Forest Biodiversity

2024-08-12

Summary of Analysis:

Assess the importance of forest areas for selected species by combining species distribution models (SDMs), forest management data, and species-specific threats. Full analysis code can be found in `scripts/forest-management-data.R`

(1) Spatial Data Preparation: - Forest Classification: The EU forest data is classified into three categories—natural, multi-use, and production forests—based. These classifications reflect different management intensities that affect forest quality and species habitats.

(2) Species and Habitat Data Integration: - Species-Specific Forest Preferences: The species distribution models are linked to European Environment Agency (EEA) habitat preferences, selecting only species that utilize woodland and forest habitats. - Forest Habitat Calculation: Forest data is aggregated to 10 km resolution grid for each forest type (natural, multi-use, and production)

(3) Threat Analysis:

- Species-Specific Threats: Threats to species are identified based on data from the Habitats and Birds Directives. These threats are linked to land cover data, which is classified by management intensity (natural, multi-use, and production). - Threat Weighting: Threat levels are quantified based on their distribution across the species' habitats, with low, medium, and high threat levels identified using quantiles. The forest areas are then penalized based on the associated threat levels, adjusted by forest management intensity.

(4) Habitat Suitability and Importance Calculation: - Forest Area Adjustments: For each species, the forest area is adjusted according to the calculated threat levels. The range weight (RW) of the adjusted forest area to the overall habitat area of each species is calculated. - Species Richness and Habitat Importance: The importance of each forest pixel is assessed by summing the adjusted habitat areas across all species. This results in two key metrics: species richness importance (based on total adjusted habitat area) and RW importance (based on the relative weight of adjusted habitats).

```
library(terra)        # For spatial data manipulation
```

```
## terra 1.7.78
```

```
library(raster)       # For handling raster data
```

```
## Loading required package: sp
```

```
library(tidyverse)    # For data manipulation and visualization
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.1     v tibble    3.2.1
## v lubridate 1.9.3     v tidyr     1.3.1
## v purrr     1.0.2
```

```
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x tidyr::extract() masks raster::extract(), terra::extract()
## x dplyr::filter()  masks stats::filter()
```

```
## x dplyr::lag()     masks stats::lag()
## x dplyr::select()  masks raster::select()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(fasterize)    # For fast rasterization of spatial data
```

```
##
## Attaching package: 'fasterize'
##
## The following object is masked from 'package:graphics':
##
##     plot
##
## The following object is masked from 'package:base':
##
##     plot
```

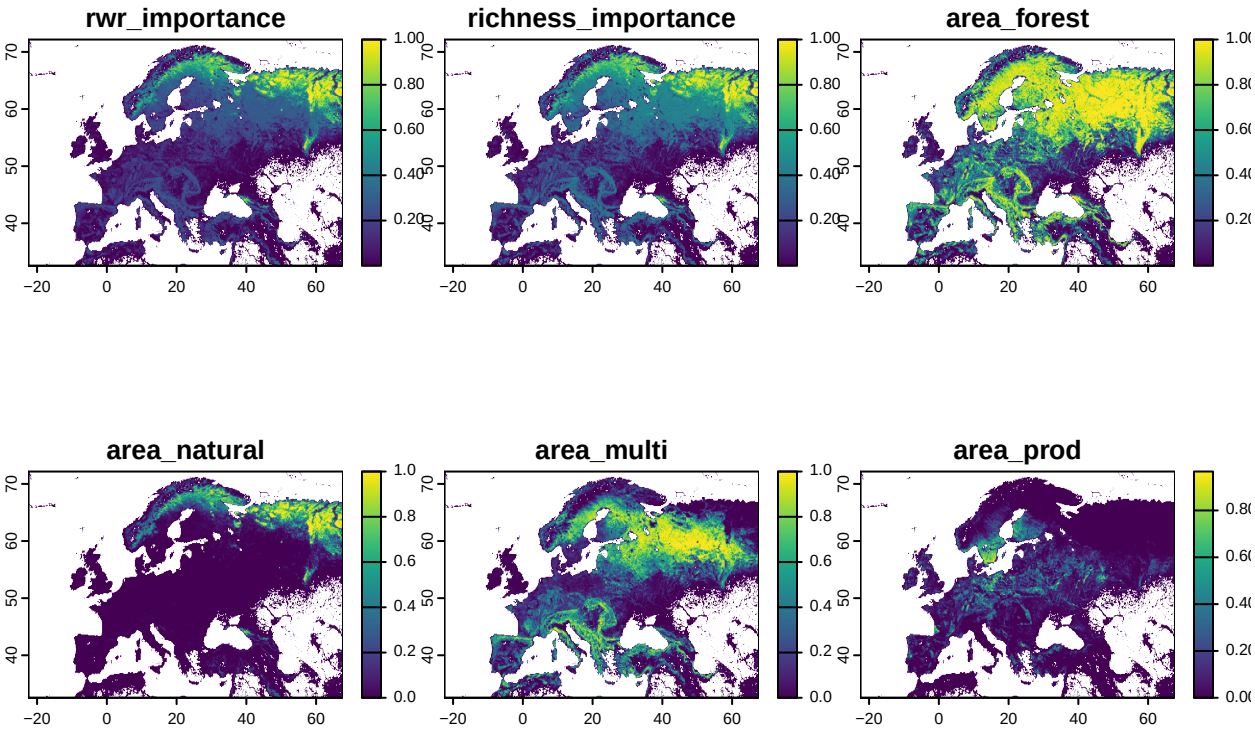
```
library(exactextractr) # For fast exact extraction of raster values using polygons
library(sf)            # For handling simple features (spatial vector data)
```

```
## Linking to GEOS 3.10.2, GDAL 3.4.1, PROJ 8.2.1; sf_use_s2() is TRUE
```

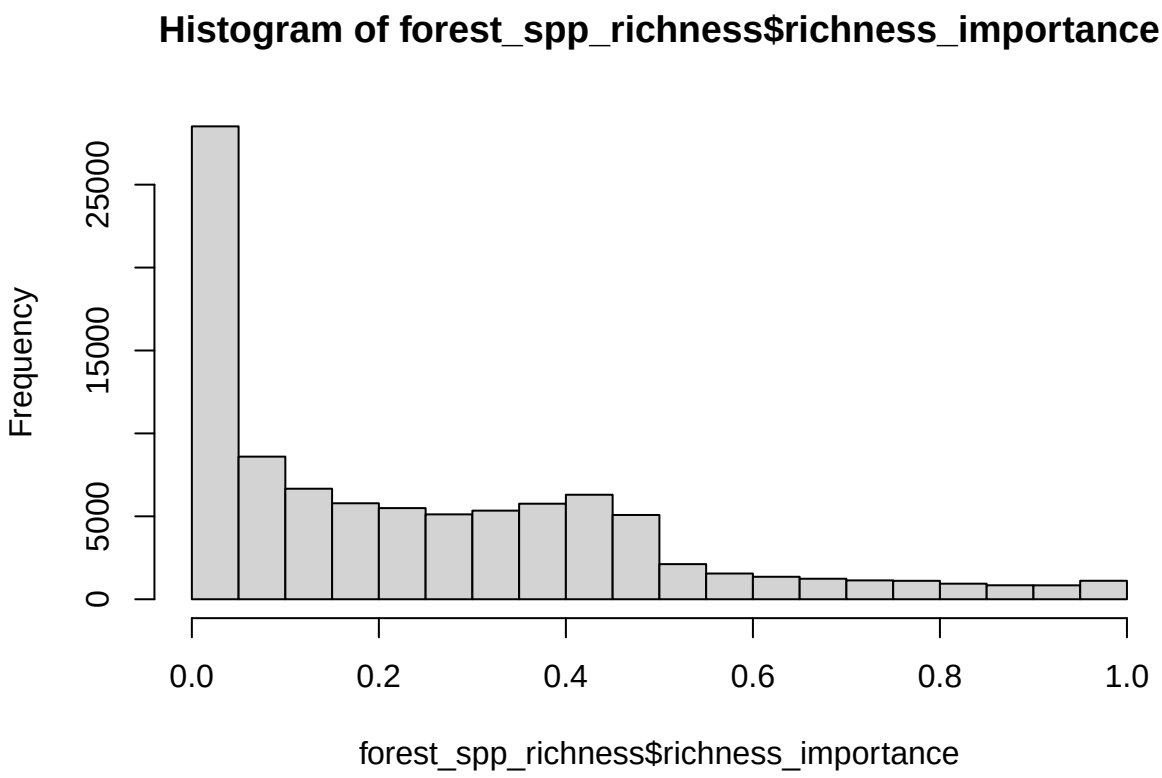
```
forest_spp_richness <- read_csv("../data/forest_spp_importance.csv")
```

```
## Rows: 94921 Columns: 8
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## dbl (8): x, y, rwr_importance, richness_importance, area_forest, area_natura...
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

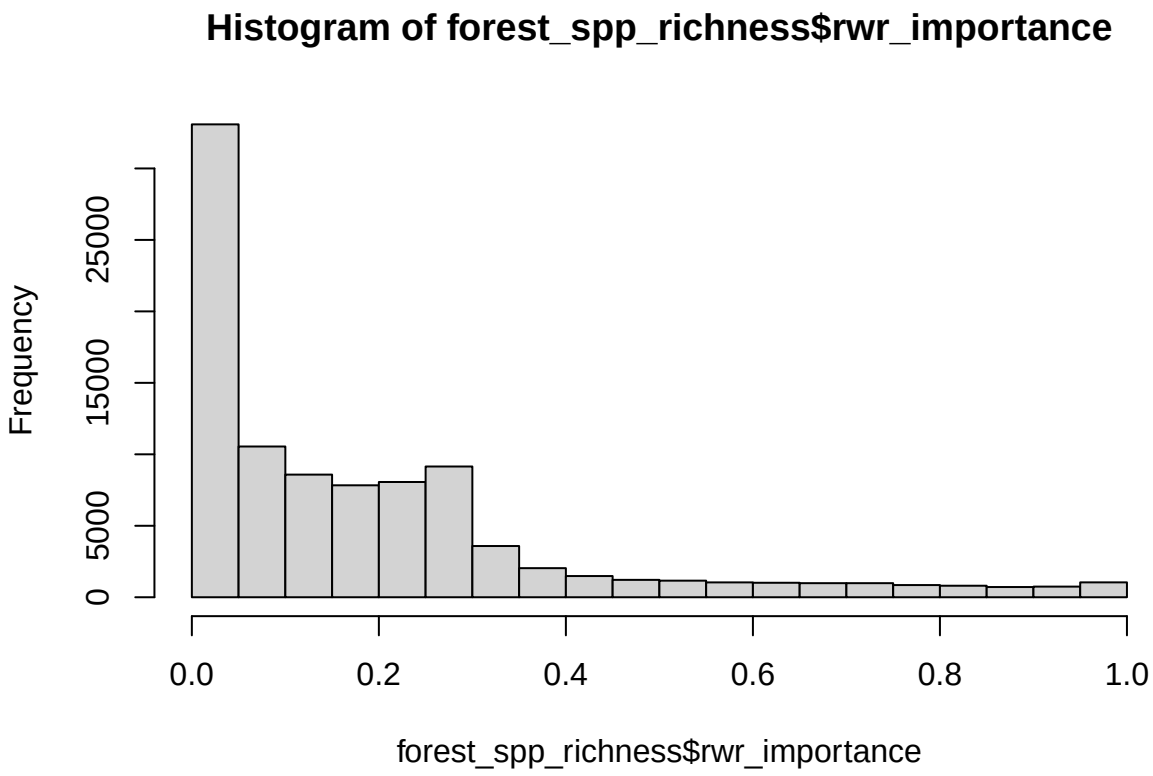
```
# Plot the resulting raster of forest species richness
plot(rast(forest_spp_richness))
```




```
# Plot histograms of richness importance and rwr importance
hist(forest_spp_richness$richness_importance)
```

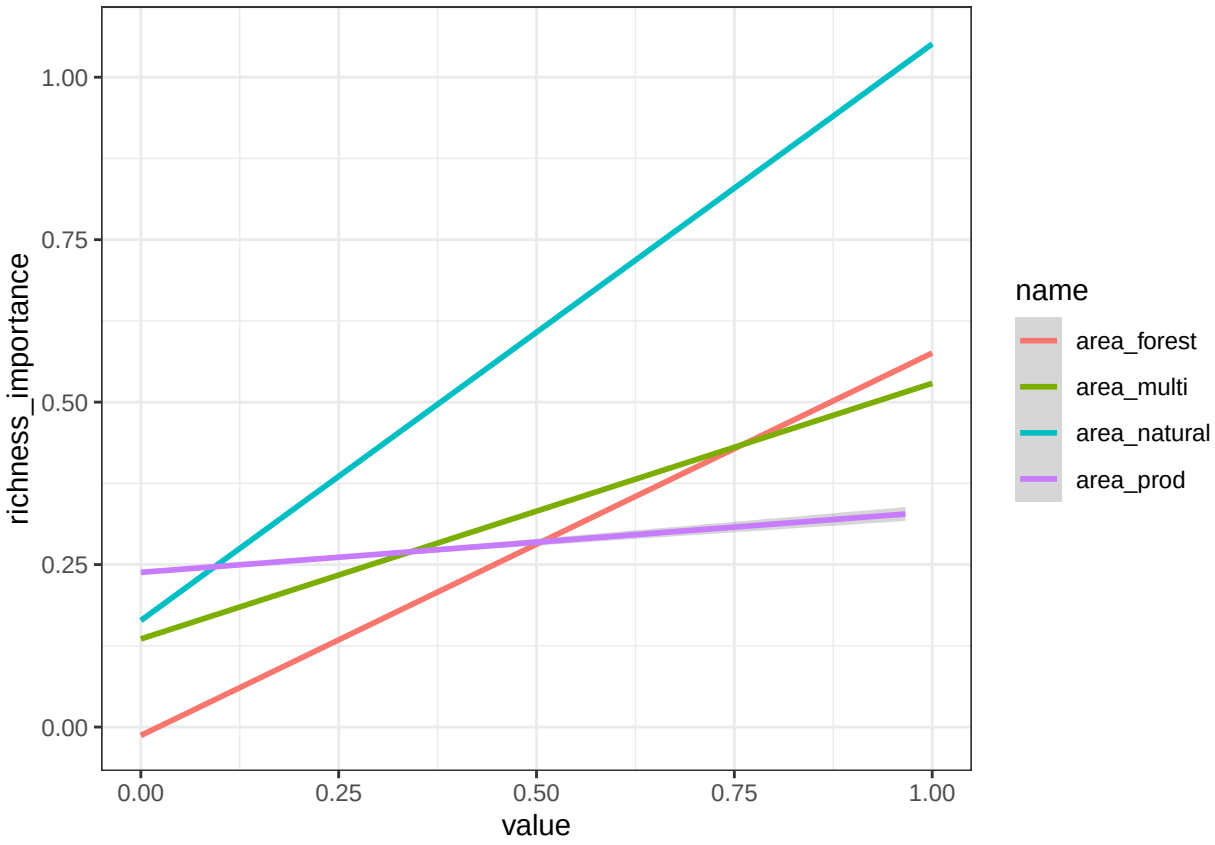



```
hist(forest_spp_richness$rwr_importance)
```




```
# Plot linear models of richness importance against other variables
forest_spp_richness |>
  pivot_longer(-c(x, y, rwr_importance, richness_importance)) |>
  ggplot(aes(x = value, y = richness_importance, color = name)) +
  geom_smooth(method = "lm", se = TRUE) +
  theme_bw()
```

```
## `geom_smooth()` using formula = 'y ~ x'
```


1.00
0.75
0.50
0.25
0.00
richness_importance
0.00
0.25
0.50
0.75
1.00
value
name
area_forest
area_multi
area_natural
area_prod