# Integrating Rasters and Vector Data

HES 505 Fall 2023: Session 16

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# Today's Plan

# Objectives

- Use `dplyr` with `predicates` and `measures` to subset and manipulate data
- Use `extract` to access raster data
- Use `zonal` to summarize access data
- Join data into a single analyzable dataframe

# Motivating Question

> How do Collaborative Forest Landscape Restoration projects compare to other National Forest lands with respect to social and wildfire risks?

# Thinking about the data

- **Datasets** - Forest Service Boundaries, CFLRP Boundaries, Wildfire Risk Raster, CEJST shapefile
- **Dependent Variable** - CFLRP (T or F)
- **Independent Variables** - Wildfire hazard, income, education, housing burdent

# Building some Pseudocode

```
1. Load Libraries
2. Load data
3. Check validity and alignment
4. Subset to relevant geographies
5. Select relevant attributes
6. Extract wildfire risk
7. CFLRP T or F
```

# Load libraries

```
1 library(sf)
2 library(terra)
3 library(tidyverse)
4 library(tmap)
```

# Load the data

- Downloading USFS data using tempfiles and `unzip`

```
### FS Boundaries
tmp <- tempfile()
fs.url <- "https://data.fs.usda.gov/geodata/edw/edw_resources/shp/S_USA.Adm
download.file(fs.url, tmp)
tmp2 <- tempfile()
unzip(zipfile=tmp, exdir = tmp2 )

fs.bdry <- read_sf(tmp2)

### CFLRP Data
tmp <- tempfile()
cflrp.url <- "https://data.fs.usda.gov/geodata/edw/edw_resources/shp/S_USA.
download.file(cflrp.url, tmp)
tmp2 <- tempfile()
unzip(zipfile=tmp, exdir = tmp2 )
cflrp.bdry <- read_sf(tmp2)
```

# Load the data

- From our class folder

```
### Wildfire Hazard Data
wildfire.haz <- rast("opt/data/2023/assignment01/wildfire_hazard_agg.tif")

## CEJST data
cejst <- read_sf("opt/data/2023/assignment01/cejst_pnw.shp")
```

# Check Validity

- The USFS datasets are new; let's check the geometries

```
1 all(st_is_valid(fs.bdry))
```

```
[1] FALSE
```

```
1 all(st_is_valid(cflrp.bdry))
```

```
[1] FALSE
```

- Make them valid

```
1 fs.bdry.valid <- st_make_valid(fs.bdry)
2 all(st_is_valid(fs.bdry.valid))
```

```
[1] TRUE
```

```
1 cflrp.bdry.valid <- st_make_valid(cflrp.bdry)
2 all(st_is_valid(cflrp.bdry.valid))
```

```
[1] TRUE
```

# Set Projection

- We know these are in different CRS
- Project to the CRS of the `raster`
- Using `%>%` to pipe data through the function

```
cflrp.proj <- cflrp.bdry.valid %>% st_transform(., crs=crs(wildfire.haz))
cejst.proj <- cejst %>% st_transform(., crs=crs(wildfire.haz))
fs.proj <- fs.bdry.valid %>% st_transform(., crs=crs(wildfire.haz))
```

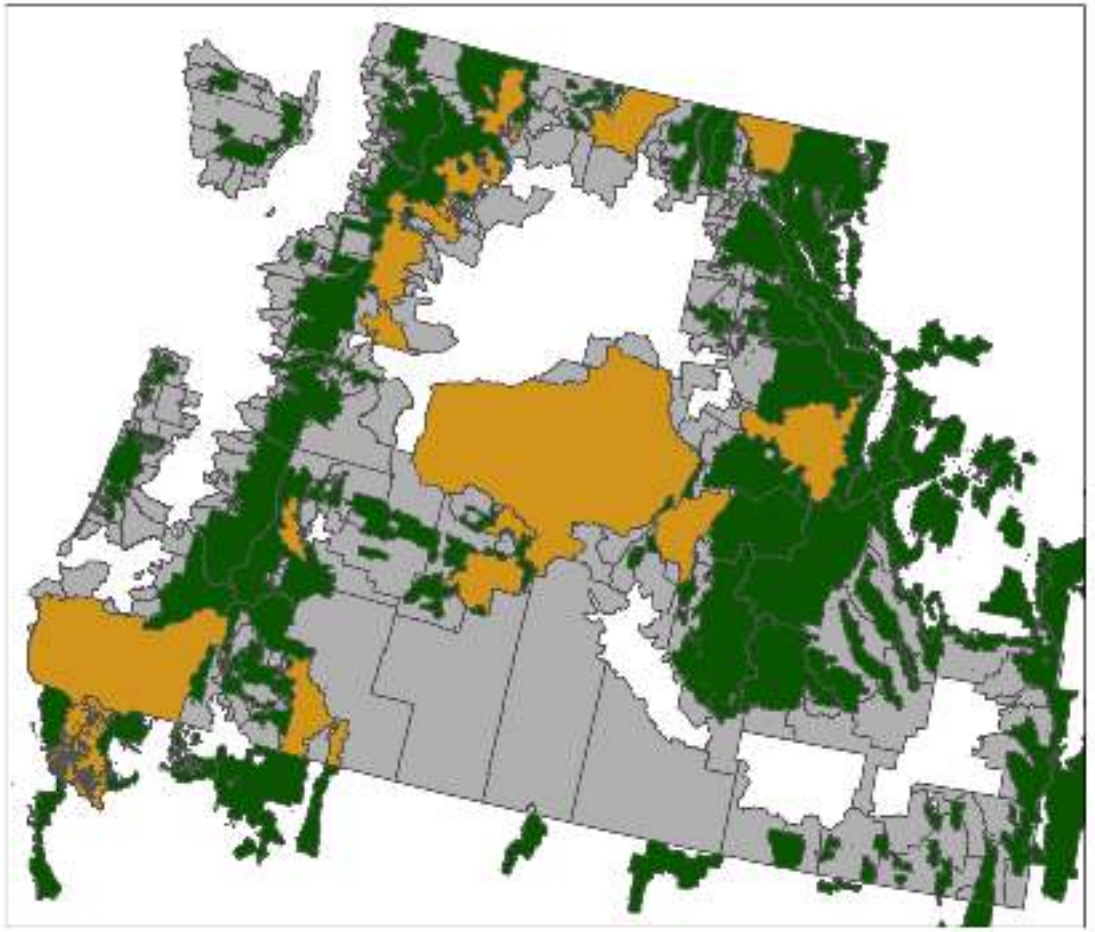
# Subset Geometries

- We can use the `[ ]` notation to subset the one dataset based on the geometry of the other
- Need USFS and CFLRP within the region
- Then need tracts that overlap USFS

```
fs.subset <- fs.proj[cejst.proj, ]
cflrp.subset <- cflrp.proj[cejst.proj, ]
cejst.subset <- cejst.proj[fs.subset, ]
```

# Subset geometries

```
sub.map <- tm_shape(cejst.subset) +
  tm_polygons(col="gray") +
  tm_shape(fs.subset) +
  tm_polygons(col="darkgreen") +
  tm_shape(cflrp.subset) +
  tm_polygons(col="goldenrod")
```



# Select Relevant Columns

- Use the codebook to identify the right columns
- Then use `select` from `dplyr`
- geometries are sticky!

```
1 cejst.df <- cejst.subset %>%
2   select(GEOID10, LMI_PFS, LHE, HBF_PFS)
3 head(cejst.df)
```

```
Simple feature collection with 6 features and 4 fields
Geometry type: MULTIPOLYGON
Dimension:     XY
Bounding box:  xmin: -1598729 ymin: 2388182 xmax: -1475201 ymax: 3000813
Projected CRS: unnamed
# A tibble: 6 × 5
  GEOID10     LMI_PFS   LHE HBF_PFS
geometry
  <chr>         <dbl> <int>   <dbl>                                <MULTIPOLYGON
[m]>
1 16025970100    0.75     0    0.6  (((-1485848 2427049, -1485813 2426977,
```

```
-148…
2 16057005500    0.43      0    0.44 (((-1567845 2843218, -1567803 2843209,
-156…
3 16057005600    0.3       0    0.05 (((-1573408 2823058, -1573412 2823071,
```

# Extract wildfire data

- Can use `zonal` for one summary statistic
- Or `extract` for multiple

```
1 wildfire.zones <- terra::zonal(wildfire.haz, vect(cejst.df), fun="mean", na
2
3 head(wildfire.zones)
```

```
    WHP_ID
1 2997.7951
2  182.8864
3  386.9580
4  173.1703
5  193.4199
6  210.4406
```