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UAS as a new source of disturbance for wildlife - an overview about current research

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Wildlife disturbance by drone use

Possible wildlife disturbance through the use of drones for nature conservation purposes has been identified as key question for PA managers, scientists and nature conservation practitioners.

Consideration

What is higher: potential negative impacts or positive effects resulting from the use of drones for precise conservation tasks?

Wildlife reactions to disturbance

Animal reaction to disturbance may vary from punctual behavior or physiological reactions to reductions in fitness (e.g. mortally by collision with vehicle or stress related decrease in productivity) or changes in spatial use (avoidance of certain areas).

Determining factors

Characteristics of the disturbing agent: size, noise emitted, speed, distance, angle of approach

Characteristics and context of the exposed animal: species, age, level of aggregation, life history stage, habitat, season

Possible responses

Different type of animals show different type of responses:

Flight and fight responses

Protection by forming large aggregations

Hiding in vegetation

Using crypticity strategies

No observable responses (but physiological stress)

The responses may vary even among individual of the same species or related to a particular context (e.g. reproductive status)

Current state of research

Due to recent expansion of UAS use, assessment of their impact is currently restricted to isolated or descriptive studies and lacks a broad scientific base.

Mulero-Pazmany, M.; Jenni-Eiermann, S.; Strebel, N.; Sattler, T.; Negro, J.J.; Tablado, Z. (2017): *Unmanned aircraft systems as a new source of disturbance for wildlife: A systematic review*. PLoS ONE 12(6):e0178448.

Vas, E.; Lescroël, A.; Duriez, O.; Boguszewski, G.; Grémillet, D. (2015): *Approaching birds with drones: first experiments and ethical guidelines*. Biology letters 11: 20140754.

Mc Evoy, J.; Hall, G.; Mc Donald, P. (2016): Evaluation of unmanned aerial vehicle shpe, fight path and camera type for wtaerfowl surveys: disturbance effects and species recognition. PeerJ 1831.

Ditmer, M.; Vincent, J; Werden, L.; …; Fieberg, J. (2015): Bears show a physiological but limited behavioral response to unmanned aerial vehicles. Current Biology 25, 2278-2283.

Hodgson, J.; Pin Koh, L. (2016): Best practice for minimising unmanned aerial vehicle disturbance to wildlife in biological field research. Current Biology 26, R387–R407.

Results (*Mulero-Pazmany et al.*)

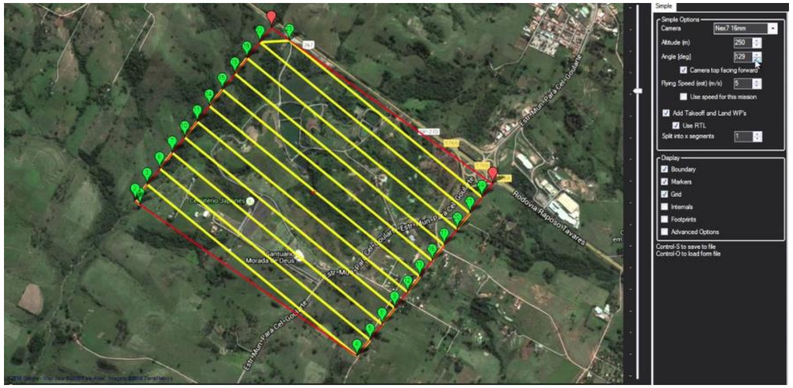
Animal reactions to UAS are conditioned by factors related to both UAS attributes and mode of operation and the characteristics of the concerned animal:

Modes of operation

Fight pattern

Target oriented : conducted towards the focal animal, approach at lower altitude above ground level (AGL), shorter distances (photography, nest inspections, animal control)

Results (*Mulero-Pazmany et al.*)



Modes of operation

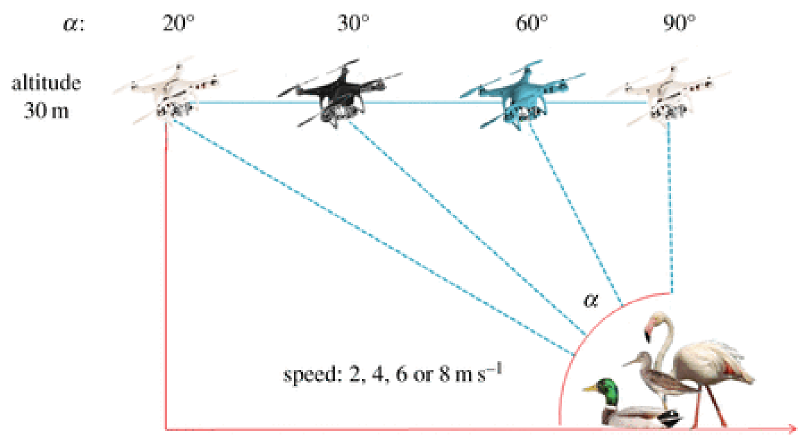
Lawn-mower: usually at higher altitudes, following a regular trajectories (mapping, surveillance, wildlife census) are less likely to affect animals.

Target oriented flights produce more reactions (higher disturbance) then other fight patterns.

→ Related to anti-predator behavior

Example of an analysed Study *(Vas et al.)*

Study led by french scientists on three bird species (mallard/*Anas platyrhynchos*; wild flamingo/*Phoenicopterus roseus*; common greenshanks/*Tringa nebularia*)



Analysis of reactions to colour of UAV, fligh speed and approach angle

Example of an analysed Study *(Vas et al.)*

In 80% of cases (204 approaches) one specific drone type could fly to within 4 m without visible reaction of birds.

No changes in behavior due to colour, speed or repeted approaches.

Approach angles have marked impacts for all three species (20°, 30°, 60°, 90°).

Vertical approach is more disturbing than horizontal.

Example of an analysed Study *(Vas et al.)*

→ When carefully flown, drones may be used in ornithology for population censuses, measurements of biotica= and abiotic variables, recording of bird behaviour. This cn be useful in particular in inaccesible areas (mountains, large wetlands)

!! The tested species feed on plants / invertebrates. Videos show other type of reactions for birds of prey , corvids and larids.

! Raise attention to physiological reactions.

Results of the analysed study

UAS attributes

Noise

Fuel engines are noisier then electric ones. Animals are influenced by noise level and changes on noise intensity (speed, trajectory changes, wind alternations).

Also depends on flying altitude

Size

Larger platforms produce more responses

Size of the threat increases perceived risk and probability of detecting it.

Shape

Predator like shapes seem to produce more impact.

Results of the analysed study

Animal characteristics

Birds are the most sensitive to UAS.

Flightless birds and large birds being more likely to show reactions than smaller ones.

Terrestrial mammals are overall less reactive to UAS then birds.

Fully aquatic animals are the least affected animal type (water layer providing some isolation from aerial stimuli).

Differences between animal types in response to UAS are related to anti-predator strategies , species naturally threatened by aerial predators react more than other animal types.

Results of the analysed study

Breedings animals (gravid or providing parental care) are on average less inclined to flee than non breeders, due to reluctance in abandon of progeny (nest) or movement difficulties (gravid females).

In some cases reproducting individuals react aggressively, probably because of increased territoriality or defense of progeny

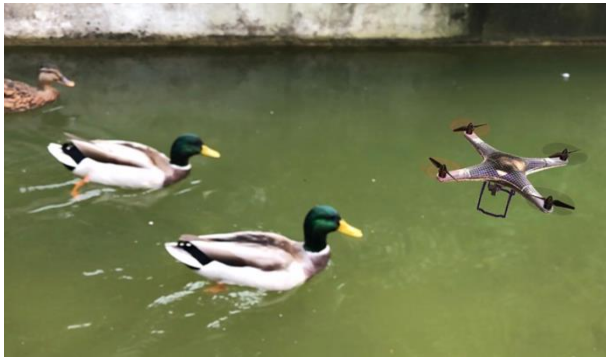
Aggregation: animal group size increases reactions towards UAS.

Results of the analysed study

- Vertical approach have higher impact than horizontal ones (association with predator attack).

- Time of the day: less reactions at night or dusk.

- Habitat: open habitats favor fleeing responses compared to close habitats.



Results of the analysed study

Non visible effects (physiological and long term effects)

- Increased physiological stress but no behavioral changes in animals subjected to close distance UAS approaches.
- May lead to higher energy expenditures, decrease in reproduction and survival, space use changes → impacts on average fitness and viability of populations.
- Abundant flight may lead to territory abandonment and decreased productivity.

Effects on bears *(Ditmer et al.)*

American black bear (*Ursus americanus*)
in Minnesota

Analysis of physiological and behavioral response:

GPS for location and movement ; Heart rate (beats/minute) for physiological responses.

Drone: flying circles 20 m AGL during a 5 min flight

UVA flights induce a physiological response, but most bears did not respond behaviorally by increasing movement rates or moving to different locations.

Effects on other animals have been reported in large public literature or by protected areas interviewed: on chamois, big horn sheep, ibex,…

Conclusions & recommandations

Small UAS, electric engines, law-mower flight patterns generally evoke no disturbance or only a short disturbance, comparable to natural predators.

AGL and distance s at which animals are observed to flee are comparable to on-foot approaches (smaller than manned aircraft or car approaches) → careful use of UAS may be a valuable alternative to traditional methods in biological studies and surveys.

Conclusions & recommandations *(modified after Mulero-Pazmany et al.)*

Currently not sufficient information on how these factors might affect wildlife to develop prescriptive policies for UAV use is available.

→ Adopt the precautionary principle in lieu of evidence.

1) Use reliable UAS operated by experiences pilotes
2) Favor low-noise or small UAS against noisier or larger ones
3) Mount the ground control station 100-300m away from the study area
4) Conduct missions as short as possible
5) Fly at the highest altitude possible
6) Avoid manouvers above animals

Conclusions & recommandations *(modified after Mulero-Pazmany et al.)*

7) Fly lawn-mower flight patterns

8) Minimize flight over sensitive species or during breeding period

9) Avoid UAS sihouettes that ressemble predator shapes

10) Avoid close-distance approaches and favor indirect ones

11) Monitor target animals before, during and after the flight. Cease UAV operations if they are excessively disruptive. .

12) For nest inspections, fly at times in which eggs/chicks are out of risk

13) If the fight are around aggresive raptor's territories, perform them at day times when the temperature is low and birds less prone to fly

14) Detailed, accurate reporting of methods and results in publications.