



Responsible drone use in biodiversity conservation

Guidelines for environmental and
conservation organisations who use drones

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Key messages

- Drawing on interdisciplinary research expertise, this document lays out principles for best practice for the use of drones as part of biodiversity conservation and/or efforts to defend rights to land.
- We outline the risks that drones can pose to local communities and wildlife and propose mitigating strategies for minimising these risks.
- As drone imagery often captures identifiable human subjects, we highlight the importance of practices to avoid capture or deleting imagery where not needed, to reduce the risk of conservation data being used for other political purposes.

Background

While geospatial technologies have long been essential tools of conservation, the development of drones has greatly expanded the possibilities for monitoring and protecting biodiversity and threatened landscapes. Drones are relatively inexpensive¹, enable visual data capture of and across vast and inaccessible places, and can facilitate less intrusive monitoring given their small size and remote nature. Drones can also empower new conservation actors, including Indigenous and local communities who can deploy drones as tools to survey and protect their territories and ways of life. However, given that drones can capture data of humans and be deployed in wildlife-rich and inhabited areas, they can also have unforeseen social and ecological impacts. The guidelines that follow were produced after the international *Drone Ecologies* workshop in 2021 and draw on interdisciplinary perspectives to propose recommendations for responsible drone usage. The authors of these guidelines are ecologists, biologists, and social scientists committed to promoting the benefits of drones while also carefully understanding and seeking to mitigate their potential impacts and dangers to humans and wildlife alike. In developing these recommendations, we draw on our work in Australia, Austria, Bolivia, Brazil, Botswana, Canada, Colombia, Czech Republic, Germany, Ghana, Guatemala, Indonesia, Mexico, Morocco, Peru, South Africa, Spain, United Kingdom, the United States, and Zambia, conducting extensive surveys using drones, analysing the social and political implications of drone use, and engaging with existing international best practices among environmental and conservation organizations working on conservation.

In detailing using drones responsibly, the briefing outlines key considerations for human communities and for wildlife, before providing a series of recommendations to consider before, during and after drone flights.

¹ This said, drones remain prohibitively expensive to communities in many parts of the world, linked with historical forms of inequality and colonial histories. The authors wish to work against these inequalities by widening access where possible.

Using drones responsibly

Considerations for human communities

Drones can enable and empower us to learn about and move in our environments in novel ways. They are also increasingly being used by and for local communities and their organisations to inform and enable effective conservation strategies, and to defend rights to land². However, as the collection of drone footage often contains images of humans this introduces the potential for surveillance and control and requires steps to mitigate potential negative impacts on human communities.

Our research shows that the presence of drones can prompt a range of reactions – from anxiety to excitement – from proximate individuals on the ground. In some cases, the use of drones has been part of deliberate attempts to intimidate local communities. For example, in the Corbett Tiger Reserve in India drones were used as part of a campaign of fear and control on local communities (see Sandbrook et al., 2021). Even when it is not the operator's intention, the use of drones can, but does not necessarily, also provoke diverse concerns related to privacy, security, and noise.

Deploying drones to capture imagery in peopled and unpeopled locations also raises issues around both consent and cultural sensitivity. Alongside ensuring familiarisation with airspace, data collection and privacy regulations relevant for drone operation within the area of operation, it is vital that organisations using drones consider the *political* and *cultural* contexts, remaining sensitive to local norms, customs, and sites.

An important secondary implication of drone use surrounds the sharing of drone data that could implicate individuals in criminal activities and lead to repercussions. For example, the circulation of data featuring images of a poacher might lead to false accusations and/or reinforce existing stereotypes

² See: <https://forestsnews.cifor.org/57666/why-the-drone-buzz-is-getting-louder?fnl=en>

about who commits crimes. Where this is deliberate, as part of law enforcement strategies, it is important to consider how the visual data produced by drones can interact with existing stereotypes about who commits crimes (for example, who is a poacher) and lead to false accusations. Where collection of human data is accidental, ethical concerns can be mitigated by deleting unnecessary footage containing identifiable images of humans, including identifiable features (such as ethnicity, gender, or religious garb). Even where monitoring illegal activities is the focus of drone use, the wider social implications need to be considered.

Central to responsible drone operations is meaningful engagement with local communities present and residing in the flight area, or those with interests in the area (e.g., Sacred burial sites or landscapes, areas accessed by nomadic groups). This involves early and ongoing engagement with communities that both recognises local and extra-local territorial knowledges, and collaboratively develops guidelines for flight and data alike. Organisations using drones should also ensure all involved persons (including contractors) are briefed on site-specific information, including customs and sensitivities.

On the other hand, there are broader concerns with the powers of states over data collection. Chinese company DJI, which dominates the commercial and research drone sector, sells drones which transmit encrypted logs back to the company servers. This has led to 'foreign-made' drones being banned on federally-managed sites and lands across the entire United States, due to concern that the Chinese government might subvert these data for other purposes³. Millions of dollars' worth of DJI kit owned by the USGA and US universities rendered unusable for most activities overnight at the stroke of a pen. There is a need to carefully consider the impact of over-regulation on drone use.

Considerations for wildlife

While drones are often used to collect data that informs effective conservation of biodiversity, their use can also disturb wildlife, whether an animal species being monitored or non-target species. Systematic exposure over time may also lastingly affect animal behaviours. It is therefore important to understand the potential risks and to design drone interventions minimising adverse impacts on wildlife.

The impact of drone disturbance has been documented for a variety of organisms inhabiting both terrestrial and aquatic habitats. Animal reactions to drones can be

understood as anti-predatory responses, and vary from: curiosity, vigilance, and alert, to alarm, fleeing responses and even aggressive behaviour. In addition, responses can be non-visible such as an increase in heart rates as has been found in bears reacting to drones. Birds are more likely affected by drone presence than other zoological groups that have been studied so far, as they inhabit the aerial spaces where drones operate. Animals with particularly high hearing capabilities, such as elephants, have also been recorded fleeing away from the aircraft. Nesting birds in their colonies, marine animals such as whales, and terrestrial animals can also be affected by low-altitude drone flights.

The occurrence, type and intensity of animal reactions depends on several factors related to animal characteristics (e.g., species, sex, reproductive status); drone attributes (e.g., noise); and drone flight characteristics (e.g., directness towards the animal, altitude) (Mulero-Pázmány et al., 2017). Drones flown directly towards animals, such as those intending to film specific targets, elicit more disturbance than the "lawnmower patterns" conducted at regular altitudes and commonly performed for mapping or wildlife monitoring purposes.

Finally, it is important to consider drones in the context of wider environmental concerns. Organisations should consider where drone parts are sourced, possible contamination (e.g. via certain batteries) and how they are disposed of to minimise adverse impacts (see: <https://www.thedronegirl.com/2015/02/07/lipo-battery/> and <https://dronesourced.com/guides/types-of-drones/>).

Recommendations

While recognising the potential of drones as comparatively accessible tools enabling the documentation of biodiversity conservation issues and the empowering of local communities, organisations should remain aware of the potential dangers of drone use, from disturbing local people and wildlife, and capturing and circulating illegal activity leading to potential conflict, to ensuring the safety and security of drone operators. We present recommendations that are important to consider when using drones in biodiversity conservation. These are intended as additional considerations, beyond the pre-departure assessments and dynamic site assessments already common when using drones in biodiversity conservation. Our recommendations are divided into considerations to be made (i) before flying drones, (ii) during drone flight, and (iii) after drone flight.

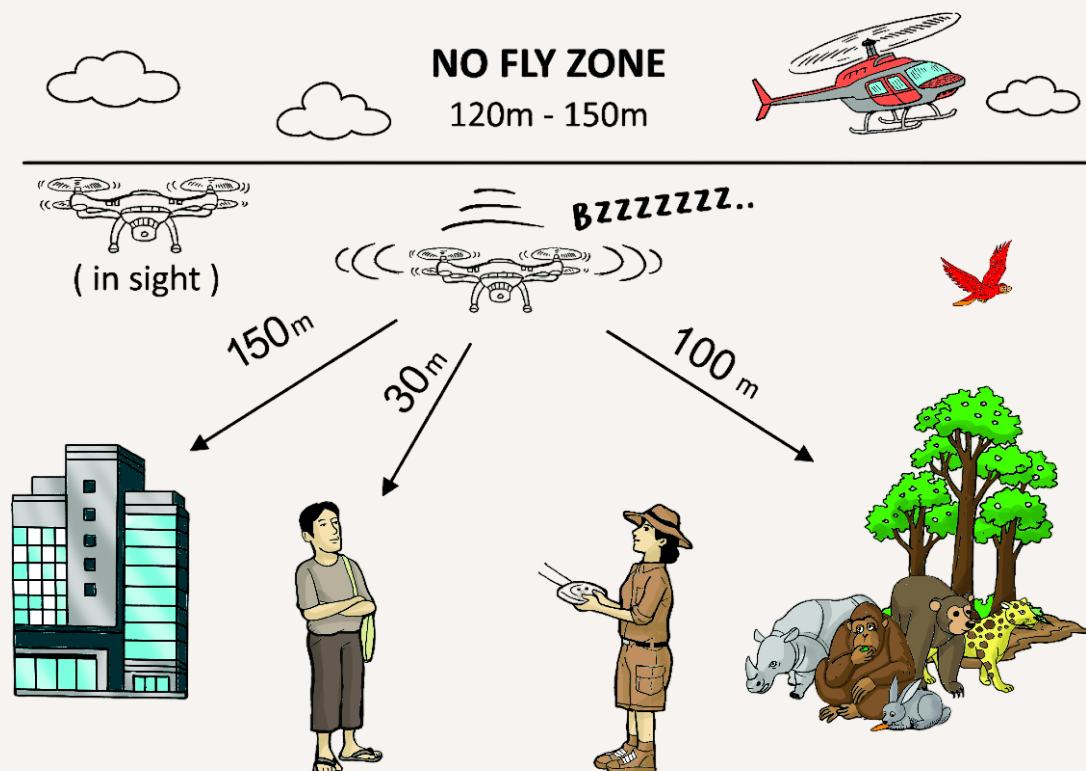
³ Read more here: <https://dronedj.com/2022/10/07/dji-dod-drone/>





Before you fly:

1. Consult, engage and/or collaborate with local communities who are the owners or stewards of areas where drones are flown, to ensure planned flights respect local rules, regulations, boundaries, and property locations, and to mitigate potential threats to safety or privacy, and the potential triggering of fear responses.
2. If subcontracting drone operations, ensure that operators are trained to engage and respect any communities using the areas to be surveyed and are well briefed in contextual information including ongoing or potential conflicts. This can be difficult to do in practice so ensure contractors are accompanied by local guides where possible.
3. Plan missions with awareness and choose the quietest drone type possible to minimize disturbance on people and wildlife that shares the airspace and environment.
4. Understand the capabilities and limitations of your equipment and work within these limits (e.g., assess weather conditions, assess whether it is suitable to fly the drone in the conditions at time of flight to reduce risks of crashing) as well as ethical and social considerations (e.g. proximity to sensitive sites, likelihood of capturing data on humans), and seek to mitigate any associated risks.



During flight:

1. Avoid accidentally capturing images of humans where features can be identified. Where illegal activities are being monitored, only identify individuals you intended to and be aware of the possible consequences.
2. Make yourself and your drone identifiable. Operators should wear identifiable clothing (e.g., high vis jacket), and drones should be appropriately marked (e.g., organisation name and any required IDs printed on it). An assistant should accompany the operator to assist with flight and answer any questions to passers-by.
3. Observe animal reactions during flight and abort the mission if animals react to the drone with aggression or fleeing away in great numbers. Also abort if fear or negative reactions to the drone are identified among humans.
4. Take off further than 100 m from wildlife and/or out of animals' sight or hearing range and fly at the highest altitude possible feasible to get satisfactory data while minimising wildlife disturbance. (e.g., 100 m above ground level).
5. Avoid abrupt changes to the speed, altitude and direction of your drone, favouring lawnmower flight patterns over direct approaches towards animals.



After you fly:

1. Take care with photographic and video data of people and culturally significant sites. Risk assess the release of drone data and check for social and ethical issues before sharing.
2. Review footage and drone data with local communities to check they are happy for it to be shared and ensure that data can be used by them where possible. Ensure that not only data but findings from drone work are properly communicated back to local stakeholders / communities after analysis is completed.
3. When your drone has reached the end of its life, dispose of it carefully to avoid environmental contamination.

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