



In partnership with the Informatics and GIS Statewide (IGIS) Program
UC Division of Agriculture and Natural Resources

Dr. Sean Hogan
Academic Coordinator, IGIS
Lead Instructor

Dr. Andy Lyons
Program Coordinator, IGIS
Lead Instructor

Dr. David Bird
Emeritus Professor,
McGill University in Montreal, Quebec

Steve Goldman
Geographic Information Officer and UAS Coordinator, CDFW

Stephen Earsom
Biologist-Pilot, Regions 4 & 5 Aviation Manager, USFWS

Jacob Flanagan
GIS Programmer & Consultant, IGIS

Dr. Kelly Easterday
Postdoctoral Researcher, UC Berkeley

Description: This workshop is designed to provide an overview of unmanned aerial systems (UAS) technology, regulations and image analysis in support of drone applications. It is targeted towards biologists who are interested exploring practical applications of UAS. Participants will gain practice conducting flight operations using two popular UAS platforms. Additionally, we'll discuss geospatial technologies for monitoring and mapping natural resources with hands-on experience on practical examples.

An optional [Mentored Research Project](#) takes place at the end of the workshop and will allow participants to practice what they've learned through a project designed by David Bird, renown ornithologist and Editor of The Journal of UAS.

What to Expect

Participants will come away with a basic understanding of drone technology and operations, how they are regulated by the FAA, USFWS and CDFW, and what to consider when planning a survey or project involving drones. Participants will also have the unique opportunity to develop their flight skills using a drone simulator followed by actual flights under supervision of a certified drone pilot, and data processing with Pix4D on their personal laptop. A detailed workshop schedule can be found below. Note this course is not intended to serve as a FAA Part 107 prep class.

Participants should be in good physical condition, capable of hiking up to a couple miles with a backpack.

Mentored Research Project (Optional)

The optional Mentored Research Project takes place April 12-13 and will allow participants to practice what they've learned by participating in a designed research project modeled by Dr. David Bird and the instructors. The research project will enable teams of participants to fly drones over a segment of Hastings Reserve to locate and count mock-turkeys (created using plastic garbage bags), which will be set out by instructors. The project will be used to test the efficacy of counting wildlife by drones, and provide participants with experience of an entire drone science workflow from setting goals to presenting results. **A prerequisite for the Mentored Research Project is completing the main workshop or a comparable drone course** (contact us for details).

TESTIMONIALS

"This was a great experience!" - SW, 2018

"I learned so much about applications, regulation, and logistics of flying.... this was the best workshop I've ever been to!" - EK, 2018

"Thank you! Best workshop ever! High value and time well spent!" - KB, 2018

"Loved this workshop! Best I've ever taken" - MR, 2018



Blog & Video

For a **description of the 2018 workshop**, please see the [IGIS Blog](#).

For an aerial video taken of the class by drone, check out this [YouTube Video!](#)

Registration

Registration cost includes one participant spot for the class in addition to meals at UC Hastings Reserve. We will travel to field sites in participant vehicles. Onsite lodging provided for an additional fee.

All registrants complete the secure online form at:

https://www.wildlifeprofessional.org/western/drone2019_reg.php

The cutoff date for early registration is **March 9, 2019**. Registration is payable by check or credit card and must be received or postmarked by **March 26, 2019**.

Registration Categories	Early Reg (by 3/9/19)	Late Reg (after 3/9/19)
	Main Class (April 9-12)	
Member, TWS Western Section or IGIS	\$475	\$520
Non-Member	\$525	\$565
Student/Early Career professional* (2 spots available at this rate)	\$375	\$415
	Mentored Research Project (April 12-13)	
Member, TWS Western Section or IGIS	\$195	\$235
Non-Member	\$240	\$280
Student/Early Career professional* (2 spots available at this rate)	\$100	\$140
	Lodging Hastings Reserve	
Staying Onsite During Main Class	\$125	\$150
Staying Onsite During Mentored Research	\$50	\$75
*Must show proof of current registration at an accredited university, or graduation within 1 year.		

The maximum enrollment is **24** for the main class and **18** for the Mentored Research Project. After the class is filled, a waiting list will be kept. A minimum of 13 participants must register by **March 9** or the workshop will be cancelled and all registration fees will be returned.

Cancellation and Refund Policy can be found at the [registration page](#).



Room and Board

Lodging

Lodging at Hastings is additional to the registration. Most lodging is dorm-style, and we have reserved the Hasting's Cabin, Ranch House, School House, and Bunk House. A refrigerator and cooking facilities are present. Virtual tours of the buildings can be found [here](#). A limited number of camping options are possible if requested through the Workshop Coordinator.



Facilities

The dorm rooms come with showers, flush toilets, and electricity. Campers may use the bathrooms within the classroom and dorms. **Cell service** is virtually nonexistent at Hastings. Please do not expect to be able to use **WIFI** or **Cell Phones** at the reserve, as both services are extremely spotty.

The dorms provide mattresses, but you'll need to bring your own sheets/bedding and sleeping bag. If you have special sleeping needs, please alert the [workshop coordinator](#) in your registration!





Off-Site Lodging

If you choose not to stay with us, the nearest lodging can be found in Carmel Valley and can be found [here](#). As these options are limited, please be sure to book early! Please inform the workshop coordinator of your lodging plans when you register!



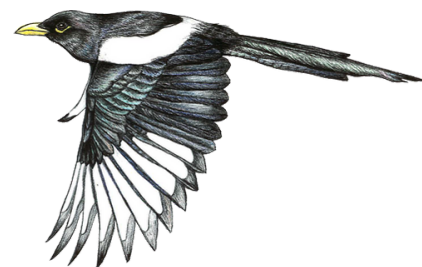
Location

Hastings Natural History Reservation

[The UC Hastings Reserve](#) provides the wildlands and facilities to conduct university and graduate level studies of natural systems in the Santa Lucia mountain range in Monterey County, California. A representative ecosystem of about 2,500 acres, Hastings was established in 1937 to be managed with minimal disturbance for research and education. Hastings encourages a community of researchers to live lightly in the ecosystem they study. We will encourage and provide time to explore and enjoy the reserve and its numerous trails.

[UC Hastings Natural History Reservation](#)
[38601 East Carmel Valley Rd.](#)
[Carmel Valley, CA 93924](#)

For more about the Reserve, please familiarize yourself with the [Hastings Welcome](#).





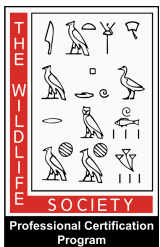
Road Conditions

There are a couple low water crossing coming in, but everyone should be able to get through OK if you go slow! Some very low clearance cars get through fine. We won't be driving much once we arrive, although you are free to travel on and off the reserve.

Hastings Etiquette

Hastings Reserve maintains 10PM-7AM quiet hours. Keep in mind that there will be long-term researchers using the reserve. Pets are not permitted on the workshop. Smoking is NOT allowed in any building or the grounds of Hastings, only within your personal vehicle.

[CLICK HERE FOR A VIRTUAL TOUR!](#)



Certified Wildlife Biologist Renewal/Professional Development Certificate Program

The Wildlife Society will allow a maximum of 16.5 Continuing Education Units in Category I of the Certified Wildlife Biologist Renewal/Professional Development Certificate Program.

A total of 19.5 will be allowed if participants choose to do the mentored research project in addition.





Workshop Schedule

(SUBJECT TO CHANGE PER INSTRUCTORS)

MAIN CLASS

Tuesday April 9, 2019 (Optional Early Registration)

- 3:00 - 4:30** Early Registration/Check-In/Explore Hastings Reserve
- 4:30 - 5:15** Introductions and Ice Breaker (Ivan)
- 5:15 - 5:30** Hastings Reserve Lecture (Hastings Reserve Manager)
- 5:30 - 6:30** Intro Presentation (Sean)
- 6:30 - 7:30** Welcome Dinner and Happy Hour
- 7:30 - 9:30** Evening Plenary (Dr. David Bird)

Wednesday April 10, 2019

- 7:00 - 8:00** Breakfast for Early Registrants
- 8:00 - 8:15** Morning Announcements (Ivan)
- 8:15 - 9:15** Equipment Orientation/Show and Tell
- 9:15 - 9:45** General FAA Regulations (Andy)
- 10:00 - 10:30** Forensic Diagnosis, Risk Matrix/Assessment
- 10:30 - 10:45** Break
- 10:30 - 11:30** USFWS Policy and Drones (Stephen Earsom)
- 11:30 - 12:30** CDFW Policy and Drones (Steve Goldman)
- 12:30 - 2:30** Lunch and Explore Hastings
- 2:30 - 3:00** Regulations Panel Discussion (Stephen Earsom, Steve Goldman, David Bird, Sean Hogan, Jacob, Kelly)
Andy as moderator
- 3:30 - 4:00** A History of Drone Use and Wildlife (Dr. David Bird)
- 4:00 - 4:30** Mission Planning, Part 1 (Kelly)
- 4:30 - 5:45** Mission Planning Demo
- 5:45 - 6:30** Mission Planning Practice on Your Devices
- 6:30 - 7:30** Dinner
- 7:30 - 9:00** Social Hour at the Ranch Cabin



Thursday April 11, 2019

- 7:00 - 8:00** Breakfast
- 8:00 - 8:15** Morning Announcements (Ivan)
- 8:15 - 8:30** Day 1 Review and Overview of Day 2 (Andy)
- 8:30 - 9:30** Safety (Sean and Andy)
- 9:30 - 11:30** Field Flight Operation (Sean, Andy, Steve Goldman, Jacob, Kelly)
- 11:30 - 12:30** Free Time/Continue Flight Operation/Fixed-wing e-Bee demo
- 12:30 - 1:30** Lunch
- 1:30 - 2:00** Field Discussion: What We Learned (Andy)
- 2:00 - 3:45** Introduction to Image Data Processing and Management (with Pix4D) (Sean and Andy)
- 3:45 - 4:00** Break
- 4:00 - 5:00** Introduction to GIS/Mapping



- 6:30 - 7:30** Bat Fly-Out
- 7:00 - 9:00** Dinner, Participant 5-Minute Lightning Talks and Poster Session (Participants, Kelly - 15 minutes)
- Pub Quiz

Friday, April 12, 2019

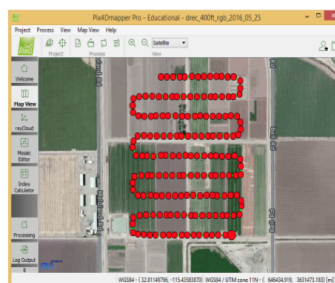
- 6:00 - 7:00** Optional Bird Walk
- 7:00 - 8:00** Breakfast/Pack Lunch for Field
- 8:00 - 8:15** Morning Announcements (Ivan)
- 8:15 - 9:15** Getting People Set up for Pix4D (Sean and Andy)
- 9:15 - 10:15** Practical GIS Exercise & Show and Tell (Sean)
- 10:15 - 10:30** Break
- 10:30 - 10:45** Hangar 360 Demo (Sean and Andy)
- 10:45 - 1:30** Continued Drone Flight Practice/Packed Lunch (Sean, Andy, Kelly)
- 1:30 - 2:30** Continue Orthomosaics Exercise (Sean and Andy)
- 2:30 - 3:00** Wrap up, Evaluations for Main Class (Ivan and Andy)
- 3:00 - 4:00** Clean Up
- 4:00** - Main Class Departure

MENTORED RESEARCH PROJECT

- 4:00 - 4:30** Overview of Capstone Project (Sean)
- 4:30 - 5:15** Conception and Prior Projects (David)
- 6:00 - 6:30** Dinner
- 7:00 - 8:30** Turkey Making Contest at the Ranch Cabin

Saturday, April 13, 2019 - Turkey Counting Project

- 7:00 - 8:00** Turkey Placement (Instructors)
- 8:00 - 9:00** Breakfast
- 9:00 - 9:30** Safety Reminders
- 9:30 - 11:00** Capstone Project Flights
- 11:00 - 12:00** Set Up for Post-Processing
- 12:00 - 1:30** Lunch
- 1:30 - 3:00** Post-Processing (Sean, Andy)
- 3:00 - 4:30** Show & Tell
- 4:30 - 5:00** Wrap Up (Andy, Ivan)





Preparation

Packing List

- Laptop Computer* for note taking and data analysis (optional, but recommended, see below)
- headlamp (required) bring new batteries and spare batteries too
- boots which cover the ankle (required!)
- windbreaker
- hat and sunscreen
- sunglasses
- fleece jacket or vest
- rain gear
- layered clothing
- hat(s) (both for sun and cold evenings)
- water bottle(s) - refillable please – there is good tap water but bring large jugs of drinking water if you want it
- **sleeping bag** – if you are in a dorm
- **linens**
- **pillow/pillowcase**
- **towels**
- **washcloth**
- personal toiletries – shampoo, soap, etc.
- **EARPLUGS!**
- prescription drugs
- small notebook for the field
- clipboard
- pen or pencil
- backpack or field pack
- thermal coffee mug to help reduce paper waste
- lunch box or bag to help reduce paper waste
- slip-on shoes for nighttime trips to the restroom

Note: You do not need to bring a drone.

Laptop and Software

On Friday April 12th, we'll do a couple of hands-on data processing and analysis exercises using Pix4Dmapper (an image stitching program) and ArcGIS. We encourage everyone to bring a laptop with the necessary software installed (instructions on obtaining temporary ArcGIS licenses will be provided), in order to complete the exercises on their own. However those who don't have laptops with the software will be able to work with someone else or follow along as one of the instructors goes through the exercise on the projector.

For the exercises, a Windows laptop is required. Macs do not work with this software. You will need 20GB of free hard drive space and a minimum of 8GB RAM (16GB recommended).

Instructor Biographies

Dr. Sean Hogan



Sean Hogan is the Academic Coordinator for the Informatics and GIS Systems (IGIS) Program in the UC Division of Agriculture and Natural Resources (ANR). Sean received his Ph.D. in Geography at UC Davis, completing a dissertation interested in: "Machine learning and data fusion methods for optimizing remote sensing and GIS based land cover classifications." Sean also has a double major B.A. in Spanish and Geography from CSU Sacramento and a M.A. in Geography from UC Davis. The core emphasis of his master's thesis was mapping spatial variability of water quality across California's rangeland watersheds.

Prior to joining ANR, Sean was a member of the UC Davis Center for Spatial Technology and Remote Sensing where he provided GIS and remote sensing support for interests in precision agriculture, monitoring natural resources and calibration of NASA's airborne imagers. He has also worked as a member of the UC Davis Rangeland Watershed Laboratory, where he provided GIS support for rangeland management and water quality research. GIS and remote sensing however were not Sean's first career specialties. He also served as deputy sheriff in the County of Sacramento (1998-2004), and before that grew up on a small ranch in the rural foothills of California, where he trained horses and helped his father with his work as a professional logger.

Sean created the IGIS style of drone workshop, making it one of the only workshops in the country under which it's possible for us to gain hands-on experience with both flights and post-processing of data.

Dr. Andy Lyons



Andy Lyons is Program Coordinator for the Informatics and GIS Program (IGIS) in the UC Division of Agriculture and Natural Resources. An alumni of UC Berkeley, he has conducted research in wildlife ecology and conservation, the politics of community based conservation programs, animal movement, land use and land cover change outside national parks, and the impact of food security programs in post-disaster contexts.

Andy has taught classes at Berkeley and Stanford in population modeling, spatial analysis using open source software, cryptography, environmental problem solving, sustainability and social justice, African studies, and environmental narratives in science fiction film. Geographically, his work has focused mostly on countries in southern Africa and California.



Dr. David Bird

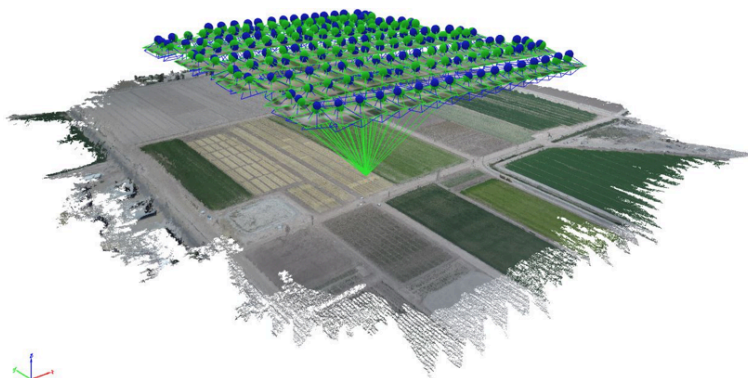


Dr. David Bird, dubbed the world expert in drone use for wildlife studies, is a recently retired Professor Emeritus of Wildlife Biology and Director of the Avian Science and Conservation Centre of McGill University in Montreal, Quebec. He received his masters and doctorate in Wildlife Biology at the same university. A renowned ornithologist, Dr. Bird is the past-president of both the Raptor Research Foundation Inc. and the Society of Canadian Ornithologists. He has also served on the Board of Directors of the American Birding Association, and was elected a member of the American Ornithological Union, the International Ornithological Union, the Board of Directors of Bird Studies Canada, and the board of Unmanned Systems Canada.

Dr. Bird is the founding editor of the Journal of Unmanned Vehicle Systems, and has published 200 peer-reviewed papers ranging on the subjects of bird husbandry, ethology, scientific communication, endangered species, human-wildlife conflicts, toxicology, and, of course, the use of UAVs. Among his numerous books, Dr. Bird wrote 'Birds of Eastern Canada' and 'Birds of Western Canada'. He also co-edited both editions of the widely acclaimed 'Raptor Management and Research Techniques'.

Dr. Bird's accomplishments include being the first person in the world to produce a falcon from artificial insemination and the first to breed and release loggerhead shrikes. Among his innumerable awards are the 1st Snowy Owl Award for Bird Conservation given by the Quebec Zoological Gardens and Quebec Ministry of Recreation, Fish and Game; the Raptor Research Foundation for Significant Contributions to Captive Breeding and Conservation of Birds of Prey; and the Roland Michener Conservation Award from the Canadian Wildlife Federation.

You may have seen Dr. Bird in one of his many television appearances, or heard of his involvement in the National Bird Project, which hopes to name the gray jay (now Canada jay, also thanks to Dave) as Canada's National Bird.





Steve Goldman

Steve Goldman has over 25 years of experience innovating with geospatial technologies focusing on natural resources management issues in California. He has worked across sectors (private/public) and is successful at implementing new technology solutions. Beyond pure GIS, he has focused on mobile content delivery and UAS (drone) program implementation.



Mr. Goldman spearheaded the UAS (drone) program for natural resource and enforcement projects within the California Department of Fish and Wildlife and serves as the Department's UAS Coordinator. He currently manages all aspects of GIS use and application towards the conservation goals of the CDFW, including a variety of projects spanning wildlife, fisheries, water, habitat conservation, oil spill response, lands, vegetation mapping, and rare species data. Additionally, he runs a small team of application developers building public-facing map-based online tools for

data discovery and decision making.

Mr. Goldman also serves as the State Representative on the Executive Committee of the California GIS Council. The purpose of the Council is to promote a greater understanding and use of the benefits of GIS, and facilitate cooperation throughout the State of California by supporting the collection, acquisition, sharing, and dissemination of GIS data, standards, and policies. He is also the CDFW representative for the State's GIS Leadership Council, where he helps develop policy, standards, and initiatives within California State Government.

Stephen Earsom



As the Southwest Region Aviation Manager of the U.S. Fish and Wildlife Service, **Stephen Earsom** has one of the most extraordinary job descriptions of any biologist. He manages aviation operations (of both manned and unmanned aerial systems) for 23 eastern states and the Caribbean. An advanced pilot instructor, he also develops trainings and safety curricula for aircraft, including as a leader of the U.S. Helicopter Safety Team. Additionally, he was the Chief Aerobics Flight Instructor for Aviation Adventures, providing advanced instruction in single-engine, multi-engine, and tailwheel aircraft.

In the realm of UAS, Mr. Earsom and his team have pioneered the use of UAS within the Service as a tool for wildlife population counts, wildfire spotting, invasive species monitoring, habitat mapping, tracking illegal land use, and even search and rescue.

Mr. Earsom is also a conservation biologist, and serves as the lead on water resources issues for Migratory Bird Program. He describes himself as a "leader and member of teams that resolve knotty issues in conservation". His mantra is "we can do better".



Dr. Kelly Easterday

Kelly Easterday is a Postdoctoral Researcher at UC Berkeley. Her research analyzes complex drivers of spatiotemporal change, including: climate, fire, land management, and the ecological history of place. Drawing on the rapidly emerging field of spatial data science including remote sensing, and geographic analysis yet rooted in the theoretical constructs of historical ecology, landscape ecology, biogeography, land management and policy, and forest ecology Kelly's work pursues a geospatially motivated mixed methods and interdisciplinary approach to assess these relationships and develop applied solutions across scales.

Jacob Flanagan

Jacob Flanagan is a Drone Technician and Data Analyst with the UCANR IGIS program. For the last several years he has used LiDAR and other remote sensing technologies to better acquire data and understand the environment, especially utilizing small UASs for precision applications. As a software and system developer, he has been working to combine multiple remote sensing methods that has led to new technologies and applications in this industry while making existing technologies more affordable. Jacob has a passion for connecting with people to discuss and develop new applications that are practical and could help shape the future.

