

**Country for the project**

Colombia

Degree programme

Industrial Engineering and Management

Flood monitoring in the Colombian Andean region using UAV-based LiDAR. Minor field study in Colombia

Before departure

Since first hearing about the possibility of conducting a Minor Field Study, we both realized that was something we wanted to do for our bachelor thesis. It sounded like an opportunity of a lifetime. However, finding a suitable project is not easy without knowing where to start. In the summer of 2022 Simon studied in Grenoble on a summer course where he met Sebastian from Bogotá. Together they were in contact and able to formalize a project with UAV-based LiDAR at UAV Colombia, where he is working part-time. We both thought that Colombia would be an interesting country to visit, and we were excited to have the opportunity of going there. No visa applications were needed, and since we both had Twinrix already, no additional vaccinations were needed for traveling to Bogotá. However, we took the yellow fever in case we would travel in Colombia as it is necessary in for example the Amazon. Regarding the language, both of us refreshed and practiced some Spanish before the trip, but nothing formal.

Upon arrival

Upon arrival, we spent the first three days with our contact person and his girlfriend traveling and exploring Bogotá and the Colombian culture together with them. After the first three days, we started our project together with the UAV Colombia team at their office. We conducted the field study for 8 consecutive weeks doing research, gathering data, and analyzing the outcome of the project. We were located both out in the field and at the office of our partner company.

Financials

From what we understood, Bogotá is one of the more expensive cities in Colombia. However, the cost of living there was much cheaper than in Sweden. Food, fruits, taxi rides and housing were inexpensive compared to the prices in Sweden. It depends on what zone you are in the country, but there will in general not be any financial problems during a stay in Bogotá. To give some examples, a minimum wage in Bogota could be around \$200 a month and a big lunch with starters, drinks and main course could cost around 14.000 Colombian pesos (around 35 SEK).

Our tips on saving money would be to eat food (especially lots of fruit) that are grown in Colombia, which was usually cheaper than imported food from other countries.

Accommodation

The security situation in Bogotá is not what we are used to in Sweden. Therefore, we contacted Sebastian for his recommendations on where to stay and that was very valuable. Moreover, Bogotá is a huge city and we had heard that the traffic is crazy, and that is why we looked at some areas close to the office that Sebastian recommended. We searched for an apartment through Airbnb and decided to settle for one within 10 minute walking distance to the office. We found a large apartment where both of us had our own bedroom and bathroom, and a large living room. However, insulation is not

commonly used because the weather is around 20 degrees all year around, and this was sometimes disturbing when trying to sleep. In total we paid about 4500 SEK per month per person for our stay.

Project

The study's centre of attention is evaluating the viability of using UAV-based LiDAR technology for flood simulation. Colombia is largely vulnerable to flooding, and the situation is expected to impair with climate change, which is why flood simulation is important. The study took place in La Calera, situated close to Bogotá, where water flooding in a river will be examined. Based on these results, the social, economical and environmental impact for different stakeholders were analyzed for the different flooding scenarios. The report ended with conclusions and discussions about whether this method is viable to capture valuable information that can be used for sustainability purposes for Bogotá and its surroundings.

All working days were different, one day you could be researching literature studies, while the other day you could be out in the field gathering data for the project. Most days were spent in the office, working in different computational programs to filter and analyze the data to be able to build a digital terrain model of the gathered information. We got assistance from our contact person throughout the entire project. He also worked in the company that we worked at and helped us with everything from translations to technical questions throughout our journey.

The minor field study ended in a presentation for the company group, where we held a digital presentation, sharing our results and findings for around 50 people situated across the company in Latin America.



Training session with a drone.

Country

Colombia is a large country, and we did not realize this until we arrived and got an explanation from Sebastian and others at the company. The traffic and being conscious of your belongings when you walk on the street were the two largest shocks when we got to Bogotá. Through traveling to nearby regions and meeting with many locals we got a better understanding of the immense diversity that Colombia offers, both in nature and people.

The nature in Colombia is incredibly beautiful and we wish to return to see more parts of the country. Moreover, all the people we encountered were nice and open towards us, and we felt very welcome. On the penultimate weekend we were invited to a Colombian barbeque at one of our colleagues at UAV Colombia and had a great time. This was representative of the gentleness we were shown throughout our stay. Sadly, it is a country scarred by violence and heavily impacted by the history of narco-traffickers, violence, para militaries etc. and when talking with locals this topic was often discussed. We also discussed that the general view of Colombia in Sweden is like that, which is unfortunate because we had an amazing experience there.



Colombia is a beautiful country where we made many new memories.

Leisure and social activities

In the everyday life we exercised before work during the morning at a nearby gym in a large shopping mall. Thereafter, during the weekdays we often worked on the project and studied during the evenings since we did not want to move around too much when it was dark. Instead, we travelled extensively during the weekends.

We had great assistance from our contact person in exploring what Bogotá and its surroundings has to offer, and especially during the weekends we always had something planned. We for example visited Villa de Leyva in Boyacá and Eje Cafetero (Colombia's coffee region). Moreover, the southern part of Colombia consists of the Amazon rainforest and Simon paid a visit to that region during one weekend meanwhile Linus joined another friend in Bogotá to Tibacuy, a small city close to Bogotá.

It was easy to know other locals and many unexpected connections were made through our initial contact person. Everyone we talked to were nice and open towards us, even though we did not speak Spanish fluently. In most of our trips we were the only foreigners, and it was an amazing experience travelling around with our contact person showing us what Colombia has to offer.



Dangerous animals in the Amazon rainforest.

Sustainability

Traveling in Bogotá can be difficult and dangerous. Due to the dense population, public transportation was not very reliable and could take a lot of time. We were also recommended not to use public transportation due to the safety risk of being robbed or similar. We lived close to the office, so we could walk there in 10 minutes which was very nice. When we had to travel elsewhere in the city, we used the application Uber. Although Uber is not allowed in Bogotá, that is what Sebastian recommended to be the safest and most convenient option. When gathering the field data, we had to use a larger car to be able to fit all the equipment in the car.

We tried to live as sustainably as possible, walking when we had the opportunity, not overconsuming, and eating food that was grown locally. We also conducted our field study with cost and labour-effective equipment and technology, which saved resources for UAV Colombia and us.

In general, the project focused on the water situation in Colombia which relates to the United Nation's Sustainability Development Goal number 6. More specifically, the impacts of flooding can relate to several more, including number 1 no poverty, 2 zero hunger, 8 decent work and economic growth, 9 industry, innovation and infrastructure and 11 sustainable cities and communities. Short and long-term damages to crops which many people live off, especially in the rural parts, can result in famine and increasing poverty. In addition, substantial damage on infrastructure is expected which all in all reduce the economic growth and harms investments for a more sustainable future.



Other recommendations and observations

If you have any questions regarding our experience or how to conduct a field study in Colombia, please reach out to us: Simon Höglund, shoglu@kth.se and Linus Rodin, linusrod@kth.se

We hope that you will be able to explore and see Colombia as we did. It was an amazing experience!