Documentation master thesis

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Contents

Chapter 1

Prerequisites

This is a documentation book, providing details on **data structure** and **analyses** of the the master thesis "Habitat-demands, micro-climate and freezing resistance of the tussock graminoids *Carex curvula* and *Nardus stricta*".

The **bookdown** package, used to create this book, can be installed from CRAN or Github:

```r
install.packages("bookdown")
# or the development version
# devtools::install_github("rstudio/bookdown")
```

The documentation was build with the following R version:

```
## R version 4.0.3 (2020-10-10)
```

Chapter 2

Introduction

2.1 Background

Carex curvula and *Nardus stricta* are the most abundant tussock forming graminoid species in acidic, alpine grassland across the European Alps. It is unknown where and why one of the two species dominates in the alpine landscape or where they occur together. We explore the habitat requirements of both species and assess whether a distinct freezing resistance explains the distribution of these two species.

2.2 Questions

- Which micro-habitat conditions select for either one of the two graminoids?

- Are the habitat requirements related to the freezing resistance in the two species?

2.3 Methods

We assessed the occurrence, abundance and vigour of both graminoid species in 113 sites, situated between 2195 - 2805 m asl (Swiss central Alps). Sites differ in elevation, topography (concave - convex), exposure, slope inclination, soil depth, soil moisture and vegetation composition. In addition to these site characteristics, we measured:

- Soil temperature (iButton T-logger, 3 cm below ground, Sept 2019 - Sept 2020, hourly)

- Cover of *Carex* and *Nardus* (40 x 40 cm around data logger)

- Freezing resistance in leaves (collected at 2370 m asl) using electrolyte leakage method after exposing leaves to freezing temperatures from -5 to -24 °C

2.4   Acknowledgements

2.5   Funding

Chapter 3

Data structure

Here, all data files used for the analyses are described. The tables are available under `https://github.com/buerap/master_thesis`.

3.1 Observational units

3.1.1 Characteristics

The described columns are available in the raw data file `raw_pos_characteristics.csv`, which contains information on the observational units.

Column	Name	Datatype	Unit	D
ID_position	Identification number of the position	numeric	-	A
ID_site	Identification numer of the site	numeric	-	A
GPS_x	GPS coordinate (longitude)	numeric	meters	L
GPS_x_accur	Accuracy of GPS coordinate (longitude)	numeric	meters	A
GPS_y	GPS coordinate (latitude)	numeric	meters	L
GPS_y_accur	Accuracy of GPS coordinate (latitude)	numeric	meters	A
elevation	Elevation	numeric	meters above sea level	E
macroexposure_d	Macroexposure in degrees	numeric	degrees	E
macroexposure	Macroexposure as geographic direction	factor	-	E
slope	Slope	numeric	degrees	Sl
exposure_d	Exposure in degrees	numeric	degrees	E
exposure	Exposure as geographic direction	factor	-	E
topography	Topography	factor	-	M
soil_depth1	Soil depth measurement 1	numeric	centimeters	So
soil_depth2	Soil depth measurement 2	numeric	centimeters	So
soil_depth3	Soil depth measurement 3	numeric	centimeters	So
ID_SP	Identification numer of the species	numeric	-	Id
species	Species	factor	-	P
corresp_control	NA	NA	-	N
control_spec_1	NA	NA	-	N
control_spec_2	NA	NA	-	N
control_spec_3	NA	NA	-	N
description	Description	character	-	D

3.1.2 Soil temperatures

The described columns are available in the data file `R_pos_temperature.csv`, which contains thermal properties of the observational units.

Column	Name	Datatype	Unit	Description
ID_position	NA	NA	NA	NA
snowmelt_GMT	NA	NA	NA	NA
wintersnow_GMT	NA	NA	NA	NA
Temp_min	NA	NA	NA	NA
Temp_max	NA	NA	NA	NA

3.1.3 Soil moisture

The described columns are available in the data file `raw_moistmeasure_moisture.csv`, which contains soil moisture measurements at the observational units.

Column	Name	Datatype	Unit	Description
ID_moistmeasure	NA	NA	NA	NA
ID_position	NA	NA	NA	NA
date_timeMEZ	NA	NA	NA	NA
moist1	NA	NA	NA	NA
moist2	NA	NA	NA	NA
soil	NA	NA	NA	NA

3.1.4 Snowmelt patterns

The described columns are available in the data file `raw_pos_snow.csv`, which contains information on snowmelt patterns at the observational units.

Column	Name	Datatype	Unit	Description
ID_position	NA	NA	NA	NA
snowmelt_GMT	NA	NA	NA	NA
wintersnow_GMT	NA	NA	NA	NA

3.1.5 Vegetation

The described columns are available in the data file `raw_pos_vegetation.csv`, which contains data from vegetation surveys at the observational units.

Column	Name	Datatype	Unit	Description
ID_position	NA	NA	NA	NA
Carexcurvula	NA	NA	NA	NA
Nardusstricta	NA	NA	NA	NA
Achilleaerbarotta	NA	NA	NA	NA
(...)	NA	NA	NA	NA
Veronicabellidioides	NA	NA	NA	NA

Vegetation survey data can be joined with species information data. The described columns are available in the data file `raw_species_information.csv`, which contains information on the surveyed species.

Column	Name	Datatype	Unit	Description
ID_species	NA	NA	NA	NA
aID_SP	NA	NA	NA	NA
genusspecies	NA	NA	NA	NA
InfoFlora	NA	NA	NA	NA
family	NA	NA	NA	NA
genus	NA	NA	NA	NA
species	NA	NA	NA	NA
subspecies	NA	NA	NA	NA
author_citation	NA	NA	NA	NA
speciesD	NA	NA	NA	NA
complex	NA	NA	NA	NA
LebensformD	NA	NA	NA	NA
redlist	NA	NA	NA	NA
LebensraumD	NA	NA	NA	NA
plant_community	NA	NA	NA	NA
functional_group_1	NA	NA	NA	NA
functional_group_2	NA	NA	NA	NA
functional_group_3	NA	NA	NA	NA

3.1.6 Vigour measurements

The described columns are available in the data file `raw_vigmeasure_vigour.csv`, which contains information on vigour (growth, phenology) of the respective tussock at the observational units.

Column	Name	Datatype	Unit	Description
ID_vigmeasure	NA	NA	NA	NA
ID_position	NA	NA	NA	NA
date_timeMEZ	NA	NA	NA	NA
stalks_n	NA	NA	NA	NA
stamens	NA	NA	NA	NA
styles	NA	NA	NA	NA
stam_styl	NA	NA	NA	NA
preflower	NA	NA	NA	NA
postflower	NA	NA	NA	NA
stalks_l1	NA	NA	NA	NA
stalks_l2	NA	NA	NA	NA
stalks_l3	NA	NA	NA	NA
stalks_l4	NA	NA	NA	NA
stalks_l5	NA	NA	NA	NA
leaf_b1	NA	NA	NA	NA
leaf_b2	NA	NA	NA	NA
leaf_b3	NA	NA	NA	NA
leaf_b4	NA	NA	NA	NA
leaf_b5	NA	NA	NA	NA
leaf_g1	NA	NA	NA	NA
leaf_g2	NA	NA	NA	NA
leaf_g3	NA	NA	NA	NA
leaf_g4	NA	NA	NA	NA
leaf_g5	NA	NA	NA	NA
notes	NA	NA	NA	NA

3.2 Freezing experiments

3.2.1 Electrolyte leakage

The described columns are available in the data file `raw_frostmeasure_freezingresistance.csv`, which contains information on freezing resistance of tissue samples from tussocks at the observational units as well as from an additional field site (transplant experiment).

Column	Name	Datatype	Unit	Description
ID_frostmeasure	NA	NA	NA	NA
ID_position	NA	NA	NA	NA
type	NA	NA	NA	NA
sample	NA	NA	NA	NA
tissue	NA	NA	NA	NA
age	NA	NA	NA	NA
replic	NA	NA	NA	NA
date	NA	NA	NA	NA
LT50.bolt	NA	NA	NA	NA
LT50.gomp	NA	NA	NA	NA

Chapter 4

Statistical analyses

We describe our methods in this chapter.

Chapter 5

References

Used packages and literature are demonstrated in this chapter.

5.1   R Packages

5.2   Literature

Chapter 6

Final Words

We have finished a nice book.

You can write citations, too. For example, we are using the **bookdown** package (Xie, 2020) in this sample book, which was built on top of R Markdown and **knitr** (Xie, 2015).

Bibliography

Xie, Y. (2015). *Dynamic Documents with R and knitr*. Chapman and Hall/CRC, Boca Raton, Florida, 2nd edition. ISBN 978-1498716963.

Xie, Y. (2020). *bookdown: Authoring Books and Technical Documents with R Markdown*. R package version 0.21.