Drones in Conservation

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Abstract

Conservationists seek to employ inexpensive, versatile, and attainable solutions to address a wide variety of environmental problems that threaten the biodiversity of protected areas. Recently, drones have pioneered a distinctly new era of remote sensing that has revolutionized methods of documenting nature. While drones offer great potential to improve conservation initiatives and raise better-informed decisions, their effectiveness remains fundamentally unexplored (López et al., 2019). This paper examines what benefits and drawbacks have been identified when considering the prospective integration of drones in conservation on a broader scale.

Keywords: drones; unmanned aerial vehicle; remote sensing; conservation; protected areas

In the last decade, drones, otherwise known as unmanned aerial vehicles, have been the subject of growing interest among both civilians and the scientific community. Since they first emerged in the consumer market, advancements in drone technology have drastically increased their versatility and potential to be used in a wide range of applications. Drones are considered a low-risk, cost-effective, and innovative solution for making systemic observations of natural phenomena at a high spatiotemporal resolution (López et al., 2019). They have completely transformed our remote sensing capabilities to study the environment and have rapidly become a fundamental utility in wildlife research and management (López et al., 2019). The use of drones has provided conservationists an accessible new way of investigating habitats that were previously out of reach, due to either location itself or external factors such as time, funding, support, logistics, and even safety concerns (Alexander, 2021).

Traditionally, data to supplement wildlife surveys has been gathered through satellite imaging and the use of manned aircraft. However, these options each possess their own set of limitations, which prevent their widespread use. For example, data from satellites can produce large-extent images spanning continents and oceans, but the spatial resolution and timing do not always meet the needs of site-specific analyses (Duffy et al., 2020). Conservation issues about individual species or sensitive habitats generally require data at finer spatial and temporal resolution (Duffy et al., 2020). Similar disadvantages are encountered by manned aircraft. Aside from a significant historical record of fatal accidents, the success of using mannedaircraft for wildlife surveys is dependent on favorable visibility conditions. The method of operating manned aircraft also demands a lot more time and resources (López et al., 2019). In contrast, unmanned aerial vehicles are a convenient alternative that is, generally, a less invasive, non-hazardous, repetitive, and reliable technique to document the environment (López et al., 2019).

In addition to accessibility, a major component of drones' growing popularity is the ability to customize them with a variety of different sensors and devices. The scope of application determines what type of unmanned aerial vehicle and combined modifications are optimal for its intended purpose. Although drones come in many different shapes and sizes, often, small consumer-grade drones, equipped with lightweight cameras and multispectral sensors will deliver sufficient, high-quality results (López et al., 2019). For applications that require obtaining a higher range of information, mid-sized drones can be equipped with compact thermal vision cameras, hyperspectral sensors, and laser scanning, such as LiDAR (López et al., 2019). Beyond multispectral band cameras, there is a broad spectrum of instruments that can be incorporated with drones to measure many distinct physical quantities such as temperature, humidity, or air pollution (López et al., 2019). For more complex tasks involving heavier payloads, larger drones can be equipped to perform remote sampling, carry cargo, or deliver assistance.

Given the abundant range of possibilities, it's no surprise conservationists have adapted consumer-grade drone technology for various applications in diverse fields of study. With some ingenuity and careful planning, a drone can execute functions that cannot be accomplished using traditional equipment (Duffy et al., 2020). Drones allow scientists to acquire aerial data for land surveys and wetland management; monitor both endangered and invasive species; document and deter illegal logging, mining, and poaching activity; detect marine litter; map coral reefs; and even assist in search and rescue operations (Duffy et al., 2020) (López et al., 2019). In non-imaging studies, drones are agile devices that can maneuver all kinds of payloads into difficult positions (Duffy et al., 2020). Fast-paced developments of sophisticated drone technology continually enable progressively ingenious conservation actions to be carried out (López et al., 2019). Some specific examples include implementing drones for fighting wildfires; collecting

biological samples to measure whale health; disease vectors control; and seed planting for habitat restoration (López et al., 2019). These only represent a few cases in which drones are making vital contributions to conservation efforts.

Despite there being many positive aspects of using drones, some negative aspects have also been identified. While drones grant us the ability to readily view nature from an elevated perspective, that perspective is powerful and should be treated with careful and ethical consideration (Duffy et al., 2020) Operating drones around human and animal subjects can invoke a range of emotional and physiological reactions, many of which are not well understood in the case of animals (Duffy et al., 2020) Drones can disrupt wildlife in protected areas and may prove counterproductive for conservation. At this point, the effects of potential wildlife disturbances require further investigation. The legality of drone use is another complex issue to be mindful of. Nationally and internationally rules are varied, and aviation authorities are still in the process of determining what laws and regulations should be put into place (Duffy et al., 2020). Additionally, the robust amount of data collected by drones can pose some technological barriers. The data collected by drones often requires intensive computer processing power and sometimes highly qualified personnel to derive accurate and meaningful information (López et al., 2019). More research is needed to assess the overall efficacy of drone data collection techniques, especially in comparison to more mature statistical and sampling methods (López et al., 2019).

Although we are still working through the challenges and complexities of integrating drones in wildlife conservation, the technology holds incredible potential. The variety of information gathered from drones provides a great opportunity to enhance the work of environmental research programs aimed at monitoring anthropogenic impacts that threaten the integrity of ecological communities (Alexander, 2021). Drones can be easily deployed almost

anywhere there is an indication of natural disturbances, which were previously detected through satellite images and environmental sensor networks (Alexander, 2021). From monitoring the smallest ecosystems to analyzing large landscapes, as well as studying animal behavior with minimal disturbance, conservation drones are proven to have a vast range of possible uses (WWF, 2020). They are revolutionizing processes of data acquisition and wildlife observation techniques in ways that can help shape future conservation decisions for many species at risk (WWF, 2020). At the present rate, many habitats are facing accelerated degradation under growing human influence, unmanned aerial vehicles are likely to play an ever-increasing role in studying and protecting our planet and all its inhabitants.

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