# Using Drones for Land Use Education

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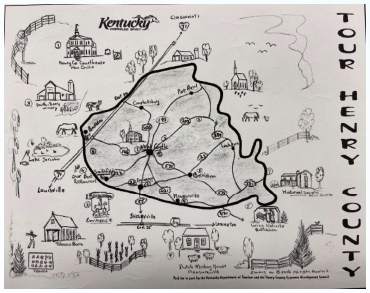
## Abstract

Summer 2020 ESIP Educator FUNding Friday work sample highlighting viability and use of drones in local aerial photography for land-use and human impact education in middle and high school.

## Introduction

As teachers in a rural county, our goal was to introduce technology that could help students see the impacts not only of natural weather patterns but also human activity on landforms in their communities. At the same time, we wanted to find a way to bring hands-on instruction to our classes this school year, knowing that there would be at least some impact on teaching due to the ongoing COVID-19 restrictions on in-person learning. To this end, we began an initiative, funded by the Summer 2020 ESIP FUNding Friday program, to get that technology, and the understanding behind what we're looking for, into the hands of students in a Corona-friendly manner.




## Materials and Resources

DJI Phantom 3 Drone
DJI Mavic Air 2 Drone
Xello Drones by DJI
Erosion Table
Google Meet
Henry County, KY Topography, Watershed, and Geologic Resource Maps

## Methodology

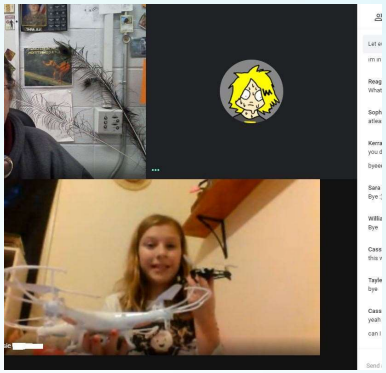
Addressing the wide requirements of the appropriate standards across many grade levels is a large undertaking. Focusing on the performance indicators, we realized that students would need to have a strong understanding of the advantages and disadvantages that drones have in aerial survey photography. They would also need to be comfortable flying the drones at a distance and being able to match landmarks to the screen reliably so that photographs could be compared over time. Our first semester was spent in a mixture of online-only and reduced in-person classes, and so keeping to a routine was difficult. However, in order to get the technology into the hands of the students, they were allowed to "check out" the drones (no small leap of faith when dealing with middle and high school students!) in order to get hands-on experience. Students were required to provide evidence that they used the drones for earth science or agriculture related assignments. Some of those photos that the students took are included below.

Aerial top-down view of neighboring farm, with water tank as reference point

Aerial top-down view of neighboring farm, with the same drone orientation as above but centered further south

While some land-use photographs have been taken, the unusual nature of the school year has prevented the proposed implementation schedule from happening. We are hopeful that the Spring semester will allow for a more predictable routine of photographing and analyzing land use and activities surrounding the school campus. During this semester we will be looking at the results of our photographs and analyzing that data to determine what factors caused any differences between dates.

One student checked out the Mavic Air 2 to practice flying and used it to find two missing horses on their property that weekend.



A student providing "proof of life" for the drones she checked out for the week

## Kentucky Academic Standards

**06-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
**08-LS2-4** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
**08-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
**08-ESS-3-3** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
**HS-ESS2-2** Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause change to other Earth systems.
**HS-ESS2-5** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
**HS-ESS3-4** Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
**Science and Engineering Practices**: Constructing Explanations and Designing Solutions, Engaging in Argument from Evidence, Developing and Using Models, Planning and Carrying Out Investigations, Analyzing and Interpreting Data
**Crosscutting Concepts**: Stability and Change, Patterns, Cause and Effect, Systems and Systems Models

## Next Steps

The students were engaged immediately, even those students that might be considered "leisure learners". While not everyone wanted to fly the drone at the school, all were interested in the flying of the drone and provided helpful hints to the pilot in charge.
The next "big step" is to create geo-sync'd aerial photographs of the three farms surrounding the school campus over specific intervals of time. Near the end of the semester/school year, we will analyze those photos for changes and corroborate those changes with weather phenomenon and human activity. Students will create an explanation for visual changes as well as planning the investigation for next fall's students with regards to which areas to focus, what phenomena to study, etc.