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Drone and UAS Use in Natural Resources and Conservation

Drones have become a big part of today's use of technology. Drones are used in construction, mapping, agriculture, military, and law enforcement. Drones are recognized by the FAA as "an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft" (1). But what about our roots as a society and our natural resources? Well, many different agencies are using drones to help conserve our resources, from protecting our forests from fires to monitoring soil conservation, agencies are also using drones to monitor aquatic creatures and land mammals, waterfowl, and endangered species across the globe. Understanding the impact these technologies have on Natural Resources Conservation and their benefit is important.

Forest Conservation is detrimental to help protect habitat, and endangered plants and to help keep our forests standing for generations to come. One of the ways drone technologies can help combat this problem is through early detection of fires. These drones are equipped with Industrial lenses for their cameras and have AI software to try to recognize early fire signs such as smoke and fires and report them to fire department centers (1). The National Forest Service has integrated the Use of UAS as they have been more implemented into the mainstream. In Arizona eh National Forest Service has used UAS to "Evaluate Forest health conditions and woody biomass on the Apache Site Greaves National Forest" (9). With both of these tools at the National Forest Service's disposal, they will be able to monitor and protect forests from future

fires as well as look into where they need to implement more trees and more conservation resources as the forests provide bountiful habitat for many species.

When it comes to monitoring our natural resources, forests and grasslands are important but what also lives within them are just as important. The National Park Service is attempting and doing trials on population assessment surveys of species both marine and land-dwelling. The NPS plans to "map thermal refugia with infrared sensors and stream turbidity with multi-spectral sensors for hydrologic surveys, as well as detect fish presence with optical sensors, are planned for Denali National Park and Preserve" (6). With these tools, the National Park Service can find ways to improve these parks from many different angles with the use of UAS. From working on fish and aquatic habitats. The National Park Service also plans to work on doing bird nest surveys. In California, a study was conducted using UAS to study waterfowl broods which are groups of young or recently hatched waterfowl. In the study they flew UAS over a pond system in the San Francisco region of California, the researchers monitored 17 ponds and used thermal imaging on the drone to help detect the broods. "From June 3–7, 2019, we identified 113 individual broods comprising 827 ducklings" (4). Drones are useful to study the animals across the earth in their habitat but can also be used to find the endangered animals that are disappearing as the days continue.

We can see that many observations were completed in a short period with the use of drone technology. In recent years, drones have allowed many agencies to closely monitor endangered species as well as other species. With the damage to many ecosystems, there has been extinction and endangerment of certain species of animals. Scientists have used drones to collect DNA from endangered marine mammal species to detect animal health. "The modified consumer drone flies through the exhaled blow of a whale and collects 'snot' on Petri

dishes" (10). Researchers at Liverpool John Moores University have used thermal imaging on drones to help detect endangered species in Madagascar. "Each species has a unique thermal fingerprint, so once the animal is detected by drone-mounted infrared cameras, machine learning can be used to tell them apart" (10). There are limits to research on some species. According to NOAA (National Oceanic and Atmospheric Administration), there are permits required to monitor certain protected and endangered marine mammal species. "Researchers may only use UAS to conduct scientific research on protected species if the proper permits and authorizations are secured" (5). These are required if flying under 400 feet of altitude while studying or monitoring marine mammals or turtles. When getting these licenses and permits you are also required to fill out a form describing your use of UAS. With the allowance of conservationists to use UAS in studies of endangered animals, there can be more research allocated to these species without directly impacting their already impacted habitat.

One of the biggest conservation concerns is soil conservation. With unhealthy soil and erosion, ecosystems can't flourish as well as agricultural production is affected. The USDA (United States Department of Agriculture) and NRCS (Natural Resources Conservation Service) have been conducting research with the help of drone technology. According to the USDA, they can use drones in many ways when it comes to Soil and what it is used for, "Drones Can be used for environmental monitoring, allowing for the tracking of soil erosion, water quality and vegetation health" (8). The NRCS in Oregon uses drones to make sure that farmers are following the regulations by conducting flyovers with drones. "NRCS Oregon entered into an agreement with this group to provide high-quality aerial

imagery that meets NRCS sampling protocols for HEL compliance reviews" (7). The U.S. Agricultural Research Service also uses drones to study water compliance and health. The U.S. Agricultural Research Service, meanwhile, analyzes drone imagery and water samples to pinpoint potential problems in irrigation water" (2). With the use of drones by the NRCS they can help protect the soil and groundwater by making sure farmers comply with their water conservation districts. These efforts keep all industries and resources bountiful and plenty.

With all the efforts from agencies such as the National Park Service, NRCS/USDA, NOAA, and the U.S. Forest Service, drones are starting to be a great tool for them to use and implement in their studies. Drones have helped scientists study endangered animals and waterfowl broods. The use of drones by the U.S. Forest Service has allowed them to catch early signs of wildfires as well as see and count the biomass of forests. Lastly, we can see the use of Drones by the USDA and NRCS and their helping detect and monitor the soil and water health used by farmers. As drones become less expensive and even more advanced, their use of them will continue to grow in Conservation efforts.

(This Essay was 1,086 words. The citations and numbers associated are below.)

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