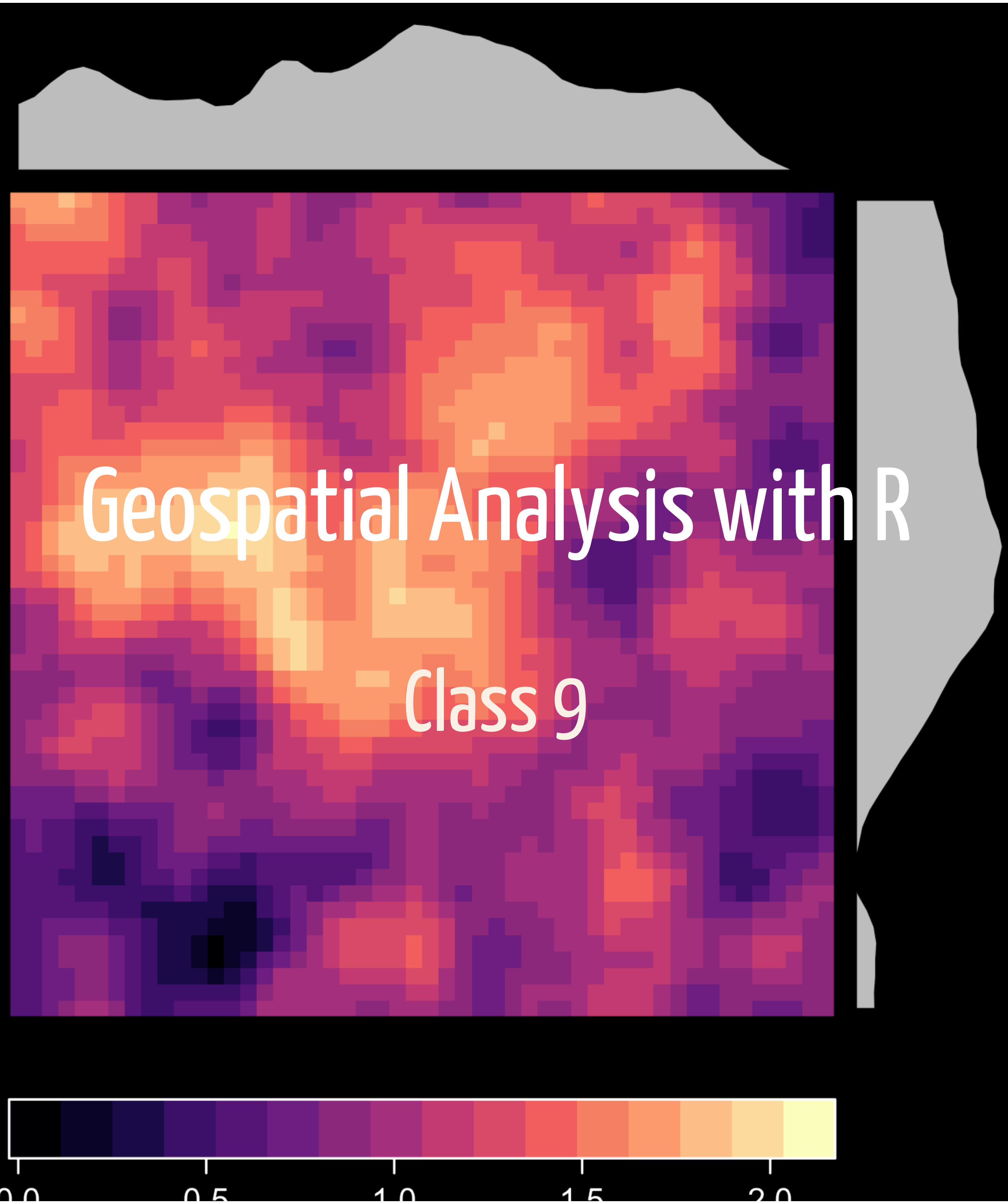
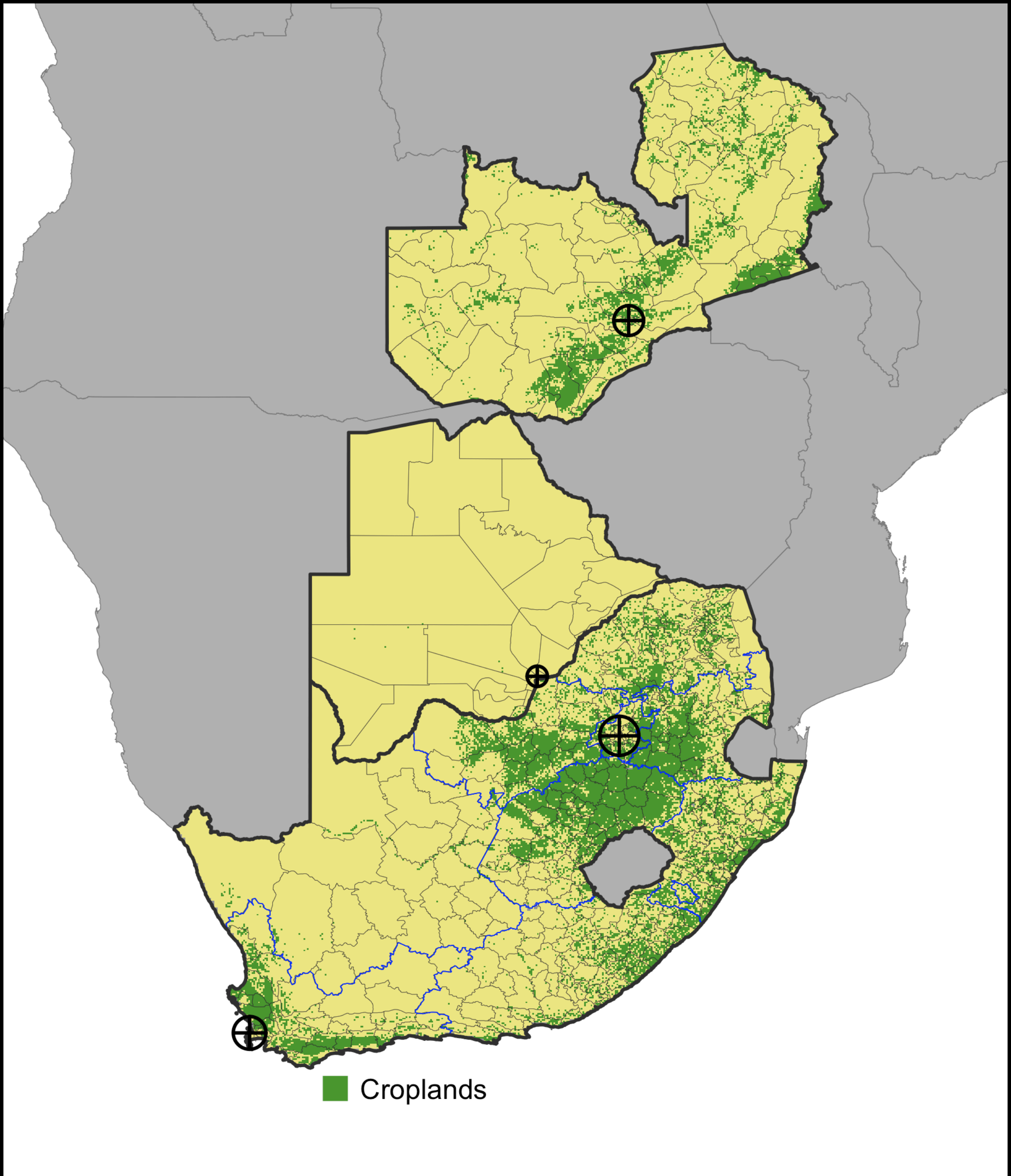


Geospatial Analysis with R

Class 9


🟩 Croplands

Today

- Summarizing
- Indexing lists
- Control structures

Programming thought of the day

- Whenever possible, let the computer do your counting for you:

```
a <- 1:1001
a[length(a)]
```

```
## [1] 1001
```

- Rather than

```
a[1001]
```

```
## [1] 1001
```

- Imagine this case:

```
set.seed(1)
b <- 1:sample(1:10000, 1)
b[length(b)]
```

```
## [1] 2656
```

Create your own data

- Create three matrices, `m1`, `m2`, `m3`
    - `m1`:
        - Random number seed: `set.seed(100)`
        - `V1` = 1:20
        - `V2` 20 random numbers from 1:100
        - `V3` 20 numbers from `rnorm`, mean = 500, sd = 100)
    - `m2`: Same variables, but `set.seed(200)`
    - `m3`: Same variables, but `set.seed(300)`
- Create vector `v`: 20 random draws from `LETTERS[1:5]`; `set.seed(1)`
- Create 2 `data.frame`s: `dat1` (`m1` & `v`), `dat2` (`m2` & `v`)
    - Name the column holding `v` "GRP"
- Create list `l` combining `m1`, `m2`, `m3`, `dat1`, `dat2`, `v`
    - Name the list elements the same as the object name.

Index into lists

- Select from `l`'s first element the 1st and 5th elements
- Do the same, using the element name and `[[]]` to get the first element of `l`
- Do the same, using `$` and the element name to get the first element
- Do the same, using `[]` and the element name to get the first element
- Select the last element of the last element of `l` (tricky without absolute indexing)

Summarizing datasets

- Calculate the row and column sums of both `m1` and `dat1`.
- Calculate the overall means and sums of all values `m2` and `dat2`
- From `dat1`, use both the base `aggregate` function and `dplyr` functions `group_by` and `summarise` to calculate the group mean, using `GRP` as the grouping variable.

Control structures

Branching

```
a <- 5
if(a > 10) {
  print("Greater than 10!")
} else {
  print("Less than or equal to 10")
}
```

```
## [1] "Less than or equal to 10"
```

Looping

```
b <- 1:3
for(i in b) print(i)
```

```
## [1] 1
## [1] 2
## [1] 3
```

*apply

- A special form of looping
- Intended for *applying* a function to data

```
l2 <- l[c("m1", "m2", "m3")]
lapply(l2, mean)
```

```
## $m1
## [1] 187.5092
##
## $m2
## [1] 183.919
##
## $m3
## [1] 197.5562
```

*apply

- Key uses:
  - Return results of loop directly into object
  - Use with anonymous functions to pass an iterator, often into more complex procedures

```r
# Simple
o <- lapply(1:2, function(x) l2[[x]])
o
```

```
## [[1]]
##       V1 V2       V3
##  [1,]  1 31 508.9886
##  [2,]  2 26 509.6274
##  [3,]  3 56 479.8366
##  [4,]  4  6 573.9840
##  [5,]  5 47 512.3380
##  [6,]  6 49 497.0683
##  [7,]  7 82 461.1146
##  [8,]  8 38 551.0856
##  [9,]  9 55 408.6186
## [10,] 10 18 731.0297
## [11,] 11 63 456.1910
## [12,] 12 89 576.4061
## [13,] 13 29 526.1961
## [14,] 14 40 577.3405
## [15,] 15 77 418.5621
```

```r
# More complex
o2 <- lapply(1:5, function(x) {
  l2[[1]][x] - l2[[2]][x]
})
o2
```

```
## [[1]]
## [1] 0
##
## [[2]]
## [1] 0
##
## [[3]]
## [1] 0
##
## [[4]]
## [1] 0
##
## [[5]]
## [1] 0
```

Looping practice

- Write a `for` loop that iterates through the vector 1:10 and prints the iterator `i` multiplied by 10
- Do the same, but instead of print `i * 10`, catch the result in a predefined empty list `o`
- Do the same as above, but use an `lapply` that assigns output to `o`
- Do the same as above, but use `sapply` instead of `lapply`
- Let's use `sapply` to find which elements of `l` are `matrix`
- Let's use `lapply` to calculate the `colMeans` of matrices and `data.frame`s in `l`

Create data using `lapply`

- Let's recreate our matrix examples

Create data using `lapply`

- Let's recreate our matrix examples

```r
seeds <- c(100, 200, 300)  # or 100 * 1:3
l3 <- lapply(seeds, function(x) {
  set.seed(x)
  m <- cbind(V1 = 1:20,
             V2 = sample(1:100, size = 20, replace = TRUE),
             V3 = rnorm(n = 20, mean = 500, sd = 100))
})
names(l3) <- paste0("m", 1:3)
```

Check the values

- Let's check them now against original values

```
m1 == l3$m1
m2 == l3$m2
all(m1 == l3$m1)
all(m2 == l3$m2)
```

- Etc, but we could do this check with a looping function!

Check using `lapply`

- We know that `l[1:3]` contains `m1`, `m2`, `m3`, and so does `l3`, so

```r
lapply(1:3, function(x) all(l[[x]] == l3[[x]]))
```

- More compact

```r
sapply(1:3, function(x) all(l[[x]] == l3[[x]]))
```