Surfing the Wave of Wildlife Tracking Data

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Wildlife Tracking Data Management

A review of challenges and opportunities
**Biologging**: The logging (tracking) of individual animals by means of attached tags
[World] A MOVING OBJECT IN ITS ENVIRONMENT

[Data] SAMPLED AT REGULAR INTERVALS

[Goal] STUDIED AT MULTI SPATIAL/TEMPORAL/ECOLOGICAL LEVELS
Risk to drown in data! Typical problems:

- Massive data flow
- Real time (high frequency)
- Multiple/distributed users
- Spatio-temporal references
- Integrated with other data sources/sensors
And more ...

- Complex structure
- Quality check
- Different users/scopes/tools
- Long term preservation/data reuse/publications
- Connection with other e-infrastructures

And more ...
Without Proper Data Management:

- Mistakes in data handling
- Analyses can be hampered
- Time consuming processing steps
- Reuse of data is limited
- Risk to repeat the same operations
- Partial exploitation of data
SPATIAL DATABASE
There is hope!
- Storage capacity
- Long term preservation
- Retrieval performance
- Data integrity controls
- Server/client structure (modular approach)
- Remote access
- Relational environment (data modelling)
- Concurrency control
- Easy automation of processes
- Integration in wider e-infrastructures
- Standards for data formats
- Documentation (metadata)
- Backup/recovery tools
- Cost effective
The Spatial Bit

- Spatial (and temporal) data types
- Spatial SQL
- Spatial indexes
- Integration of environmental layers ("from a geographical space to an animal's ecological space")
Spatial Database can make:

- **Easy** what is complex
- **Fast** what is slow
- **Automated** what is “hand work” based
- **Permanent** what is temporary
- **Unique** what is replicated

More time for science!
Why Open Source?

No costs for licenses

Great spatial tools for management and analysis

Use of standards (interoperability)

Support of community

Open approach to knowledge
Why PostgreSQL/PostGIS?

Spatial functions

Spatial indexes

Geography data type, raster, topology, network, 3D

Supported by many software

Active and collaborative community

Advanced features (windows functions, Pl/R, Pl/Python, ...)

Fast development
Other options for data management: SPATIALITE

No DBMS administration, no complex installation
Simple with good performances
Portable file
Good for single users, simple applications, move data
Implement many OGC specifications
Spatial Database for GPS Wildlife Tracking Data
A Practical Guide to Creating a Data Management System with PostgreSQL/PostGIS and R
Foreword by Ran Nathan
Data Management is Important!
Eurodeer Project

Collaborative Science for Movement Ecology
Eurodeer in two words

Scientific network
33 Research Groups
11 Countries
Eurodeer community
in practice

- Shared database
- Working groups for papers
- Protocols and standards
- Annual meetings
- Website(s)
- Mailing list
GPS locations: > 4,400,000
Animals: 988
Study areas: 25
Main outputs at 01.01.2016

4 Eurodeer papers published
3 Eurodeer–related papers published
4 Eurodeer papers submitted
2 Eurodeer papers in progress
1 Eurodeer–related book published
4 Eurodeer–related PhD thesis
Roe Deer

Most abundant deer in Europe
Ecological plasticity
Management interest
Implications of Focus on a Single Species

- Eurodeer community is large but manageable
- Partners know each other
- Metadata are very detailed
- All environmental gradients are covered
- Good arena to define standards
Participation

Open!
Everyone is welcome

- Bottom-up approach
- Participation is voluntary
- Access to data of others only with data
- Decisions based on consensus
- Financial support from partners (and sponsor)

VECTRONIC Aerospace
Clear agreements make for long friendships!

**TERMS OF USE**

**RULES**

- It is all about data use, not ownership!
- All data are stored in a central repository
- Data can be used after agreement with data owners
- Data can be withdrawn by the database at any time
Data, but not only knowledge first!

- Main focus: tracking data
- Contextual information
- Ancillary environmental information
- Knowledge to interpret and analyse data
- Resources and tools
Technical Issues with a Shared Database

- Quality checks
- Standardization of data structure
- Standardization of data content
- Standardization of ancillary information
- Different sampling rates
- Global spatio-temporal references
- Permission policy
- Remote access from different tools
- Increasing size of data sets
E-infrastructure

DATABASE

- PostgreSQL+PostGIS+R+QGIS
- Remote access
- Specific db tools
- 1 DB manager, 2 data curators
- Concurrency control
- Interoperable
Roe deer '770', August 2005 - Homerange 90%
Ongoing activities

EUROUNGULATES!

- **EURODEER**
  - The European roe deer (Capreolus capreolus) is a widespread species in Europe. In the EURODEER database, X research institutes are sharing their data to investigate scientific questions at regional scale.
  - [READ MORE »](#)

- **EUREDDEER**
  - The red deer (Cervus elaphus) is a large deer species, common in Europe. EURODEER database, strictly connected with the EURODEER, is growing fast and is expected to support scientific papers soon.
  - [READ MORE »](#)

- **EUROBOAR**
  - The wild boar (Sus scrofa), also known as the wild pig, is a suid native to much of Eurasia and one of the widest-ranging mammals. The EUROBOAR project just started to create a network of researchers and a shared database.
  - [READ MORE »](#)

- **EURIBEX (?)**
  - [Image of ibexes]
EUropean ROe DEER Information System (EURODEER) is an open, bottom up project to support a collaborative process of knowledge and data sharing among researchers to produce better science related to movement ecology of roe deer.
Next steps

- Exploit Google Earth Engine
- Integrate Sentinel 2
- Collaborations with other e-infrastructures
- Extend network
- Increase data
- Long term fundings!
Other Data Sharing Projects in Movement Ecology

- Movebank
- ZoaTrack
- WRAM
- Obis-SeaMap
- Seaturtle.org
- ...
Data Sharing is Good!