



An Unmanned Aerial Vehicle for Sub-Saharan Africa (International Potato Center)

Attack of the drones: Delivering data from the sky

Drones, or unmanned aerial vehicles (UAVs), are no longer a thing of the future. From their perspective high in the sky, these hovering insect-like machines grant researchers new and valuable insights on how crops evolve across landscapes and over time.

“Satellite images are not detailed enough . . . UAVs with specially developed cameras are necessary in order to capture the detail and information needed,” explains Hildo Loayza, physicist and member of the drone team at the International Potato Center in Peru, known by its Spanish acronym CIP.

One of the biggest challenges to making smart investments in agriculture is the lack of evidence to base decisions on. Especially in developing countries, the lack of basic data makes it difficult for decision makers to assess the opportunities and trade-offs of different investments or interventions.

But with the use of drones, that status quo may be about to change.

Drones developed and tested in Peru

Scientists from CIP, a partner of the CGIAR Research Program on Water, Land and Ecosystems, have been making significant progress in developing and testing the use of drones for data collection.

When CIP began its remote sensing program more than 12 years ago, it used balloons mounted with cameras. The balloons were often unsafe, expensive and time intensive to develop and operate. But in 2012, the program began using drones, and it was a game changer.

Drones such as the Oktokopter X are capable of carrying up to two kilograms of camera and

computer equipment and flying at altitudes of more than 100 meters for up to 12 minutes, depending on the weight of the sensor. The Oktokopter XL, acquired from MikroKopter in Germany and assembled by CIP scientists, is also able to fly at a stationary position, which makes it an excellent tool for aerial photography.

Photographing the ground from up high, a monitoring activity also referred to as remote sensing, provides valuable information about how crops develop. By inspecting the images captured, scientists can gauge how much light is reflected from plant coverage, which enables them to determine factors such as canopy cover, biomass accumulation, nutrient content, diseases and water use in a certain area.

Testing the UAV (International Potato Center)



In this way, drones play an important role in providing scientists with images and data on plant numbers and type, the lay of agricultural land and patterns in the field associated with the presence of pests and diseases, variations in fertility or damage due to climatic extremes.

Exploring opportunities in Africa

Last year, CIP scientists expanded their activities and began constructing remote sensing tools to study potato and sweet potato cropping areas in Africa.

Many farmers in Africa, as in Peru, grow their crops on small plots and marginal lands, oftentimes growing more than one crop at a time. This diversity complicates assessments of agricultural activities, and one goal of introducing drones is to provide decision makers with more precise information.

To illustrate the potential for remote sensing with drones, the team conducted a case study in Kumi District in Uganda.

“By looking at satellite images of very high resolution, we discovered that the government’s statistics underestimated the area planted with sweet potato by around 50%,” explains Project Leader Roberto Quiroz from CIP. The misestimation is understandable because a lot of the plots are nearby roads or mixed in with other land uses.

However, high quality satellite images of landscapes may not always be available.

“Then you ask yourself, why do you need drones if you can do the same thing with satellite images? Well, we tried making similar assessments of potato crops in Kabale District in Uganda and in Ethiopia. We could not get a single image throughout the growing season due to clouds – and that’s where drones make a difference,” argues Quiroz.

In addition, acquiring satellite imagery is much more costly than the use of drones.

The CIP team is working to create opportunities for stakeholders, such as government institutions, to use remote sensing as a monitoring tool that can help forecast yields and refine agricultural statistics. Already, CIP collaborates with ministries of agriculture and bureaus of statistics in Tanzania and Uganda, is negotiating with similar institutions in Rwanda, and has launched a community of practice that includes stakeholders from all sectors.

Quiroz describes, “For example, we are working with the University of Nairobi to potentially build consultancy teams that can provide remote sensing

services in neighboring countries – while at the same time creating jobs for young professionals.”

Potential for use in developing countries everywhere

The drone team at CIP has been breaking new ground with its research on using drones for remote sensing, and researchers around the world seem interested in applying the technology.

Already, one PhD student from Panama is writing his thesis using this technology, and next year, the Institute of Agricultural Resources and Regional Planning of the Chinese Academy of Agricultural

Sciences will send two students to CIP to explore the potential for using drones in agricultural research in China.

The work on drones in agricultural research is part of a larger effort across the CGIAR, with activities linked to the CGIAR Research Program on Roots, Tubers and Bananas (RTB), the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), as well as the CGIAR Research Program on Water, Land and Ecosystems.



UAVs help researchers understand how crops evolve across landscapes over time. (International Potato Center)

The CGIAR Research Program on Water, Land and Ecosystems (WLE) combines the resources of 11 CGIAR centers, the Food and Agriculture Organization of the United Nations (FAO) and numerous national, regional and international partners to provide an integrated approach to natural resource management research. WLE promotes a new approach to sustainable intensification in which a healthy functioning ecosystem is seen as a prerequisite to agricultural development, resilience of food systems and human well-being. This program is led by the International Water Management Institute (IWMI), a member of the CGIAR Consortium, and is supported by CGIAR, a global research partnership for a food-secure future. wle.cgiar.org

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