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Drone Ecology

LESLEY EVANS OGDEN

Steep coastal cliffs, foggy weather, and smoke-filled skies can impede wildlife monitoring and endanger the lives of researchers working in remote areas. Field biologists are now exploring the utility of harnessing unmanned aircraft systems (UASs)—or *drones*—as a scientific tool.

“This technology is going to be revolutionary for a lot of [ecology] related fields,” says Adam Watts, assistant research professor at Nevada’s Desert Research Institute.

In 2008, US Geological Survey (USGS) scientists began testing the utility of fixed-wing and hovering aircraft for a variety of missions, such as locating pygmy rabbit burrows in sagebrush, surveying sandhill cranes, and monitoring forest insect infestations. For the pygmy rabbits, which are endangered in Washington State, drones could prove to be a major time saver for closely examining the tiny rabbit’s habitat and food preferences. Biologists have had to painstakingly pick plant leaves and take them to the lab to study chemical signatures. A USGS drone called the Raven can carry cameras capable of infrared spectrometry, a technique that may provide spectral chemical sensing of vegetation from the air, which would vastly speed up access to this type of data.

The US Forest Service and university researchers are also testing drones. Watts used UASs to count manatees, wading birds, and sage grouse nests, and to survey vegetation around Lake Okeechobee while at the University of Florida. And with a \$5 million award from Google, the World Wildlife Fund is testing the deployment of drones to monitor wildlife and to combat the poaching of endangered rhinos, tigers, and elephants. The still-evolving systems may eventually help track down wildlife criminals while reducing personnel time on the ground and providing a deterrent by keeping a watchful eye along roads and fences.

Small UASs can mean large cost savings. The average weekly rate for flying a small UAS with a ground crew is \$3000, explains Mike Hutt, who leads the USGS National UAS Project Office, compared with \$30,000–\$50,000 for similar missions with manned helicopters. With electric engines, small UASs also have smaller ecological footprints than petroleum-fueled manned aircraft do, and their quiet engines are less disruptive to wildlife.

Hutt’s original area of expertise is remote sensing, and, as he explains, UAS data have another clear advantage over satellite data. To monitor Colorado’s pine beetle infestation, the USGS relies on Landsat satellite imagery, which flies over the area during summer afternoons, when thunderstorms build up. “So we would get a lot of images with a lot of clouds. It would take months to get a mosaic of images that would allow us to look [in detail] at an area,” he says. Monitoring the forest with a small drone is a huge advantage, explains Hutt, who thinks the technology will supplement, rather than replace, traditional aircraft and satellite observations.

How difficult is it to fly a UAS? It depends on the size and complexity of the aircraft, explains Dominique Chabot, a PhD student at McGill University who’s studying the utility of UASs, with David Bird, a professor of wildlife biology. A self-described “techno-geek,” Chabot focuses on off-the-shelf electric drones. Originally designed for crop surveillance, these UASs resemble radio-controlled hobby airplanes. “There’s a steep learning curve,” says Chabot. Although aircraft have a preprogrammed autopilot, the user must pilot manually if the aircraft gets into trouble. Chabot spent dozens of hours practicing with a flight simulator.

Nevertheless, technical issues are not the greatest challenge to using UASs, say researchers. The restrictive and sluggish permitting processes required by

Transport Canada and the US Federal Aviation Administration (FAA) stifle the tools’ utility for scientific applications, making ad hoc, time-sensitive flights difficult to arrange. The other challenge, says Bird, is to convince the public “that these planes are not going to be used for terrible things.” Congress has ordered the FAA to overhaul regulations and to open the skies to private drones by 2015, but this will involve navigating what the *Washington Post* describes as “a patchwork of state regulations.”

Perhaps the most important advantage of UASs is the potential to save human lives. “The greatest source of [accidental] mortality to wildlife biologists is dying in a plane or helicopter crash,” says Bird. He had a close call himself in a helicopter and references recent tragedies in Alberta, California, and Idaho, in which biologists and pilots were killed.

Bird, founding editor of the new *Journal of Unmanned Vehicle Systems*, launched by Canada’s National Research Council Press, says that his veer toward drone research was almost accidental. Contacted by farmers wanting him to design a UAS to scare away crop pests such as starlings, Bird says that his “mind exploded” with ideas for using drones to study wildlife. What’s next? This fall, Bird is heading a team of UAS experts to track the movements of threatened woodland caribou bearing satellite transmitters in Goose Bay, Labrador, Canada. For Bird and the other scientists who see their potential, drones are like a child’s new toy: not yet fully understood but promising excitement and a world of possibilities.

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