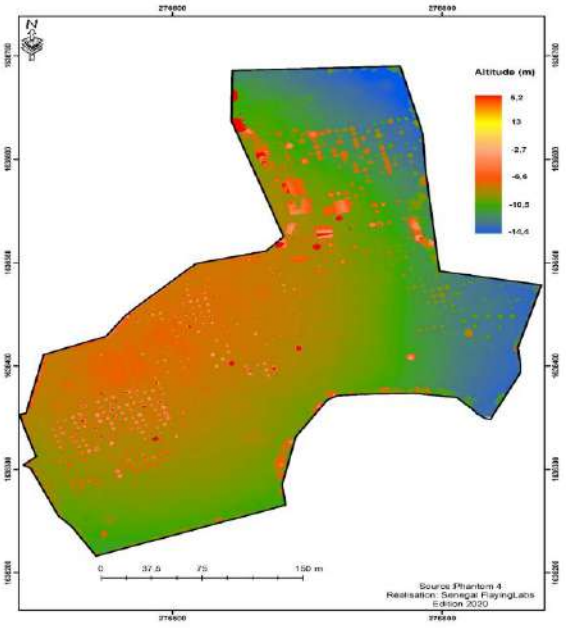
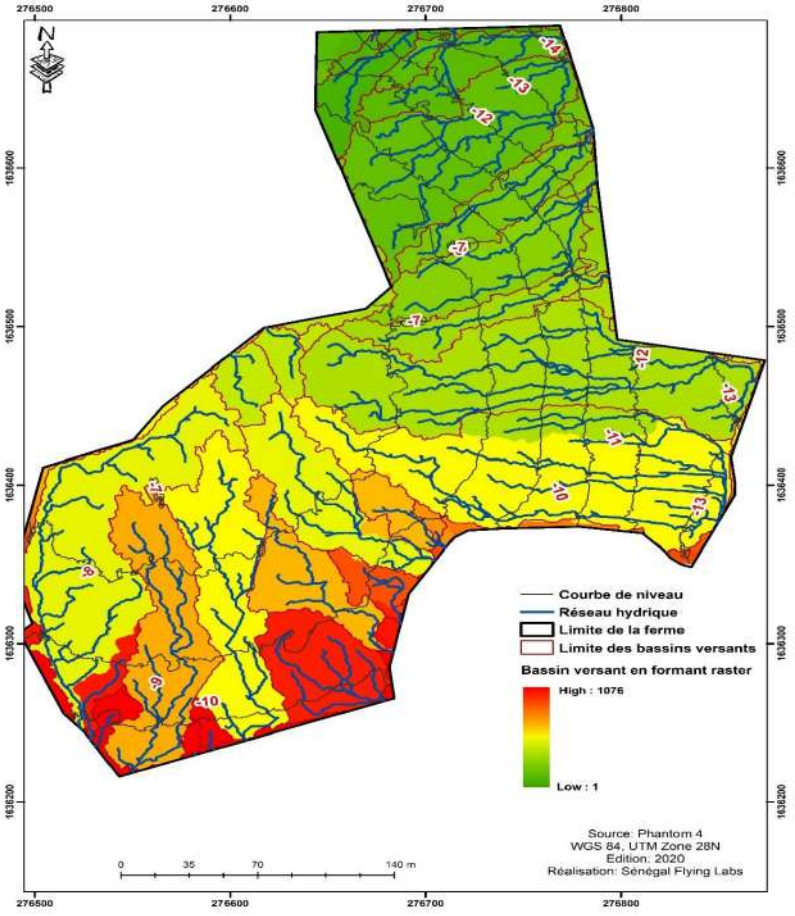
Use of drones for 3D irrigation network mapping

Orthomosaic of the farm



Digital Surface Model of the area mapped



Map of irrigation network, watersheds and contour lines within the farm boundaries

OVERVIEW	
Flying Labs	Sénégal Flying Labs
Geographic area	Pout, Thiès (Sénégal)
Date	January 2020
Sector program	EcoRobotics

SCOPE	
Stakeholders (clients)	The owner of Roga yadia farm
Challenge	The objective of the project was to document and map the boundaries of the farm and its current state in order to apply for and eventually obtain a land certificate. The main challenge was to collect data, which would allow for creation of such maps and documents and help its owner show and justify the investments made on the farm, as well as create a base for further deeper analysis of the land and irrigation network.
Scope	1) Mark the boundaries of the farm using a high resolution drone imagery 2) Define the topographic profile of the land using a digital terrain model 3) Generate contour lines to better orient the direction of water flow for irrigation purposes and installation new wells 4) Create various maps and other cartographic products, e.g. a map of watersheds and positions of wells within the farm
Outcome	The methodological approach was divided into four parts: 1) Site visit 2) Flight mission planning 3) Drone data acquisition 4) Data processing and analysis The first actions included establishing the boundaries of the farm using a drone. After planning and executing an automatic drone flight, the data was processed and analysed using several different applications, including a photogrammetry and GIS software. The outputs included an orthomosaic, terrain models, maps of watersheds, water networks as well as functional and not functional wells, contour lines, a farm location map and a land use map. The orthomosaic helped to illustrate and prove the investments - buildings, fence, infrastructure and irrigation network. The use of drones has proved to be time-saving in the production of deliverables.
Next steps	The farm location map will serve as a document to facilitate the process of obtaining a land certificate. The products of the analysis will also allow the client to know the exact boundaries of his farm, precise shape of the terrain and the direction of the

	water flow. This information will facilitate better decision-making for further development of the farm and increase its productivity. After obtaining the land certificate, the initial analysis outputs will be completed with additional data (e.g. study of soil type) in order to perform a deeper analysis.

DATA ACQUISITION	
Size of area	9 ha (0.09 km2)
Drone	DJI Phantom 4
Sensor(s)	RGB camera
Flight plan software	Pix4D Capture
Flight height	60 m
GSD (Accuracy)	2.43 cm/pix
Number of images acquired	170
Number of flights	1
Time invested in data acquisition	13 mn 50 s
Georeferencing	Onboard GPS

DATA PROCESSING & ANALYSIS	
Processing software	Pix4Dmapper
Processing time	1 day
Data products	DSM, DTM, orthomosaic
Analysis tools	ArcGIS 10.5, Global Mapper, Picterra
Analysis outputs	Map of watersheds, contour lines, map of water networks, map of functional and not functional water wells, farm location map, land use map
Final outputs shared with stakeholders	Farm location map, orthophoto, DSM, DTM, watershed map, map of functional and not functional water wells
Data sharing	Soft copies, Google Earth