

NGAOUNDÉRE FINAL REPORT

PART 1: Project Overview

- **Problem Statement**

Climate change is the main challenge facing humankind in the 21st century. Through its impact on ecology, precipitation, temperature and weather systems, global warming is directly affecting all countries¹. No part of the globe's surface is immune. However, some people and some spaces, especially urban ones, are more vulnerable than others. This is the case of the Ngaoundéré city site in Cameroon, which faces recurring challenges related to urban floods, which are increasing as its uncontrolled urbanization continues. Urbanization has been largely spontaneous, resulting from the increasing occupation of many flood or wetlands and mountain slopes without adequate land management. To improve the management of its territory, the Ngaoundéré City Council (NCC), in collaboration with the Cameroon Inclusive and Resilient Cities Project (CIRCP) financed by the World Bank via the Ministry of Housing and Urban Development (MINHUD), must update spatial data in open access on the built space and the essential infrastructures located in flooding risk zone on the major beds of the main rivers. These are:

- ✓ The Bini Stream and its tributaries whose floods often affect parts of Malang, Dang and Bini neighborhoods;
- ✓ The Mabanga Stream and its tributaries crossing Djalingo, Gadambanga, Joli Soir, Baladji 1, Baladji 2, Mbibakala, Madagascar, Gare voyageurs, Gare marchandises, Mbibar, Bidjoro, Manwi and Calmé neighborhoods;
- ✓ The Soum Soum River and its tributaries affecting Sabongari 3 and Sabongari Norvegien neighborhoods;
- ✓ The Mardock River and its tributaries affecting a good part of the neighborhood of the same name, and the Airport neighborhood.

In addition to these flooding risks zones, there are those of rock falls located on the slopes of the Ngaoundéré, Ngaounday, Ngaoussay Mountains which may affect neighborhoods such as Onaref, Socaret and Burkina. These issues occur during the raining season (July, August and September) are of growing concern. Floods and rock falls can't really be predicted but they can be fixed before the construction of houses by planning urban growth. The benefits and outcome of fixing these issues are: better disaster management related to floods and rock falls by designing targeted decision support products and/or tools to help key stakeholders use risk information to address the risk of natural disasters in the town, strengthen local capacities and establish the necessary institutions to support the design and implementation of interventions to increase the resilience of the town of Ngaoundéré based on evidences, and enable the city dwellers of Ngaoundéré to live in a protected and better environment.

¹ Butera F. M., Adhikari R., & Aste N., (2014). *Sustainable Building Design For Tropical Climates. Principles and Applications for Eastern Africa*. Retrieved from www.unhabitat.org, 425 p.

The consequences of leaving the problem unaddressed are: destruction of dwellings and property, destruction of crops, diseases related to dirty water following floods, loss of human life's, difficulties of the populations living in the flood zones to move, difficulties of access to drinking water, social crisis related to flood mismanagement and accentuation of urban disorder. The town of Ngaoundéré having been chosen for the pilot project of implementation of the Open Cities Initiative in Africa.

Ngaoundéré City Council, the Division, Sub-division, the Divisional Delegation of Housing and Urban Development, Municipalities, the Divisional Delegation of Environment, Protection of Nature and Sustainable Development, the Divisional Delegation of State Property, Survey's and Land Tenure, Neighborhood Development Committee, dwellers of the neighborhood facing flooding and rock fall risk, the University of Ngaoundéré, Civil Society Organizations and local Non-Governmental Organization have being involved in all stages of the collaborative mapping campaign.

The data thus generated will enable council and local authorities to better plan urban growth, land use, urban development and the various interventions in the city in the event of floods and rock falls. The city dwellers of Ngaoundéré will then live in a protected and better environment. In the long term, Ngaoundéré will be able to serve as an example of success, for its neighboring localities, in urban planning and computer-aided management of natural resources.

- **Brief overview of the project, from inception to completion**

From June 2018 to January 2019, we organized the urbanized area of Ngaoundéré into 68 sectors and mapped using several different but complementary methodologies, tools and technologies. These sectors were mapped based on a process led by the Ngaoundéré City Council, with the help of the members of neighborhood development committees and civil society, supported by the students of the University of Ngaoundéré, the Experts in geography, topography, cartography and economic development. The main deliverable of the project is the Atlas, whose construction focused on 18 neighborhoods most at risk of flooding, and the Ngaoundéré and Ngaoussay mountains, which are subject to rock fall risks. The process of precision collaborative mapping, involved the members of the local community supported by our field operators under the supervision of the entire technical team of the Open Cities Africa - Ngaoundéré Project.

PART 2: Data Collection Process

2.1: Field Data Collection

As part of the Open Cities Africa - Ngaoundéré Project, 328 km² have been mapped and validated using a participatory precision approach. Thus, more than 35000 objects (buildings, streams and streets) were mapped on OSM in 2 months. During this phase, the team alternated between digitization, field and computer quality control and validation of data mapped under OSM. In addition, some data collected as part of ACAGER's previous activities and those collected in the field by mapmakers using the Android QField tablet application represent over 7000 objects

(places of worship, schools, hospitals, stores, water points, etc.), which were all loaded on OSM. In addition, using JOSM, the main land-use types (wetlands, grasslands, scrub, mountain area, agricultural land, forests, residential, industrial, railway and university areas) in the city of Ngaoundéré have been mapped offline and uploaded to OSM. In fact, all these data were downloaded from OSM to QGIS, processed and supplemented by those of the construction studies to produce the Atlas.

✓ **Area of interest #1:** Flood zone of the city of Ngaoundéré

The Google Earth image visual interpretation coupled with field work let us to delineate the floodplains of the town of Ngaoundéré. It is based on a good knowledge of our work environment. The essential parameters we have used are color, form and association. The following combinations were made for the Ngaoundéré city site:

- At the site of the town of Ngaoundéré, most of the floodplain areas are first of all rivers and correspond to the major bed of the latter;
- Low elevation areas are the areas most likely to be flooded.
- On the site of the town of Ngaoundéré, the areas cultivated during the dry season generally correspond to the flood zones.
- When the space is not densely populated, as is the case in the city center, people avoid building in the flood zones.

Based on the above criteria, we tried to bring out the boundaries of the flood zone. The possibilities to visualize the images of archives and/or in 3 dimensions that offer Google Earth made it possible to refine at first the limits of flooding zone.

We would like to point out that, as part of Open Cities Africa project, Google Earth has been used exclusively for the exploration of the field. Our digitization was based on Bing and ESRI World Imagery via JOSM.

▪ **Demarcation/validation on the Field**

The limits obtained by photo interpretation have been introduced in the QFIELD application on tablets. The studied areas (Highly Developed Areas) that were very difficult to verify in the laboratory were visited during the validation runs of the boundaries of the flood zone in the field.

During this phase, points were regularly placed on the boundaries of the flood zones certified by the resident populations. The choice of points rather than the Tracking is justified by the difficulty we have to walk on the limit of the flood zone because of the presence of buildings, the lack of tracks, etc.).

This was followed by an adjustment (displacement of the nodes) of the limits according to the points collected on the ground under GIS in laboratory in order to determine the reliable limits of the flooding risk zones.

Finally, the superposition to the racks and other types of land use in the database allowed delineating areas of the flooding risk.

This field work helped to adjust the flood risk zone layer of the city of Ngaoundéré to the reality observed on the ground. In fact, it is a preparatory stage for collecting and validating information with the main stakeholders (the populations living in these areas). So, we went to the field with young people from the neighborhoods concerned, with tablets to locate houses in areas of the flooding risk zone using the QFIELD application. Still with the use of tablets, we also characterized neighborhood flood risk areas with some representatives of the local community.

✓ **Area of interest #2:** Geomorphic hazard zones in the city of Ngaoundéré

The visual interpretation of Google Earth image coupled with field work are the main methods used to delineate the geomorphologic risk zone of the city of Ngaoundéré.

A rough demarcation was made using contour lines. The closed contour lines initially allowed to mark out the foot of the mountain. This preliminary demarcation was then superimposed on Google Earth images after conversion of .SHP into .KML.

Then, the display of the 3D images available under Google Earth made it possible to adjust the limits taking into account the resolution of the SRTMs (1 second arc) which had previously been used for the extraction of contour lines.

As we have already noted above, Google Earth has been used exclusively for the exploration of the field. Our digitization was based on Bing and ESRI World Imagery via JOSM.

▪ Delimitation/validation on the Field

The layer obtained by visual interpretation was introduced in the QField project on tablets. The studied areas (Highly constructed Areas) in which it was difficult to verify in the laboratory were visited during the validation. During this phase, points were regularly placed on the boundaries of risk zones. This was followed by an adjustment (displacement of the nodes) of the limits according to the points collected on the ground under GIS in laboratory in order to determine the reliable limits of the geomorphological risk zones.

✓ **Area of interest #3:** Capturing High Resolution UAV Images of Flood and Geomorphological Areas in Ngaoundéré City

The general objective of the aerial mapping campaign, which took place from 27 to 30 November 2018, then from 12 to 13 December 2018 in Ngaoundéré, was to obtain the digital cartographic and altimetric models that enable us to conduct studies on the risks of aerial mapping and geomorphological flooding in the city of Ngaoundéré.

The mapping method used is aerial photogrammetry by drone. To summarize very briefly, it is, from geolocated aerial photographs, to establish a 3-dimensional model of the studied area, to extract two main results, a digital elevation model (DEM) and an orthophotography.

The MNE is an altitude model containing houses and vegetation. This is a 2.5 D model (a single Z value for an XY coordinate set). Orthophotography is a photographic image that has been corrected for deformations due to the relief, the inclination of the axis of view and the distortion of the lens. An orthophotography is therefore a product that can be superimposed on a map. In other words, an orthophotography seems to be taken vertically from all the points it appears.

An eBee Plus drone from the manufacturer Sensefly was used on this mission. It is a fixed-wing drone with a 55-minute flight autonomy in favorable wind conditions. It contains a photographic camera of 20 M pixels, and is positioned by a GNSS geodesic bi-frequency type Septentrio AsterX. This device is autonomous but remains controlled by a ground station composed of a radio and a laptop with the software eMotion 3. The radio range is 3 km and involves a shift of the team between each flight.

A calibration point measurement campaign was carried out by Mr. Mathias KOM, Surveyor-Geographer. These points were marked on the ground by traces of yellow paint, or were materialized by crossed planks painted yellow and fixed to the ground. Identified on aerial photographs, and known coordinates, the points will be used in the calculation of aerotriangulation to restore the models in the selected reference frame. The points were lifted with a dual mode Leica receiver in static mode, a second receiver stationed continuously on the Ngaoundere I point (B 322).

The post-processing scheme is described in the following sequence:

- Pre-processing of GNSS data, before air operations;
- Preliminary treatment on site:
 - Calculation in rapid mode of aerotriangulation;
 - Calculation of dense point clouds in medium mode (1 out of 4 points);
 - Calculation of DEMs and orthophotographs for coverage control.
- Final treatment at the office:
 - Accurate calculation of aerotriangulation;
 - Calibration of the camera;
 - Calculation of dense point clouds in full mode;
 - Calculation of DEMs and orthophotograph;
 - Integration of results under GIS for quality control.

After these different stages of data collection and processing, we went back to the field to present the populations with maps from previous activities. These working sessions allowed to validate the maps with the populations and to collect their different proposals with the aim of reinforcing their resilience vis-a-vis the risks of natural disasters.

✓ **Data Model** (and how it potentially evolved)

The data compiled in the Open Cities Africa - Ngaoundéré Project Database has many sources namely: Ngaoundéré (NCC), the Association for Mapping and Resource Management (ACAGER), OpenStreetMap (OSM), photo-interpretation of high-resolution satellite images and field surveys.

Thus, at the NCC, we obtained information on the socio-economic infrastructure of the city of Ngaoundéré. ACAGER has put at our disposal the layers of information containing the main types of land use, the hydrographic networks and roads of the urban space of Ngaoundéré. We have uploaded to OSM all the buildings in the city already digitized and available online. It is important to note here that this basic information obtained from NCC, ACAGER or even those downloaded on OSM, have been updated and/or supplemented by photo-interpretation of high-resolution satellite images of space of Ngaoundéré and through field data collection campaigns.

The photo-interpretation of the high-resolution satellite images served mainly to update the OSM data and the delineation of the risk zones (floods and morphologies) of the city of Ngaoundéré. The updating of the OSM data consisted largely of completing the digitization of buildings that had not yet been digitized. At first, this work was done based on Bing imagery. But at the end of the first phase of quality control and quality assurance, we found that many of the city's existing buildings did not exist in the OSM Database. For the future, we opted for Esri global imagery because they are more recent than those of Bing, and thus allow to digitize the buildings of the urban space of Ngaoundéré closer to the reality of the field.

The field data collection campaigns allowed us to supplement the basic data obtained from CUN, ACAGER and those available on OSM, and to characterize the flood zones, the buildings located on the floods risk zones and those located in areas with morphological hazards. This field data collection work was therefore carried out in several phases. The first consisted in the complementary collection of the basic data on all the urban space of Ngaoundéré. The second phase of field data collection allowed us, first, to refine the delineation of flood risk zones, and to characterize all the buildings located in the area in a second time. The third phase focused on the characterization of buildings exposed to ground movements. It was during the fourth and final phase of field data collection that we realized very high-resolution images of certain risky areas of the city of Ngaoundéré including the junction of the rivers Soum-Soum and Mabanga, and the area of the Mount Ngaoundéré.

In the field, we used 10 tablets of Samsung Galaxy Tab A6 awarded to 10 of our mappers to characterize all buildings located in areas of neighborhoods at risk of flood and morphological using the Android application QField. Each of our mappers has been associated with 2 inhabitants of each neighborhood to allow them to immerse themselves in new collaborative mapping tools to increase their resilience to the effects of climate change, and to facilitate their exchanges with other inhabitants of the neighborhood. For taking high-resolution images of some risky areas of the urban space of Ngaoundéré, we used a UAV Ebee Plus of Sensefly manufacturer.

The collection and processing of information was done using free and open source applications. Indeed, we carried out all the treatments of the information according to their type and according to the objectives aimed at specialized software. Thus, JOSM was used for various mapping activities on OSM, OpenAerialMap (OAM) was used to share online drone images of the project (<https://map.openaerialmap.org/#/12.63427734375,7.013667927566642,5/square/1222302?k=fueako>), and QGIS for the realization of the Database, the layout and the production of the various maps of the Atlas. The figure 1 below summarizes the data modeling of the Open Cities Africa - Ngaoundéré Project:

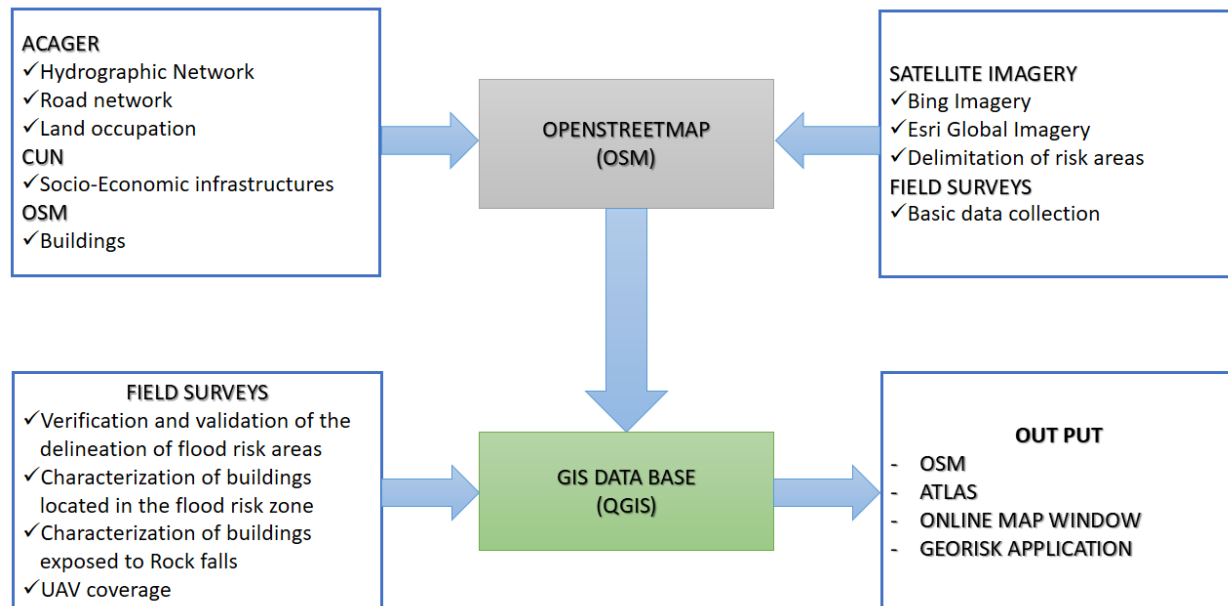


Figure 1. Data Model of the Open Cities Africa - Ngaoundéré Project

✓ **Field Mapping** (and any training activities prior)

Upon the return of the team members who participated in the regional launching workshop of the Open Cities in Africa project in Kampala, it was organized on June 23, 2018 a return to the attention of some Cameroonian students and those of the 12 African countries gathered at the University of Ngaoundéré as part of the second group of the professional Master in Geomatics, Planning and Resource Management (GAGER)². From July 30, 2018 to August 18, 2018, it was organized under the guidance of OSM Cameroon members:

- The training of 12 mappers including 06 girls and 06 boys;
- Preliminary training on basic data collection with the cards (in hard copy) and using QField;

² <http://gager-undere.auf-foad.org>

- Preliminary training for the animation of Focus groups for participatory mapping and characterization of flood risk areas;
- Basic exercises on Focus Group animation and basic data collection for participatory mapping in the field.

2.2: Data QA/QC

After the training of the Mappers to digitalization, they mapped, under our supervision, on OpenstreetMap via the HOT Tasking Manager (<https://tasks.hotosm.org/project/4800>). From the beginning of the month of October, the Open Cities Ngaoundéré team started the phase of quality control and quality assurance of building digitization made by the OSM Mappers. This work had the main support the HOT Task. However, this first campaign of digitalization was done against the backdrop of Bing imagery under JOSM. At the end of this first check, we found in the field that there were still buildings that had not been mapped, because they did not exist on the bottom of the Bing imagery. In order to find a solution to this problem, exchange and training sessions have been scheduled in Yaoundé with the partners of OpenStreetMap Cameroon.

After returning from the Yaoundé mission, Prof. Tchotsoua organized and facilitated a Yaoundé work restitution session with the OpenStreetMap Cameroon Community Leaders. At the end of the restitution, we decided to carry out a new operation of mapping and validation of the buildings of the urban perimeter of Ngaoundéré using the new tips received. For greater efficiency, we opted to use a third task previously created under TeachOSM Tasking Manager (<https://tasks.teachosm.org/project/730>), dedicated exclusively to the mapping and validation of buildings in the urban perimeter of Ngaoundéré.

The mapping of the buildings then the validation were carried out under JOSM using the tricks that the different Mappers of the Open Cities Ngaoundéré team had already been able to discover. We also used Andrew Wiseman's advice received during the October 02, 2018 webinar on validating OSM data. Finally, we took into account the tips and tricks given to Prof. Tchotsoua by the Cameroon OpenStreetMap community, the main one being to digitize the buildings of the city of Ngaoundéré based on Esri global imagery. This operation also served as the second phase of quality control and quality assurance for digital buildings under OSM under this project. It also allowed the Ngaoundéré team to map the city's built space a little more precisely.

2.3: Geospatial Data Overview

Sector	Sub-sector	Object	Tags OSM		Attributes QGIS/QFIELD	Number of the Layer	Number of objects in the layer	Number of Attributes
			Key	Value				
Tourism and leisure	Culture	Museum	tourism	museum	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	1	1	13
		Monument	historic	memorial	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	2	4	13
		Public Library	amenity	library	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	3	3	13
	Leisure	Public garden	craft	gardener	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	4	5	13
		Urban forest	landuse	forest	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	5	1	13
	Sport	Stadium	leisure	pitch	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	6	18	13
		Sports complex	building	civic	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	7	1	13
Administration	Local authorities	Public services	office	administrative	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	8	100	13
		Division and Subdivision Offices	office	administrative	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	9	4	13
		City hall	amenity	townhall	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	10	4	13
		Chiefdom	office	administrative	Name, Coordinates (X, Y, Z)	11	55	4
	Defense and security	Gendarmerie	amenity	police	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	12	6	13

Sector	Sub-sector	Object	Tags OSM		Attributes QGIS/QFIELD	Number of the Layer	Number of objects in the layer	Number of Attributes
			Key	Value				
		Police	amenity	police	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	13	12	13
		Firefighters	amenity	fire_station	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	14	1	13
Basic equipment	Non-state actor establishments	NGO	office	ngo	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	15	17	13
	Health establishments	Hospitals	amenity	hospital	Neighborhood, Population size, Coordinates (X, Y, Z), Business, Source of financing, Year of construction, Health area, District of Health, Status, Year of creation, Doctor, Nurse State graduate, Registered Nurse , Social assistant, Matron, Clerk, Garage, Building number, Good building, Building_p, Bad building, Number of Beds, Laboratory, Maternity, Pharmacy, Refrigeration, Water point, Latrine, Reforestation, Fence, Device, Personal housing	16	2	34
		Health centers	amenity	clinic	Neighborhood, Population size, Coordinates (X, Y, Z), Business, Source of financing, Year of construction, Health area, District of Health, Status, Year of creation, Doctor, Nurse State graduate, Registered Nurse , Social assistant, Matron, Clerk, Garage, Building number, Good building, Building_p, Bad building, Number of Beds, Laboratory, Maternity, Pharmacy, Refrigeration, Water point, Latrine, Reforestation, Fence, Device, Personal housing	17	17	34
		Analysis laboratory	amenity	clinic	Neighborhood, Population size, Coordinates (X, Y, Z), Business, Source of financing, Year of construction, Health area, District of Health, Status, Year of creation, Doctor, Nurse State graduate, Registered Nurse , Social assistant, Matron, Clerk, Garage, Building number, Good building, Building_p, Bad building, Number of Beds, Laboratory, Maternity, Pharmacy, Refrigeration, Water point, Latrine,	18	1	38

Sector	Sub-sector	Object	Tags OSM		Attributes QGIS/QFIELD	Number of the Layer	Number of objects in the layer	Number of Attributes
			Key	Value				
					Reforestation, Fence, Device, Personal housing, Management, Existence, Monthly recipes, Date of payment			
		Pharmacies	amenity	pharmacy	Neighborhood, Coordinates (X, Y, Z), Contacts, Photo Number, Owner, Owner Name, Tax Status, Tax Type, Sleeps, Building Number, Number of Rooms, Number of Sells, Points of Sale Water, Latrines, Device, Electricity, Ramps, Office, Store, Management, Existence, Existence, Number of employ, Monthly recipes, Date of payment	19	12	28
	School establishments	Nursery school	amenity	kindergarten	School Name, Coordinates (X, Y, Z), Status, Level, Creation Year, Girl, Boy, Total, Master by Student, Contractual, Employee, Banco seko, Board, Semi-Hard, Hard, Table Bench, Good, Passable, Bad, Ratio pupil, Ratio pupil 1, Ratio pupil 2, No water, Latrines, Garbage bin, Reforestation, Fencing, Teacher housing, Others, EPA, School Council	20	44	33
		Primary school	amenity	school	School Name, Coordinates (X, Y, Z), Status, Level, Creation Year, Girl, Boy, Total, Master by Student, Contractual, Employee, Banco seko, Board, Semi-Hard, Hard, Table Bench, Good, Passable, Bad, Ratio pupil, Ratio pupil 1, Ratio pupil 2, No water, Latrines, Garbage bin, Reforestation, Fencing, Teacher housing, Others, EPA, School Council	21	88	33
		Secondary school	amenity	college	School Name, Coordinates (X, Y, Z), Status, Level, Creation Year, Girl, Boy, Total, Master by Student, Contractual, Employee, Banco seko, Board, Semi-Hard, Hard, Table Bench, Good, Passable, Bad, Ratio pupil, Ratio pupil 1, Ratio pupil 2, No water, Latrines, Garbage bin, Reforestation, Fencing, Teacher housing, Others, EPA, School Council	22	26	33
		Training centers	amenity	college	School Name, Coordinates (X, Y, Z), Status, Level, Creation Year, Girl, Boy, Total, Master by Student, Contractual, Employee, Banco	23	25	33

Sector	Sub-sector	Object	Tags OSM		Attributes QGIS/QFIELD	Number of the Layer	Number of objects in the layer	Number of Attributes
			Key	Value				
					seko, Board, Semi-Hard, Hard, Table Bench, Good, Passable, Bad, Ratio pupil, Ratio pupil 1, Ratio pupil 2, No water, Latrines, Garbage bin, Reforestation, Fencing, Teacher housing, Others, EPA, School Council			
	Worship and religion	Churches	amenity	place_of_worship	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	24	80	13
		Mosques	amenity	place_of_worship	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	25	227	13
		Cemeteries	landuse	cemetery	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	26	5	13
Transport and mobility	Bus	Bus stop	highway	traffic_signals	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	27	11	13
		Taxi stop	power	pole	Object Name, Coordinates (X, Y, Z), Activity, Status (Public, Private), Services Offered, Contacts (Phone, email, website), Capacity (Number of people)	28	4	13
		Bus shelters	highway	street_lamp	Object Name, Coordinates (X, Y, Z), Activity, Status (Public, Private), Services Offered, Contacts (Phone, email, website), Capacity (Number of people)	29	4	13
		Crossroad	highway	mini_roundabout	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	30	59	13
Water	Infrastructure	Water tower	man_made	water_tower	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	31	22	13
		Fountain bollard	man_made	water_tap	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	32	2	13
		Borehole	man_made pump	water_well manual	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	33	94	13

Sector	Sub-sector	Object	Tags OSM		Attributes QGIS/QFIELD	Number of the Layer	Number of objects in the layer	Number of Attributes
			Key	Value				
		Well	man_made	water_well	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	34	39	13
	Network	Main stream	waterway	river	Name, Description, length	35	497	3
		Secondary stream						
Referential	Administrative limits	Neighborhood limit	admin_level	9	Name, Area, Description	36	68	3
	Land use	Residential area	landuse	residential	Object Name, Area (m2)	37	180	2
		University area	landuse	university	Object Name, Area (m2)	38	1	2
		Wetland	landuse	wetland	Object Name, Area (m2)	39	8	2
		Scree	landuse	scree	Object Name, Area (m2)	40	6	2
		Grassland	landuse	grassland	Object Name, Area (m2)	41	43	2
		Scrub	landuse	scrub	Object Name, Area (m2)	42	53	2
		Forest	landuse	forest	Object Name, Area (m2)	43	33	2
		Play ground	landuse	recreation_ground	Object Name, Area (m2)	44	28	2
		Farmland	landuse	farmland	Object Name, Area (m2)	45	119	2
		Railwail footprint	landuse	railway	Object Name, Area (m2)	46	2	2
		Industrial area	landuse	industrial	Object Name, Area (m2)	47	3	2
	Survey	Building exposed to inundation				48	3329	48
		Inundated building				49	615	48
		Building exposed to geomorphological risk				50	1415	43
Waste management	Waste management	Garbage bins	waste	trash	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	51	32	13
		Wild junk pile	amenity	waste_disposal	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	53	113	13
Economic activity	Business	Societies	office	company	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	54	1	13

Sector	Sub-sector	Object	Tags OSM		Attributes QGIS/QFIELD	Number of the Layer	Number of objects in the layer	Number of Attributes
			Key	Value				
		Flea market	shop	second_hand		55	8	29
		Supermarket	shop	supermarket		56	7	28
		Shops	shop	variety_store		57	1882	32
		E Schops	shop	electronics		58	121	30
	Finance	Bank	amenity	bank	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	59	6	13
		Microfinance	amenity	bank		60	37	25
		Insurance	office	insurance		61	15	25
	Communication	Radio channel	man_made	communications_tower		62	2	24
		TV channel	man_made	communications_tower	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	63	1	13
		Newspaper/Press	office	newspaper	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	64	2	13
	Services	Gas station	amenity	fuel		65	20	28
		Travel agencies	office	travel_agent		66	14	28
		Railway station	railway	station	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	67	1	13
		Airport	aeroway	aerodrome	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	68	1	13
		Post Office	amenity	postoffice	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	69	9	13
	Accommodation and restoration	Restaurants	amenity	restaurant		70	156	28
		Hostel	tourism	hotel		71	16	28
		Milk Bar	amenity	cafe		72	39	29
		Snack	amenity	bar		73	157	31
		Nightclub	amenity	nightclub		74	2	29

Sector	Sub-sector	Object	Tags OSM		Attributes QGIS/QFIELD	Number of the Layer	Number of objects in the layer	Number of Attributes
			Key	Value				
		Driving School	amenity	driving_school		75	10	30
	Merchant equipment	Bakeries	shop	bakery		76	31	32
		Billboards	office	advertising_agency	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	77	42	13
		Truck Park	amenity	parking	Coordinates (X, Y, Z), Neighborhood, Type, Category, Name, Contacts (Phone, email, fax), Picture, Opening time, Closing time, Capacity	78	11	13
		Slaughterhouses	amenity	slaughterhouse		79	2	20
TOTAL							10132	1381

PART 3: Project Results

3.1: Monitoring and Evaluation

Theme 1: Data Collection and Release

Indicator	Metric	Target	Data Source	Disaggregation
1.1 Amount of area mapped using a participatory approach, that has been validated	328 sq km	4 sq km	<ul style="list-style-type: none"> - Decree of delimitation of the urban perimeter - Aerial images (satellite and drone) 	N/A
1.2 Number of geospatial layers developed relevant to the resilience problem identified	79	101 layers	<ul style="list-style-type: none"> - SRTM NASA - Ngaoundéré City Council - ACAGER - OpenStreetMap - National Institute of Cartography - Central Bureau of the Census and population Studies - National Institute of Statistics - National Participatory Development Program (NPDP) - Ministry of Public Work 	N/A 1. Museum 2. Monument 3. Public Library 4. Public garden 5. Urban forest 6. Stadium 7. Sports complex 8. Public services 9. Division and Subdivision Offices 10. City hall 11. Chiefdom 12. Gendarmerie 13. Police 14. Firefighters 15. NGO 16. Hospitals 17. Health centers 18. Analysis laboratory 19. Pharmacies 20. Nursery school 21. Primary school 22. Secondary school 23. Training centers 24. Churches 25. Mosques 26. Cemeteries 27. Bus stop 28. Taxi stop 29. Bus shelters 30. Crossroad 31. Water tower 32. Fountain bollard 33. Borehole

				34. Well
				35. Main stream
				36. Secondary stream
				37. Neighborhood limit
				38. Residential area
				39. University area
				40. Wetland
				41. Scree
				42. Grassland
				43. Scrub
				44. Forest
				45. Play ground
				46. Farmland
				47. Railway footprint
				48. Industrial area
				49. Building exposed to inundation
				50. Inundated building
				51. Building exposed to geomorphological risk
				52. Garbage bins
				53. Wild junk pile
				54. Societies
				55. Flea market
				56. Supermarket
				57. Shops
				58. E Shops
				59. Bank
				60. Microfinance
				61. Insurance
				62. Radio channel
				63. TV channel
				64. Newspaper/Press
				65. Gas station
				66. Travel agencies
				67. Railway station
				68. Airport
				69. Post Office
				70. Restaurants
				71. Hostel
				72. Milk Bar
				73. Snack
				74. Nightclub
				75. Driving School
				76. Bakeries
				77. Billboards
				78. Truck Park

				79. Slaughterhouses
1.3 Number of attributes collected relevant to the resilience problem identified	1381	800 attributes (tags)	<ul style="list-style-type: none"> - SRTM NASA - Ngaoundéré City Council - ACAGER - OpenStreetMap - National Institute of Cartography - Central Bureau of the Census and population Studies - National Institute of Statistics - National Participatory Development Program (NPDP) - Ministry of Public Work 	See the Tab of the Section 2.3 above
1.4 Number of government or other pre-existing datasets used relevant to the resilience problem identified	3	24 datasets	<ul style="list-style-type: none"> - Ngaoundéré City Council - National Institute of Cartography - Central Bureau of the Census and population Studies - National Institute of Statistics - National Participatory Development Program (NPDP) - Ministry of Public Work 	N/A <ul style="list-style-type: none"> - Ngaoundéré City Council; - National Institute of Cartography; - Central Bureau of the Census and population Studies.
1.5 Data collection has taken into account gender vulnerabilities	The team look at the impacts of floods on the social life and economic activities of women, and especially the losses that these disasters cause to them.			

Theme 2: Data Product Development

Indicator	Metric	Target	Data Source	Disaggregation
2.1 Number of people attending presentations who are made aware of the data product	433 people 16% women	200 people 40% women	-Focus group attendance records - Information meeting attendance records	Civil Society Organizations 3 women 4 men Traditional authorities 0 woman 17 men Administrative authorities 2 women 10 men Community groups 13 women 121 men OSM community of Ngaoundéré 29 women 61 men Students 23 women 151 men
2.2 Number of people trained to use data product	309 people 21% women	155 people 59% women	-Training sessions	Civil Society Organizations 3 women 4 men Traditional authorities 0 woman 17 men Administrative authorities 2 women 10 men Community groups 13 women 81 men OSM community of Ngaoundéré 24 women 41 men Students 23 women 91 men
2.3 Number of people with improved understanding of the resilience	223 people 25% women	140 people 57% women	-Appropriation	Civil Society Organizations 3 women 4 men Traditional authorities 0 woman

problem identified based on data product				17 men Administrative authorities 2 women 10 men Community groups 11 women 41 men OSM community of Ngaoundéré 18 women 27 men Students 21 women 69 men
2.4 Number of people who would use data product to inform their disaster risk management decisions	180 people 31% women	112 people 51% women	-Capitalization	Civil Society Organizations 3 women 4 men Traditional authorities 0 woman 17 men Administrative authorities 2 women 10 men Community groups 11 women 28 men OSM community of Ngaoundéré 18 women 20 men Students 21 women 46 men

Theme 3: Capacity Strengthening and Institutional Development

Indicator	Metric	Target	Data Source	Disaggregation
3.1 Number of training events held	17	16 events 3 Training seminars 10 Focus groups 3 Institutional Capacity Building Meetings	N/A	1 Training seminar 3 Institutional Capacity Building Meetings 13 Focus groups

3.2 Number of people trained	142 people 32% women	137 people 60% women	Training Session	TRAINING SEMINAR Students 24 women 62 men OSM community of Ngaoundéré 21 women 35 men
3.3 Number of people participating in community mapping activities	264 21,21% women	91 people 47% women	Participatory Mapping Session	Traditional authorities 0 women 33 men Community groups 36 women 129 men Students 11 women 15 men OSM Community of Ngaoundéré 6 women 12 men Administrative authorities 0 women 2 men
3.4 Number of stakeholder groups consulted (in planning activities, product development, etc.)	6 33	6 groups 50% women	Stakeholder groups	<ol style="list-style-type: none"> 1. Ngaoundéré City Council 2. Vina Divisional officer 3. Ngaoundéré 1 sub divisional officer 4. Ngaoundéré 2 sub divisional officer 5. Ngaoundéré 3 sub divisional officer 6. Ministry of Housing and Urban Development 7. Cameroon Inclusive and Resilient Cities Project 8. Divisional Delegation of Housing and Urban Development 9. Divisional Delegation of Environment, protection of Nature and Sustainable Development 10. Firefighters 11. Divisional Delegation of state property, survey's and land tenure

				12. Divisional Delegation of Social Affairs 13. Divisional Delegation of Basic Education 14. Divisional Delegation of Secondary Education 15. Divisional Delegation of Economy, Planning and Regional Development 16. National Participatory Development Program 17. Lamido (Divisional traditional chiefdom) 18. Neighborhood chiefdom 19. OpenStreetMap team Cameroon 20. World Bank 21. European Union 22. GIZ 23. Red cross 24. Geomatics Lab 25. Urban planning and development Laboratory 26. NYCC (National Youth Council of Cameroon) 27. Women's Association of Ngaoundere 2 28. Union of Groups of common interest of women planters of 12 poles (Sabongari 3) 29. Dynamic women of Gadamabanga 30. Target Neighborhoods Development Committee 31. Brick manufacturers 32. Population living in Risk zones 33. Students
3.5 Number of women engaged in the design of community maps	31	53 women 100% women	Women engaged in the design of community maps	Civil Society Organizations 0 women Community groups 22 women Administrative authorities 0 women Students 3 women OSM community of Ngaoundéré 6 women

3.6 Gender-differentiated vulnerabilities identified through Gender Analysis	The team determined the differentiated degree of vulnerability of each component of the communities living in the areas of risk through the impacts of the floods on the main economic activities and the socio-cultural barriers to self-determination of women.			
3.7 Number of barriers to women's participation in Open Cities Africa identified	(in addition to providing a metric, please identify what the barriers are)	3 1. Disinterest in digital tools for spatial data collection; 2. Working conditions (difficulty adapting to work in risk areas and working hours are not adapted to those of household activities); 3. Sociocultural barriers (In Ngaoundéré, female leadership is not yet well improved).	Gender analysis	N/A
3.8 Number of barriers to women's participation in Open Cities Africa addressed	(In addition to providing a metric, please identify the barriers that were addressed)	3 1. Sensitized and trained women (mainly students) in the use of collaborative mapping tools; 2. Adapted our working hours to the availability of women involved in the project; 3. Meets some heads of	-Gender analysis -Project activities	N/A

		women families involved in the project to explain to them the merits of the missions in which their women or girls are involved.		
3.9 Exchanges and/or discussions with other City teams	<p><i>We started them at the launch event in Kampala and continue on the Open Cities Africa online training platform. For the future, we plan to establish partnerships with teams with issues close to that of our city and especially those that will allow us to improve in the new free mapping tools. The Kinshasa team, for example, has created a Geomatic's association; we have already contacted them to propose a partnership with the Geomatic's Lab of the University of Ngaoundéré which is one of the key stakeholders of our project. We also get contact with the Senagalese National Association of Geomaticiens lead by Dr Soulaye Wade of the Saint Louis Team.</i></p>			

3.2: Gender

The city of Ngaoundere is facing recurring challenges related to urban floods, which are increasing as its uncontrolled urbanization continues. Urbanization has been largely spontaneous, resulting from the increasing occupation of many flood or wetlands and mountain slopes without adequate land management. Now that people have occupied flood plains, the risk of flood disasters is higher. The participatory mapping can make it easier to develop rescue plans and also help better planning of urban growth that avoids areas of flooding risk and even landslides risk.

These challenges affect different skills and capacities for Women and Men

For women:

- Under-schooling;
- Higher levels of poverty;
- Traditional women's occupations;
- Childcare responsibilities;
- Lack of technical skills;
- Low financial resilience after a disaster, after floods, women are financially vulnerable because they have lost all or part of their investment. Often, other women come to the aid of victims by putting at their disposal dry plots, or they wait for the waters to retire to restart their activities;
- High dietary requirements during menstruation, pregnancy and lactation, in case of floods, women end up eating lower quality foods and much less;
- High degree of exposure to diseases.

For men:

- Extensive responsibilities of caring for their families;

- Spatial segregation due to the fact that those who settled in the flooding zones are mainly the poorest men, this situation affects men more than women because it is the men who are in charge of finding the place where the family will have to settle and look for financial means to build houses;
 - Weak levels of risk awareness;
 - Men are the one in charge of rebuilding houses and of replacing the significant material loosed after flooding.
- Our team incorporated these findings from Gender Analysis into project approach and activities by:Producing and making available to the target populations, thematic maps concerned with surface covered by water during floods, number of houses and urban infrastructures to be affected or affected, number of people to be affected and/or to relocate, number of deaths, facilitate the conception of alert and rescue plans and facilitate the evaluation of investment costs from Open Cities Africa - Ngaoundéré database. All these was collected for the period 2016-2018.Digitizing and updating information on risk areas in the OpenStreetMap Database;
 - Extension of reports and field observations to local community will increase the understanding of risk information by men.

To encourage the participation of women as both members of the project team and as community stakeholders we have:

- Recruit 50% women for field data collection;
- Evaluate the Mappers on the basis of the result and not on the time taken at the work place (adapting working hours to better fit women's schedules);
- Organize meetings with heads of women's families involved in our activities to explain the project mission;
- Creating social network groups.

3.3: Stakeholder and Community Engagement

Name	Potential Role/Contribution	Level of Prioritization
Authorities		
- Ngaoundéré City Council (Ministry of Decentralization and Local Development)	<ul style="list-style-type: none"> - Project leader (Client) - Beneficiary of project deliverables for sustainability - The project will provide decision support tools for better management of their territory - Better knowledge of flood risk and techniques to prevent it - Acquisition of knowledge and collaborative mapping techniques via OSM 	High
- Departmental Delegation of the Ministry of Housing and Urban Development	<ul style="list-style-type: none"> - Project manager - Provides project management, technical monitoring and administrative support - The project will provide decision support tools for better management of Ngaoundéré City Council territory 	High
- Vina Divisional officer (Ministry of Territorial Administration)	<ul style="list-style-type: none"> - Administrative support in the implementation and execution of the project - Better knowledge of the territory of Ngaoundéré city and the floods risk 	High
- Departmental Delegation of the Ministry of Environment, protection of Nature and Sustainable Development	<ul style="list-style-type: none"> - Technical support - The project will provide decision support tools for better management of Ngaoundéré City Council territory 	Medium
- Emergency Department (Departmental Delegation of the Ministry of Health)	<ul style="list-style-type: none"> - Beneficiary - The project will provide decision support tools (maps, application) for better intervention in disaster flood zones 	Low
- Firefighters (Ministry of Defense)	<ul style="list-style-type: none"> - Beneficiary - The project will provide decision support tools (maps, application) for better intervention in disaster flood zones 	Low
- Departmental Delegation of the Ministry of state property, survey's and land tenure	<ul style="list-style-type: none"> - Technical support - The project will provide decision support tools for better management of Ngaoundéré City Council territory 	Medium
- Departmental Delegation of the Ministry of Social Affairs	<ul style="list-style-type: none"> - Beneficiary - The project will provide decision support tools for better management of Ngaoundéré City Council territory 	Low
- Departmental Delegation of the Ministry of Basic Education	<ul style="list-style-type: none"> - Beneficiary 	Low

Name	Potential Role/Contribution	Level of Prioritization
	- The project will provide decision support tools for better management of Ngaoundéré City Council territory	
- Departmental Delegation of the Ministry of Secondary Education	- Beneficiary - The project will provide decision support tools for better management of Ngaoundéré City Council territory	Low
- Departmental Delegation of the Ministry of Economy, Planning and Regional Development	- Financial support - The project will provide decision support tools for better management of Ngaoundéré City Council territory	Low
- Traditional authorities	- Local support in the implementation and execution of the project - The project will provide decision support tools that will help them better prevent flooding and develop their rescue plan.	High
OSM Community		
- OpenStreetMap Cameroon	- Technical support - Popularization of collaborative mapping tools and techniques	High
Civil society organization		
- ADEES: Association for Environmental and Social Economic Development;	- Awareness on risks - The project will provide a large amount of data that they can capitalize	Medium
- APROSPEN: Action for the promotion of health, production and the environment;	- Awareness on risks - The project will provide a large amount of data that they can capitalize	Medium
- CANALDEV: Canal development;	- Awareness on risks - The project will provide a large amount of data that they can capitalize	Medium
- PROMPT: Mapping and tourism promotion company	- Awareness on risks - The project will provide a large amount of data that they can capitalize	Medium
International organizations		
- World Bank	Financial, technical and scientific support	High
- European Union	Financial, technical and scientific support	High
- GIZ	- Beneficiaries - The project will provide a large amount of data that they can capitalize	Low
- Red cross	- Intervention techniques in risk areas, prevention and management of floods	Medium

Name	Potential Role/Contribution	Level of Prioritization
	- The project will provide a large amount of data that they can capitalize	
University of Ngaoundéré		
- Geomatics Lab	- Technical and scientific support - Training of students, teachers and researchers of the Lab to new tools of collaborative mapping via OSM - Field work materials (tablet and maps) at the end of the Project will be transfer to the Lab for students training	High
- Urban planning and development laboratory	- Technical and scientific support - Training of students, teachers and researchers of the Laboratory to new tools of collaborative mapping via OSM	Medium
Community groups		
- NYCC (National Youth Council of Cameroon)	- Awareness on risks - Better knowledge of flood risk and techniques to prevent it - Acquisition of knowledge and collaborative mapping techniques via OSM	Medium
- Women's Association of Ngaoundere 2	- Awareness on risks - Better knowledge of flood risk and techniques to prevent it - Acquisition of knowledge and collaborative mapping techniques via OSM	Medium
- Union of Groups of common interest of women planters of 12 poles (Sabongari 3)	- Data collection and awareness on risks - Better knowledge of flood risk and techniques to prevent it - Acquisition of knowledge and collaborative mapping techniques via OSM	Medium
- Dynamic women of Gadamabanga	- Data collection and awareness on risks - Better knowledge of flood risk and techniques to prevent it - Acquisition of knowledge and collaborative mapping techniques via OSM	Medium
- Target Neighborhoods Development Committee	- Data collection and awareness on risks - Better knowledge of flood risk and techniques to prevent it	High

Name	Potential Role/Contribution	Level of Prioritization
	- Acquisition of knowledge and collaborative mapping techniques via OSM	
- Brick manufacturers	- Awareness on risks - Better knowledge of flood risk and techniques to prevent it	Low
- Population living in those Risk zones	- Data collection and awareness on risks - Better knowledge of flood risk and techniques to prevent it - Acquisition of knowledge and collaborative mapping techniques via OSM	High

In terms of how our approach to stakeholder engagement evolved during the course of the project, overall, we have not encountered any particular challenges as each of the engaged stakeholders has played its role well. For example, the administrative authorities issued us all the authorizations in time and the Urban Community of Ngaoundéré provided us with the logistical means for some of our fieldwork. In view of the sustainability of the activities of the Open Cities Africa project, the Ministry of Housing and Urban Development via the Cameroon Inclusive and Resilient Cities Project has been strongly involved in the finalization of our product and its various maps. The Atlas thus produced has been prefaced by the Minister of Housing and Urban Development.

3.4: Final Product

Our team had the opportunity to step in to share their experiences with the User Centered Design process. To this end, we have received different requests from stakeholders: the Ngaoundéré City Council would like to have an Atlas for planning urban development. The University, on the other hand, suggest having a platform where these data must be stored in order to allow them a more fluid download for scientific works. Populations living in the flood land also need maps of their neighborhood to track development activities.

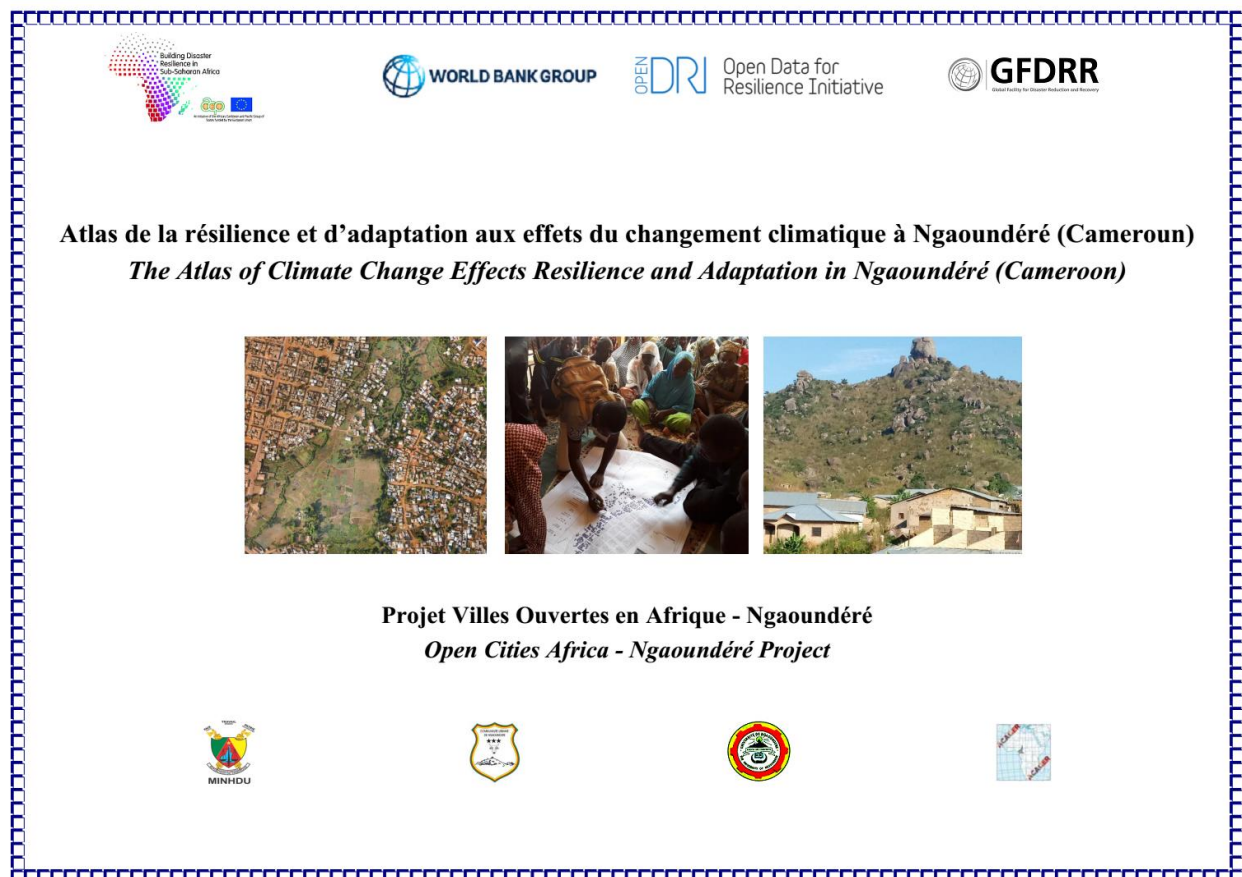
The User Centered Design process has changed our contact with stakeholders who feel more responsive to their needs to achieve goals that are sometimes individual into community goals. We feel much more at the service of the stakeholders who need to solve their problem and we make our contribution by providing them with data translated into paper or digital maps.

The final product of the Open Cities Africa - Ngaoundéré is an Atlas which contains 93 maps including 03 presenting the Ngaoundéré City Council, 12 flood zones along the rivers, 74 of the neighborhoods impacted by floods, at the rate of 02 per neighborhoods, 01 flood simulation at the Soum-Soum and Mabanga rivers junction, and 03 of mountainous areas exposed to rock falls.

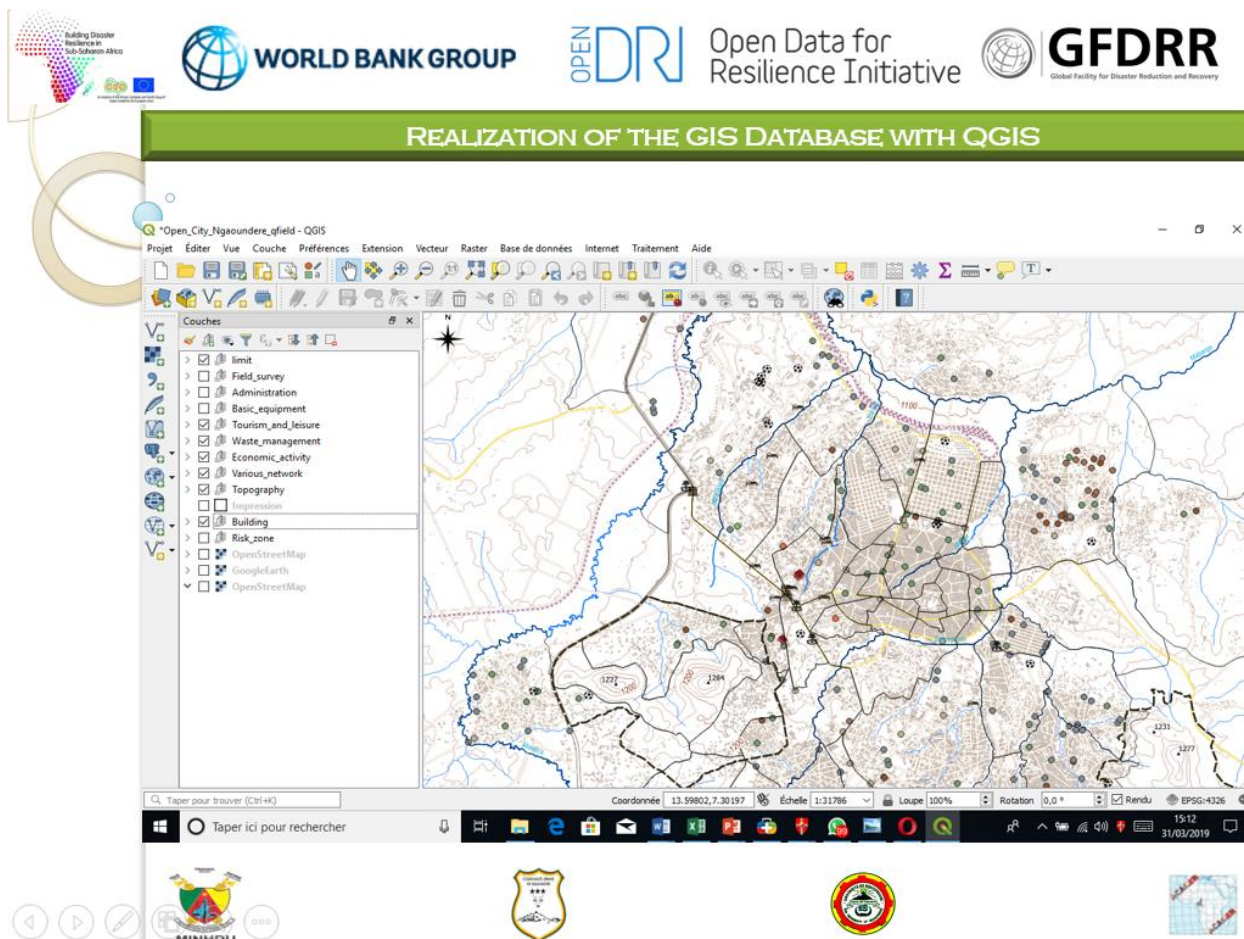
All the maps of the document are commented on the statistical data of the district and our knowledge of the field. The document is entirely written in French and English to facilitate its exploitation by the greatest number of stakeholders. The complete Database and Atlas are available for free download on the ACAGER website (<http://acager.org/>) via the following links:

- <http://acager.org/portalgis/en/?type=limits>: for the Database;
- <http://acager.org/en/index.php/2019/05/12/atlas-de-la-resilience-et-dadaptation-aux-effets-du-changement-climatique-a-ngaoundere/>: for the full version of the Atlas.

High resolution images that best represent our product.



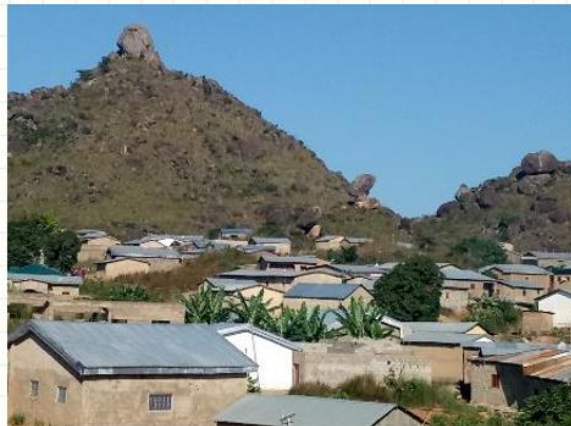
Picture 1. The front cover of the Open Cities Africa - Ngaoundéré Team Product



Picture 2. Partial view of the GIS database built and which allowed the production of maps



Recurring floods



<https://opendri.org/g/cartographie-libre-ngaoundere-changement-climatique/>

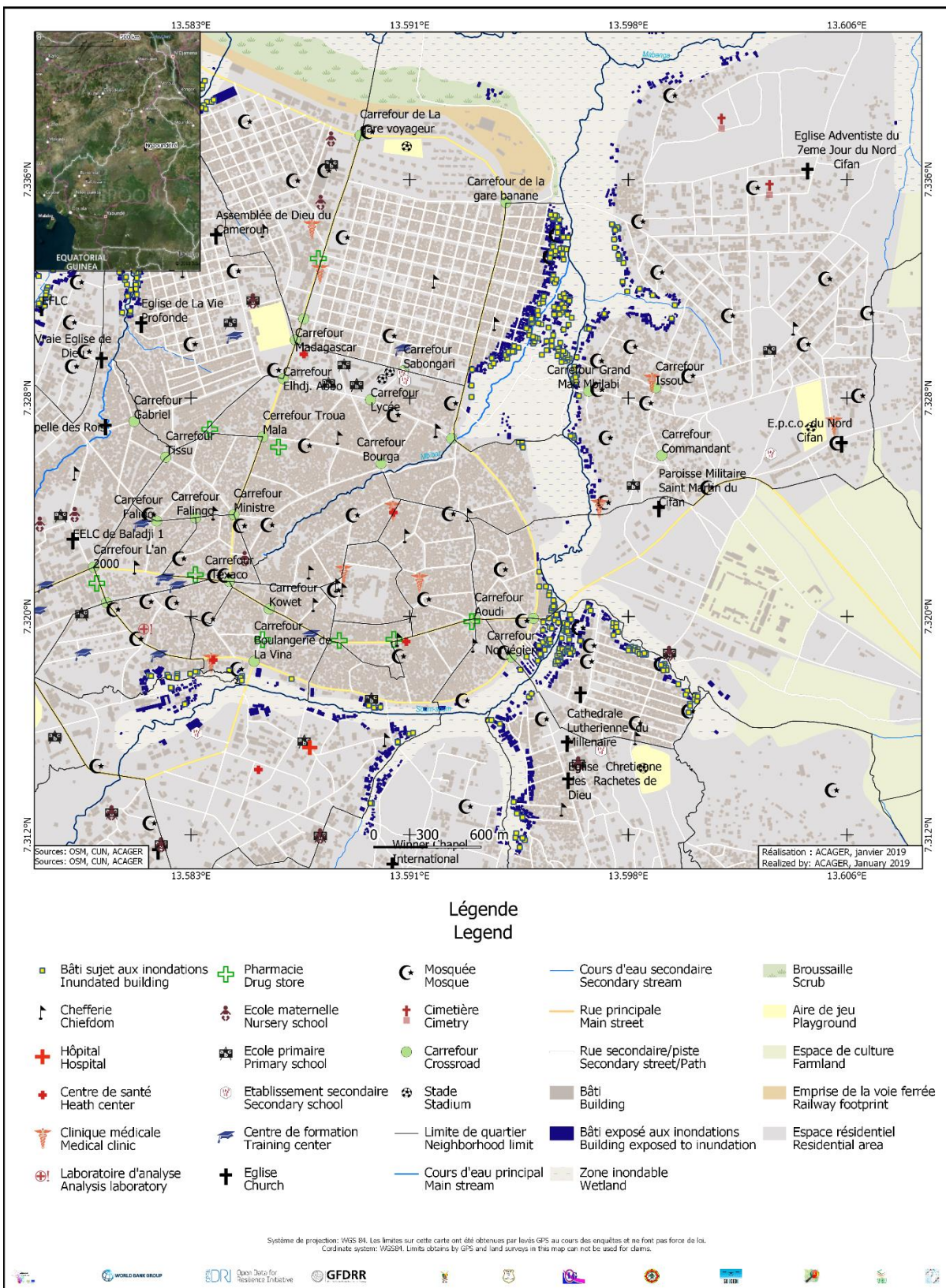
Exposure to rockfall

Picture 3. Problem Statement in pictures



Picture 4. View of the maps on tarpaulin and copies of the Atlas handed to the leaders of the neighborhoods of risk areas, the Lamido of Ngaoundéré, the Government Delegate to the Ngaoundéré City Council, Departmental Delegates, the Minister of Housing and Urban Development, the Cameroon Inclusive and Resilient Cities Project, the World Bank Group Representation in Yaoundé and the University of Ngaoundéré

CARTE D'EXPOSITION AUX RISQUES D'INONDATION DE LA RIVIERE SOUM-SOUM SOUM-SOUM RIVER FLOOD RISK MAP



Stream Length in km: 7.45

Flow direction: S - N

Flood prone area in ha: 109.59

Number of exposed buildings: 1313 including 1 service station, 3 mosques, 1 primary school, 1 football field and 1 prison.

Number of regularly impacted buildings during the raining season: 238 (18.13%)

Number of deaths related to floods during the last 3 years: 7

Mapped Ward in the area:

- **Aoudi**
- **Camp Norvégien**
- **Nord CIFAN**
- **Sabongari 3**
- **Sabongari América**

During the last 3 years, we can see that the impacts of the floods are increasing. This suggests that if nothing is done, both at the level of the resident populations (better organization and strengthening of the activities of the Neighborhood Development Committees (NDC) with regard to the fight against the floods), that at the level of the decision-makers it is it is very likely that the consequences of flooding will double over the next 3 years.

For decision-makers, the following actions are recommended:

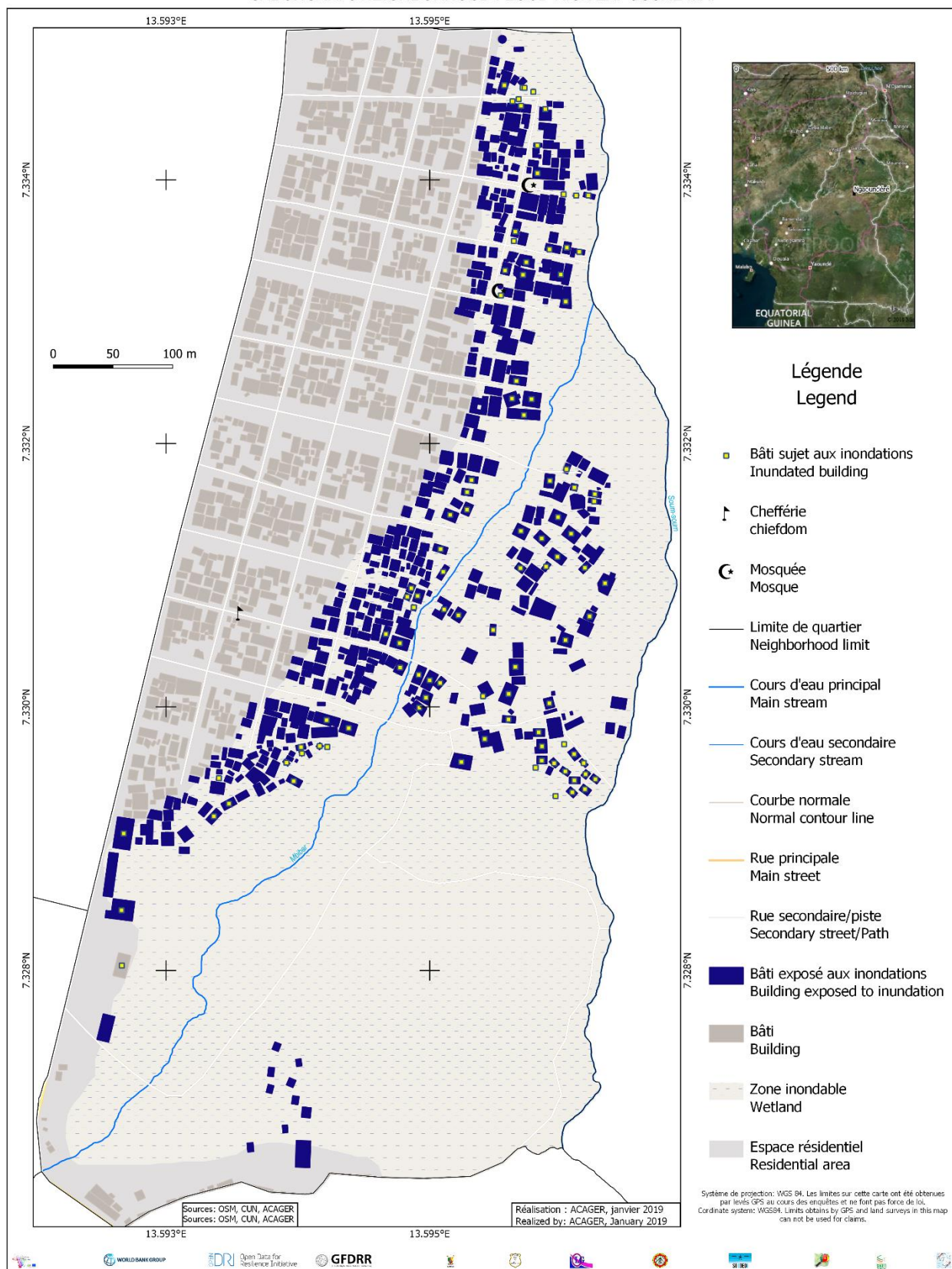
- **Curving of the Soum-Soum watercourse;**
- **V-shaped pipe in the steep upstream section of Soum-Soum;**
- **U-shaped channel with construction of the water retention reaches in the downstream section from the Boulagerie de la Vina junction to its confluence with Mabanga;**
- **Materialization in the field using concrete plates in flood risk areas to prevent new construction from erecting;**
- **Regular collection of garbage.**

Given the speed of the water, it is strongly recommended that in case of floods, emergency plans are activated by shore.

Following these observations, we propose, for the most affected neighborhoods in the Soum-Soum watershed, a certain number of actions/activities to be undertaken both by the populations and by the administrative and municipal authorities.

Picture 5. View of the Soum-Soum Stream map and its commentary in the Atlas

CARTE D'EXPOSITION DU QUARTIER SABONGARI 3 AUX RISQUES D'INONDATIONS
SABONGARI 3 NEIGHBORHOOD FLOOD RISK EXPOSURE MAP



Data collection Period: August 14 - November 23, 2018

Surface Area in ha: 36.84

Flood prone area in ha: 24.28 (65.91%)

Total population in 2018: 4042

Female population in 2018: 2003 (49.56 %)

Total number of buildings: 1099

Number of exposed buildings: 458 (41.67%)

Number of regularly impacted buildings during the raining season since 2015: 101

Number of destroyed or abandoned buildings: 7

Number of people living in houses regularly flooded during the rainy season in the last three years: 584 of which 149 are women, 159 men, 180 schoolarised children and 96 unschoolarised children.

Recommendations:

For populations impacted or potentially impacted, it is suggested:

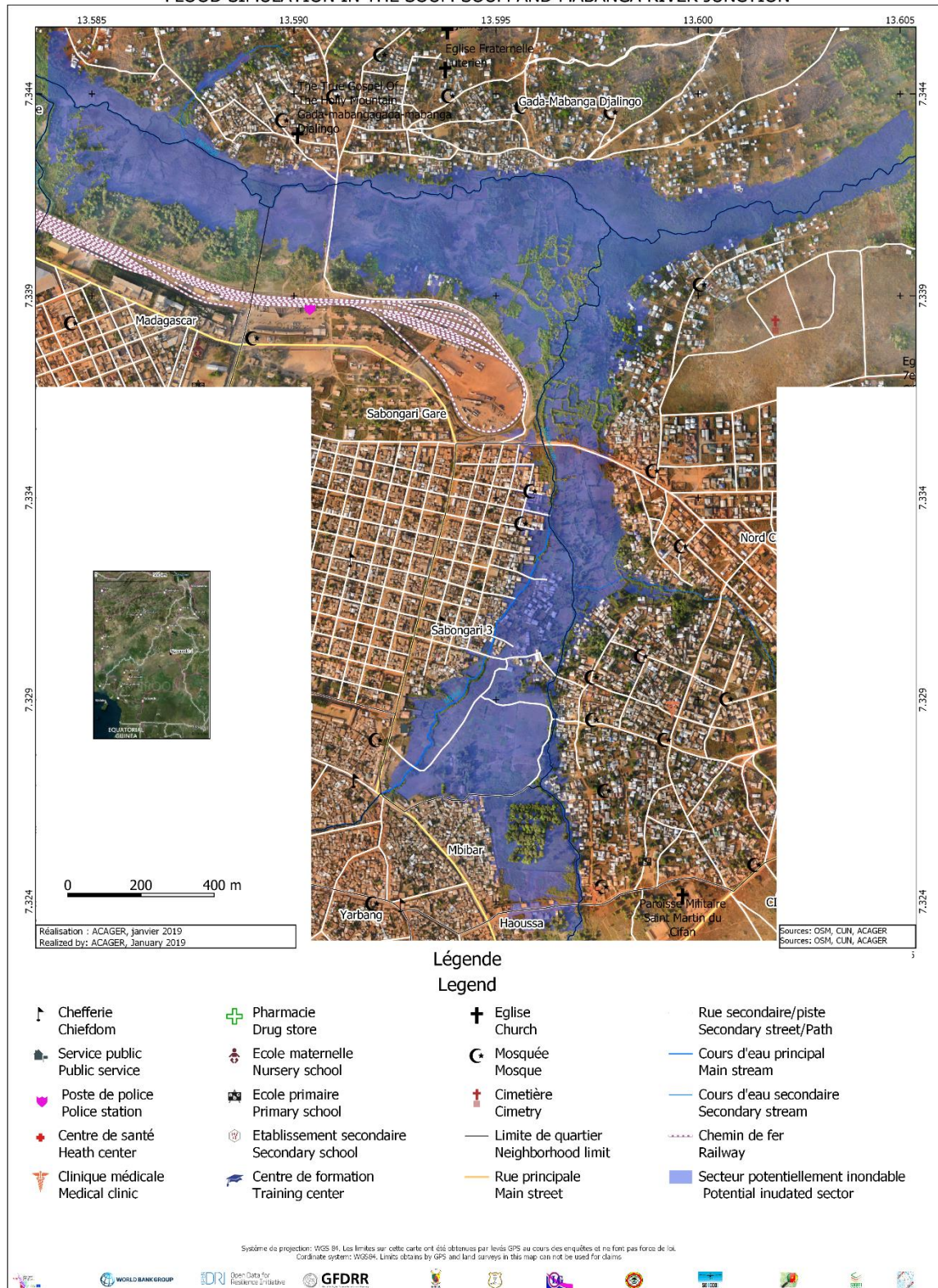
- *Awareness by Sabongari 3 Neighborhood Development Committee (NDC) to good management of household waste;*
- *Set up an alert system in the Sabongari 3 Neighborhood through whistles, social networks or Short Message Service (SMS);*
- *Encouragement of the planting of trees including fruit plant whose roots can contribute to the fight against bank erosion.*

Decision-makers must:

- *Intensify awareness of good waste management in the Sabongari 3 Neighborhood ;*
- *Fight against construction in the flood risk zone of the Sabongari 3 Neighborhood;*
- *Mark on the field with the populations of the Sabongari 3 Neighborhood the flooding risk sector;*
- *Create a green belt in the Sabongari 3 neighborhood look after by its people.*

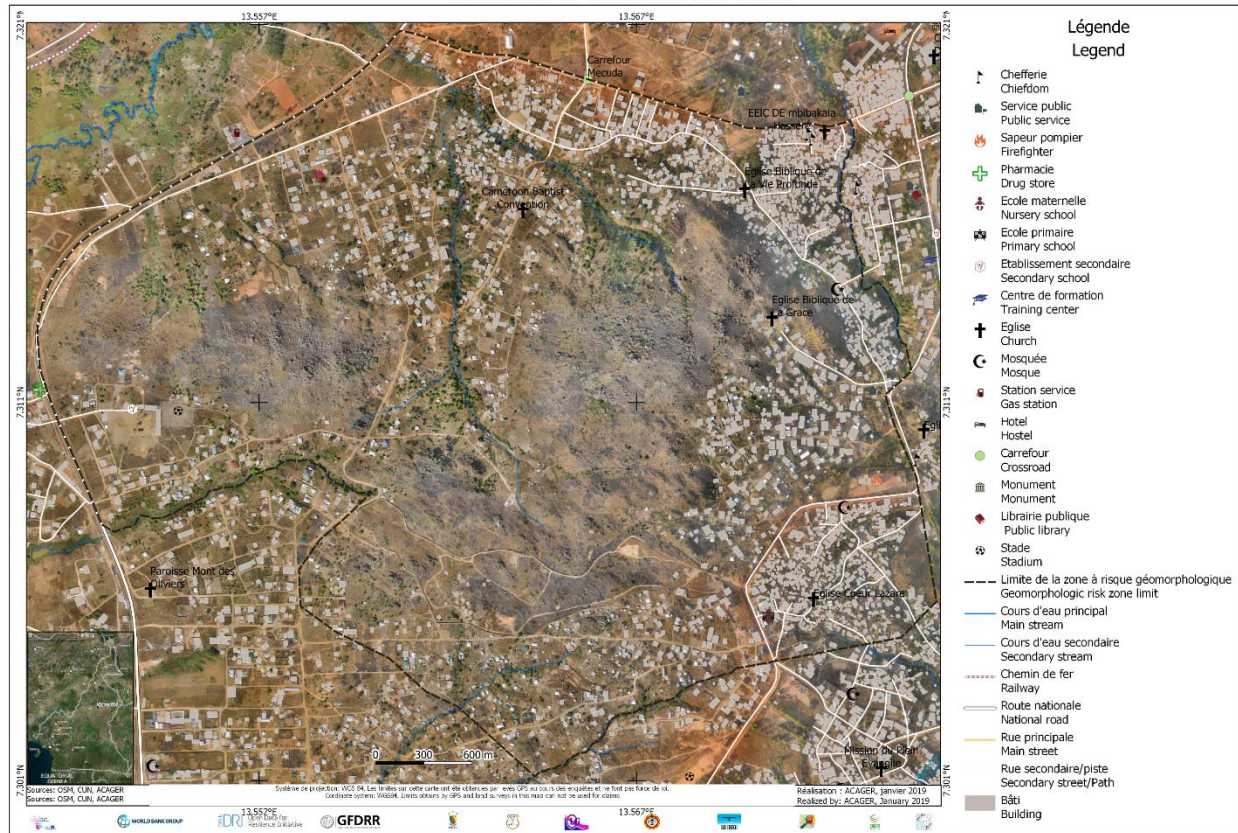
Picture 6. View of the Sabongari 3 ward map and its commentary in the Atlas

SIMULATION DES INONDATIONS AU CONFLUENT DES RIVIERES SOUM-SOUM ET MABANGA
FLOOD SIMULATION IN THE SOUM-SOUM AND MABANGA RIVER JUNCTION



Picture 7. View of the flood simulation in the Soum-Soum and Mabanga river junction

SPATIO-CARTE DU MONT NGAOUNDÉ
SPATIAL MAP OF NGAOUNDÉ MOUNTAIN



Data collection Period: **August 14 - December 5, 2018**

Risk area in ha: **366.57**

Total number of buildings: **5937**

Statistics per Neighborhood:

<i>Neighborhood name</i>	<i>Total number of buildings</i>	<i>Number of exposed buildings</i>	<i>Percentage of exposed buildings</i>
<i>Bamyanga Lycée</i>	<i>625</i>	<i>69</i>	<i>11.04</i>
<i>Béka Hosséré</i>	<i>1604</i>	<i>111</i>	<i>6.92</i>
<i>Mbibakala Hosséré</i>	<i>755</i>	<i>755</i>	<i>100.00</i>
<i>Mont Ngaoundéré</i>	<i>93</i>	<i>93</i>	<i>100.00</i>
<i>Onaref</i>	<i>1123</i>	<i>580</i>	<i>51.65</i>
<i>Socaret 1</i>	<i>1284</i>	<i>623</i>	<i>48.52</i>
<i>Socaret 2</i>	<i>453</i>	<i>450</i>	<i>99.34</i>
<i>Mount Ngaoundéré zone</i>	<i>5937</i>	<i>2681</i>	<i>45.16</i>

Our field surveys show that 90.35% of the inhabitants of the Mount Ngaoundéré area are not aware of the risks. For those who are aware of this, the risks of falling rock (54.44%), landslide (37.78%), collapse (6.67%) and gully (1.11%) are respectively the best known.

In terms of risk adaptation strategies developed by the inhabitants of the Mount Ngaoundéré area, 64.71% of respondents are for earthworks and 35.29% are for the construction of retaining walls for the remaining.

The following actions are recommended:

- *Stabilization in situ of the blocks likely to hurtle on slopes;*
- *Demarcation or materialization in the field using concrete slabs specifying the type or types of geomorphological risks of the zone;*
- *Fight against water erosion by dense root matrix trees planting and building stone biefs in gullies.*

Picture 8. View of the Mount Ngaoundéré spatial-map and its commentary in the Atlas



Picture 9. Solemn delivery of the Atlas to the Ngaoundéré City Council Government Delegate by the Divisional Officer of Vina

PART 4: The Open Cities Africa Experience

4.1: Challenges & Successes

The main challenge the team faced was to engage all stakeholders in participatory mapping activities. The fact is that they did not perceive at first glance the benefits and benefits of the different activities of the Project. For populations in risk areas, for example, they wanted the project to help them by providing them with money or by carrying out the necessary works to reduce or even eliminate the risk. However, once we explained to them the objectives of the project and the future impact of their strong involvement in the various activities, their collaboration was frank. It is also the greatest pride of the Open Cities Africa - Ngaoundéré Project i.e. the strong involvement of local stakeholders including the City Council, the administrative authorities, the traditional chiefdoms and the populations of the impacted areas.

4.2: Lessons Learned

The first lesson we learn from this project is the importance and reliability of free data from a collaborative mapping process conducted with method and rigor. The second is the importance of a perfect collaboration between the different stakeholders, which has the advantage of having a greater diversity of reliable information on the one hand, and to ensure their effective use so a more great influence in decision-making. The third lesson is taking into account the needs of the stakeholders in the design of a product if we want it to be useful to them.

4.3: Recommendations

The aspects of the initiative that we have appreciated is first the availability and openness of the facilitators and project managers, in the sense that they have never hesitated to provide us with the necessary technical and financial means to the success of our various activities. The second is online continuing training, the Webinars that undoubtedly contributed to the capacity building of the project teams in Africa.

In terms of recommendations, we propose to facilitate mobility of the members of the various teams between them, to allow them to stay with other teams in order to observe *in situ* the working method of others, and especially to share experiences from real situations on the field. We think it would be good to organize at least one regional meeting to allow the different teams to share the experiences face to face, since the work has ended. This meeting is important because, it will allow the teams to think together about the activities they can carry out in order to sustain the skills and achievements of the Open Cities Africa initiative.

PART 5: Sustainability Plan

PART 5.1: Assessing the Benefits to Sustain

Benefit #1:	Sectoral Direct Impacts Help organizations to improve their specific impacts
Sustain? (Y/N)	No
Approximate Timeline	/
List Actors/Stakeholders that would be involved:	NGOs, traditional authorities, community groups, firefighters, emergency department of the hospital, Red Cross, OSM Cameroon.

Benefit #2:	General improvement of data for policy and decision makers
Sustain? (Y/N)	Yes
Approximate Timeline	Start in June 2019 (For details see Objective #2 in Part 5.4 of this Final Report)
List Actors/Stakeholders that would be involved:	The administrative authorities, the Ngaoundéré City Council, the district municipalities, the traditional authorities, the divisional delegation of the habitat and the urban development, the divisional delegation of the environment, the protection of the nature and the durable development , the divisional delegation of the economy, planning and spatial planning the divisional delegation of social affairs, the divisional delegation of State property, Surveys and land tenure, the divisional delegation of basic education, the divisional delegation of secondary education, NGOs and Associations for development.

Benefit #3:	Social impacts for local communities through better data access and use
Sustain? (Y/N)	Yes
Approximate Timeline	Start in July 2019 (For details see Objective #3 in Part 5.4 of this Final Report)
List Actors/Stakeholders that would be involved:	NGOs, traditional authorities, community groups, firefighters, emergency department of the hospital, Red Cross, OSM Cameroon, individual consultants to NGOs

Benefit #4:	Mapping Skills and Career
Sustain? (Y/N)	Yes
Approximate Timeline	Start in July 2019 (For details see Objective #1 in Part 5.4 of this Final Report)
List Actors/Stakeholders that would be involved:	The students of the University of Ngaoundéré, the Geomatic's Lab, the OSM community of Ngaoundéré, the managers of the urban data management, the cartographers, the individual consultants to NGOs, the populations of the city of Ngaoundéré.

Benefit #5:	Open Data/Mapping in Government
Sustain? (Y/N)	Yes
Approximate Timeline	Start in July 2019 (For details see Objective #3 in Part 5.4 of this Final Report)
List Actors/Stakeholders that would be involved:	Ministry of Housing and Urban Development; Cameroon Inclusive and Resilient Cities Project; Ministry of Decentralization and Local Development; Ministry of the Economy, Planning and Spatial Planning; Ministry of Territorial Administration; National Participatory Development Program.

Benefit #6:	Growing the Global Network of Mappers
Sustain? (Y/N)	Yes
Approximate Timeline	Started on May 15, 2019 (For details see Objective #1 in Part 5.4 of this Final Report)
List Actors/Stakeholders that would be involved:	Students of The Ngaoundéré University; the Geomatic's Lab; the OSM community of Ngaoundéré; those responsible for urban data management; cartographers; individual consultants to NGOs; Neighborhood Development Committees.

PART 5.2: Assessing the Challenges

Sustained Benefit #2: General improvement of data for policy and decision makers	
<p>Financial Challenges:</p> <ol style="list-style-type: none"> 1. Lack of regular funding; 2. Challenges related to volunteering and livelihoods; 3. "Commons" Fails (assuming the OSM platform is a shared resource system - called "commons" - then those acting exclusively out of self-interest can have a neutral/negative effect on the entire resource system and without contributing to its development). 	<p>Address Financial Challenges:</p> <ol style="list-style-type: none"> 1. Seek funding from donors by setting up projects that fall within their area of intervention; 2. Encourage different stakeholders to carry out voluntary activities even if their financial means are very limited; 3. Sensitize the different stakeholders on the importance of spatial data sharing so that they realize that the pursuit of the general interest will strengthen their respective personal interests.
<p>Social Challenges:</p> <ol style="list-style-type: none"> 1. Negative competition; 2. Capacity; 3. Social equity/access; 4. Religious barrier for some women groups. 	<p>Address Social Challenges:</p> <ol style="list-style-type: none"> 1. Help the different stakeholders to have a better collaboration; 2. Build the capacity of stakeholders in the organization, management and administration of funds; 3. Train people who are not yet privileged members of society to the tools of free mapping to enable them to make a career; 4. Organize free mapping training conducted by women for women and women's groups exclusively.
<p>Technical Challenges:</p> <ol style="list-style-type: none"> 1. Choosing the wrong hardware or software for the task; 2. OSM expertise not sufficiently in-depth in the country = rely on external technical support; 3. Challenges in locating and monitoring new map changes, large number of changes, and validation gaps. 	<p>Address Technical Challenges:</p> <ol style="list-style-type: none"> 1. Promote the use of OSM software to stakeholders; 2. Support local cartographers to acquire higher level technical mapping skills; 3. Ensure as often as possible better data validation and error correction to help data users to rely on the accuracy of the map.
<p>Institutional Challenges:</p> <ol style="list-style-type: none"> 1. Difficulties related to OSM software integration in government and other important systems (International NGOs, UN, World Bank); 2. Inability to "sell" the concept of open access data in general; 3. Highly unstable political environment, brain drain, and NGOs considered primarily for-profit or corrupt entities. 	<p>Address Institutional Challenges:</p> <ol style="list-style-type: none"> 1. Promote the use of OSM software with government, local NGOs, international NGOs, UN, World Bank; 2. Advocate for open access data; 3. Recruit and share data contributors.

Sustained Benefit #3: Social impacts for local communities through better data access and use	
<p>Financial Challenges:</p> <ol style="list-style-type: none"> 1. "Commons" Fails (assuming the OSM platform is a shared resource system - called "commons" - then those acting exclusively out of self-interest can have a neutral/negative effect on the entire resource system and without contributing to its development). 	<p>Address Financial Challenges:</p> <ol style="list-style-type: none"> 1. Sensitize the different stakeholders on the importance of spatial data sharing so that they realize that the pursuit of the general interest will strengthen their respective personal interests.
<p>Social Challenges:</p> <ol style="list-style-type: none"> 1. Negative competition; 2. Religious barrier for some women groups. 	<p>Address Social Challenges:</p> <ol style="list-style-type: none"> 1. Help the different stakeholders to have a better collaboration; 2. Organize free mapping training conducted by women for women and women's groups exclusively.
<p>Technical Challenges:</p> <ol style="list-style-type: none"> 1. Challenges in locating and monitoring new map changes, large number of changes, and validation gaps. 	<p>Address Technical Challenges:</p> <ol style="list-style-type: none"> 1. Ensure as often as possible better data validation and error correction to help data users to rely on the accuracy of the map.
<p>Institutional Challenges:</p> <ol style="list-style-type: none"> 1. Highly unstable political environment, brain drain, and NGOs considered primarily for-profit or corrupt entities. 	<p>Address Institutional Challenges:</p> <ol style="list-style-type: none"> 1. Recruit and share data contributors.

Sustained Benefit #4: Mapping Skills and Career	
<p>Financial Challenges:</p> <ol style="list-style-type: none"> 1. Lack of regular funding; 2. Challenges in Organizational Leadership, Business Management, Capacity. 	<p>Address Financial Challenges:</p> <ol style="list-style-type: none"> 1. Seek funding from donors by setting up projects that fall within their area of intervention; 2. Build Organizational Leadership Capabilities Through Collaborative Mapping Project Management Training.
<p>Social Challenges:</p> <ol style="list-style-type: none"> 1. Negative competition; 2. Religious barrier for some women groups. 	<p>Address Social Challenges:</p> <ol style="list-style-type: none"> 1. Help the different stakeholders to have a better collaboration; 2. Organize free mapping training conducted by women for women and women's groups exclusively.
<p>Technical Challenges:</p> <ol style="list-style-type: none"> 1. Choosing the wrong hardware or software for the task; 	<p>Address Technical Challenges:</p> <ol style="list-style-type: none"> 1. Promote the use of OSM software to stakeholders;

<p>2. OSM expertise not sufficiently in-depth in the country = rely on external technical support;</p> <p>3. Challenges in locating and monitoring new map changes, large number of changes, and validation gaps.</p>	<p>2. Support local cartographers to acquire higher level technical mapping skills;</p> <p>3. Ensure as often as possible better data validation and error correction to help data users to rely on the accuracy of the map.</p>
<p>Institutional Challenges:</p> <p>1. Difficulties related to OSM software integration in government and other important systems (International NGOs, UN, World Bank);</p> <p>2. Inability to "sell" the concept of open access data in general.</p>	<p>Address Institutional Challenges:</p> <p>1. Promote the use of OSM software with government, local NGOs, international NGOs, UN, World Bank;</p> <p>2. Advocate for open access data.</p>

Sustained Benefit #5: Open Data/Mapping in Government	
<p>Financial Challenges:</p> <p>1. Challenges related to volunteering and livelihoods;</p> <p>2. "Commons" Fails (assuming the OSM platform is a shared resource system - called "commons" - then those acting exclusively out of self-interest can have a neutral/negative effect on the entire resource system and without contributing to its development).</p>	<p>Address Financial Challenges:</p> <p>1. Encourage different stakeholders to carry out voluntary activities even if their financial means are very limited;</p> <p>2. Sensitize the different stakeholders on the importance of spatial data sharing so that they realize that the pursuit of the general interest will strengthen their respective personal interests.</p>
<p>Social Challenges:</p> <p>1. Negative competition.</p>	<p>Address Social Challenges:</p> <p>1. Help the different stakeholders to have a better collaboration.</p>
<p>Technical Challenges:</p> <p>1. Choosing the wrong hardware or software for the task;</p> <p>2. Challenges in locating and monitoring new map changes, large number of changes, and validation gaps.</p>	<p>Address Technical Challenges:</p> <p>1. Promote the use of OSM software to stakeholders;</p> <p>2. Ensure as often as possible better data validation and error correction to help data users to rely on the accuracy of the map.</p>
<p>Institutional Challenges:</p> <p>1. Difficulties related to OSM software integration in government and other important systems (International NGOs, UN, World Bank);</p> <p>2. Inability to "sell" the concept of open access data in general.</p>	<p>Address Institutional Challenges:</p> <p>1. Promote the use of OSM software with government, local NGOs, international NGOs, UN, World Bank;</p> <p>2. Advocate for open access data.</p>

Sustained Benefit #6: Growing the Global Network of Mappers	
Financial Challenges: 1. Challenges related to volunteering and livelihoods; 2. "Commons" Fails (assuming the OSM platform is a shared resource system - called "commons" - then those acting exclusively out of self-interest can have a neutral/negative effect on the entire resource system and without contributing to its development).	Address Financial Challenges: 1. Encourage different stakeholders to carry out voluntary activities even if their financial means are very limited; 2. Sensitize the different stakeholders on the importance of spatial data sharing so that they realize that the pursuit of the general interest will strengthen their respective personal interests.
Social Challenges: 1. Negative competition; 2. Social equity/access; 3. Religious barrier for some women groups.	Address Social Challenges: 1. Help the different stakeholders to have a better collaboration; 2. Train people who are not yet privileged members of society to the tools of free mapping to enable them to make a career; 3. Organize free mapping training conducted by women for women and women's groups exclusively.
Technical Challenges: 1. OSM expertise not sufficiently in-depth in the country = rely on external technical support; 2. Challenges in locating and monitoring new map changes, large number of changes, and validation gaps.	Address Technical Challenges: 1. Support local cartographers to acquire higher level technical mapping skills; 2. Ensure as often as possible better data validation and error correction to help data users to rely on the accuracy of the map.
Institutional Challenges: 1. Highly unstable political environment, brain drain, and NGOs considered primarily for-profit or corrupt entities.	Address Institutional Challenges: 1. Recruit and share data contributors.

PART 5.3: Assessing the Challenges

1. *Who are you already working with? (Recall your stakeholder analysis?)*

We worked with the different stakeholders below:

Authorities
- Ngaoundéré City Council (Ministry of Decentralization and Local Development)
- Departmental Delegation of the Ministry of Housing and Urban Development
- Vina Divisional officer (Ministry of Territorial Administration)
- Divisional Delegation of the Ministry of Environment, protection of Nature and Sustainable Development

- Emergency Department (Departmental Delegation of the Ministry of Health)
- Firefighters (Ministry of Defense)
- Divisional Delegation of the Ministry of state property, survey's and land tenure
- Divisional Delegation of the Ministry of Social Affairs
- Divisional Delegation of the Ministry of Basic Education
- Divisional Delegation of the Ministry of Secondary Education
- Divisional Delegation of the Ministry of Economy, Planning and Regional Development
- Traditional authorities
OSM Community
- OpenStreetMap Cameroon
Civil society organizations
- ADEES: Association for Environmental and Social Economic Development
- APROSPEN: Action for the promotion of health, production and the environment
- CANALDEV: Canal development
- PROMPT: Mapping and tourism promotion company
International organizations
- World Bank
- European Union
- GIZ
- Red cross
University of Ngaoundéré
- Geomatics Lab
- Urban planning and development laboratory
Community groups
- NYCC (National Youth Council of Cameroon)
- Women's Association of Ngaoundéré 2
- Union of Groups of common interest of women planters of 12 poles (Sabongari 3)
- Dynamic women of Gadamabanga
- Target Neighborhoods Development Committee
- Brick manufacturers
- Population living in the Risk zones

2. Have any of these roles or relationships changed since project inception?

Neither the roles of the stakeholders, nor their relationship with the Open Cities Africa - Ngaoundéré Project technical team, as presented in the stakeholder engagement have changed since the project began to this date.

3. Have new actors/stakeholders emerged?

In view of the sustainability of Open Cities Africa - Ngaoundéré project activities, two new actors have been involved, these are:

- The Ministry of Housing and Urban Development;
- Cameroon Inclusive and Resilient Cities Project (CIRCP).

These two stakeholders are from the state and they intervene at the national level. Their involvement in the project has allowed them to see the importance of the new collaborative mapping tools for urban development, and to propose that the method of data collection, processing and analysis of the Open Cities Africa Project be implemented in other cities of the country.

4. Can you identify gaps in essential services and functions performed by these actors/stakeholders, when it comes to addressing the problem statement?

The shortcomings of the basic services provided and the essential functions exercised by the actors / stakeholders, in finding a solution to the problem statement, that we have identified are:

- Lack of basic map or data for city management;
- Lack of data on the city;
- Difficulty of sharing ideas and vision for the city;
- Poor urban roads planning;
- Laxism in urban management;
- Non exploitation of the Youth potential of the city and the University of Ngaoundéré;
- Administrative tolerance in Ngaoundéré urban space management;
- Lack of will of inhabitants of the city to improve the management of the urban space.

PART 5.4: Develop Sustainability Goals

Sustainability Goal #1:	Mapping Skills and Career
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Primary Activity	Secondary Activities / Deliverables	Person/Group Responsible	Resources Needed	Timeline
1. Teacher training at Ngaoundéré University, high schools and secondary schools to new tools for collaborative mapping	a. OSM awareness-training workshop	- OSM Ngaoundéré Community - ACAGER	- Fees and support for trainers - Refreshments - Coffee breaks - Lunch breaks - Room rental - Broadband internet connection for all participants	June 17 - 26, 2019
	b. Collecting field data for mapping	- OSM Ngaoundéré Community - ACAGER	- Fees and support for trainers - Refreshments	June 17 - 26, 2019
	c. Mapathon	- OSM Ngaoundéré Community - ACAGER	- Refreshments - Coffee breaks - Lunch breaks - Room rental - Broadband internet connection for all participants	June 17 - 26, 2019
2. Training of students in new collaborative mapping tools	a. OSM awareness-training workshop	- OSM Ngaoundéré Community - The University of Ngaoundéré - Geomatic's Lab - ACAGER	- Fees and support for trainers - Refreshments - Coffee breaks - Lunch breaks - Room rental - Broadband internet connection for all participants	From May 2019
	b. Collecting field data for mapping	- OSM Ngaoundéré Community - The University of Ngaoundéré	- Fees and support for trainers - Refreshments	From May 2019

		- Geomatic's Lab - ACAGER		
	c. Mapathon	- OSM Ngaoundéré Community - The University of Ngaoundéré - Geomatic's Lab - ACAGER	- Refreshments - Coffee breaks - Lunch breaks - Room rental - Broadband internet connection for all participants	June 2019
3. Introduction of OSM software in student training curricula	a. Preparation of tutorials (course material) for OSM to facilitate teaching	- OSM Ngaoundéré Community - The University of Ngaoundéré - Geomatic's Lab	Fees for the preparation of the tutorials	July - August 2019
	b. Awareness-raising workshop - teacher training and hands- on mappings at OSM	- OSM Ngaoundéré Community - The University of Ngaoundéré - Geomatic's Lab	- Fees and support for trainers - Coffee breaks - Lunch breaks - Refreshments	September 2019
	c. Perform Student Practical Work on ongoing projects	- OSM Ngaoundéré Community - The University of Ngaoundéré - Geomatic's Lab	Collaboration between the different sectors and the University of Ngaoundéré	From the academic year 2019-2020

Sustainability Goal #2:	General improvement of data for policy and decision makers
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Primary Activity	Secondary Activities / Deliverables	Person/Group Responsible	Resources Needed	Timeline
1. Capacity building of state agents for the exploitation of	a. Open Space Geospatial Research and Download Training	ACAGER	- Fees and support for trainers - Coffee breaks - Lunch breaks - Refreshments	June - July 2019

open access geospatial data			<ul style="list-style-type: none"> - Rent and sound of the room - Broadband internet connection for all participants 	
	b. Training in reading and visual-interpretation of maps on OSM	ACAGER	<ul style="list-style-type: none"> - Fees and support for trainers - Coffee breaks - Lunch breaks - Refreshments - Rent and sound of the room - Broadband internet connection for all participants 	June - July 2019
	c. Training in reading and visual-interpretation of satellite images	ACAGER	<ul style="list-style-type: none"> - Fees and support for trainers - Coffee breaks - Lunch breaks - Refreshments - Rent and sound of the room - Broadband internet connection for all participants 	June - July 2019
2. Make available to the State up-to-date data for ongoing projects	a. Identification of the various development projects in progress	<ul style="list-style-type: none"> - Government Sectorial - Ngaoundéré City Council - The World Bank Group - ACAGER 	Means of travel for the survey team	From the month of June 2019
	b. Stakeholder awareness of the importance of current geospatial data	<ul style="list-style-type: none"> - Government Sectorial - Ngaoundéré City Council - The World Bank Group - ACAGER 	Means of travel for the survey team	May - June - July 2019
	c. Collecting field data and mapping online	<ul style="list-style-type: none"> - Government Sectorial - Ngaoundéré City Council 	<ul style="list-style-type: none"> - Refreshments - Coffee breaks - Lunch breaks 	From the month of June 2019

		<ul style="list-style-type: none"> - The World Bank Group - ACAGER 	<ul style="list-style-type: none"> - Broadband internet connection for all participants 	
3. Provide better validation of data to help data users to rely on the accuracy of the map	a. Define the areas to be mapped primarily according to current state projects	<ul style="list-style-type: none"> - Government Sectorial - OSM Ngaoundéré Community - The University of Ngaoundéré - Geomatic's Lab - ACAGER 	Means of travel for the survey team	From the month of June 2019
	b. Training of young mappers in the control and quality assurance of data available under OSM	<ul style="list-style-type: none"> - Government Sectorial - OSM Ngaoundéré Community - The University of Ngaoundéré - Geomatic's Lab - ACAGER 	<ul style="list-style-type: none"> - Fees and support for trainers - Refreshments - Coffee breaks - Lunch breaks - Rent and sound of the room - Broadband internet connection for all participants 	June - July 2019
	c. Organize work sessions dedicated to the control and quality assurance of the data available under OSM	<ul style="list-style-type: none"> - OSM Ngaoundéré Community - ACAGER 	<ul style="list-style-type: none"> - Refreshments - Coffee breaks - Lunch breaks - Rent and sound of the room - Broadband internet connection for all participants 	From the month of August 2019

Sustainability Goal #3:	Social impacts for local communities through better data access and use
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Primary Activity	Secondary Activities / Deliverables	Person/Group Responsible	Resources Needed	Timeline
1. Training of members of women's associations	a. Training in reading and visual-interpretation of OSM and paper charts	<ul style="list-style-type: none"> - OSM Ngaoundéré Community - ACAGER 	<ul style="list-style-type: none"> - Fees and support for trainers - Refreshments - Coffee breaks 	July - August - September 2019

by women mappers			<ul style="list-style-type: none"> - Lunch breaks - Rent and sound of the room - Broadband internet connection for all participants 	
	b. Training in reading and visual-interpretation of satellite images	<ul style="list-style-type: none"> - OSM Ngaoundéré Community - ACAGER 	<ul style="list-style-type: none"> - Fees and support for trainers - Refreshments - Coffee breaks - Lunch breaks - Rent and sound of the room - Broadband internet connection for all participants 	July - August - September 2019
	c. Training in the use of the GEORISK application	<ul style="list-style-type: none"> - OSM Ngaoundéré Community - ACAGER 	<ul style="list-style-type: none"> - Fees and support for trainers - Refreshments - Coffee breaks - Lunch breaks - Rent and sound of the room - Broadband internet connection for all participants 	At the end of the development of the GEORISK application
2. Training populations in risk areas to use data	a. Training in reading and visual-interpretation of OSM and paper charts	<ul style="list-style-type: none"> - OSM Ngaoundéré Community - ACAGER 	<ul style="list-style-type: none"> - Fees and support for trainers - Refreshments - Coffee breaks - Lunch breaks - Rent and sound of the room - Broadband internet connection for all participants 	July - August - September 2019
	b. Training in reading and visual-interpretation of satellite images	<ul style="list-style-type: none"> - OSM Ngaoundéré Community - ACAGER 	<ul style="list-style-type: none"> - Fees and support for trainers - Refreshments - Coffee breaks - Lunch breaks - Rent and sound of the room 	July - August - September 2019

			- Broadband internet connection for all participants	
	c. Training in the use of the GEORISK application	- OSM Ngaoundéré Community - ACAGER	- Fees and support for trainers - Refreshments - Coffee breaks - Lunch breaks - Rent and sound of the room - Broadband internet connection for all participants	At the end of the development of the GEORISK application
3. Popularization of geospatial data in open access on the internet	a. Field data collection training using GPS Essentials, ODK or OMK applications for the update of the Database created as part of the Open Cities Africa - Ngaoundéré Project	- Ngaoundéré City Council - OSM community of Ngaoundéré - Populations of risk areas - ACAGER	- Fees and support for trainers - Coffee breaks - Lunch breaks - Refreshments - Rent and sound of the room - Broadband internet connection for all participants	September - October 2019
	b. Online publication of the pdf version of the Atlas for free download	- The University of Ngaoundéré - ACAGER	Financial support for the team in charge of publishing the Atlas online	After the return of 27 April 2019
	c. Development of the GEORISK mobile app	- The University of Ngaoundéré - ACAGER	Financial support for the team in charge of the development of the application	From the month of June 2019