Raster Data: II

HES 505 Fall 2023: Session 14

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Today's Plan

Objectives

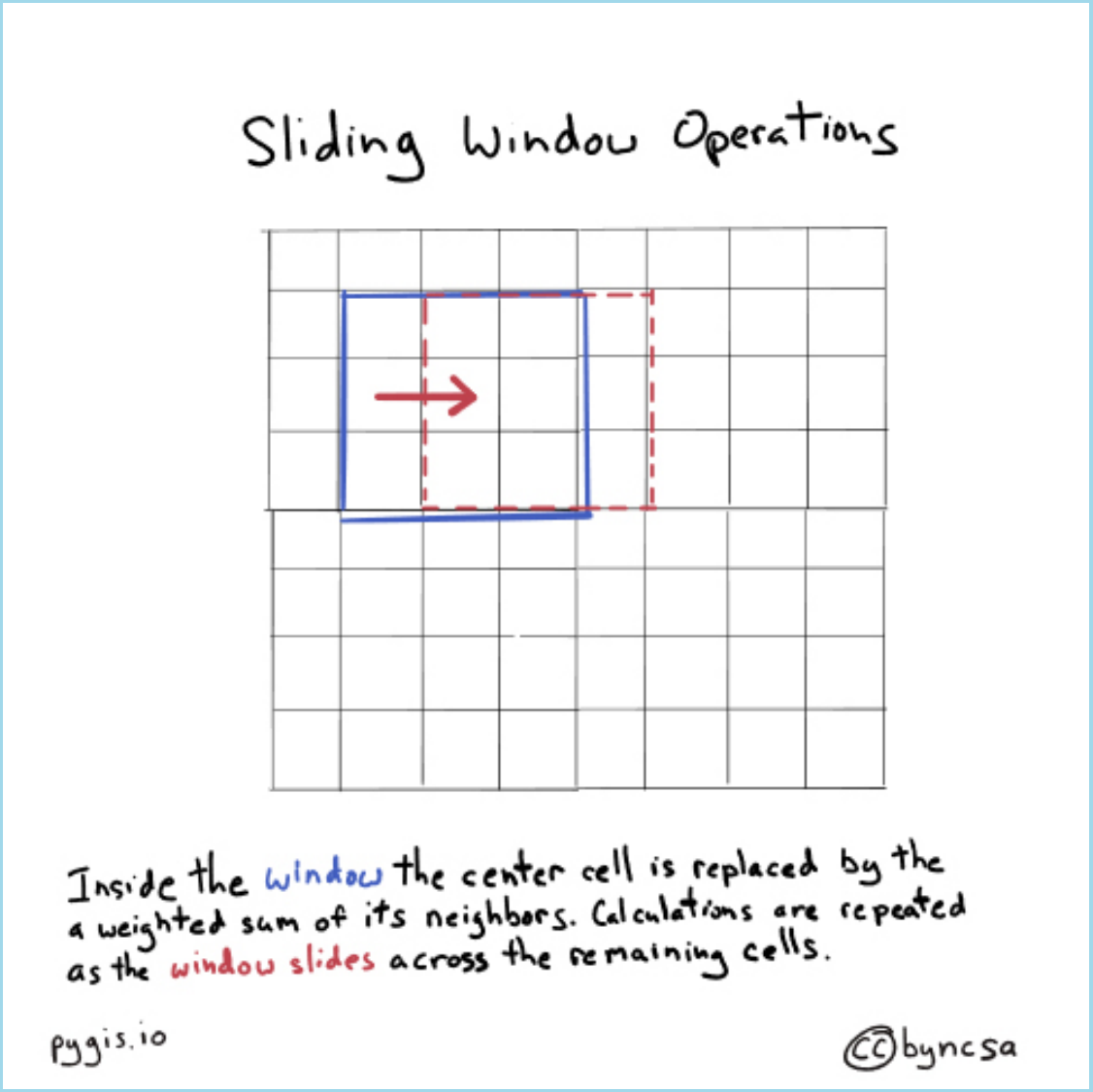
- By the end of today, you should be able to:
  - Use moving windows as a means of smoothing raster data
  - Reclassify data using conditional statements and reclassification tables
  - Use raster math as a means of creating new data based on an existing dataset.

Moving Windows

Why use moving windows?

- To create new data that reflects “neighborhood” data
- To smooth out values
- To detect (and fill) holes or edges
- Change the thematic scale of your data (without changing resolution)

What is a moving window?



Implementing Moving Windows in R

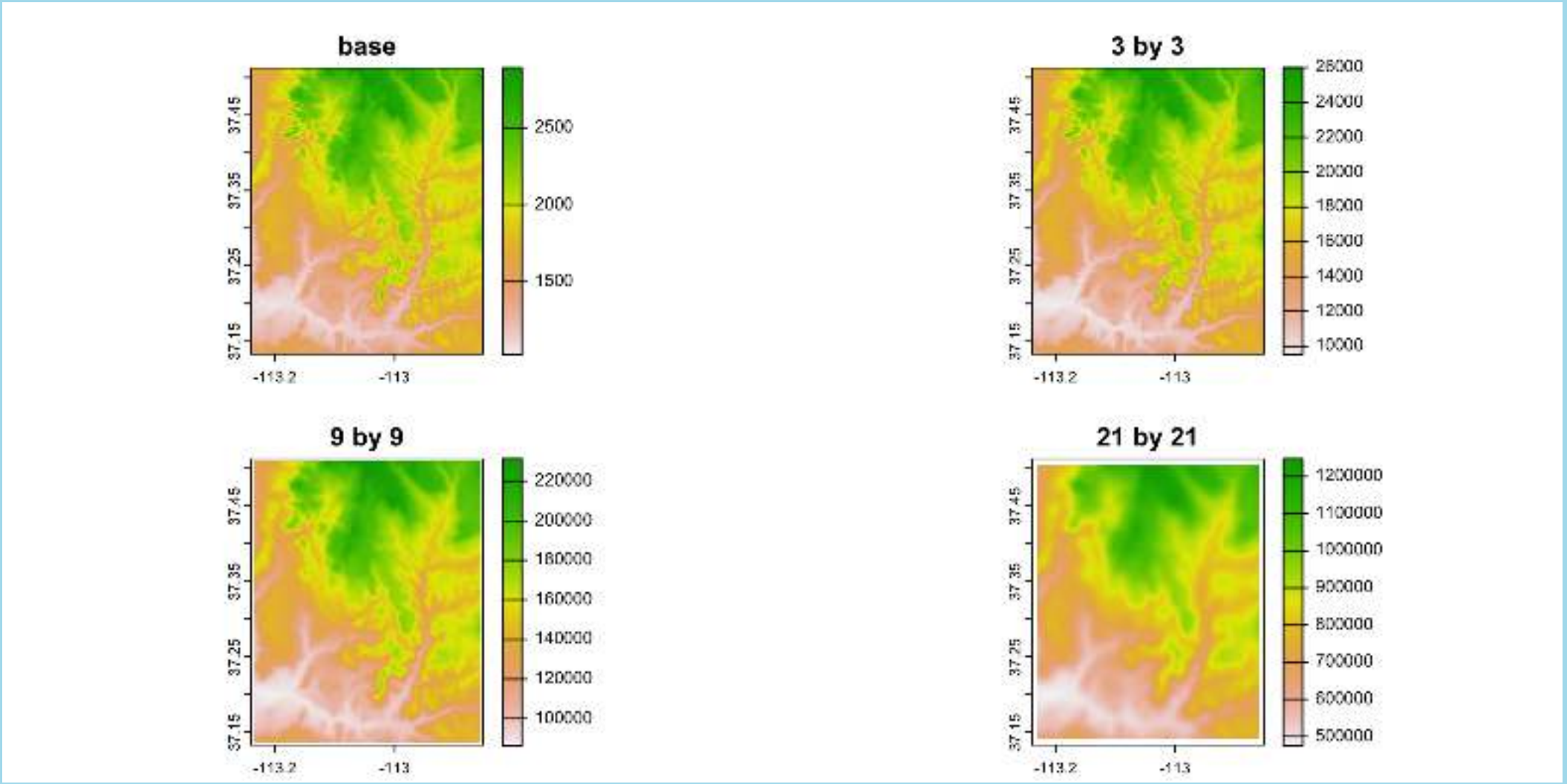
- Use the `focal` function in `terra`

```
focal(x, w=3, fun="sum", ...,
na.policy="all", fillvalue=NA,
expand=FALSE, silent=TRUE, filename="",
overwrite=FALSE, wopt=list())
```

`focal` for Continuous Rasters

```
1  library(tidyverse)
2  library(terra)
3  library(spData)
4  srtm = rast(system.file("raster/srtm.tif", package = "spDataLarge"))
5  srtm3  <-  focal(x = srtm, w = 3)
6  srtm9  <-  focal(x = srtm, w = 9)
7  srtm21  <-  focal(x = srtm, w = 21)
```

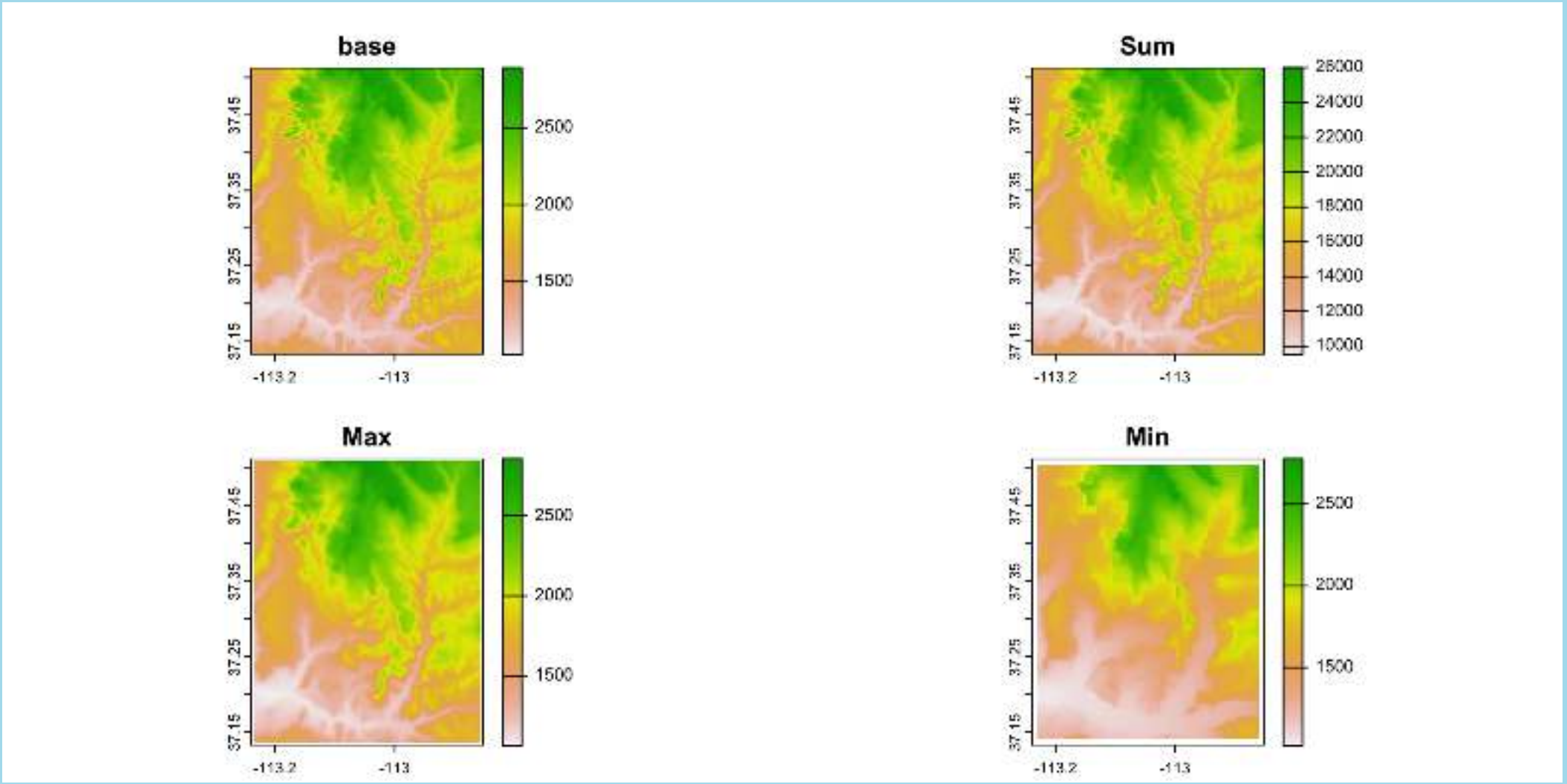
focal for Continuous Rasters



`focal` for Continuous Rasters

```
srtmsum  <-  focal(x = srtm, w = 3, fun="sum")
srtmmax  <-  focal(x = srtm, w = 9, fun="mean")
srtmmin  <-  focal(x = srtm, w = 21, fun="min")
```

focal for Continuous Rasters



`focal` for Continous Rasters

- can alter the size and shape of window by providing a weights matrix for `w`
- Can create different custom functions for `fun` (see the help file)
- `na.policy` for filling holes or avoiding them

Reclassification

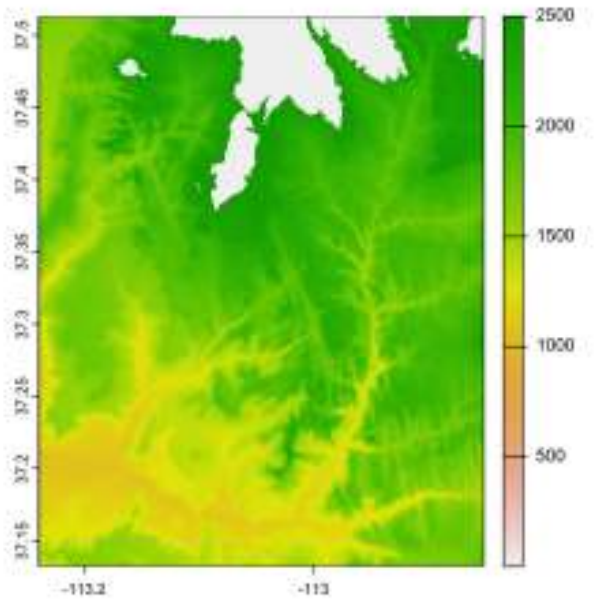
Reclassification

- Create new data based on the presence of a particular class(es) of interest
- Combine classes in a categorical map
- Useful as inputs for overlay analyses

Reclassifying rasters in R

- Using [ ] and conditionals

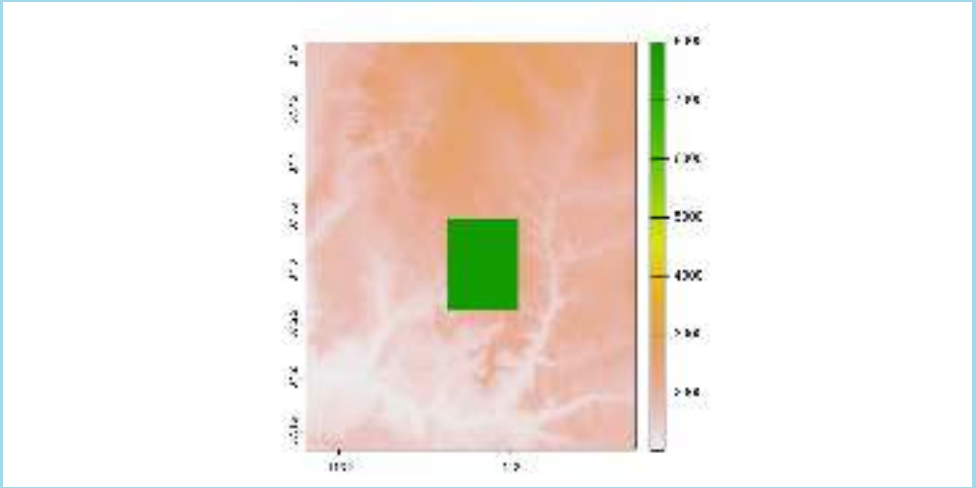
```
1  srtm = rast(system.file("raster/srtm.tif", package = "spDataLarge"))
2  srtm.lowelev <- srtm
3  srtm.lowelev[srtm.lowelev > 2500] <- 1
4  plot(srtm.lowelev)
```



Reclassifying rasters in R

- Using [ ] and conditionals

```
1  srtm = rast(system.file("raster/srtm.tif", package = "spDataLarge"))
2
3
4  srtm.na <- srtm
5  srtm.na[200:300, 200:300] <- NA
6  srtm.na[is.na(srtm.na)] <- 8000
7  plot(srtm.na)
```



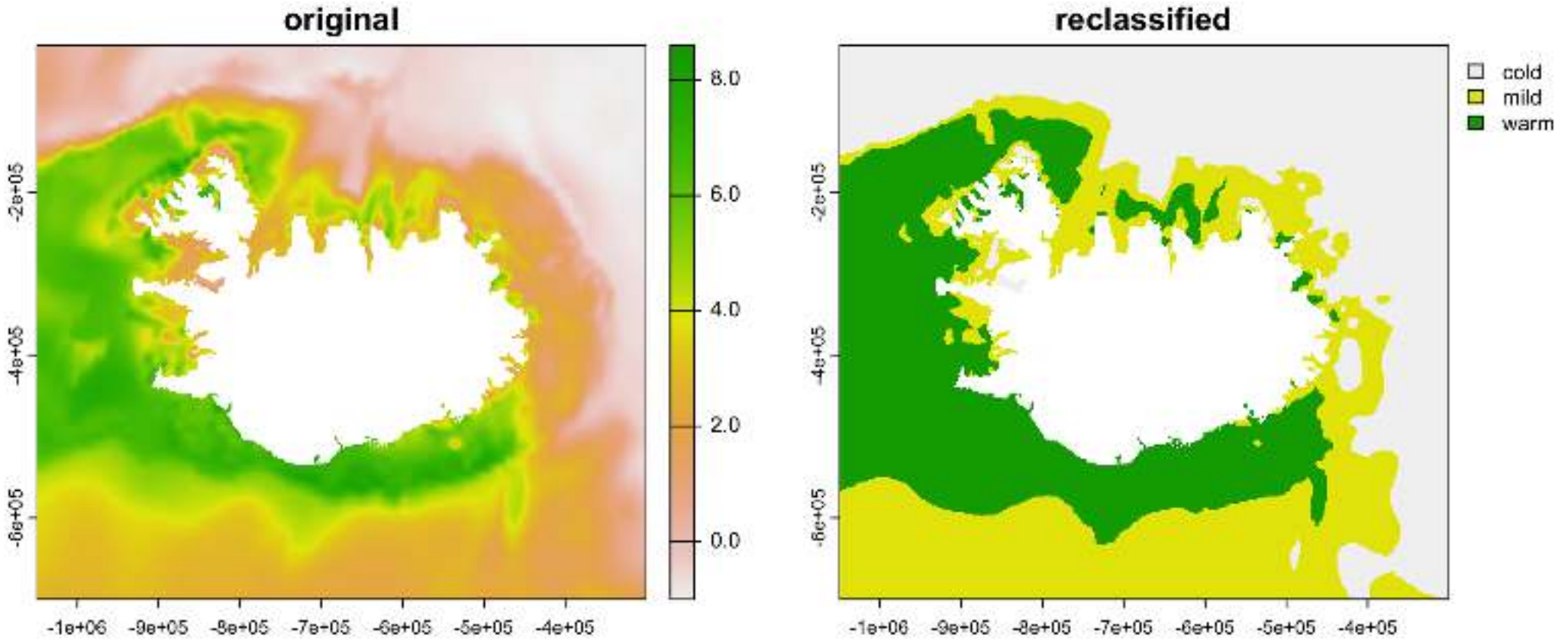
Reclassifying Categorical Rasters

- Need a classification matrix
- Use `classify`

```
mintemp <- rast("ftp://ftp.hafro.is/pub/data/rasters/Iceland_minbtemp.tif")
cm <- matrix(c(
  -2, 2, 0,
  2, 4, 1,
  4, 10, 2), ncol = 3, byrow = TRUE)

# Create a raster with integers
temp_reclass <- classify(mintemp, cm)
tempcats <- c("cold", "mild", "warm")
levels(temp_reclass) <- tempcats
```

Reclassifying Categorical Rasters

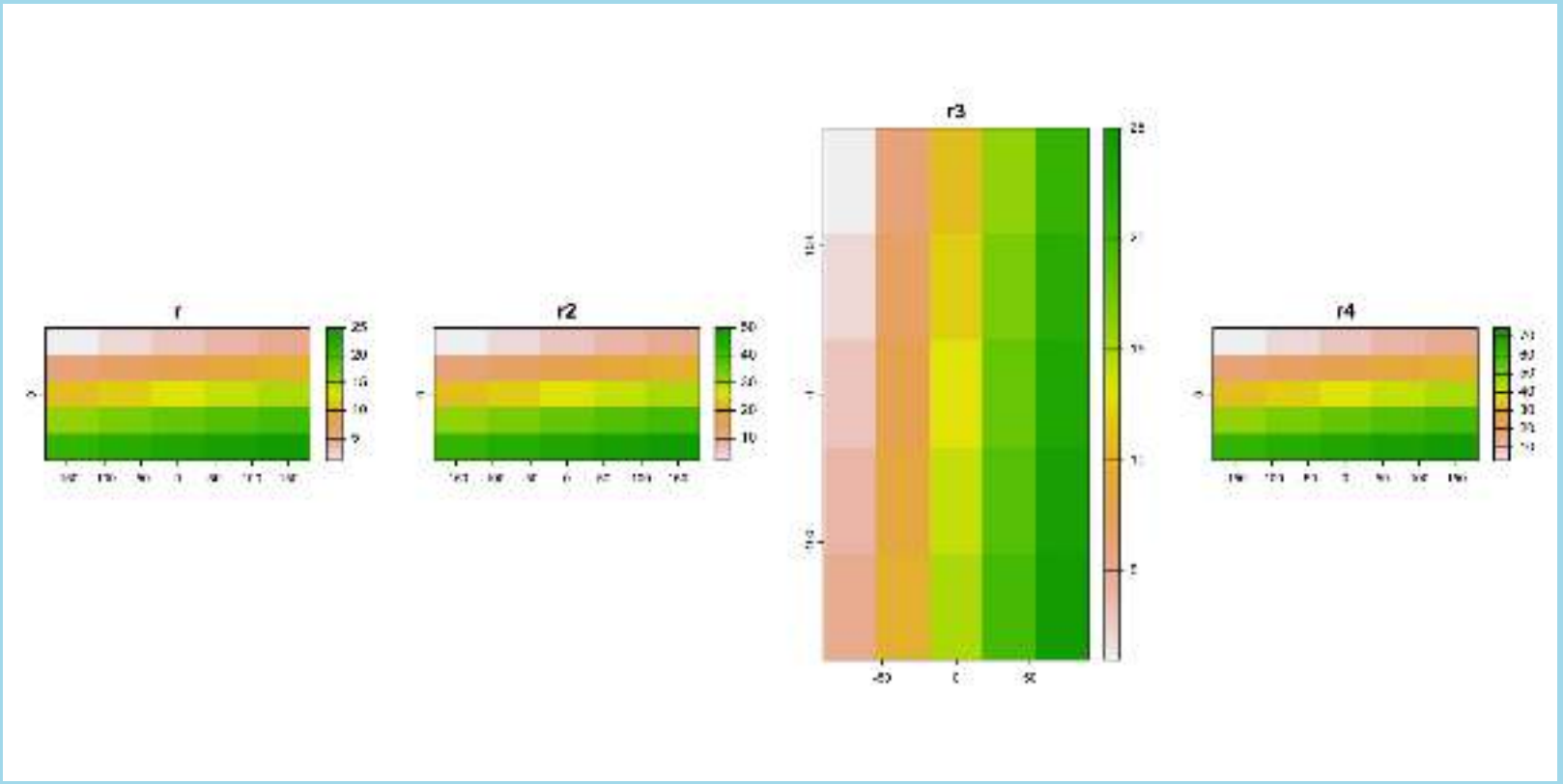


Raster Math

- Performs cell-wise calculations on 1 (or more) `SpatRasters`
- Generally works the same as matrix operations
- All layers must be aligned

Raster Math

```
r <- rast(ncol=5, nrow=5)
values(r) <- 1:ncell(r)
r2 <- r*2
r3 <- t(r)
r4 <- r + r2
```



Cell-wise operations

- `terra` has a special set of `apply` functions
- `app`, `lapp`, `tapp`
- `app` applies a function to the values of each cell
- `lapp` applies a function using the layer as the value
- `tapp` applies the function to a subset of layers

Context-specific Functions

- `distance` and relatives are based on relationships between cells
- `terrain` allows calculation of slope, ruggedness, aspect using elevation rasters
- `shade` calculates hillshade based on terrain