
2 cycle_hire_osm_projected = st_transform(cycle_hire_osm, "EPSG:31466")
3 raster_template = rast(ext(cycle_hire_osm_projected), resolution = 100, crs = st_crs(cycle_hire_osm_projected))
4
5 ch_raster1 = rasterize(cycle_hire_osm_projected, raster_template,
6                       field = 1)
```



Using rasterize

- The **fun** argument specifies how we aggregate the data
- Useful for counting occurrences (using **length**)

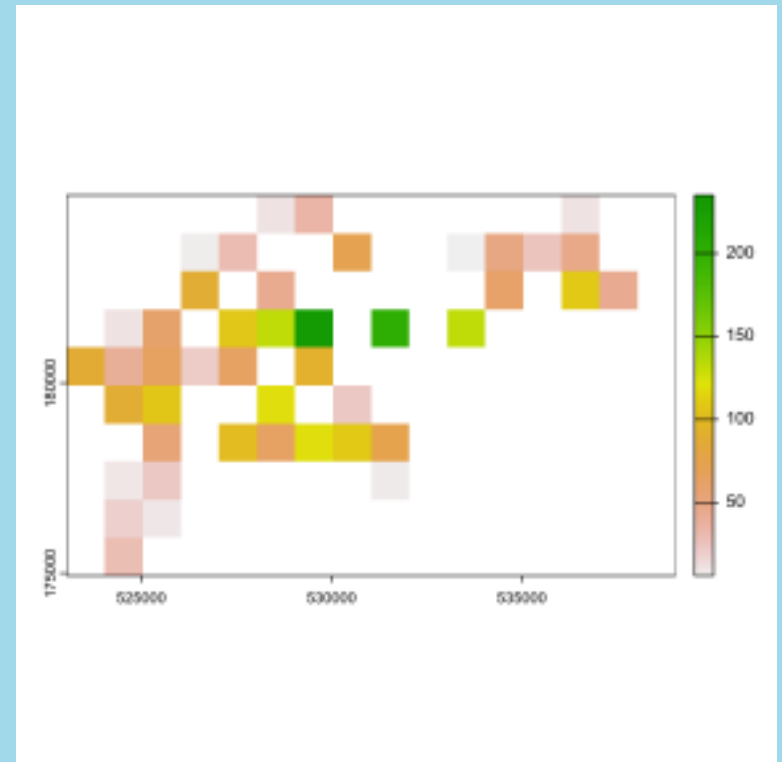
```
1 ch_raster2 = rasterize(cycle_hire_osm_projected, raster_template,
2                         fun = "length")
```



Using **rasterize**

- The **fun** argument specifies how we aggregate the data
- Can use a variety of functions

```
1 ch_raster3 = rasterize(cycle_hire_osm_projected, raster_template,
2                         field = "capacity", fun = sum)
```



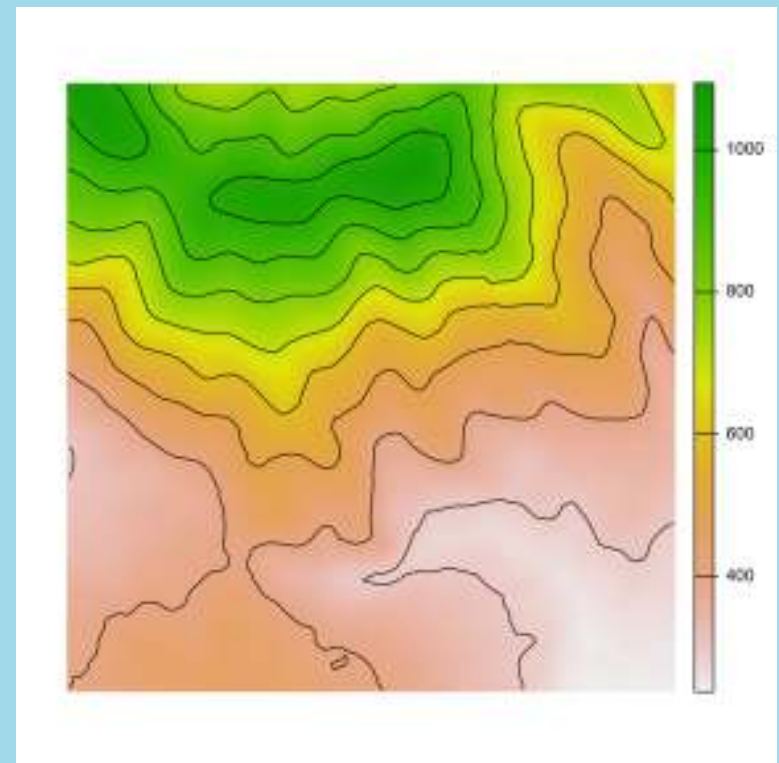
Lines and Polygons

- Can use `rasterize` or `stars::st_rasterize`
- Result depends on the `touches` argument

Converting rasters to vectors

- Less common, but can convert to vector data
- `as.points`, `as.contour`, and `polygonize`

```
1 dem = rast(system.file("raster/dem.tif", package = "spDataLarge"))
2 cl = as.contour(dem)
```



Generating New Data

Generating New Data

- Sometimes we want a raster describing the spatial context of vector data
- **distance** is a simple method
- We'll use interpolation in the next few weeks

Generating Distance Rasters

- returns a distance matrix or **SpatRaster**

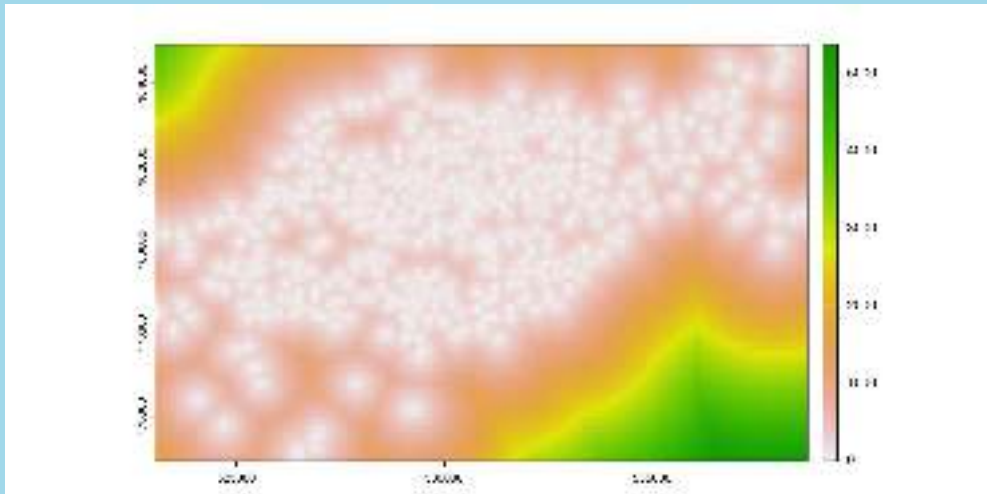
```
1 cycle_hire_osm = spData::cycle_hire_osm
2 cycle_hire_osm_projected = st_transform(cycle_hire_osm, "EPSG:27700")
3
4 cycle_dist <- distance(vect(cycle_hire_osm_projected))
5 head(as.matrix(cycle_dist))[1:5, 1:5]
```

	1	2	3	4	5
1	0.0000	2550.9619	1736.118	407.1558	1922.3728
2	2550.9619	0.0000	1072.401	2820.4804	725.2172
3	1736.1178	1072.4011	0.000	1908.1413	360.7490
4	407.1558	2820.4804	1908.141	0.0000	2148.0087
5	1922.3728	725.2172	360.749	2148.0087	0.0000

Generating Distance Rasters

- returns a distance matrix or **SpatRaster**

```
1 raster_template = rast(ext(cycle_hire_osm_projected), resolution = 100,  
2                       crs = st_crs(cycle_hire_osm_projected)$wkt)  
3 ch_raster1 = rasterize(cycle_hire_osm_projected, raster_template,  
4                       field = 1)  
5  
6 ch_dist_rast <- distance(ch_raster1)  
7 plot(ch_dist_rast)
```



Creating Vector Data by Extraction

- Sometimes we want to use rasters to create new attributes
- **fun** controls how the cells are aggregated

```
1 cycle_hire_osm = spData::cycle_hire_osm
2 cycle_hire_osm_proj_buff <- st_transform(cycle_hire_osm, "EPSG:27700") %>%
3   st_buffer(., 5000) %>%
4   as(., "SpatVector")
5
6 cycle_ext <- extract(ch_dist_rast, cycle_hire_osm_proj_buff)
7 head(cycle_ext)
```

	ID	last
1	1	1360.147
2	1	1280.625
3	1	1204.159
4	1	1131.371
5	1	1063.015
6	1	1000.000

