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QWeCI

Quantifying Weather and Climate Impacts on Health in Developing Countries

M5.3.b – Field Campaign Year one

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Lead contractor :	UCAD
Coordinator of milestone :	Dr C. M. F. Kebe
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Dissemination Level		
PU	Public	PU
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Field campaigns are crucial activities for the climate health programme within QWeCI. During the project for work in Senegal, the established field investigation area of Barkedji was identified for Arboviruses investigations. Thus this site is being used for the QWeCI project the piloted project WP 5.3 on RVF and malaria in Senegal.

Three (3) scientific research teams (*Institut Pasteur de Dakar* (IPD), *Laboratoire de Physique de l'Atmosphère et de l'Océan Siméon Fongang* (LPAO-SF) in UCAD, *Centre de Suivi Ecologique* (CSE)) and two (2) stakeholders/end users, PNLP (*Programme National de Lutte contre le Paludisme*, National Malaria Control Programme) and DSV (*Direction des Services Vétérinaires*, National Livestock Service) are identified as partners to work closely within this program.

CSE and UCAD focus their activities on instrumentation and data collection of climate, meteorology, hydrology, water quality and remote sensing (land use and land cover changes…). IPD is in charge of all aspects related to entomology. PNLP and DSV are involved respectively on clinical malaria data and clinical livestock collection and survey.

This report gives an overview on field activities during the first year of the QWeCI project.

1. Barkedji site Instrumentation description

The study will be carried out in an area of 15 km radius centred on the Barkedji village (14°47' to 14°53'W, 15°13' to 15°20'N). This area belongs to the Sahelian bio-geographic domain characterized by a short rainy season (from June to October) and a long dry season (November to May) with annual rainfall ranging from 300 to 500 mm. The Barkedji site is one of the famous Environment and Health Observatories in Senegal. IPD have worked on the Barkédji site since 1990's, and this Observatory has been the study area of several research projects during the last two decades.

Barkedji is located in the Sahalian transmission profile characterized by a seasonal transmission of vector borne diseases during the short rainy season. The presence of temporary ponds which remain almost the only sources of water until January in the area, and which the pond dynamics is completely under rainfall control, constitutes the local ecological characteristics that influence locally the interrelationships between the vectors, parasite and hosts.

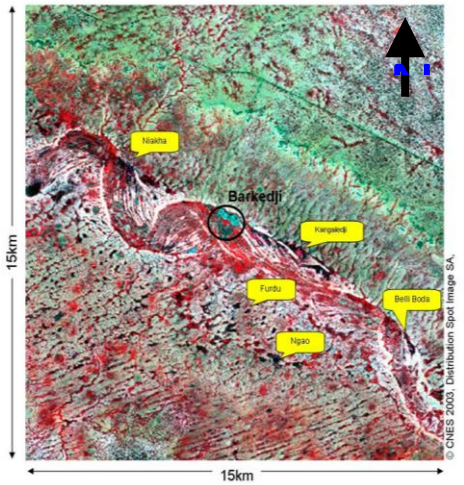

Figure1: An overview of Barkedji Health-Environment Observatory from SPOT 5 satellite image.

2. Data monitoring during rainy season

For data monitoring, missions are organised every month. These missions are coordinated between the teams of researchers involved in the project in order to have the same sampling time for all the data collected. The following parameters are collected during this one year field campaign:

- water level in the ponds;
- water quality of the ponds (Ph, temperature, turbidity, conductivity, etc.);
- climate data (rainfall from raingauge station near the Barkedji village and Niakha automatic weather station);
- entomological data;
- clinical malaria data surveillance;
- clinical livestock survey data will be collected through sentinel and transhumant herds;
- land use and land cover analyses.

2.1 Water level monitoring of pounds

At the beginning of the rainy season, we monitor the pond's instrumentation around the Barkedji site. This task has been done jointly by CSE and UCAD. Four sentinel ponds were selected (Furdu, Kangaledji, Ngao and Niakha, photos 1, 2 and 3) and we have installed OTT staff gauges with these technical specifications (tables 1 and 2). They are of a light design of 2 mm thick sheet steel, white enamelled, with black graduation (in cm) and black numbering.

Table 1: Technical specifications of staff gauges used in Barkedji Health and Environment Observatory

Weight	net approx.1.45 kg
Length of staff gage	1000 mm
Colour Background Figures and E-pattern	 white black
Fixing on Steel section	yes

Table 2: Some information about the location of staff gauges in sentinel ponds in Barkedji site

Pond	Gauge	Latitude	Longitude	Graduations
Niaka	Staff gauge 1	15.29534 N	14.89926 W	0-1
	Staff gauge 2	15.29548 N	14.89970 W	1-2
	Staff gauge 3	15.29601 N	14.89949 W	1-2
Ngao	Staff gauge 1	15.25519 N	14.86028 W	2-3
Kangaledji	Staff gauge 1	15.27307 N	14.84413 W	1-2
	Staff gauge 2	15.27249 N	14.84476 W	1-2
	Staff gauge 3	15.27164 N	14.84279 W	1-2

Photo 1: A general overview of Furdu pond; this picture was taken on July 12th 2010, at 10h55 before a rainfall event of 25.0 mm that occurred in the afternoon.

Photo 2: A general overview of Niakha pond; this picture was taken on July 12th 2010 at 17h45, after a rainfall event of 25.0 mm that occurred in the afternoon.

Water quality monitoring of pounds

These data are collected by this equipment Consort C 561© Bioblock. We can collect all these parameters:

- pH 0.01 – 14.00 pH, precision +/-0.2% measurement;
- mV +/-1100 mV; precision +/-0.2% measurement;
- Conductivity 0.01 µS/cm - 1000 mS/cm, precision +/-1% full scale;
- Salinity 0 - 100 g/l, precision +/-1% full scale;
- TDS 0.1 mg/l - 100 g/l, precision +/-1% full scale;
- Temperature 0.0 – 100.0°C, precision +/-0.5°C.

2.2 Climate data

Climate data are collected respectively from raingauges and weather stations installed near the sentinel ponds. Figure 2 show data collected from raingauge installed at Barkedji village during the 2010 rainy season.

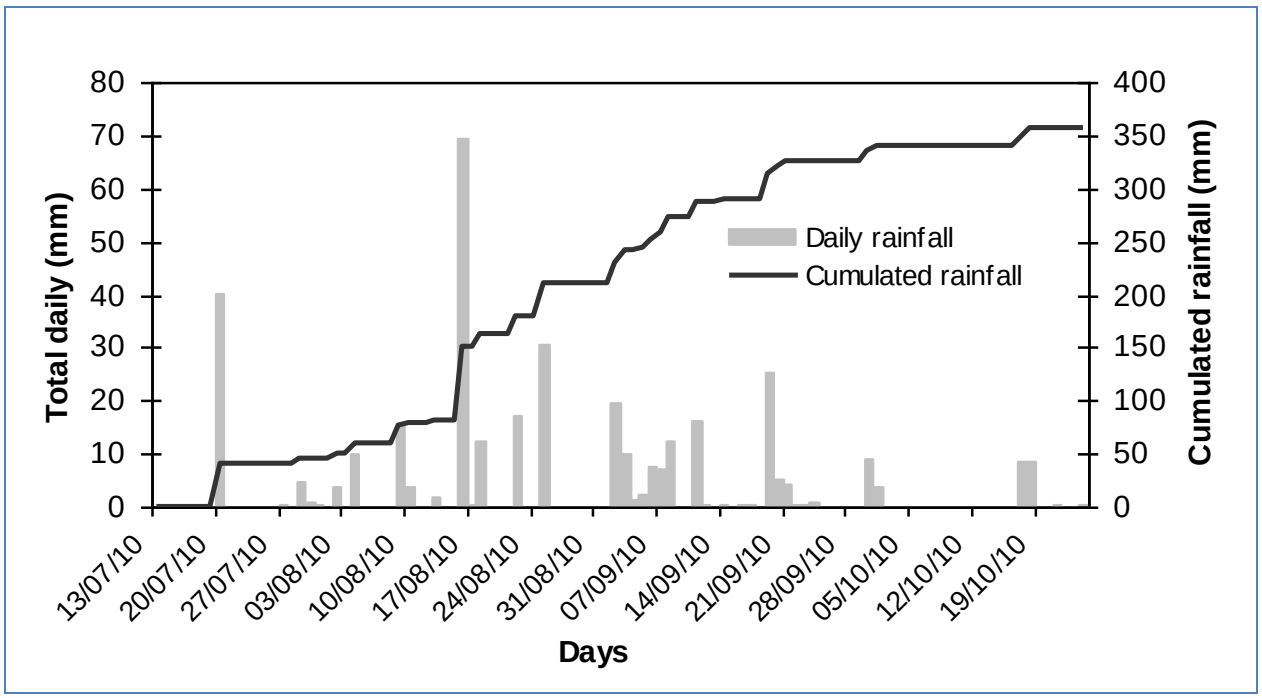

Figure 2: 2010 rainy season profile in Barkedji village

For the monitoring of climatic parameters, a weather station is installed not far from Niakha Pond. Different sensors are connected to a CR215 datalogger from Campbell Scientific and it is used as an acquisition station. These following parameters are monitored: air temperature, humidity, solar radiation, wind (speed and direction) and precipitation with SBS500 tipping bucket raingauge from Campbell Scientific (photos 3, 4 and 5).

Photo 3: View of Niakha Campbell Scientific BWS automatic weather station.

Photo 4: Samo Diatta (QWeCI Post-doc) and Jacques André NDIONE set up a raingauge station in Barkedji

Photo 5: Samo Diatta (QWeCI Post-doc) downloading data from Niakha Basic Weather Station. The other person is Papa Dame Mbaye, CSE's driver.

2.3 Entomological data

The global approaches of the field entomological studies were to estimate entomological parameters described in the Liverpool Malaria Model (LMM) as well as new parameters relevant for i) a validation for malaria in Senegal and ii) a development of models for RVF.

For malaria vectors, six villages belonging to the four land cover/land use identified within the study area were selected: Barkedji and Niakha situated in wooded savanna, Keur Bandji in steppe, Kangaledji in bare soils, Wouro Samba Kibel and Wouro Sileymani in shrubby savanna. Rift Valley fever vectors were sampled near the principal ponds (Niakha, Kangaledji, Fourdou and Ngao).

Mosquito collections were made bi-monthly from July to December. In villages, mosquitoes were collected using two sampling methods: (1) capture of females landing from 07:00 pm to 06:00 am indoor and outdoor and (2) pyrethrum spray catches of resting females. RVF vectors were collected using CDC near ground pools and bed net traps using human, goat or sheep as baits.

Upon collection, mosquitoes were sorted and identified morphologically. Blood meals from fed mosquitoes were blotted onto filter paper to determine the host source. A random sample of malaria vectors from each species were dissected to extract ovaries and to determine the mosquito reproductive age. Mosquitoes were stored individually in numbered vials with desiccant for laboratory processing (malaria vectors) whereas for RVF vectors, they were pooled in monospecific pools.

General findings

a) RVF vectors

In total 10160 mosquitoes (6846 from CDC light traps and 3314 from bed net traps) belonging to 33 species and 6 genus were collected (table 3). Aedes vexans and Culex poicilipes represented respectively 23 and 27%. Ae. vexans was more abundant in Niakha pool whereas Cx. poicilipes was more frequent in Kangaledji pool. The highest densities for Ae. vexans were obtained at the beginning of the rainy season in July (Niakha, Kangaledji and Fourdou) and in September in Ngao pool. Whatever the ground pool considered, Ae. vexans and Cx. poicilipes were predominantly collected by CDC light trap placed near the main ground pools. In the different bed-net traps used, the human-baited trap was less attractive as no Ae. vexans was collected.

For the different baits used, except for Kangaledji ground pool, the human-baited net was less attractive. No Ae. vexans were collected in Niakha and Kangaledji.

b) Malaria vectors

The table 4 the results obtained are presented. In total, 2990 anopheline specimens belonging to 7 morphological species were collected by the two sampling methods (1579 by human-landing collections and 1411 by pyrethrum spray catch collection. An. gambiae s.l. (represented in the study zone by An. gambiae and An. arabiensis) was predominant and represented 99% of the species collected. In all 6 villages, An. gambiae females exhibited exophagic tendencies. The observed mean densities (bites per man per night) were higher in the middle of the rainy season in October (Barkedji, Kangaledji, Wouro Samba Kibel and Wouro Sileymani) whereas in Niakha and Keur Bandji, the highest densities were observed in September. The mean parity rates varied from 60% (Keur Bandji) to 93% (Wouro Sileymani).

Table 3: Mosquitoes collected by CDC light traps and bednet traps around the main ground pools from July to December 2010

Species	Collection methods	Niakha	Kangalédji	Ngao	Fourdou
Ae. vexans	CDC light trap	1434	56	814	265
	Human-baited net	-	-	-	2
	Goat-baited net	71	3	-	25
	Sheep-baited net	37	16	-	31
Cx. poicilipes	CDC light trap	252	853	349	439
	Human-baited net	6	49	-	14
	Goat-baited net	39	43	-	39
	Sheep-baited net	156	61	-	28
Others	CDC light trap	1122	415	429	418
	Human-baited net	251	82	-	36
	Goat-baited net	564	207	-	163
	Sheep-baited net	815	377	-	199

Table 4: Species and number of anophelines collected by Human-landing and Pyrethrum Spray collections in the six villages studied from July to December 2010

Species	Barkedji		Kangaledji		Keur Bandji		Niakha		W. S. Kibel		W. Sileymani	
	HLC	PSC	HLC	PSC	HLC	PSC	HLC	PSC	HLC	PSC	HLC	PSC
An. coustani	0	0	0	1	0	0	0	0	0	0	0	0
An. flavicosta	0	0	0	0	0	0	0	0	0	0	0	0
An. funestus	1	0	0	0	0	1	0	0	0	0	0	0
An. gambiae s.l.	1505	462	243	61	181	10	217	0	205	25	52	0
An. pharoensis	7	2	8	1	1	0	1	0	0	0	0	0
An. rufipes	1	0	0	0	0	0	0	0	0	0	0	0
An. ziemanni	0	0	3	1	0	0	0	0	0	0	0	0
Total	1514	464	254	64	182	11	218	0	205	25	52	0

HLC: Human-Landing Collections; PSC: Pyrethrum Spray Collections

2.4 Clinical data Collection

Clinical data (number of malaria cases) are collected by the NMCP in the area of Barkedji.

2.5 Clinical Livestock survey

From July to December 2011, 1129 blood sampling have been collected from cattle, goats and cows herds. Sampling analysis is ongoing process for identifying IgM and IgG antibodies.

2.6 Land use and land cover analysis

Land use and land cover change have been analysed by CSE for these years (1973, 1987 and 2009; figure3). Below, you can find a land cover map realised by Ba (2010)[1].

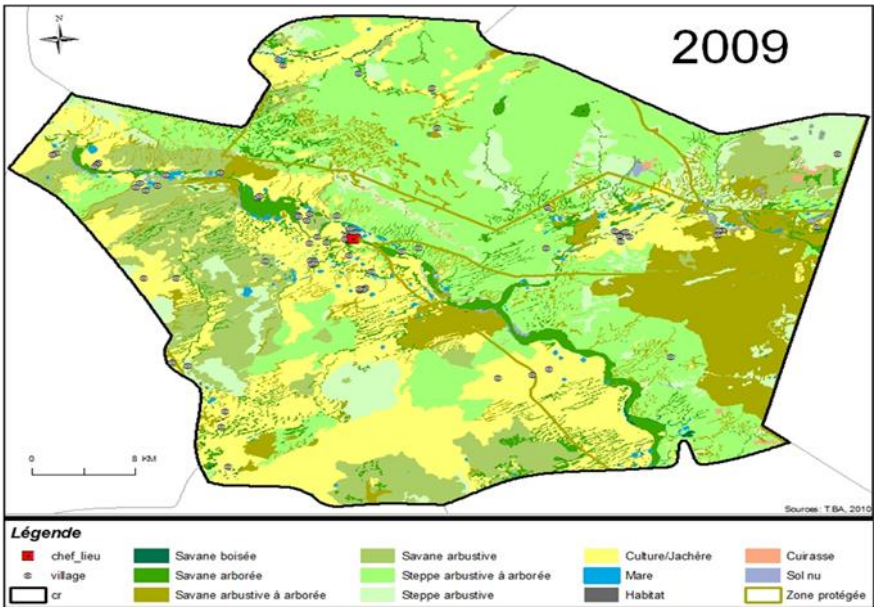

Figure 3: Land cover map of Barkedji rural community in 2009 (Ba, 2010).

3. Conclusion and perspectives

During rainy season 2001, activities are mainly focussed on the data collection on the existing network installed until the AMMA IMPact Project runs that is currently delayed and will allow new instrument acquisition.

[1] BA T, 2010, *Dynamique de l'occupation du sol de la Communauté rurale de Barkédji au Ferlo (Nord Sénégal)*, Mémoire de DEA, FST-UCAD, 48p

For the coming rainy season (2011), new instruments will be deployed in Barkedji sites. A network of ten (10) raingauges will installed for a better spatial resolution of rain fields at the Barkedji observatory. A second automatic weather station will be installed at Belli Boda with the same variables collected from the first one and with the same sampling time.