Tracks as a non-invasive tool for monitoring large carnivores

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Forest Resources Management (GxABT/Ulg)

Master Thesis

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- Low population densities
- Low reproductive rates
- High metabolic needs
- Large territories

} Carnivores populations decline around the world

Ecological importance: at the top of food chains, regulating role

Need for monitoring techniques !

Direct methods (direct observations):

- Questionnaires, interviews, and sighting reports (tourists, rangers, hunters,...)
- Harvest reports and pelt registration
- Road mortality samples
- Spotligt survey
- Catch-per-unit-effort
- Capture-mark-recapture (trap or remote camera)
- Transect, strip, or area sampling
- Radiotelemetry

Photo: Miles Brown

Photo: https://whistlingforthejaguar.wordpress.com

BUT

Carnivores are **difficult to observe** (and to catch) : **low densities**, **elusive**, often **nocturnal**

→ Direct methods are **expensive** and **invasive**

→ Samples are generally too small

Indirects methods (signs):

- Scent-station surveys
- Scat deposition transects
- Den and burrow surveys
- Vocalization response surveys
- Frequency of depredation complaints
- Hair or fecal analyses
- Track counts along a transect

BUT

Need to correctly identify signs

Need to check if signs density is correlated to animal density (other factors: vegetation, substrate, prey density, …)

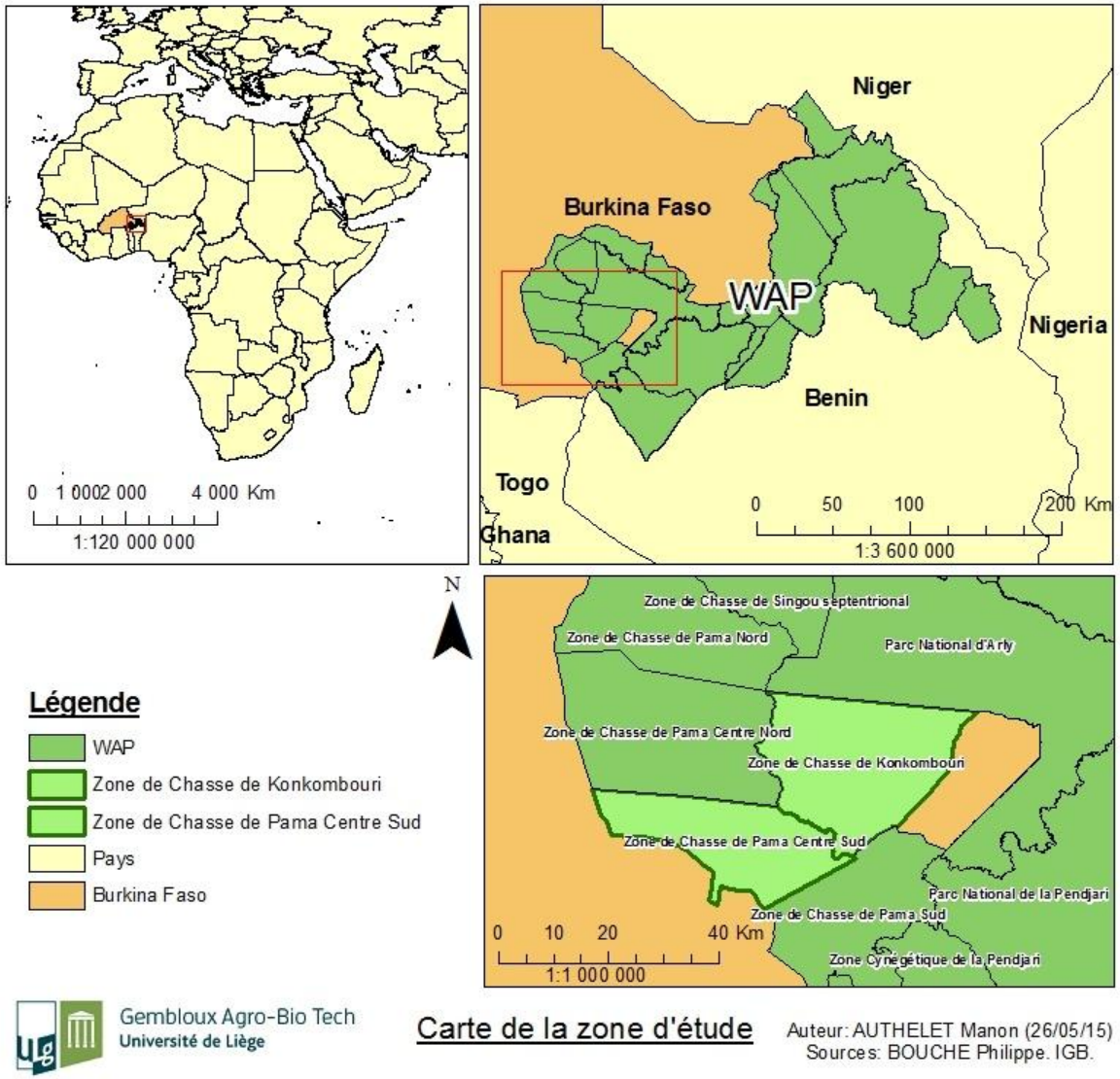
Study Area

Februray to May 2015

Hunting zones of Konkombouri (700 km²) and Pama Centre Sud (525 km²) in **Burkina Faso**

W-Arly-Pendjari Complex

Last viable populations of large carnivores in West Africa

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Advantages of footprints

- ✓ Have been used for hundreds of years by a lot of indigenous people
- ✓ No need to observe or handle individuals → **Non invasive**
- ✓ **Less cost** and field effort, **better detection probability**
- ✓ Work for **rare, nocturnal or cryptic** species
- ✓ Carnivores are known to **use roads** created by men
- ✓ Numerous **potentialities** : presence, activities, movements, range, abundance, sex, age , individual recognition...

But track interpretation is subject to a lot of subjectivity… → Need for **standardization**

Improve indirect methods for the counting and the monitoring of large carnivores populations

Large carnivores counting

- Perform the **track counting** of the large carnivores (lions, hyenas, cheetahs and wild dogs) to estimate their abundance
- Determine the effect of the **sampling rate** on the results precision to give recommandations

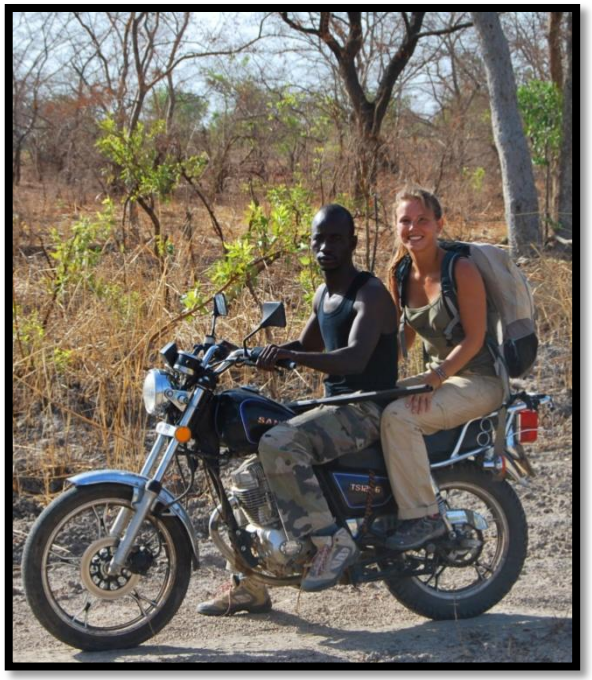
Lion individuals recognition

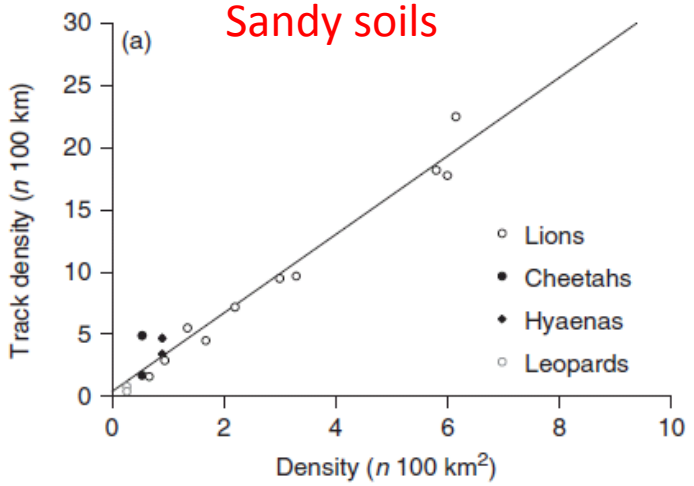
- Generate orthophotos and Digital Elevation Model of lion footprints
- Identify measurable parameters allowing to **uniquely identify an individual**

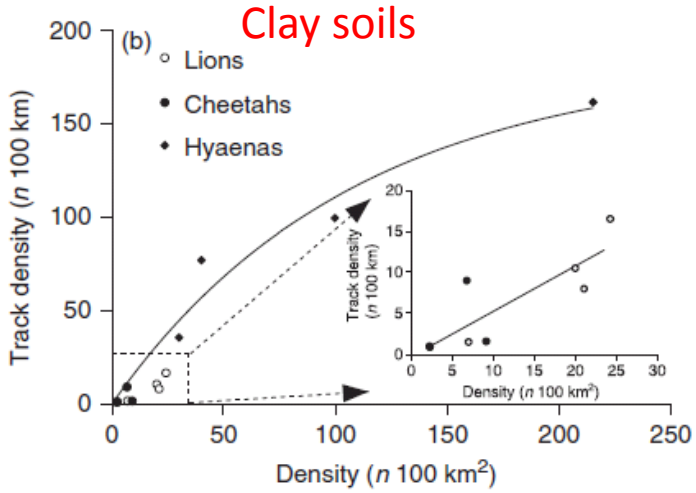
Principle:

Count tracks of large carnivores along sections of roads of known length (STANDER, 1998; FUNSTON et al., 2010)

For all species: **correlation between the « density »** (IKA) of fresh tracks along transects and **population density** (FUNSTON *et al.*, 2010).







Results

✓ Estimates of lions, hyenas, leopards and cheetahs population abundance and density

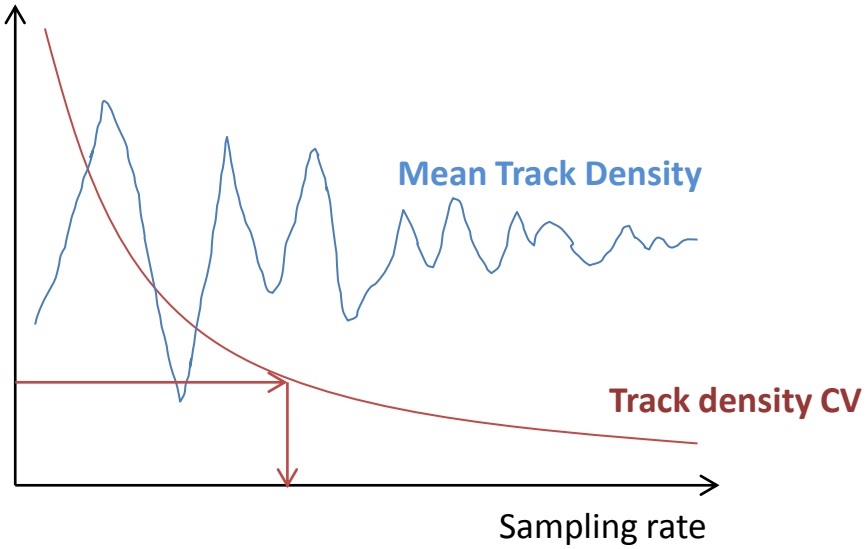
✓ Effect of the sampling rate on the precision of the results:

- Number of **transects** = penetration rate (km/km²)
- Number of **repetitions**

Boostrap Analysis:
Resample for each possible sampling level

Desired sampling rate when the CV reaches an acceptable level

CV = 20%



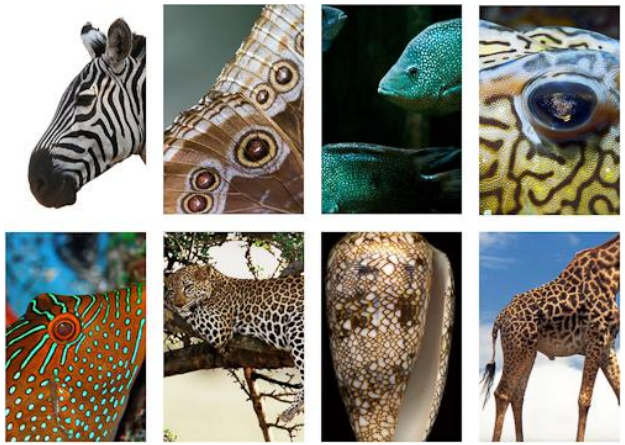
Many facets of wildlife research demand the **recognition of individuals** in a population

Natural features or tagging:

Invasive, difficult for low density or rare species, expensive

Tracks:

Noninvasive, perfect for low density or reclusive species, cheaper



Some studies have tried to implement **objective identification techniques** for some felids (cougars, tigers,…) :

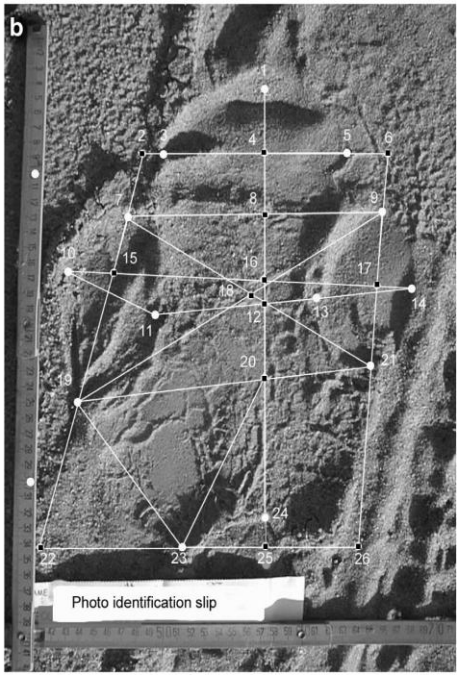
- Form
- Localization
- Measurements

} Of/made on the footprints

Organization *Wildtrack* has invented a « **Footprint Identification Technique** » for the rhinoceros :

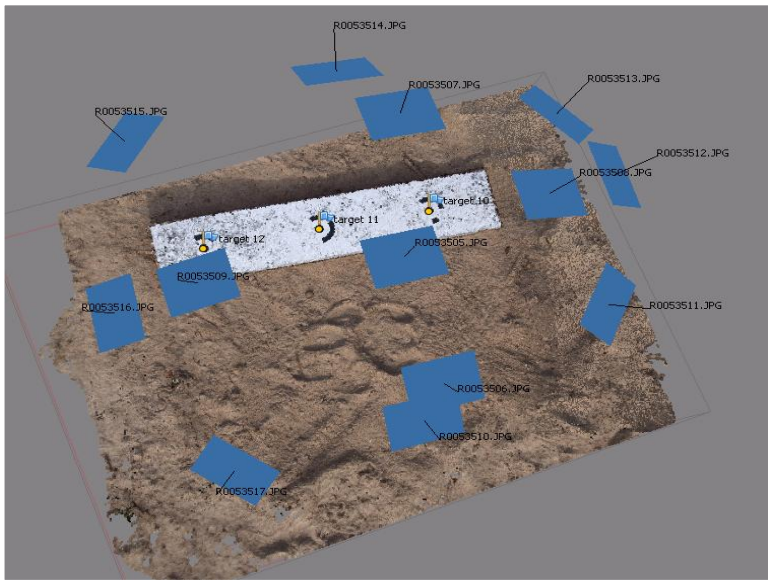
➢ Representation of a footprint with **landmarks**

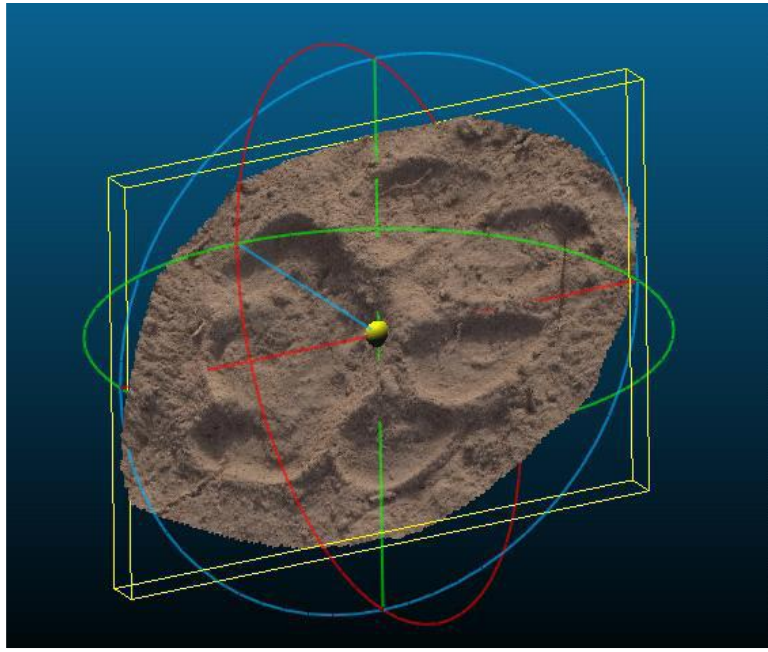
➢ Series of measurements , constituting a **geometric profile**



SOURCE:
ALIBHAI, JEWELL & LAW (2008).

Lion footprint 3D reconstruction





Goal: Find measurable parameters on orthophoto or DEM that allow to identify an individual:

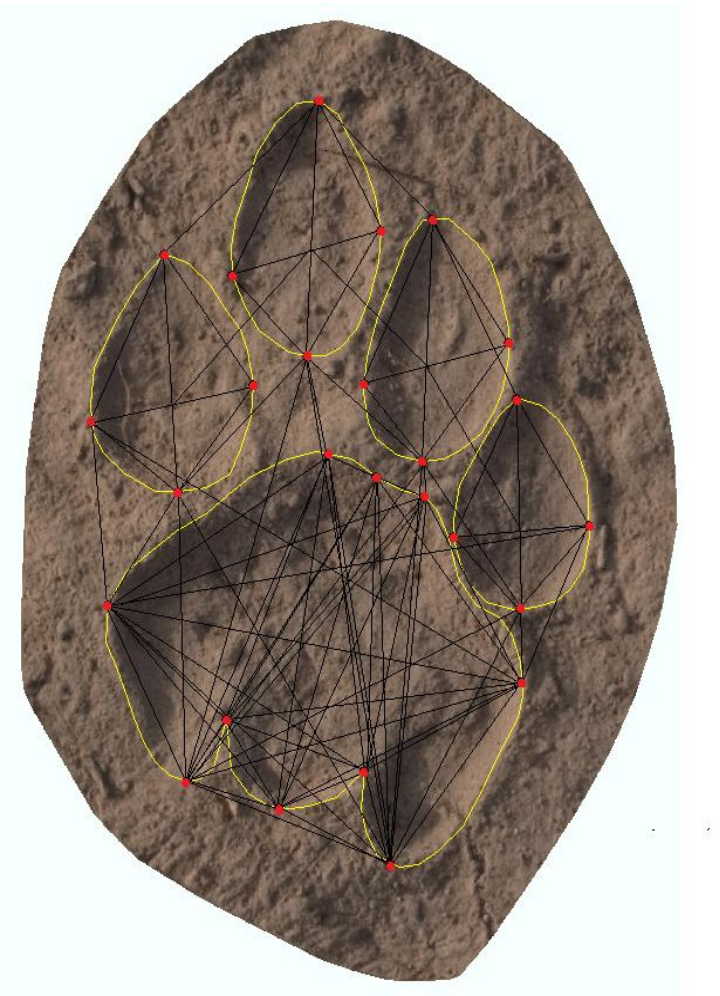
→ Vary the most for footprints of different individuals
&
Are as constant as possible for footprints of the same indivual

26 points placed manually on each footprint

→ 161 measures / footprint:

- 115 linear measurements
- 36 angular measurements
- 5 areas
- 5 perimeters

→ Statistical analyses



Results:

- Footprints of different individuals are sometimes more similar than footprints of the same individual
  → Variability due to **different identities** + variability due to **other factors** (imprint conditions)

- Statistical analyses have not allowed to underscore some variables
  → Sample was too small
  → Variability could be **too high in uncontrolled envi**ronment

- Need for a large **training dataset** of footprints of **known individuals** to appreciate within-individual variability

- **3D parameters** are **too variable** and not linked to identity but to substrate depth and nature, behavior, slope,… → Not useful for the recognition but well for edge extraction

Track Counting

- Great accuracy if correct sampling rate
- **Non-invasive**
- **Low cost**
- Can be applied by **local communities**

- **Operator effect**
- **Ok for relative abundance** but need to use another method to construct the relationship between track density and absolute density for the study area

Track recognition

- **Non-invasive**
- Perspectives : CMR, individual monitoring, home range, movements, other species…

- **High within-individual varibility**
- **Tested in artificial conditions but doubts concerning its application in real conditions**
- **Heavy cost** for the development of the method: need a big dataset and scientific expertise to build the algorithm → Gain ?!
- **Subjectivity** → Need for automation

Thank you for listening !

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