PLS 198: UAVs in Agriculture
Spring 2019

Course syllabus

I. Basic information

Lecture: Mon. 11:00-11:50am
Asmundson 242 (Big Hanna)
Laboratory: Wed. 1:10-4:00pm
Asmundson 242, field site, PES 1137
Instructor: Travis Parker
Contact: trparker@ucdavis.edu
Office hours: By appointment
Instructor-of-record: Paul Gepts
Contact: plgepts@ucdavis.edu

II. Description

Pre-requisite: Consent of instructor

Lecture: 1 hour; laboratory: 3 hours. Applications for unmanned aerial vehicles in agriculture, including federal drone regulations, sensor types, mission planning, image capture, processing in QGIS, and future directions. No previous drone experience required.

III. Grading

Exam 1:	30%
Final exam:	30%
Final project:	30%
Participation:	10%

Both exams will be one third multiple choice, two thirds short answer. The final will be cumulative. Actual questions released from the FAA's knowledge test will be included in the tests, so it may be worthwhile to study practice tests accordingly.

The final project will be team-based, and will require you to come up with a research question, state your hypotheses, capture the required imagery, and process the results using the software skills you will develop during the course. These will need to be submitted by 5pm on 6/12, the day of the final.

Standard letter grading will be used. The class can be taken P/NP by taking a copy of the syllabus to the Office of the Registrar and filing a 'Grading Variance Exception' petition by the 25th day of instruction.

Forming a study groups for part 107 certification is encouraged.

IV. Course objectives

By the end of the course, students are expected to be able to:
a. Describe the current range of activities being conducted with UAVs.
b. Compare and contrast the value of the major vehicle and sensor types for aerial imagery acquisition.
c. Discuss the major vegetation indices that can be captured using drones, and describe their relevance for precision agriculture and plant breeding.
d. Learn how to safely operate a UAV, in both manual and programmed flight modes.
e. Understand the legal regulations surrounding UAV use to a level of competency that they could pass the Part 107 Remote PIC exam.
f. Develop flight plans for optimal orthomosaic quality of a given area.
g. Create 2D orthomosaics and 3D models from drone-based imagery using a range of sensor types.
h. Compare and contrast the use of UAVs in diverse agricultural systems, such as row crops, rangeland, and plant breeding projects.
i. Employ scalable techniques such as masking and high-throughput shapefile construction to efficiently isolate areas of interest in GIS.
j. Apply GIS to extract geospatial data gathered by UAVs, such as canopy geometry and vegetation indices.
k. Use UAV-based imagery and models to answer a pertinent research question.
l. Discuss the future of drones and what factors might affect their widespread use.
m. Describe current and future issues surrounding drone use.

V. Meeting locations

Lecture location:

Asmundson 242 (Big Hanna): All dates

Lab locations:

Asmundson 242: 4/3, 4/10, 4/17, 4/24

Field site: 5/1, 5/8. The main field site will be immediately south of the sheep unit, on the west side of highway 113. This is far from buildings, pedestrian traffic, and the university airport, and is very close to row crop fields, orchards, vineyards, and pasture area. If you plan a project in another area for 5/8, please let Travis know at least three days in advance.

Field site:
https://www.google.com/maps/place/38%C2%B031'35.0%22N+121%C2%B046'30.8%22W/@38.5243019,-121.7772296,1274m/data=!3m1!1e3!4m6!3m5!1s0x0:0x0!7e2!8m2!3d38.5263841!4d-121.7752121

Computer labs: The final labs will be in the computer lab. PES 1137 will be the meeting location on 5/15, 5/22, 5/29, and 6/5.

VI. Course timeline

Lecture date	Lecture topic	Additional personnel	Lab date	Laboratory topic	Lab location	Additional personnel
4/1	Course overview, the use of UAVs in agriculture		4/3	Introduction, discussion of student's interests. In-field flight introduction. UC flight safety and regulations.	Asmundson 242	Telha Rehman
4/8	Mission planning and imagery processing		4/10	FAA compliance part I. Flight safety review.	Asmundson 242	
4/15	The right tool for the job: Comparison of UAVs with traditional airborne platforms, major UAV classes		4/17	FAA compliance and remote pilot certification (Part II)	Asmundson 242	
4/22	Sensors and cameras, vegetation indices		4/24	Q and A about sensors, cameras, indices. Group assignments, prep for projects and final exam. Flight simulator. Safety homework.	Asmundson 242	Alex Mandel
4/29	Exam 1		5/1	In-field flight training	Field site	Taylor Becker
5/6	UAV applications: Genetics of weed competitiveness; SmartFarm (Project plan due)	Jill Brigham	5/8	Project imagery	Field site	
5/13	UAV applications: Remote sensing applications for biostimulant screening in processing tomatoes	Meerae Park and Zhehan Tang	5/15	Orthomosaicking, NDVI, and advanced outputs using Pix4Dmapper, QGIS basics?	PES 1137	
5/20	UAV applications: Nitrogen management in small grains	Taylor Nelsen	5/22	GIS in UAS research	PES 1137	
5/27	No lecture, memorial day		5/29	GIS and R in UAS research	PES 1137	Alex Mandel & interns?
6/3	UAS directions and issues	Elvira de Lange?	6/5	Final projects	PES 1137	Taylor Nelsen?
6/12	3:30-5:30pm: Final exam					