

concordance=TRUE

A tutorial for Step Selection Function

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1 Introduction

In addition to Resources Selection Functions (RSF) a more detailed analysis for telemetry data can be conducted by using Step Selection Function (SSF). The use of latter is providing answers to the actual selection of animals on their habitat rather than analysing the use of a habitat only. (DO WE WANT TO CITE, HERE FOR EXAMPLE Simone and friends). So far most of the SSF were done in GIS to use spatial data together with mathematics equations. However, more and more packages are provided in R and thus becomes a valuable alternative. This tutorial provides an overview on how to implement SSF with R. The main package we will use in the following is the package **adehabitatLT**. All single steps that need to be taken care of are summarized in (Figure 1). In our tutorial we use telemetry data from Cougars/Mountain Lion (*Latin name*) collected by Simone Ciuti¹. As spatial parameters x tables for ruggedness, slope, canopy cover etc. are available. Describe study area...

$$w(x) = \exp(\beta x_1 + \beta x_2 + \dots + \beta x_n)$$

Why did we not use the data (Wildboar) prepared for the **adehabitatLT** package? - No information on details, metadata provided, it is hard to understand when to use which dataset and why.

2 Preparations

Before you can actually start using the tutorial for conducting SSF you need to load a bunch of packages in R. Some of them require others so that you have to add all these to your library:

2.1 Packages - what we need

```
# installing packages -----
## for implementing SSF
# install.packages("adehabitat") # outdated version, not needed for this tutorial
install.packages("adehabitatHR")
install.packages("adehabitatHS")
install.packages("adehabitatLT")
install.packages("adehabitatMA")
install.packages("tkrplot")
install.packages("hab", repos = "http://ase-research.org/R/") # regular
install.packages("hab", repos = "http://ase-research.org/R/", type = "source") # for source

# for handling raster data
install.packages("move")
install.packages("raster")
install.packages("rgdal")
#install.packages("")

# loading the packages
# require(adehabitat) # keep fingers off this package. It is outdated.
require(hab)
require(adehabitatMA)
require(adehabitatHR)
require(adehabitatHS)
```

¹we might have to specify that and name and thank the institute.../collected/containing

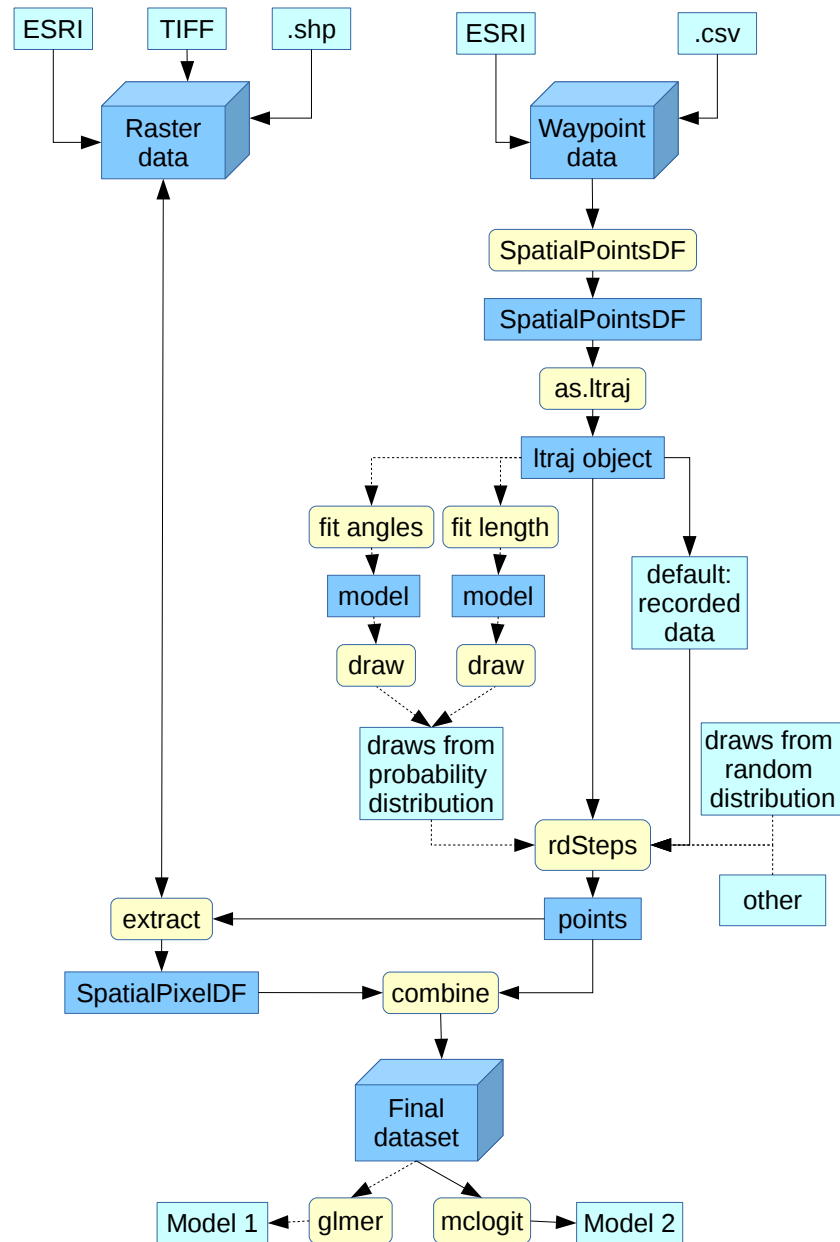


Figure 1: *Conducting a SSF using existing R-packages*: this figures provides an overview of the steps necessary to conduct a SSF. The steps are separated in subsections, which the turtorial will guide you through.

```
require(adehabitatLT)

## for i dont know

#require(move)
#require(raster)
#require(rgdal)
#require(tkrplot)
#require(raster)
#require(sp)
```

3 Loading telemetry data (*.csv, ESRI)

The data for the analysis should be saved in a simple *.csv file format. The table should have column headings in the first line and for each observation include at least the following values:

1. x-coordinate (easting)
2. y-coordinate (northing)
3. date and/or time

Note that the coordinates need to be provided in the same coordinate system and spatial projection as the raster data.

Depending on your analysis you can include further values such as:

1. ID for each record
2. animal ID
3. GPS precision
4. other recording parameters such as season
5. temperature / elevation at the moment of record
6. other values that might be of interest in the further analysis

Use the following commands to set your working directory and read the data:

```
setwd("/your/working/directory")
xmpl = read.csv("xmpl.csv", head=T)
```

You can use `head(xmpl)` to check, whether it worked by executing `head(xmpl)` in R.

4 Creating a Spatial Points Data Frame

The functions used along the rest of the toolchain can only process data that are

```
require(sp)
cougarsSPDF = SpatialPointsDataFrame(coords = cougars[,c("easting", "northing")], data
= cougars)
names(cougarsSPDF)
```

5 Create a ltraj object

6 Compute random steps

The function **rdSteps** removes the first and the last data point. That's what you want.

7 Spatial covariates

This section explains the use of spatial parameters that will be tested for selection by the target species. You should store these data in raster files (probably ESRI (*.adf) or *.tif) and for time reasons already clipped to your area. How you can do this in R please read the GIS instructions from the other group ;)

7.1 Load raster data (ESRI, *.tif, (*.shp))

With a simple function stored in the package **raster** you are able to upload any raster file into R. Exemplarily we are using the raster data for ruggedness and canopy cover for the study area.

```
#install.packages("RArcInfo")
#require(RArcInfo)
require(raster)
require(rgdal)

require(sp)

#?raster
#getwd()
#setwd("/home/Peter/")

ruggedness <- raster("/home/Peter/Dokumente/uni/WS_14_15/Best Practice R/Dataset/NEW GIS
# plot(ruggedness) # uncomment this if you just quickly want to run the script. Takes a m

landcover <- raster("/home/Peter/Dokumente/uni/WS_14_15/Best Practice R/Dataset/NEW GIS
# plot(landcover) # uncomment this if you just quickly want to run the script. Takes a m

canopycover <- raster("/home/Peter/Dokumente/uni/WS_14_15/Best Practice R/Dataset/NEW GIS
# plot(canopycover) # uncomment this if you just quickly want to run the script. Takes a m

disthighway <- raster("/home/Peter/Dokumente/uni/WS_14_15/Best Practice R/Dataset/NEW GIS
# plot(disthighway) # uncomment this if you just quickly want to run the script. Takes a m

distroad <- raster("/home/Peter/Dokumente/uni/WS_14_15/Best Practice R/Dataset/NEW GIS
plot(distroad) # uncomment this if you just quickly want to run the script. Takes a m
```

7.2 Extract coordinates for comparison of used and random points

Peter is successfully doing this step!!

8 Final SSF model

9 Acknowledgements

Don't forget to thank TeX and R and other opensource communities if you use their products! The correct way to cite R is shown when typing `"citation()"`, and `"citation("mgcv")"` for packages.