



Drones to facilitate the monitoring of grazing animals: which applications and opportunities?

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Context

- Drones are now **accessible and affordable**
- **A framework of use is hard to define** because of the complexity of the regulations and rapid technical evolutions.
 - Drone misuses are numerous and so the risks when using them
- Research have focused a lot on the « **Panacea** » of how drones can perform **autonomous long range flight for autonomous animal counting**
 - But Long flight or completely autonomous drones are an **inaccessible dream** for most of the livestock farmers around the world due to the complexity of the regulations preventing the high risks **of this kind of operations**



Objectives

To study piloted drones as eyes in the sky

➔ Farmers using « super-enhanced » binoculars from the sky

- Define a clear and « ready to be adopted » framework of use for drones for monitoring animals for:
 - Easy uses by farmers piloting drone themselves
 - Research to improve solutions adapted to this framework (Specially IA-based solutions)
- Analyse the SWOT of this framework



Methodology : meeting various stakeholders for building the use framework + SWOT

Livestock farmers

- Interviews
- Demonstrations + workshops (n=2)
- Surveys
 - French National survey on PLF tech adoption (n=2134)
 - SM@RT survey on PLF adoption (n=330)
 - ICAERUS survey on drones (n=21)



Regulators

- Operator Obtain the Professional french drone licence
- Survey (n=0)



Drone stakeholders

- Interview of drone service stakeholders (n=5)
- Interview of drone training center (n=2)
- Interview of drone dealer (n=1)



Research

- SLR on animal counting and management through drone images (n=37)
- ICAERUS survey (n=10)



Methodology : year-round on-farms deployment to test our framework and build SWOT analysis



A sheep pastoral farm



A beef farm
Ferm'Inov

Meadows



Woody rangeland

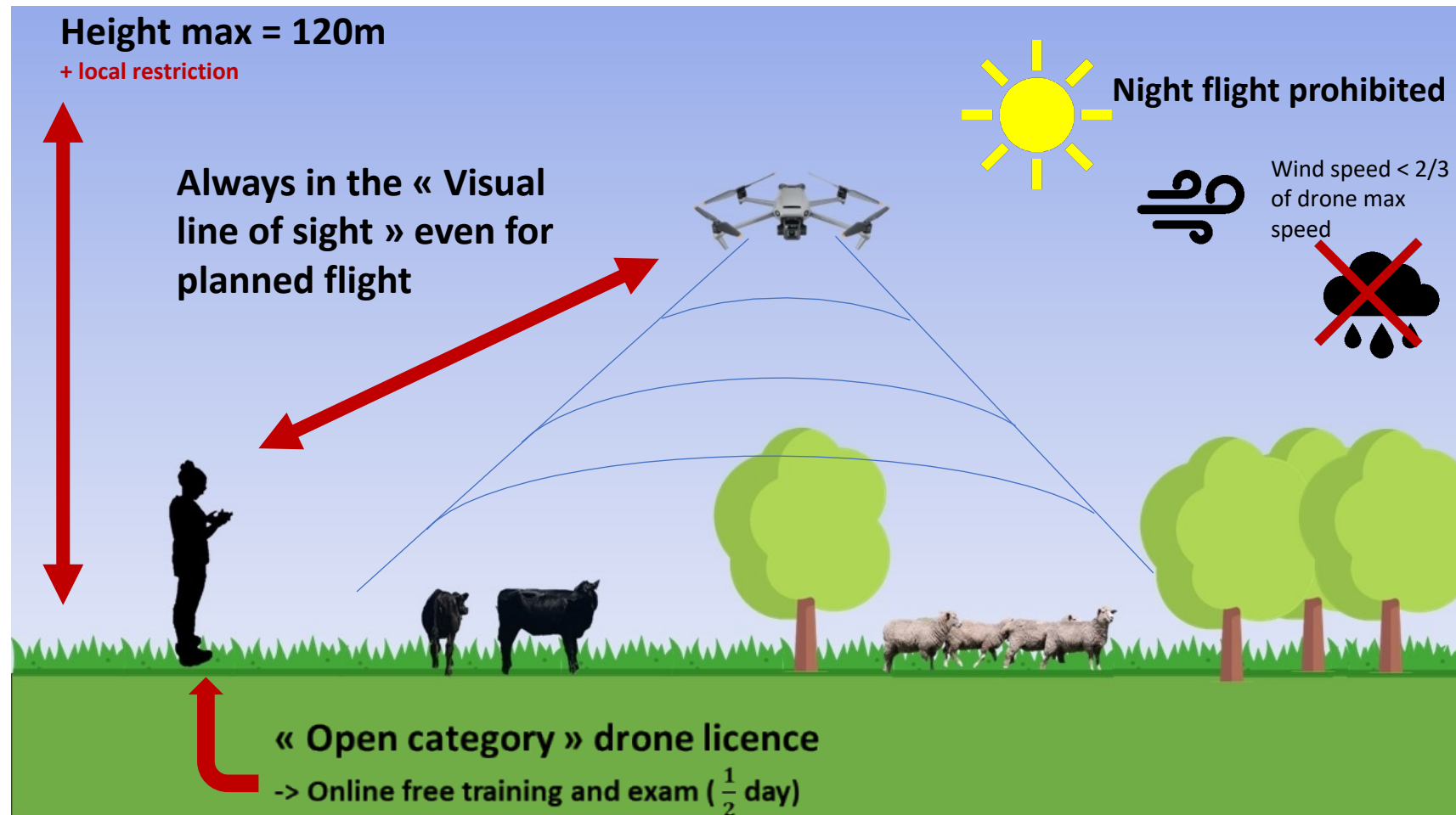


Summer mountain
rangeland



*2 pilot farms for 2 species, 2
regions, 3 landscapes
-> Tests, feedbacks collection*

Result : a framework of drone use « ready to be adopted »



An « eye in the sky » that can't go very far but can see further

Result : a framework of drone use for small farms



Which technology to use ?

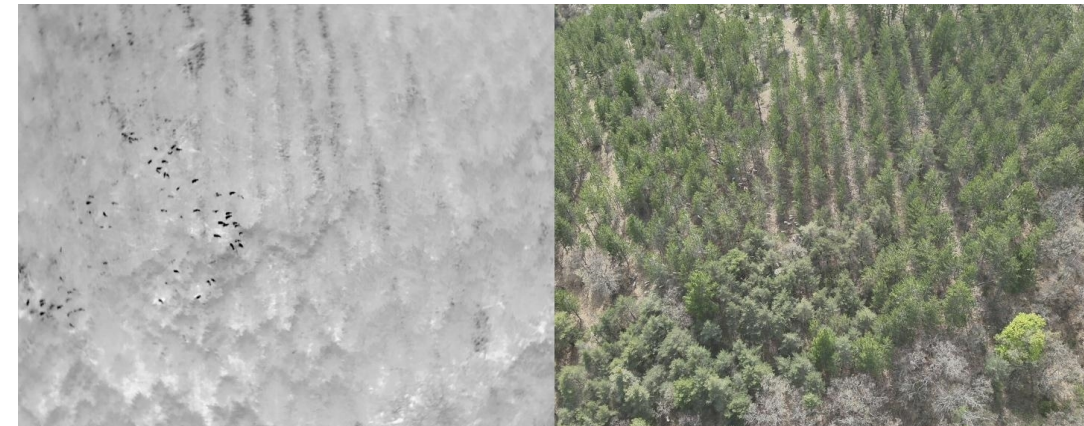


A « classic » drone platform

- Leisure drones and entry level « enterprise » drones
- Restrictions are relative to drone weight

The payload

- RGB camera
- Thermal camera (to be better assessed along the year)



Options

- Speaker

Cost : from 400€ + VAT (<250 g ; zoom X2 only) to 4500€ + VAT (920 g ; zoom x56 + thermal)



Result : activities possible in the framework

- **Animal detection:**
 - In the grasslands around (< 1-2 km radius) depending environment and of your sensor (RGB, thermal, zoom)
 - Over obstacles: vegetation, topography, roads or river impossible to cross ...
- **Behavior monitoring:**
 - Detect abnormal behavior in a herd/flock
 - Monitor lameness
 - Discrete eye to monitor protection dogs behaviors for example
- **Grasslands environnement checking:**
 - **Land:** discovering the specificity of large lands
 - **Grass:** approximative growth, heterogeneity, presence of a specy
 - **Water:** water access, irrigation
 - **Fences**
- **Animal counting:**
 - Simply on the video feedback
 - By freezing the animal with a picture
 - Assisted by software
- Etc.

Many tasks that are done through visual checks can be assisted with a drone

The eye of the farmer can see further, over obstacles and move quicker



Use of drones : SWOT ANALYSIS

Strengths	Weaknesses
<ul style="list-style-type: none"> A « Ready to be deployed » framework <ul style="list-style-type: none"> Off-the-shelf and general-purpose technologies A tech easy to handle Minimal training and certification A relatively safe tool in these conditions for people, for animals, for the tool itself 	<ul style="list-style-type: none"> Regulations very hard to handle Use is much more limited than expected Not a lot of impact assessment or peer feedbacks or advisors available for users Risk of incident or limitations due to other sky users of the sky on grasslands (Air Force, Manned aircraft, other drones) A scary technology for other rural stakeholders
Opportunities	Threats
<ul style="list-style-type: none"> AI based image analysis to improve efficiency of some tasks Opportunity to become a multi-purpose tool in rural areas Use of other sensors Development of service-providers on rural areas for those activities or more complex ones 	<ul style="list-style-type: none"> Temptation for users to leave the framework and become vulnerable to many risks Complexification of the regulations due to too many misuses New restrictions on this framework use to deploy autonomous drones for other applications

A technology ready to be deployed but with limited use.

The drone uses impacts should be better investigated to have more elements on the Strengths vs Weaknesses and to guide farmers in the adoption process.



Next steps

- **Promote a safe, legal and efficient use of drones** (Guidelines and full description will be available in the next months in <https://icaerus.eu/>)
 - To farmers
 - To researchers for having drone-based solutions compatible with this framework and better impact assessments
 - To policy makers
- **Evaluate the impact of drone in this framework**
 - **Social** impact regarding the methodology of *Hostiou and Fagon (2022)*
 - **Environmental** assesment through LCA
 - **Economical** assesment through LCC
- **Develop new solutions**
 - Test and optimize models of animal counting through drone images or videos
 - *Open image datasets (and videos) are available on Zenodo and will be extended*



Conclusion / Perspectives

- Drones are not just a cheap alternative to helicopters in big ranches and can be « super-enhanced binoculars » for many more users specially the small farms holders
- The framework presented is not the only one but it is a « ready-to-be-adopted » framework in many use case around europe and the world
 - This framework should be better investigated on its components and on its impacts to guide farmers in their adoption process
- There are opportunities for Research stakeholders to develop drone solutions to monitor animals or grasslands on this framework





Thank you for your attention ! Questions ?

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