Using drones to count the elephants : a new approach of wildlife inventories

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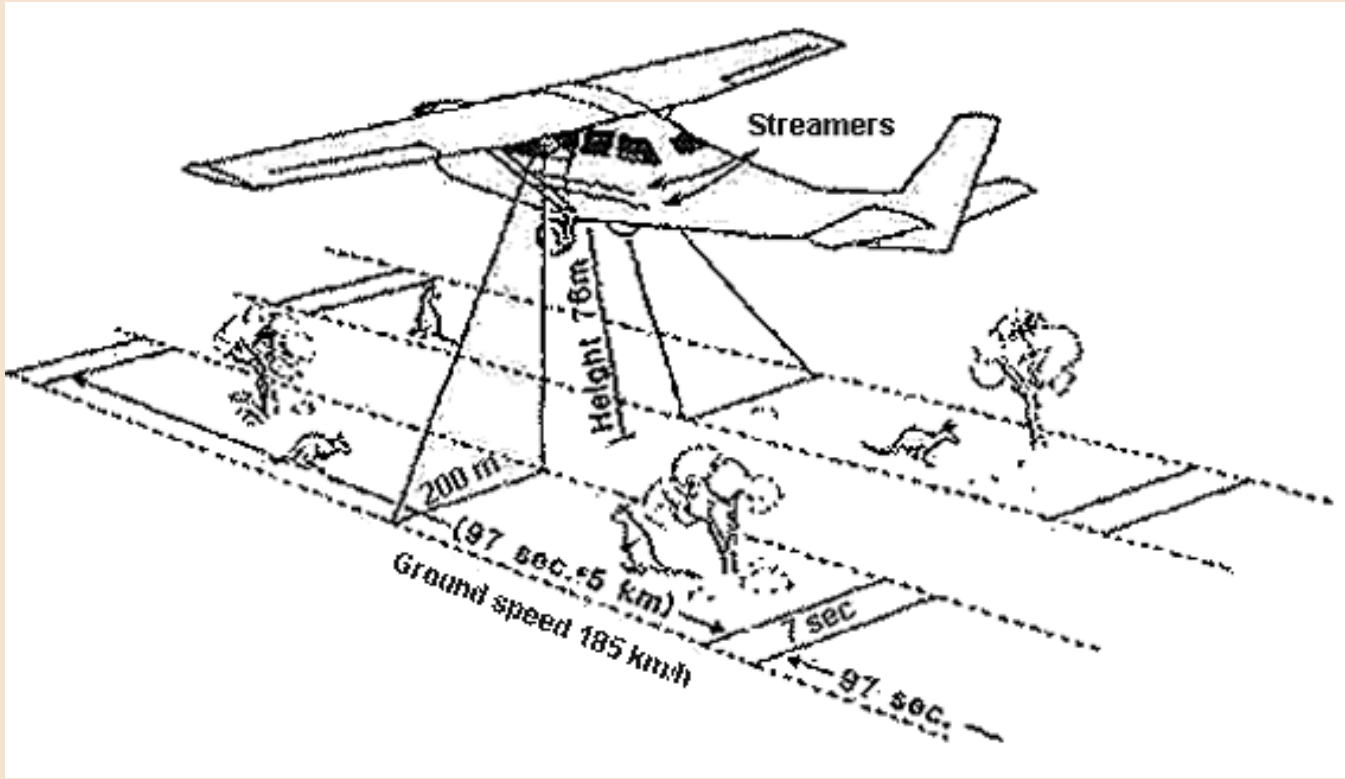
1. Context

Alarming decrease of elephant populations in West-Africa

The management of those populations needs inventories

1. Context

The usual method is fixed-width transect (strip) inventory



1. Context

Drawbacks of the traditional aerial-based inventories

- Price
- Risk
- Operator dependence
- Estimation of animal density not very accurate

1. Context

« UAV are to be understood as uninhabited and reusable motorized aerial vehicles » (Blyenburg, 1999)

These vehicles are remotely controlled, semiautonomous, autonomous, or have a combination of these capabilities

1. Context

Advantages of UAS aerial inventories

- Quick
- Relatively cheap
- Non-risky
- Easy for the operator
- Images are permanent documentation

But…

- Inventoried surface?
- Detection of animals?

1. Context

The mini-UAS Gatewing X100

1. Context

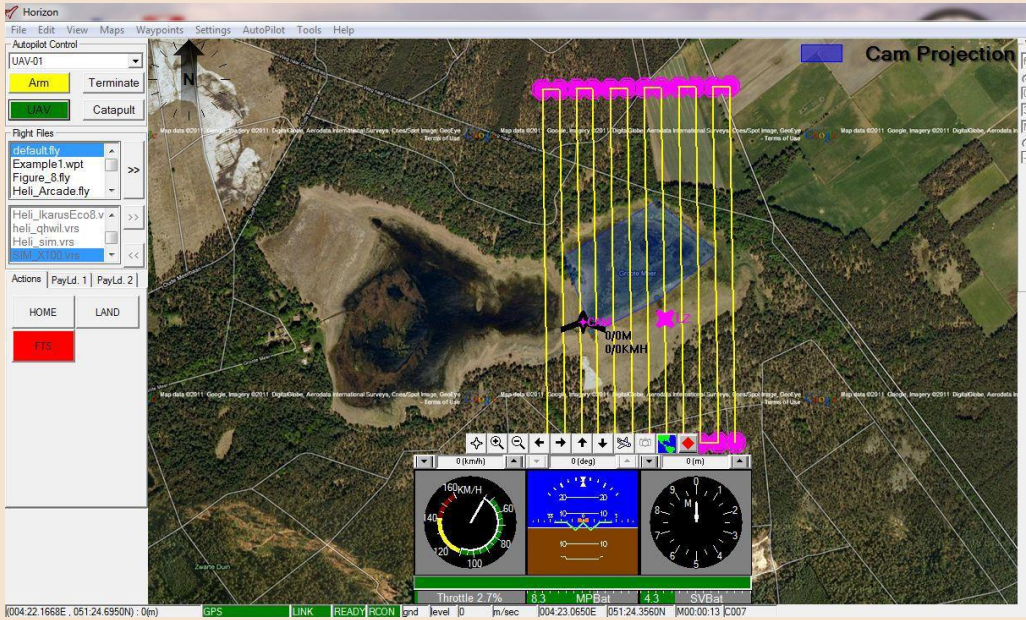
UAV characteristics :

- 2 kg, 1 m wingspan
- Electric propulsion
- Completely autonomous flight
- Catapult launch
- Cruise speed 80 km/h
- Flight altitude from 100 to 750 m high
- Flight duration max 45 min
- Amateur digital camera of 10 MPixels

1. Context

Controls :

- Ground Control Station with Modem Antenna
- Quickfield to prepare the flight plan based on georeferenced images
- Horizon to simulate and monitor the flight
- Emergency controls



1. Context

Main research question

Are aerial elephant inventories with UAS feasible?

Specific questions

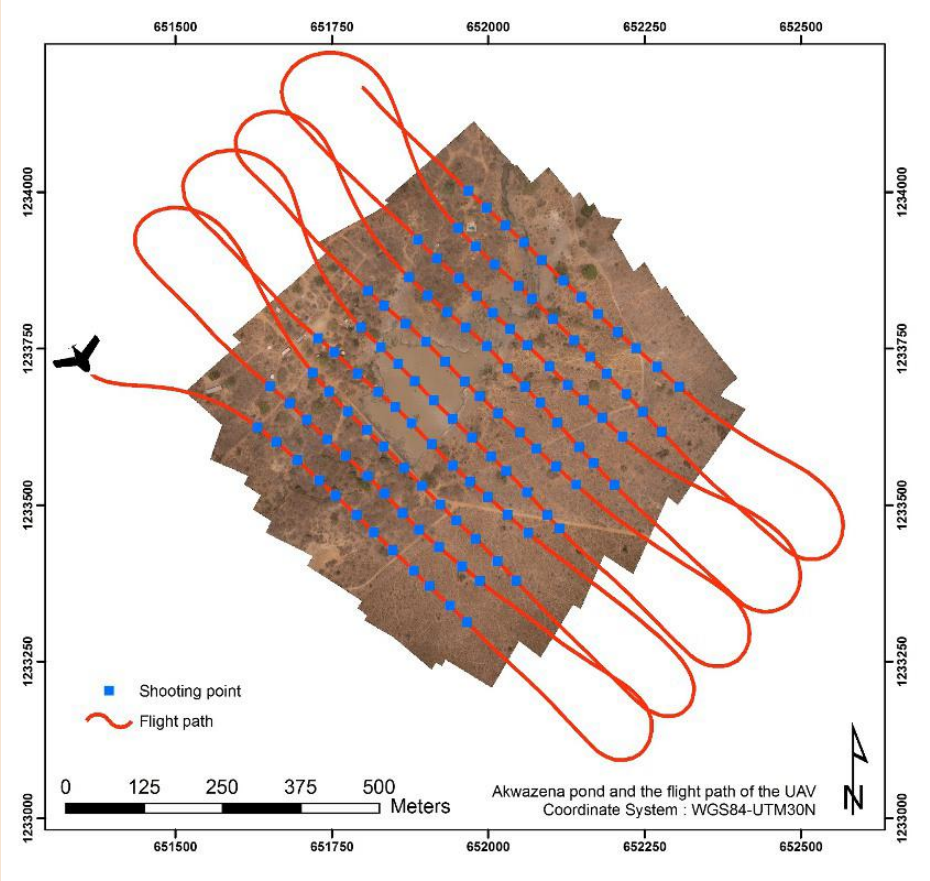
1. On wich altitude should fly the UAV?
2. Are the elephants disturbed by the UAV?
3. Are the elephants easily detectable?
4. How the inventoried surfaces can be measured?
5. Is image overlapping a necessity?

2. Aerial inventories

Test area

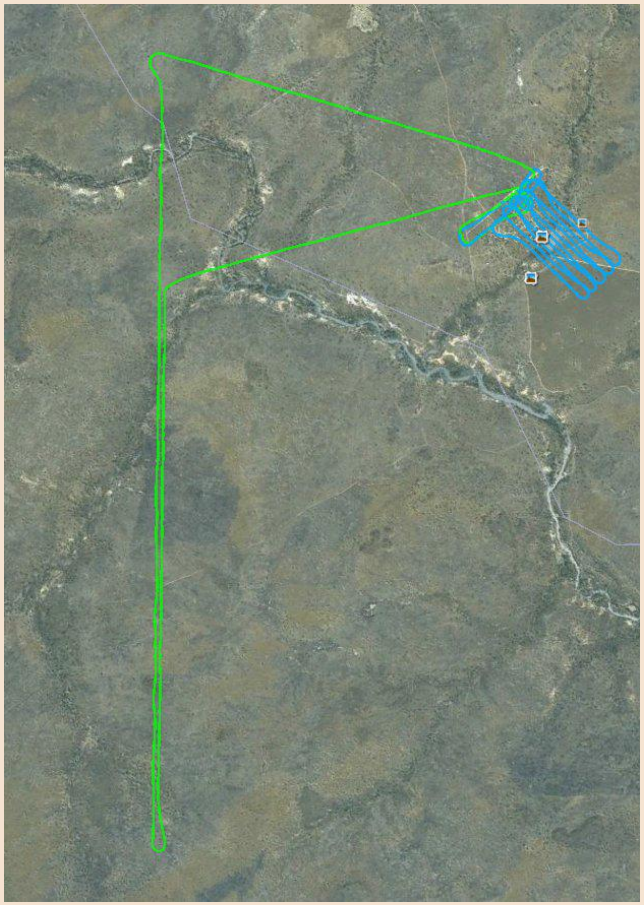
2. Aerial inventories

Testing the detectability

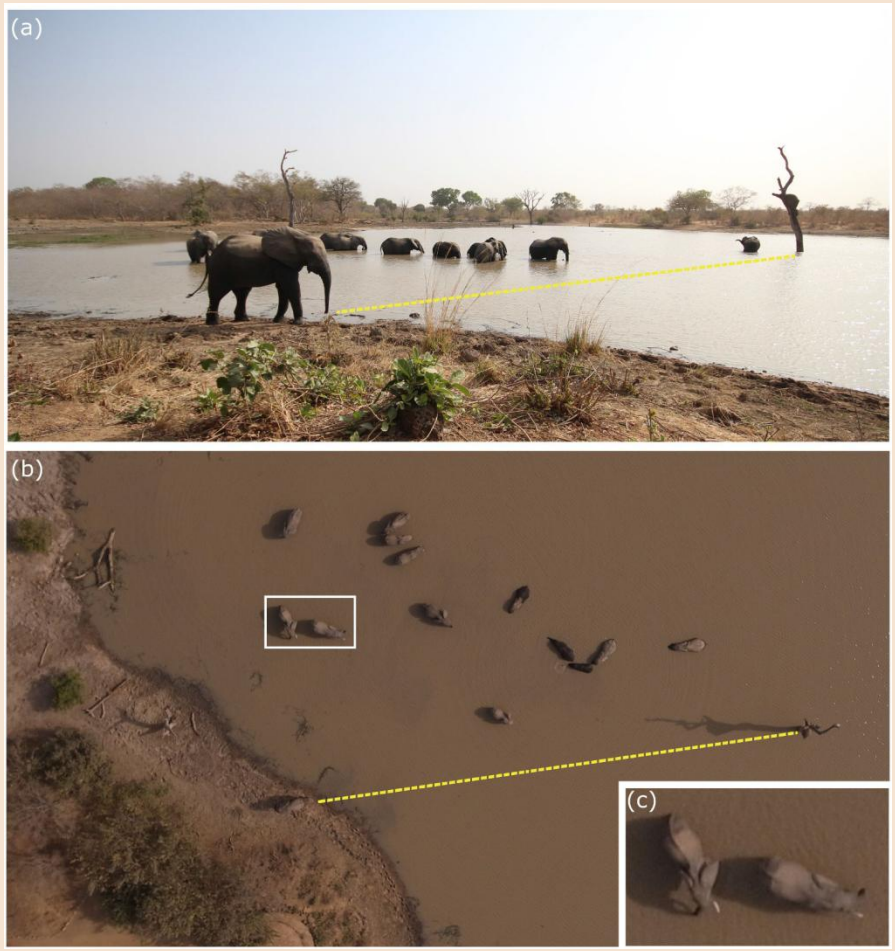


2. Aerial inventories

Testing the feasibility of inventory



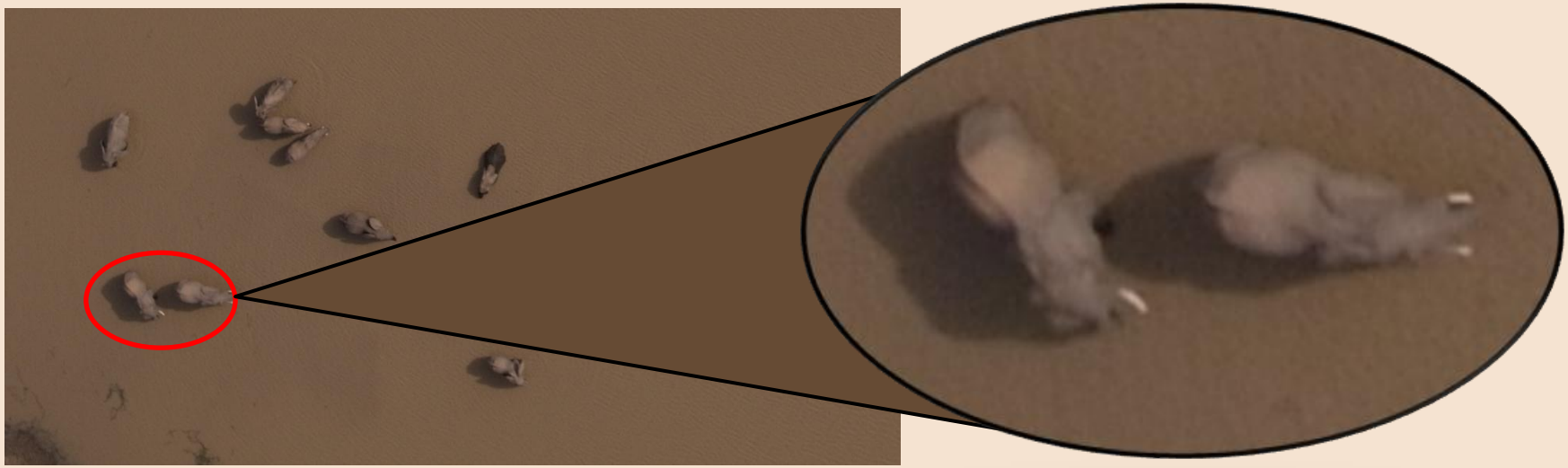
3. Results



2. Animals not disturbed

3. Good detectability

3. Results



1. Balance between the animal size and the surface inventoried => 100 m

3. Results

5. Images overlap

Conclusion

Interesting perspective

We tried a new method and it works well!

- All questions answered
- 1 article published in PlosOne
- Another one coming in TCS developping the 4th question about the sample strip area

Conclusion

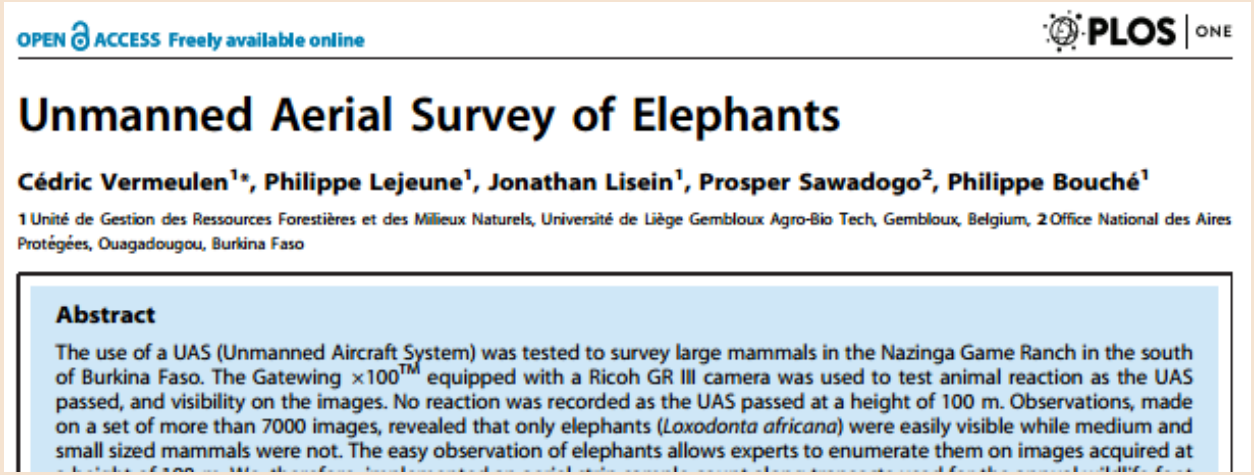
But improvements are required :

- Autonomy
- Image resolution
- Adaptated planning software for transect flights
- Algorithm for (semi-)automatic detection of the elephants

Thank you for your attention

Article

- ✓ Vermeulen C, Lejeune P, Lisein J, Sawadogo P, Bouché P (2013) Unmanned Aerial Survey of Elephants. PLoS ONE 8(2): e54700. doi:10.1371/journal.pone.0054700



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Unmanned Aerial Survey of Elephants

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Abstract

The use of a UAS (Unmanned Aircraft System) was tested to survey large mammals in the Nazinga Game Ranch in the south of Burkina Faso. The Gatewing ×100™ equipped with a Ricoh GR III camera was used to test animal reaction as the UAS passed, and visibility on the images. No reaction was recorded as the UAS passed at a height of 100 m. Observations, made on a set of more than 7000 images, revealed that only elephants (*Loxodonta africana*) were easily visible while medium and small sized mammals were not. The easy observation of elephants allows experts to enumerate them on images acquired at

- ✓ Lisein J, Linchant J, Lejeune P, Bouché P, Vermeulen C (accepted) Aerial surveys using an Unmanned Aerial System (UAS): comparison of different methods for estimating the surface area of sampling strips