Drones in Wildlife Research

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Wildlife researchers have often faced challenges such as lack of funding and elusive animals, drones are quickly becoming an effective and efficient tool in data collection of wildlife. The implementation of drones through remote sensing practices is an ever-growing subject in wildlife conservation and research. This development of drone technology and function has increased the possibilities of remote sensing in the field (Simic Milas et al., 2018). This improvement can be regarded as the third generation of platforms regarding remotely sensed data (Simic Milas et al., 2018). The idea of drones is not new, its roots can be traced back to Julius Neubronner's early experiments with pigeons and photography (Simic Milas et al., 2018). However, modern drone technology has revolutionized remote sensing in wildlife research, offering unprecedented precision and efficiency. This type of collection can produce novel data and improve data collection(Hodgson et al., 2018). In wildlife monitoring and research, several types of data collection have emerged. Including advances in e-DNA analysis, camera traps and acoustic recorders, and telemetry devices(Hodgson et al., 2018). Drones however offer a new approach to data collection. The ability of drones to carry remote sensing technology and collect ecological data makes them prime candidates for research purposes (Anderson & Gaston, 2013). This paper explores both the benefits and challenges of implementing Remotely Piloted Aircraft (RPA) and the potential to apply this technology in wildlife research.

Drones offer a wide variety of benefits to wildlife researchers. Drones are rapidly replacing surveying by conventional light aircraft (Corcoran et al., 2021). This is due to the ability of these drones to gain higher-resolution images, attach sensors, and fly lower than conventional aircraft (Anderson & Gaston, 2013; Andrew & Shephard, 2017). These revolutionary technologies in drones allow for better detection and data collection of smaller and more secretive animals than ever before (Christie et al., 2016). These drones also reduce stress on animals compared to methods such as trapping or direct observation (Scholten et al., 2020). Drones are often less expensive compared to traditional survey methods (Christie et al., 2016). They are remotely operated by pilots and many times safer than traditional survey techniques such as conventional light aircraft (Christie et al., 2016). Drones also offer thermal imaging to detect nocturnal species or often offer multispectral sensors for habitat analysis (Agudo et al., 2018). Drones may also integrate AI and Machine learning. This technology can analyze and process data in real-time (Boopathi, 2024). Drones also offer the ability to be automated. Autonomous flight paths and repetitive surveys can offer wildlife data that is free of bias (Koh & Wich, 2012). Although drones offer a wide variety of impressive benefits, their use is not without some challenges.

Drones may be an upcoming and revolutionary technological advancement in wildlife research, but they also have some challenges and ethical considerations. These challenges may include things such as disturbance to wildlife. Drones cause noise pollution which may be attributed to behavioral changes in some species (Weston et al., 2020). Drone usage also brings up legal restrictions. FAA regulations, permits, and privacy concerns are all hot topic issues in the use of drones (Stoica, 2018; Tsiamis et al., 2019). Drones also face battery life concerns and weather limitations(Gao et al., 2021). Their use depends on certain field conditions (Gao et al., 2021). Drone use in surveys also requires a large amount of data collection (Caillouet et al., 2019). This data can sometimes have challenges in the storage and processing of these large datasets. This can lead to the inability of drone usage for large surveying projects (Lyons et al., 2019). Despite the variety of challenges facing the use of drones, the applicability of this technology is indisputable.

Drones offer a wide range of applications in wildlife research. Data collected by these drones can be used to help manage populations and prevent biodiversity loss (Anderson & Gaston, 2013; Christie et al., 2016). Drones can be used for population surveys. Waterfowl is a prime example of an applicable use of drones for population surveys (Dundas et al., 2021). Through the help of drones and integrated AI we can gather accurate population surveys of ducks across the globe (Dundas et al., 2021). Another key application is tracking animal movement patterns, where drones have proven invaluable. In an ongoing study by the Minnesota DNR thermal imaging drones are being used to identify and capture whitetail fawns for a collaring study (Obermoller et al., 2021). Drones may also be used for population health monitoring. Injuries and diseases can be monitored in populations through the help of RPAs (Rietz et al., 2023). Drones were used in Rietz et al. to study boar carcasses and the detection probability of African Swine Flu (Rietz et al., 2023).

Drones have proven to be extremely valuable tools in wildlife research, through their accessibility, precision, and efficiency. Their applicability includes but is not limited to population surveys (Dundas et al., 2021), tracking animal movements (Obermoller et al., 2021), and mapping habitats (Lyons et al., 2019). However, there still are some challenges this emerging technology will have to face. The issues of privacy, regulations, and potential wildlife disturbance still loom over the use of this technology. These issues must be addressed to ensure the continued use of drones. As technological advancements continue in drones, the potential applications of this technology will revolutionize wildlife research. This technology provides researchers with a cost-effective and non-invasive way of sampling animals which can fill in knowledge gaps. This can lead to better management practices and the conservation of our natural resources into perpetuity. As we face accelerating environmental changes, drones offer not just hope but a transformative solution to maintaining the world's biodiversity and ensuring a sustainable future for many generations to come.

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