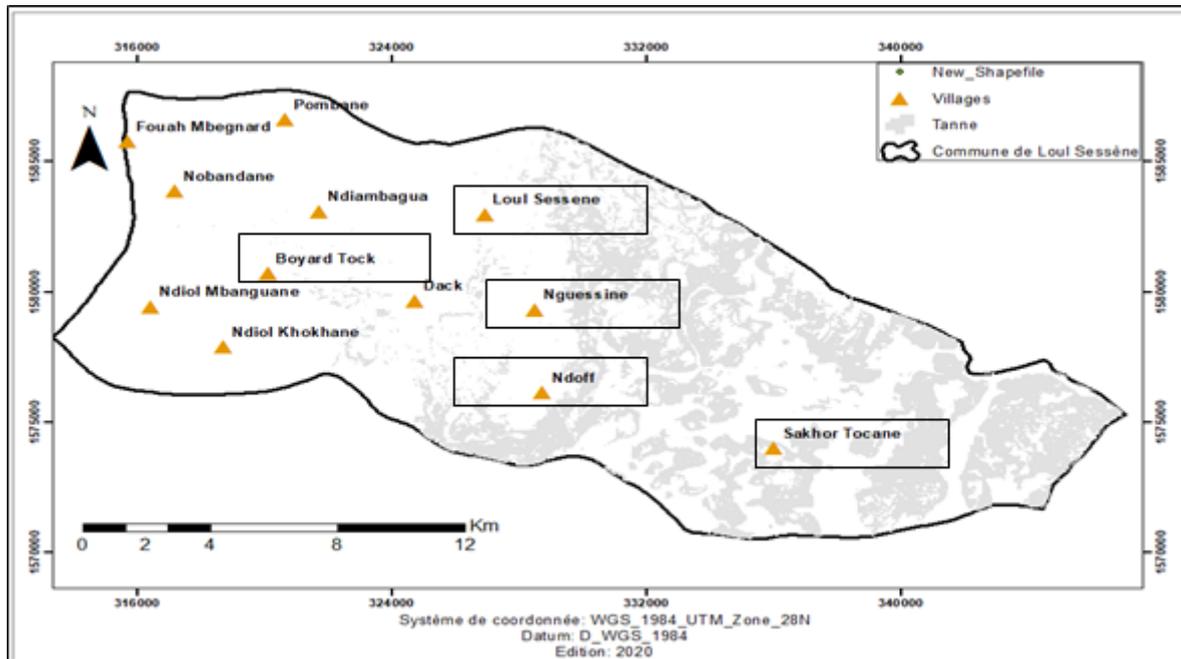
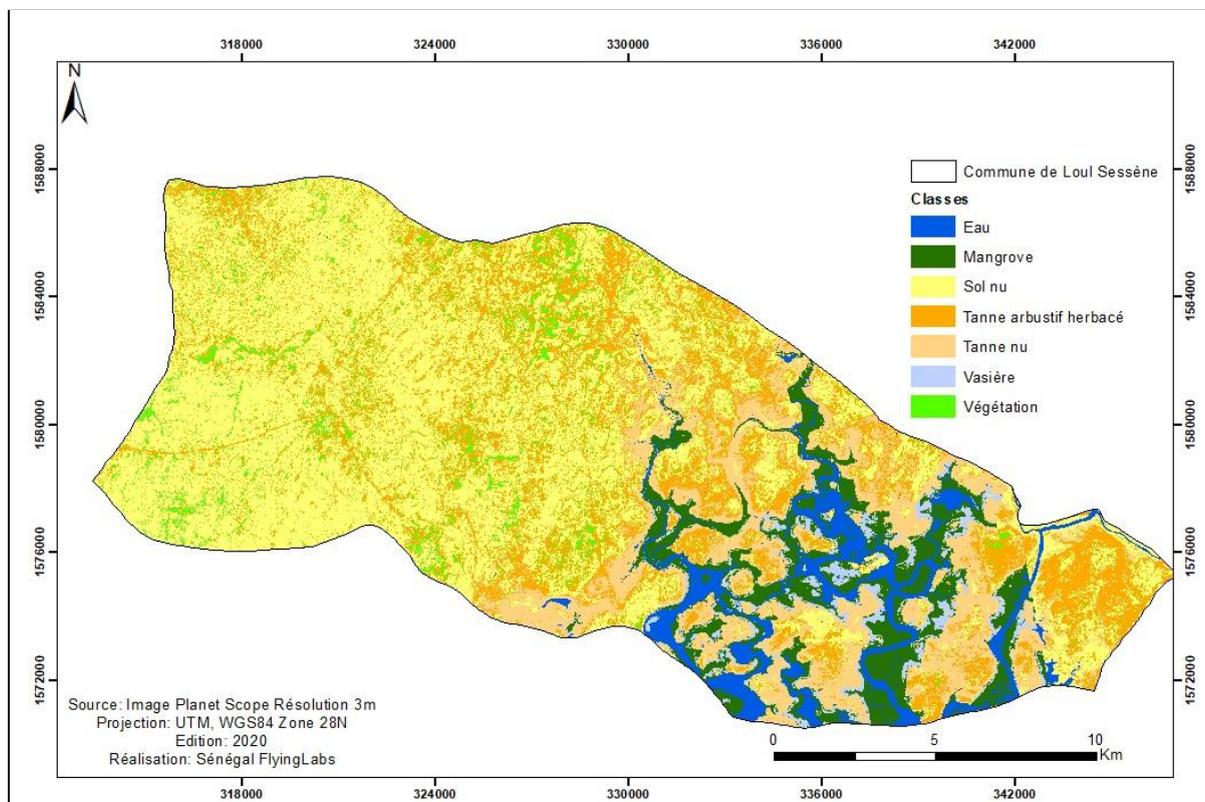


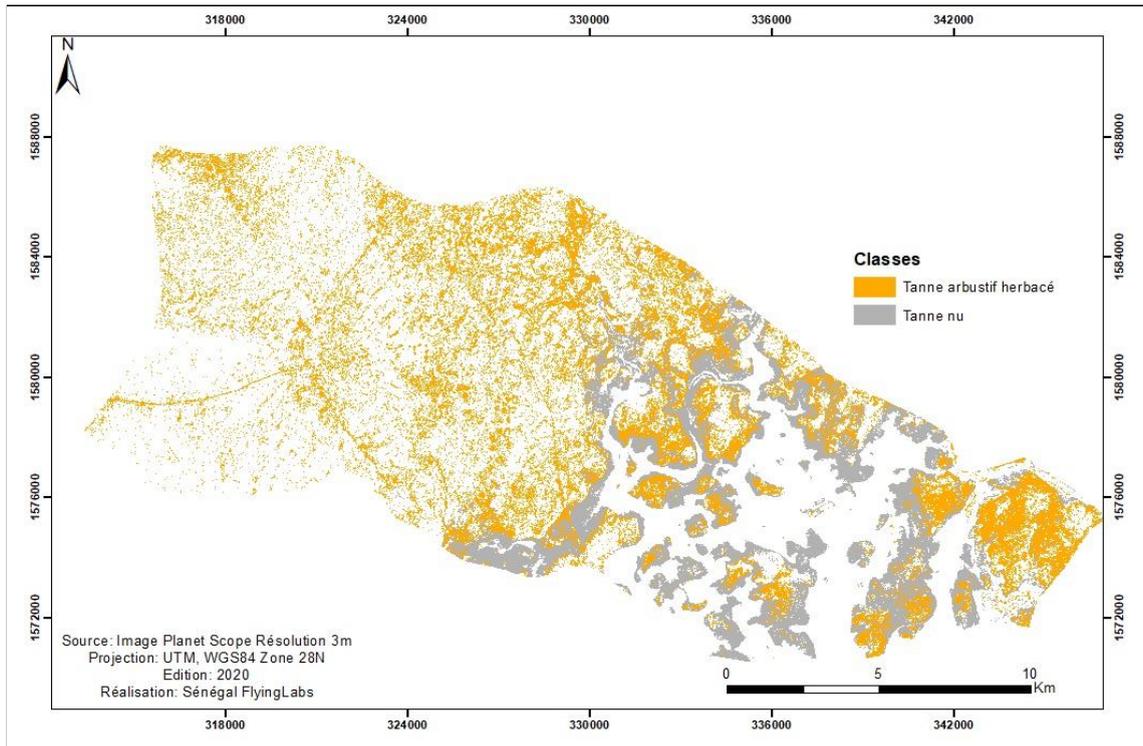
Drone mapping of saline lands in the Commune of Loul Sessène



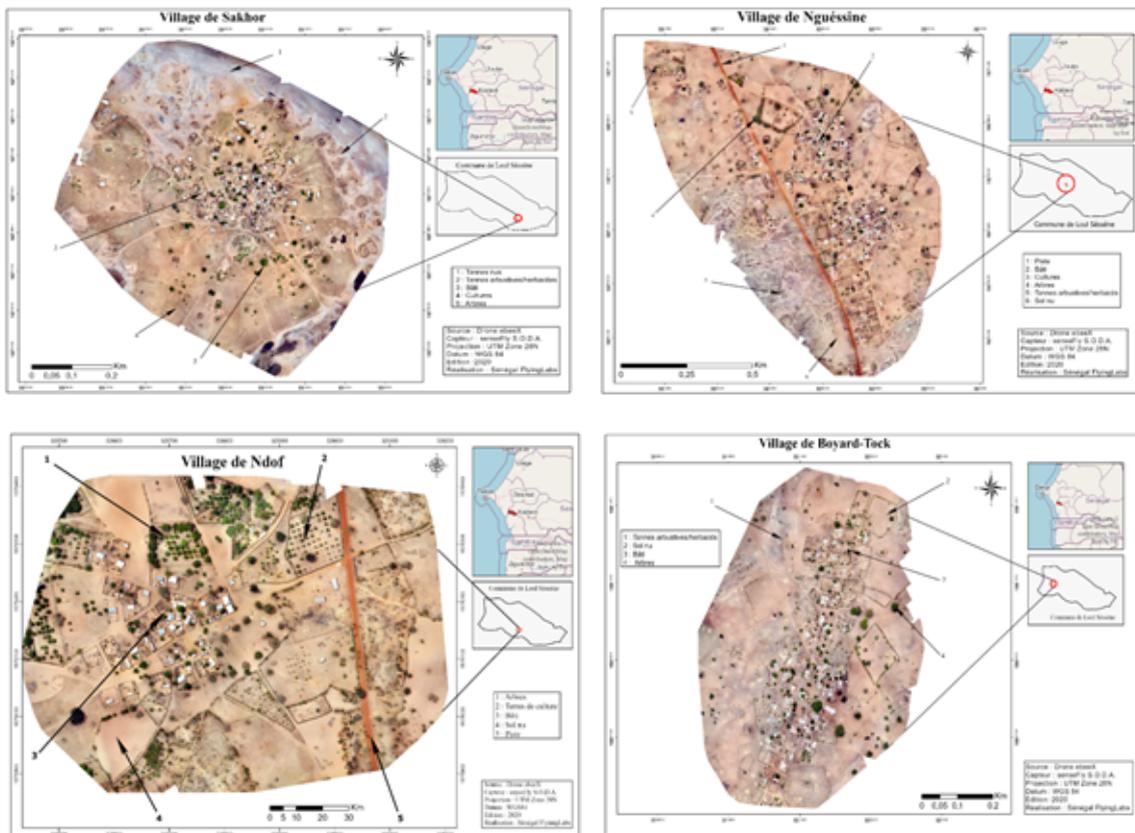
Map 1: Commune of Loul Sessène



Map 2: Land use in the commune of Loul Sessène



Map 3: Spatial distribution of saline soils



Map 4: Cartography of four villages of the commune of Loul Sessène

OVERVIEW	
Flying Labs	Senegal Flying Labs
Geographic area	Commune Loul Sessène, Region of Fatick, Senegal
Date	15 - 21 June 2020
Sector program	DevRobotics
Main SDGs	GOAL 11: Sustainable Cities and Communities GOAL 13: Climate Action GOAL 15: Life on Land

SCOPE	
Project stakeholders	Agricultural and Rural Prospective Initiative (IPAR) Town Hall of Loul Sessène
People impacted	The population of Loul Sessène 32 800 ha is composed of 19 villages and 20 hamlets
Number of people impacted	The population of the commune is estimated at 21,687 in 2015 for over 500 households (latest official census report)
Challenge	<p>Land salinization is one of the major constraints to food security due to loss of cultivated land as well as ecosystem losses and economic losses and is therefore a major impediment to development in West Africa.</p> <p>Estimation of the exact area of saline lands is a major challenge and the satellite imagery does not provide sufficient resolution for this task.</p>
Scope	<p>The area of interest covered 32,800 hectares. The team was tasked to map the commune of Loul Sessene with high resolution images to be able to estimate the area of the saline flats (French <i>tannes</i>) to allow understanding the dynamics of the spatio-temporal evolution of saline lands. The project would allow for creation of a database of salt exploitation areas, better understanding of all land use units and, as a result, a more concise development of infrastructures to fight against salinization.</p> <p>The objective is to show the capabilities of drones and artificial intelligence to positively contribute to socio-economic and environmental policies.</p>
Outcome	The characteristics of saline lands were classified in three categories:

	<ul style="list-style-type: none"> ● Bare flats: extremely salty soil that is characterized by a total absence of vegetation due to the excessive concentration of salt, ● Herbaceous flats: very salty soil covered with herbaceous vegetation and ● Shrubby flats: salty soil characterized by the presence of shrubs such as Combretum glutinosum, Balanites aegyptiaca, Acacia seyal, Acacia nilotica, etc. <p>The first flight mission was conducted to map the different types of flats in the village of Ndoff (flight height: 110 m).</p> <p>With the results of the image processing, conclusions were drawn to classify the flats into two categories: 1 - bare flats and 2- herbaceous and shrubby flats. The herbaceous and shrubby flats are difficult to identify even with high-resolution drone images because they overlap for the most part. The Planet Scope satellite images of the commune alone were not sufficient to estimate an exhaustive surface area of the distribution of the flats and land use units, hence the programming of a second collection mission to validate all these units.</p> <p>The second mission therefore consisted of collecting GPS data (polygons of bare flats, herbaceous shrub flats, mangrove, bare soil, vegetation and mudflat) and drone images to validate the results of the supervised classification using satellite images with a resolution of 3m.</p> <p>Resources produced: land use map, salt land distribution map and maps of the villages of Ndoff, Boyard Tock, Nguessine and Sakhor Tocane.</p>
<p>Impact</p>	<p>The project will allow the actors to:</p> <ul style="list-style-type: none"> ● better fight against the phenomena of salinization; ● allow the local population to fight against the harmful effects of salinity on fishing, culture and livestock; ● allow the local officials of the commune to refine strategies to control this phenomenon.
<p>Next steps</p>	<p>First, another workshop will be scheduled by IPAR to educate the stakeholders, partners and especially the local population about the importance of this mapping work.</p> <p>Secondly, the drone mapping will be extended to the entire commune of Loul Sessène. The pilot phase allowed the classification of the different types of flats and land use with satellite images. However, with a centimeter-level resolution of</p>

	drone images, a clear and precise classification of the flats and land use can be obtained.
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COMMUNITY ENGAGEMENT AND STAKEHOLDER SUPPORT

Consent for data acquisition	The salt lands are already at the heart of the local population's concern.
Activities to engage with the community	<ul style="list-style-type: none"> ● Sharing workshop with all stakeholders was organized on March 14, 2020 at the level of the City Hall on the project of mapping by drone of salted lands, followed by a demonstration of piloting. ● Meeting with the mayor to assess needs and clarify objectives and strategies and identify priority areas. ● The first field mission took place from June 15 to 21, 2020 and ● The second field mission took place from July 3 to 5, 2020. ● In each mapped area, a presentation of the work to be done, the equipment and its requirements was made to the village notables and leaders.
Community groups engaged with	<ul style="list-style-type: none"> ● Local authorities, ● Women's organizations, ● Local population, ● Local civil society actors and professional organizations, notably ENDA Tiers Monde, ANCAR (Agence nationale de conseil agricole et rural), CAD (Comité d'aide au Développement) de Fimela (a locality in western Senegal), CLM (Cellule de Lutte contre la Malnutrition), ● ISRA (Institut Sénégalais de Recherche Agronomique), ● CSE (Compagnie Sahélienne d'entreprises).
Community attendance	<ul style="list-style-type: none"> ● Sharing workshop on March 14, 2020: over 50 people ● Meeting with the mayor: 3 people ● Collection phase: 2 focal points ● Workshop of restitution of the pilot phase: about 20 people
Community feedback	The community was delighted with the professionalism of the team and the association made with them in the data collection and the results of the sharing workshops.
Stakeholder support	Organization of a workshop to share the results of the pilot phase Involvement of the local population in the data collection phase.

FIELDWORK

Size of area	Boyard-Tock: 12.8 ha or 0.128 km ²
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	Nguéssine: 46 ha or 0.46 km ² Ndoff: 37.2 ha or 0.372 km ² Sakhor Tocane: 19.4 ha or 0.194 km ²
Drone	eBee X
Sensor(s)	Sensefly S.O.D.A
Flight plan software	eMotion
Flight height	110 m above ground
GSD (Accuracy)	2.50 cm/pix
Number of images acquired	Boyard-Tock : 169 Nguéssine : 383 Ndoff : 154 Sakhor Tocane : 201
Number of flights	4 (one flight per site)
Time invested in data acquisition	Boyard-Tock : 18mn 15s Nguéssine : 23mn 57s Ndoff : 11mn 14s Sakhor Tocane : 14mn 42s
Georeferencing	Onboard GPS

DATA PROCESSING & ANALYSIS

Processing software	PIX4Dmapper
Processing time	4 days
Data products	Orthomosaic, DTM, DSM
Analysis tools	ArcGIS Pro, IDRISI Selva
Analysis outputs	Maps of the 4 villages, supervised classification, radiometric correction, image mosaic, image extraction
Final outputs shared with stakeholders	Orthomosaic, DTM, DSM, maps of the 4 villages
Data sharing	Google Drive, email