Plan Overview

A Data Management Plan created using DMPonline

Title: Accounting for individual variability in landscape connectivity modelling: An integrative framework to identify spatial priorities for brown bear (Ursus arctos) conservation across Europe

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Template: NTU PGR Data Management Plan

Project abstract:

The ongoing expansion of urban and transport infrastructure in the European territory, intensified by the impacts of climate change, limit the ability of individuals to migrate, disperse, mate, feed, and thrive. Species with large area requirements, such as large carnivores, are particularly affected by these factors. Among the large carnivore species, the European brown bear (*Ursus arctos*) triggers most of the conservation and management decissions in the inhabited countries of the continent, due to its key role in ecosystems and the potential damages derived from human-bear interactions. Moreover, bears social hierarchy and seasonal ecology makes it a good model species to explore fundamental questions about spatial ecology and connectivity but complicates modelling processes to understand their spatial patterns. This PhD project aims to study the implications of brown bear movement and habitat-selection strategies in connectivity modelling, by using a multi-country approach. By using movement data, I will be conducting individual-based approaches to capture the complexity of brown bear spatial patterns in three distinct regions of Europe. Within these analyses I will assess the implications of potential variations among individuals and contextual factors for identifying priority areas for ecological connectivity. This project provides an exciting opportunity to predict changes in the behaviour and spatial patterns of populations under future climate and land-use scenarios. The final outcomes are expected to improve integral and adaptive frameworks helping practitioners to allocate conservation efforts for wildlife connectivity and coexistence.

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Copyright information:

Accounting for individual variability in landscape connectivity modelling: An integrative framework to identify spatial priorities for brown bear (Ursus arctos) conservation across Europe

1. Project details

Full name:

Maria del Pino Garcia Sanchez

Unique ID:

N1244768

Provisional project title:

Accounting for individual variability in landscape connectivity modelling: An integrative framework to identify spatial priorities for brown bear (Ursus arctos) conservation across Europe

Project start date:

20230-10-01

Project end date:

2026-10-01

Project context:

-I am studying **brown bear movement behaviour across three European regions to identify ecological connectivity requirements** and define conservation priorities for the species within distinct landscape scenarios. Specifically I will be using brown bear movement data collected by external research institutions, in Finland, Slovakia and Romania.

At the first stages of the project, the aim is to conduct predictive biological models to understand how bears move, use the available space and the effect of contextual factors within the studied regions. The outcomes of these models will be used to identifying priority areas for this species conservation over space and time. This will help to allocate effective conservation measures for brown bears based on specific traits from each geographical context.

In this project **I will work in collaboration with two external Research Groups especialised in movement ecology and landscape connectivity**. The researchers are part of the supervisory group of this project and they have access to the animals data I need to carry out my research.

The secondary data used throughout the project is animal telemetry data and open access spatial

information. I will be managing these data by open access programmes and spatial data analysis software. **I will be producing research publications and my PhD Dissertation** from the results of the analyses conducted.

All the project will be desk-based work conducting analyses with secondary data and writing my dissertation. **Desk-based work will be conducted on the NTU Brackenhurst Campus, Southwell; and on the external supervisors Institutions based in Spain and Romania during trainning stays overseas**.
The PhD (tuition fees and stipend) is funded by a studentship from NTU.

1. Defining your data

Describe your data and how you will be working with it

I will be working with **three different types of data** during all the life of the project: data extracted from literature; animal telemetry data; and environmental and landscape information.
A. Data extracted from reviewing published literature or archival materials which have been specifically curated for general public access or display. Online search operators will be used to identify previous and current academic work in the field of interest.

B. Telemetry dataset of brown bears fitted with GPS-GSM/Iridium collars . This data is a large spatial-temporal monitoring dataset that has been collected under external projects and fundings, and it is considered sensitive data. The dataset will be provided from three Institutions based in Finland, Slovakia and Romania, respectively.

The characteristics of the bears GPS telemetry data provided by these Institutions are:

Country	Monitoring period	Nr. individuals	Nr. locations	Fix/hour
Finland	2002-2013	46	35,603	2
Slovakia	2008-2016	25	74,809	1
Romania	2006-2023	31	52,258	1-2

Agreements have been reached between all the involved parties to allow me accessing and employing the data for this project. Written proof of these agreements are attached to this DMP.

C. Open access environmental information. I will consult and download spatial layers and other information services offered by international institutions platforms (e.g. Copernicus Service; NASA Earth Data – EOSDIS/ SEDAC; Data portal from Museums and Universities).

I will use the described data for the:

- Completion of the introduction of my project and collection of methods by reviewing previous brown bear movement and connectivity studies focused in the European regions of study,

collecting and writing insights from **A** at the first stage of my project;
- Implementation of individual-based models to study movement behaviour and landscape connectivity of brown bears, processing and analysing data **B** and **C** at from the second to the last stage of my project .

What formats and software will you use?

1. **Collected and reviewed scientific publications** will be managed using Mendeley. Data will be extracted manually to a MS Excel sheet, cathegorised and assessed.
2. **Bear telemetry data** will be managed using MS Excel, and converted to CSV files to be mapped and processed in ArcGIS and R. Analyses employing this data will be mainly done using R.
3. **Environmental information** will be processed and extracted using ArcGIS and R.

Generated codes from the analyses will be saved as .rmd and .r; and uploaded in Github, in a private repository <bearmovecode> shared with my Director of studies.
Results from the analyses will be mapped and studied using ArcGIS and QGIS. The generated maps and layers will be saved as .shp, .asc and .tiff files.

How much data do you expect to generate?

All the data used in my research is secondary data. It has been collected by external persons, and I will not be collecting any data during the life of this project but use the above mentioned **to generate research publications and to write my PhD Dissertation**.

Multiple files will be generated to store and manage all the information to be used:

1. Information collected from reviewing previous research in a .xslx file of ~ 1,200 KB
2. Telemetry data in a .csv file of ~ 50,000 KB; multiple .shp of 15,000 to 50,000 KB
3. Spatial environmental layers in .grid, .asc or .tif fomat, of ~ 100 GB in total
   Generated codes of ~20 KB
   Generated multiple maps .tif of 20,000 KB each

2. Compliance & data ownership

Is some/all data subject to any institutional, legal, ethical, or commercial conditions?

I will adhere to the following NTU regulations and policies:

- The NTU RDM Policy
- Data Security- Portable Devices and Media Policy
- Research Data Storage Policy
- Information Classification Policy
- NTU Research Ethics Policy

Additionally, I will meet the requested conditions stated from the data owners (see attached

agreements).

What do you need to do to comply with these obligations?

I will need to **request permission to access and use** the bear telemetry data (B) owned by external Institutions. This dataset will be restricted to myself and the supervisors of my project. I will be working with three external colaborators, part of my supervisor team**.** These collaborators are researchers and practisioners with a great career on studying brown bear ecology, behaviour, conservation and management across Europe. They have collaborated in previous projects with the Research Institutes owning the telemetry data, and they have good knowledge of the dataset I will be using in this project.

I will **send to the owners of the data a request by email before starting a new analysis** . In this email I will include an abstract of the investigation to be addressed using their sensitive data. I will not start any analyses until I obtain a confirmation reply to my request from these parties.

The **principles of data minimisation** will be followed during this project, and only the data specifically needed for this research will be collected.

All sensitive data **will be stored securely on NTU systems during the life of my project** . Details on how this project will meet the policies regarding data sharing and security can be found in sections 3 - 5.

Who owns the data?

- The bear telemetry data (B) is owned by the following Research Institutes of the countries

  - **Finland:** LUKE, Natural Resources Institute, Ounasjoentie 6, 96200 Rovaniemi, Finland
  - **Slovakia:** Carpathian Widlife Society, Tulská 2461/29, 960 01, Zvolen, Slovakia
  - **Romania:** National Institute for Research and Development in Forestry "Marin Dracea", Closca street 13, Brasov, Romania

- Any existing third-party data (A,C) will remain the property of the provider.
- During the project, I will own all data generated from my analyses of the databases listed above.

3. Working with your data

Where will you store your data?

- All sensitive data will be stored on the NTU DataStore as soon as possible, and will be kept on a password protected private hard-drive prior transfer.
- Non-sensitive data will be kept on my password protected private hard-drive, and the NTU OneDrive.

How will you back-up your data?

- The NTU DataStore provide automatic back-up to three different locations, and as such no further back-up solutions are required
- Non-sensitive data will be backed up on external hard-drives. I will have a copy of all the data in each device. R scripts will be stored on the researchers Github account; a free, version-control tool for backing up code.

Who else is allowed to access this data during the project?

Access to the NTU DataStore folder containing sensitive data will be restricted to myself and to those supervisors who have been granted access to the data. This way I will ensure that whilst I am conducting trainning overseas, at least one member of the supervisory team in the UK has access to the data.

The full supervisors team will have access to my non-sensitive data during the project. Once, requested, I will share the data of interest in a shared folder of a Private Channel in *Microsoft Teams*.

How will you organise your data folders?

Folders general structure and substructure for each type of data I will be using:

A. :/<project>/<**literature**>/
                /<[regionCODE]_papers>/<files>
                /<files>
B. :/<project>/<**GPS**>/
                /<agreements>/<files>
                /<GPSdataset>/<files>
C. :/<project>/<**GIS**>
                /<layers>/<[variable_type]>/<[YEAR]>/<[ASCII or other format]>/<files>
                /<maps>/<files>

How will you name your files?

By data type, following from above:

A. *Previous scientific research and projects information*
    literature/<[regionCODE]_papers>/<files>
 file name: [Publication_year]_[first_author_surname]_[paper_title_keywords].pdf

    literature/<files>
 file name: review_dataset.xlsx

B. *Bear telemetry data*
  GPS /<agreements>/<files>
file name: [regionCODE]_agreement.pdf

  GPS /< GPSdataset >/<files>
file name: beargps_[version].csv
file name : [regionCODE]_gps.csv

C. *Environmental information*
  GIS /<layers>/<[variable_type]>/<[YEAR]>/<[ASCII or other format]>/<files>
file name: [name_shapefile_layer].shp OR [name_raster_layer].asc

  GIS /<maps>/<files>
file name: [name_map]_[nr_dissertation_chapter].tiff

How will you manage different versions of your files?

Sensitive data will be appended with 'v1' and 'v2' etc, but multiple versions will be avoided where possible.

R script and folders containing **generated data** that can be publicly shared will be managed in my Github account. Also, the last versions of my codes that can be publicly shared writen in R Markdown will be shared in Rpubs with my supervisors.

How will you ensure your data is understandable to others?

R scripts will be thoroughly commented, and formatted to be read easily by R markdown.
A readme text file will also be created in each folder to explain structure of the folders and what is contained in each file.

Maps will include a clear legend with all the elements presented. Grids or any other geographical references in maps will be provided as long as this is not contrary to the conditions established to protect sensitive data. Captions will be added to both graphs and maps when included in the dissertation text to describe the information presented.

4. Archiving your data

What data should be kept, or destroyed, after the end of your project?

At the end of my project the access to sensitive data will cease, and all copies will be shared to the owner of the data and destroyed from the user hard-drives or NTU system.

As non-sensitive and shareable data, I will keep my research outputs (publications, methodological framework, analyses results) and make it openly available with as few restrictions as possible. The rest of the data that would be required to replicate any findings (codes, environmental layers) will be also kept and shared.

Where will you archive your data?

- **Sensitive data will not be archived or shared openly in any repositories.**
- **Non-sensitive data**, that can be publicly shared, will be **deposited on Figshare**. Additionally, shared codes will be archived in a specific repository on the student's Github and R-pubs accounts.

When will you archive your data?

All the **archived data,** that will be publicly available, will be uploaded before submitting any analyses outcomes for publication/peer review.

How long will the data be archived for?

Following the NTU Records Retention Schedule, the **research data archived and shareable** will be retained for 10 years from the date of deposit.

5. Sharing your data

How will others learn that your data exists?

All shareable data will be made known or visible through open access scientific publications, including data citation and data access statement.
The information generated along the project will be also available in the above mentioned repositories (Figshare, R-pubs, Github), fully searchable and free to use.

After submission and depositing my shareable data in the mentioned repositories, I will register my data with NTU by submitting a Data Registry Form. A metadata record for my research data will be created in NTU IRep. This record will offer a full description of my data, as well as linking directly to the record of all associated publications and codes.

Which data will be accessible to others?

- The files supporting methodology and results of all published research or other documents

created for its dissemination.

- Bears telemetry data will not be publicy available.

Who will you share your data with and under what conditions?

- Any information not published due to its sensitive data will be shared to practicioners or researchers by a direct consultation request.
- Open access data uploaded in online repositories will be available to download under a CC-BY 4.0 license
- Non-sensitive data in the NTU Data Archive upon request under a CC-BY 4.0 license.

How will you share your data?

- All shareable data will be available for immediate download from Figshare and Github.
- To access to any additional data deposited in the NTU Data Archive, users will email the Library Research Team for access.

6. Implementing your DMP

How often will this plan be reviewed and updated?

My supervisor team will review this plan every 12 months at annual monitoring, or sooner if required, and I will make the appropiate updates.

What actions have you identified from the rest of this plan?

I will complete and send the **Active Research Data Storage** to store my sensitive data along the life of my project.

All agreements to use the bear telemetry data will be required at the beginning of the project including the ethical, legal or contractual constraints on data access if considered by the owners. Thus, I will provide a writen proof of the request and the permission given by the owners of the data, allowing me to access and use the data along the life of the project.

What support/ information do you need to complete these actions?

I will consult the NTU Library RDM webpages and contact the NTU Research Data Management Officer to help check over the DMP and ensure that the data storage and shared options proposed are

appropriate for the research intended.