

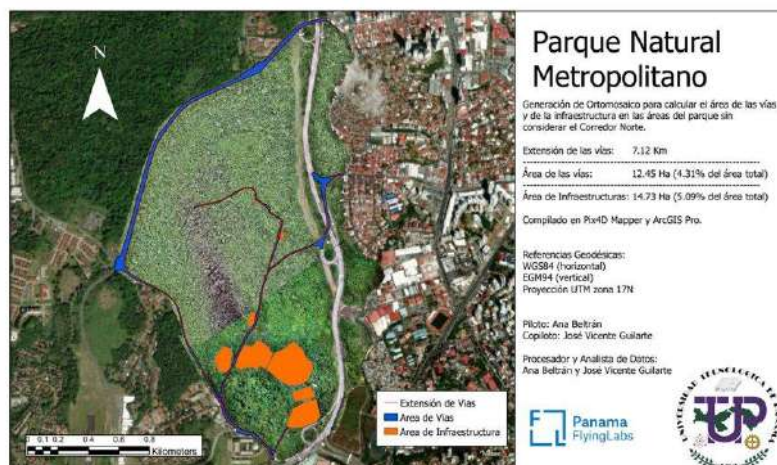
Mapping a National Park in Panama City to Support its Management



VTOL drone (WingtraOne) and part of the group that participated in the mapping of the first section of the park (Panama Flying Labs team and Continex collaborators team)



Panama Flying Labs pilot (DJI Inspire2) and support from a park ranger at the take off site



Delivery of the final orthomosaic and the Identification of infrastructure within the park and the West Boundary Roads

OVERVIEW	
Flying Labs	Panama Flying Labs
Geographic area	Parque Natural Metropolitano, Av. Juan Pablo II, ciudad de Panamá
Date range	January 2020 - August 2021
Sector program	EcoRobotics
Main SDGs	GOAL 13: Climate Action GOAL 15: Life on Land

SCOPE	
Project stakeholders	Patronato del Parque Natural Metropolitano Universidad Tecnológica de Panamá
People impacted	Directly: Park administration workers and main authorities. Indirectly: The animals that live in the park. Visitors to the park.
Number of people impacted	8 park personnel who manage the products 3 park personnel that assisted the Flying Labs team with the flights 2 members from a partner company 5 volunteers
Challenge	The Metropolitan Natural park is a nature sanctuary, wildlife preserve and the lungs and heart of Panama City. It currently lacks updated maps that would aid in identifying the impact of its surroundings and to quantify the amount of Kan Grass (originally an invasive species). Today this Kan Grass is a source of food for some animals. Due to the lack of data, it has also proven difficult to measure other indicators that affect the park and in turn has promoted a barrier to developing an assertive management of the land as well as vital decision making.
Scope	Due to the national park being located in an airport zone which is considered a prohibited area, it was resolved that both Vertical Take-Off and Landing (VTOL) and multicopter drone types be used to carry out the mapping. In addition, to support the field operations, 3 spotters were strategically placed further away from the take-off zone. Moreover, communication was enhanced with the use of radios and cell phones using the Zello app together with proper phraseology. All these steps were taken in an effort to minimize the risk that would normally be implied by the visual conditions and interferences within the park.

Outcome	<p>The image collection was done in two sections: the North and South section. The WingtraOne with Post-Processing Kinematic (PPK) georeferencing was used to capture images in the North section and these images were processed using PIX4Dmapper.</p> <p>The South section had its images captured using the DJI Inspire 2 drone at different take-off locations. This presented issues in the processing phase because of uncalibrated images. Therefore, the approach taken to process the South section imagery was to use the “Merged Project” option. The merge assisted in identifying uncalibrated image zones which were the densely forested areas. The issue was resolved by performing more flights in smaller sections with the safe trigger mode in PIX4Dcapture. The images were processed, orthomosaics were generated and the digitalization of features was done manually using ArcGIS Pro.</p>
Impact	<p>21 people will have access to the products and deliverables. 8 of these people will use them directly to support management decisions.</p> <p>Short-term decisions will be based on:</p> <ol style="list-style-type: none"> 1. The identification of the Kans grass which will be used to improve the management of firewall surveillance rounds during summer. 2. Some building shots that were used to make projections of how the buildings are being used. 3. The importance of having an approximation of the paved area.
Next steps	<p>The client expects to acquire a drone to conduct a study of the superficial water in the park with other sensors.</p>

COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT

Consent for data acquisition	<p>In-person and virtual meetings with the Park Administration Director and the team were held as well as communication through chats and calls with the person in charge to support the Flying Labs team on every mapping mission. In order to have a written consent, a letter of agreement was received from the stakeholders.</p>
Activities to engage with the community	<p>A trial mapping in a section of the Kans Grass area to show the potential of an orthomosaic, to visually identify and measure the area coverage of the plant in January 2020 was demonstrated.</p>
Community groups engaged with	<p>Government officials, national police, representatives from the Metropolitan Park and volunteers from the University</p>

Community attendance	8 people
Community feedback	<p>The director of the park was content with the results and invited personnel of the park to participate in the final presentation where a summary of the project and deliverables was shown.</p> <p>Ranger personnel expressed interest in the operations and were enthusiastic to help on each flight day. A young lady (Environmental Technician at the park) expressed how important it was to join the crew because it showed the operational workflow was not limited to just turning on the drone and flying.</p>
Stakeholder support	N/A

DATA ACQUISITION	
Size of area	VTOL: 307.9 ha (3.079 km ²) Multicopter: 154.94 ha (1.549 km ²) Total: 462.84 ha (4.628 km ²)
Drone	VTOL: WingtraOne Multicopter: DJI Inspire 2
Sensor(s)	VTOL: RGB / Sony RX1R II Multicopter: RGB / ZENMUSE X4S
Flight plan software	WingtraPilot and PIX4Dcapture
Flight height	VTOL: 115 m above ground level Multicopter: 105 - 128 m above ground level
GSD (Accuracy)	VTOL: 1.96 cm/pix Multicopter: 3.45 cm/pix
Number of images acquired	4907
Number of flights	WingtraOne: 2 Inspire 2: 25
Time invested in data acquisition	9 days
Georeferencing	WingtraOne PPK and CORS base Inspire 2 (onboard GPS)

DATA PROCESSING & ANALYSIS	
Processing software	PIX4Dmapper
Processing time	65.7 hrs
Data products	Raw images and videos 2 orthomosaics (North and South park zones) 2 Digital Surface Model (North and South park zones) 3D mesh model videos Delivery layouts: North, South and joined map
Analysis tools	ArcGIS Pro
Analysis outputs	2 Visible Atmospherically Resistant Index (VARI) maps (North and South park zones) 4 thematic maps (areas calculation)
Final outputs shared with stakeholders	Raw data, orthomosaic, DSM, DTM and deliverables
Data sharing	OneDrive