Research Activity Report
Supported by "Leading Graduate Program in Primatology and Wildlife Science"

	2024. 11, 11
Affiliation/Position	Wildlife Research Center/M1
Name	Casey Mack

1. Country/location of visit

Chubu University/Ena City

2. Research project

Basic Skills for Field Biology course for M1 students

3. Date (departing from/returning to Japan)

2023. 11. 06 – 2023. 11.08 (3 days)

4. Main host researcher and affiliation

Prof. Ikki Matsuda, WRC, Kyoto University & Dr. Sugita Satoru, Chubu University

5. Progress and results of your research/activity

The Basic Skills for Field Biology field course was an exciting 3-day intensive, filled with lectures and hands-on learning.

On the first day, we heard a lecture on the laws of unmanned aerial vehicle use in Japan, as well as the parts of the drone and what they do. We learned that drone operators must register their drone with the Ministry of Land and Forest and receive a license before flying it. We learned that the laws of done usage should be followed to make sure everyone is safe. For example, we learned you cannot fly over populated areas and events.

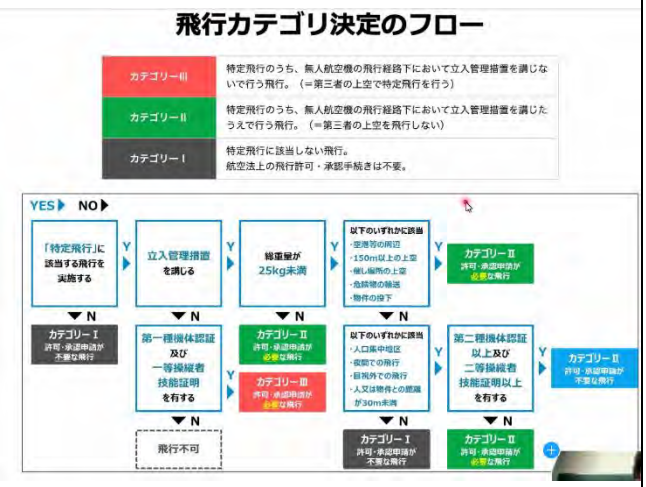

Figure 1 Flowchart of questions to ask before using the drone to figure out which permits you need.

Then, we learned the interface for the drone control center, as seen in the screen capture on the right. This screen is quite busy, displaying lots of information such as the drone distance from the 'home point' in both horizontal and vertical measures, as well as horizontal and vertical speed, battery percentage, GPS connection, and satellite imagery.

Figure 2 Display screen labeling some of the controls and information

Then, there are controls where you can adjust the settings of the camera on the drone. We practiced manually operating drones using "micro-drones" indoors. We were able to practice the manual controls, as these are the same on the larger drones, too. It is kind of like a video game consol!

These drones were less than one hundred grams, and do not require the same laws that larger drones have. These batteries only lasted about 3 minutes each! This drone model kit included three batteries in the pack, so my whole group was able to practice flying the micro drones. During this part, we learned how important communication is between team members. It is very useful to have at least two people helping to operate the drone, one to use the controls, and one to hold the screen and update the pilot with any important information if it is difficult for them to view the screen while flying. The screen-holder can also answer any questions if any passers-by ask questions to the team without distracting the pilot! We also learned about the importance of pointing the controller toward the drone to allow the best signal to be transmitted.

Figure 3 My group mates and I spelling out WRC, captured by the drone

Next, we went outside and practiced flying the drones! We practiced using the 'return to home' function, which overrides the controls and brings the drone back to the starting point automatically. This came in handy later, when the wind speed picked up and created dangerous flying conditions as it was near electricity lines, and we got an alert on the screen to land the drone ASAP. We used this function without incident! It was surprising to me how short the battery life was on the drone. We got alerts on the screen when the battery was close to dying, and it even marks the farthest distance from the home point where the 'return to home' function can work, or else the battery would not make it all the way back and you have to land wherever it dies.

We also created a pre-determined drone flight route for our drone, using the DGI Pro software, on "Waypoint Flight mode." Here, we could pin places on the map for our drone to locate, then choose an action at each point if we want. We can also choose the height, speed, and action that the drone does after finishing the mission. This mode does not require manual operations, but it is still important for the drone operator to keep the drone in their sight, in case of any unexpected interferences.

On the final day, we learned how to digitally analyze the data collected from the drone and create renderings from it using AgiSoft MetaShape software. We created our own 'Orthophoto', '3D Point Cloud,' and 'Digital Surface Model (DSM)' that showed the elevation of the area. The renderings use a lot of power to make, so sometimes your laptop might take a long time!

Lastly, we heard a lecture on the many different applications for drone use, including disaster prevention and coverage. For example, after a landslide, it would be quite dangerous to access the area and check for injured people and assess the damage, but a drone can fly over the area safely. During this lecture, we learned the pros and cons of several types of drones. The multicopter drone, which is the one we used in this course, has multiple motors allowing it to hover in place, and gain altitude without moving horizontally. This makes for great photo and video capturing, but it has quite a short battery lifetime and does not perform so well at high altitudes. The fixed-wing type is lighter and can fly faster

and longer. But, it is not able to hover and does not perform well in lower altitude flights. Thus, it is important to consider many factors before choosing the best drone model for your intended purposes.

We also learned about the factors to consider when deciding to use a drone versus aircraft versus satellite imagery. Each device provides a different spatial resolution of the imagery: drones at 0.01m-0.2m, aircraft at 0.1m to 1m, and satellites at 0.3m to 100m. Thus, smaller devices like drones can be more accurate, but it would take a lot longer to cover a large area compared to satellite imagery or even aircraft.

I hope I can implement what I have learned in this intensive course into my field research. I think it would be interesting (and perhaps more cost effective) to collect population location data with the drones that have GPS tracking technology. Also, drone surveys would be much more cost effective faster, and easier to perform for vegetation monitoring than periodically doing traditional methods like ground or helicopter surveys. Information collected from the drone can be utilized immediately, as opposed to hours or days with other methods. Though, I will have to investigate the laws and regulations of drone usage at my field site, because each country determines their own regulations.

Figure 4 Example of Ortho-photo and photo position renderings from MetaShape

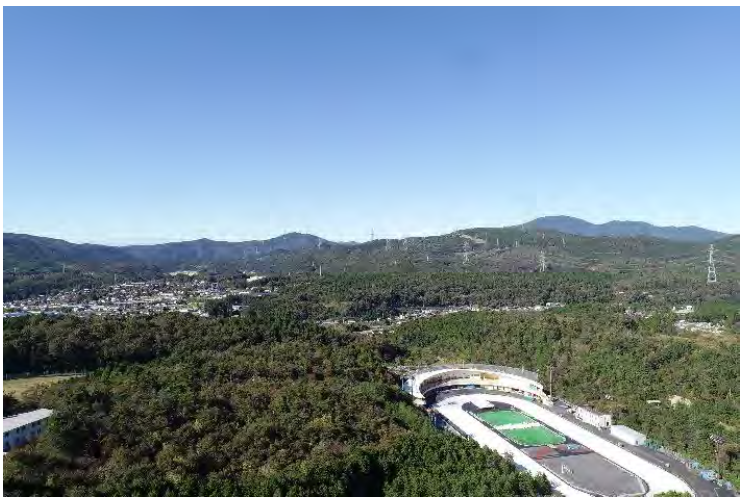

Figure 5 Photo of the field captured using the drone

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6. Others

Acknowledgements

- I would like to thank Dr Sugita Satoru, of Chubu University International Digital Earth Applied Science Research Center. He provided great insight into the methods and uses for drone flights, as well as the actual drones and explanations of the analysis software!
- I would also like to thank the PWS program for the opportunity to attend this program, especially Professor Ikki Matsuda for taking us on this course. Then, I extend my gratitude to my fellow students Xorlali, Liu Liu, Honoka, Madoka, Fitri, Haruka, Hizuki, Gakuto, and Rie (Chubu University PhD student) for their support, translation assistance, and camaraderie!

Figure 6 Group photo at the entrance to the Chubu University Ena Training Center