TABLE I - HAMLETS, CLANS, VILLAGES AND ADMINISTRATIVE CHIEFTAINCIES

A. MVAYE-OUEST CANTON

Note: The hamlets located between Nyabissan and Asseng are listed below by order of succession along the Nyabissan-Maan village road:

Hamlets	Clans (1)	Villages/Administrative Chieftaincies
NDJO'OP 1+2	Ekan + Eyanfok	NYABESSAN
NKOLOSSONG	• Essambira	NYABESSAN
Nyabissan Centre	(population mélangée)	NYABESSAN
Nyabissan village	Ekan	NYABESSAN
Kouane	"	NYABESSAN
Oding 1	Essokaye	NSEBITO
Oding 2	"	NSEBITO
Abem 1	Ekan	ABEM
Efon	Essokaye	NSEBITO
Bedemba	Ekan	ABEM
Melongo	"	ABEM
Nkol melongo	"	ABEM
Nlozok	Essamendzan	MDEN I
Ntebezok 1	Ekan	NTCBEZOK
Ntebezob 2	"	NTCBEZOK
Ntebezok 3	"	NTCBEZOK
Abem 2	Ekan	ABEM
ALEN II.1	Ebokaye	ALEN II
Melen I.2	Essamendzan	MELEN I
Melen I.2	"	MELEN I
Nlemeyong 1	Eyanfok	NHEMEYONG
Nhemeyong 2	"	NHEMEYONG
Nhemeyong 3	"	NHEMEYONG
Nhemeyong 4	"	NHEMEYONG
Alen II.2	Ebokaya	ALEN II
Nsebito Abengsi 1	Essokaye	NSEBITO
Nsebito Abengsi 2	"	NSEBITO
Nsebito Abengsi 3	"	NSEBITO
Nsebito Bethel	"	NSEBITO
Nsebito 1	"	NSEBITO
Akom	Essakak	AKOM
Tom 1	Essamendzan	TOM
Tom 2	"	TOM
Asseng 2	Eyanfok	ASSENG
Asseng 1	"	ASSENG

(1) Except for Nkolossong hamlet which belongs to the Essambira clan of the Ntoumou, all other hamlets belong to the Mvaye clans in this canton.

B. BOUCLE DU NTEM AND EBENMEYONG CANTONS (part)

TABLE I (continued)

Hamlets	Clans (1)	Villages/Administrative Chieftaincies
Aloum I.1	Essamangone	
Aloum I.2	Essamba	ALOUM I
Aloum I.3	Essambira	
Engong	Essambira	
Oken	"	
Onone - obéten	"	
Kouane	Essambale	
Nazareth	"	MELEN II
Banganté	Essambira	
Abou M'gok	Essambak	
N'kol N'sia	"	
N'Keyem	Essamangone	
Bingokom	"	
Monguère	"	AYA'AMANG
Aya'amang		
Abeng 1	Essamengan	
Abeng 2	"	
Eben meyong 1	Eyanfoh	EBENNEYONG
Eben meyong 2	"	
Ovan	Essokaye	

(1) The hamlets in Boucle du Ntem Canton (Aloum I, Melen II and Aya'Amang) belong to N'toumou clans. Mvaye clans are found in Ebenmeyong on the right bank of Ntem river.

Table 2 - Socio-Economic influence zone close to the Project: Primary socio-demographic structures by hamlet and village-chieftaincy (resident population)

	No. of famil-ies	No. of wowen family heads	No. of married men	No. of married women	No. of polyga mous house-holds	No. of kit-chens	No. of minorsd epend-ents	Re-sident populati on	No. of young depend-ent house-holds	No. of single mothers	No. of illegiti mate children
Ndjo'op 1+2	4	-	4	4	-	4	7	15	-	-	-
Nkolessong	4	-	4	5	1	5	26	35	-	-	-
Nyabessan centre	9	2	8	10	2	10	59	79	1	3	3
Nyabessan village	7	-	7	7	2	8	23	40	1	1	1
Ekouane	1	-	1	1	-	1	11	13	-	-	-
NYABESSAN	25	2	24	27	5	26	121	182	1	4	4
Abem 1	8	-	8	9	1	8	45	62	-	-	-
Bedemba	2	-	2	2	-	2	11	15	-	-	-
Melongo	6	-	6	6	-	6	29	41	-	-	-
Nkol Melongo	3	-	3	4	1	4	13	20	-	-	-
Abem 2	4	-	4	4	-	2	14	22	-	-	-
ABEM	23	-	23	25	2	22	112	160	-	-	-
Ntebezok 1	4	1	4	7	2	7	23	35	1	1	1
Ntebezok 2	3	-	3	3	-	3	19	25	-	1	1
Ntebezok 3	4	-	8	13	3	6	19	40	5	1	1
NTEBEZOK	11	1	15	23	5	16	61	100	5	3	3
Alen II 1	7	-	7	10	1	9	38	54	-	2	3
Alen II 2	3	1	2	2	-	3	9	14	-	-	-
ALEN II	10	1	9	12	1	12	47	68	-	2	3
Nlozok	2	1	1	1	-	2	11	15	-	-	-
Melen 1+2	14	-	4	15	1	14	62	91	-	5	12
MELEN I	16	-	15	16	1	16	73	106	-	5	12
Nhemeyong 1	9	3	6	6	1	9	29	44	-	1	2
Nhemeyong 2	3	-	3	3	-	3	8	14	-	2	3
Nhemeyong 3	5	-	5	7	2	6	27	39	-	-	-
Nhemeyong 4	6	-	6	7	1	7	3	36	-	-	-
NHEMEYONG	23	3	20	23	4	25	67	133	-	3	5
Oding 1	3	-	3	4	1	3	16	13	-	-	-
Oding 2	11	-	11	11	-	11	31	53	-	-	-
Efon	2	1	1	1	-	2	6	9	-	1	1
Nsebito-Abengsi 1	2	-	2	2	-	2	8	12	-	3	5
Nsebito-Abengsi 2	2	-	4	4	-	2	11	15	2	4	5
Nsebito-Abengsi 3	27	3	22	25	3	29	74	126	-	-	-
Nsebito-Bethel	6	-	7	10	1	8	13	30	1	2	2
Nsebito 1	1	-	1	1	-	1	4	6	-	3	4
NSEBITO	54	4	51	58	4	58	163	274	3	13	17
AKOM	8	4	4	4	-	10	18	30	-	3	4
Tom 1	4	1	2	4	2	5	32	42	-	1	1
Tom 2	20	2	15	17	2	21	69	90	-	3	5
TOM	24	3	17	21	4	26	101	132	-	4	6
Asseng 1	7	1	5	7	2	9	21	35	-	-	-
Asseng 2	4	3	1	1	-	4	6	12	1	-	-
ASSENG	11	4	6	8	2	13	27	47	1	-	-
TOTAL CANTON MYAYE-OUEST	205	22	184	217	28	224	784	1232	10		54

Table 2 Continued

	No. of families	No. of wowen family heads	No. of married men	No. of married women	No. of polygamous households	No. of kitchens	No. of minors dependents	Resident population	No. of young dependent households	No. of single mothers	No. of illegitimate children
Aloum I 1	6	2	3	3	-	6	10	19	-	1	2
Aloum I 2	2	1	-	-	-	3	1	5	-	-	-
Aloum I 3	3	-	4	5	1	3	22	31	1	-	-
ALOUM I	11	3	7	8	1	12	33	55	1	1	2
Engong	3	-	3	4	1	4	21	28	-	1	3
Okeu	5	1	5	5	-	6	11	22	1	3	8
Ohone-Obéteu	1	-	1	2	1	2	8	11	-	-	-
Ekouane	4	-	4	6	2	6	18	28	-	1	2
Nazarêth	1	-	1	1	-	1	-	2	-	-	-
Bangangté	1	-	-	-	-	-	-	1	-	-	-
Abou Mzok	4	1	4	4	-	3	3	11	1	-	-
N'kol N'sia	3	-	3	3	-	3	3	9	-	-	-
MELEN II	22	2	21	27	4	25	64	112	2	5	13
N'koyem	1	1	1	1	-	1	7	11	1	-	-
Bingokom	15	1	12	16	3	16	29	60	-	-	-
Monguène	7	2	5	5	-	6	28	40	-	2	2
Aya'amang	9	2	7	7	-	9	19	35	-	-	-
AYA 'AMANG	31	6	25	29	3	34	83	146	1	2	2
TOTAL CANTON (1) BOUCLE DU NTEM I (partim)	64	11	53	64	8	71	180	313	3	8	17
Abeng 1	2	-	2	2	-	2	4	6	-	-	2
Abeng 2	3	2	1	1	-	3	-	4	-	-	-
Eben meyong 1	1	-	1	1	-	1	15	17	-	1	2
Eben meyong 2	4	2	1	1	-	4	10	15	-	-	-
Ovan	2	-	1	1	-	2	7	10	-	-	-
EBENMEYONG	12	4	6	6	-	12	36	54	-	1	4
TOTAL ZONE D'ETUDE	281	(2) 37	243	287	36	307	1000	1599	15	46	76

(1) Excluding Ngo'Abang located at the borderline of Equatorial Guinea.
(2) For 14 widowed or divorced men heads of family and 218 married men heads of family.

Table 3: Socio-Economic influence zone close to the Project - Matrix of clannish hexagon (1)

Clans of men (patri-locality)	Ekan	Essa kaye	Essa men dzane	Ebo kaye	Eyan fok	Essa kak	Mvaye Clans	Essa men-gone	Essam bak	Essam bira	Ntoum-ou Clans	Total Study Area
Ekan	x	14	6	5	2	1	28	6	-	3	9	37
Essakaye	11	x	5	1	5	2	24	2	-	2	4	28
Essamendzane	13	12	x	2	9	1	37	1	-	-	1	36
Ebokaye	2	1	1		2	1	7	1	-	-	1	8
Eyanfok	7	10	8	-	x	2	27	1	-	2	10	30
Essakak	3	3	3	-	1	x	10	-	-	-	-	10
Essassoune	-	2	2	-	2	-	6	-	-	-	-	6
Ens. Clans Mvaye	**36**	**42**	**25**	**8**	**21**	**7**	**139**	**11**	**-**	**7**	**18**	**157**
Essamengone	3	4	-	1	2	1	11	x	8	2	11	22
Essambak	4	3	1	-	3	-	11	11	x	6	17	28
Essambira	10	6	6	-	11	-	33	7	3	x	10	43
Essakotane	3	-	2	-	2	-	7	3	1	-	4	11
Eba	1	-	-	-	-	-	1	-	1	2	3	4
Azok	-	-	-	-	-	-	-	6	-	1	7	7
Autres clans												
Ntoumou (3)	1	2	3	-	-	-	6	5	4	2	11	17
Ens. Clans Ntoumou	**22**	**15**	**12**	**1**	**18**	**1**	**69**	**32**	**17**	**14**	**63**	**132**
Divers clans												
Boulou (4)	4	7	5	-	-	-	16	-	-	-	-	16
Divers clans Betti	-	4	-	-	2	-	6	-	-	-	-	6
Autres groupes ethniques (5)	1	2	1	-	3	-	7	-	-	1	1	8
ENSEMBLE ZONE D'ETUDE	**63**	**70**	**43**	**9**	**44**	**8**	**237**	**43**	**17**	**22**	**82**	**319**
Epouses Equato-Guinénnes	1	-	1	-	-	-	2	5	7	1	13	15

Table 3A : Socio-Economic influence zone close to the Project

- Matrix of clannish hexagon (percentages) (1)

Clans of men (patri-locality)	Ekan	Essa kaye	Essa men dzane	Ebo kaye	Eyan fok	Essa kak	Mvay e Clans	Essa men-gone	Essam bak	Essam bira	Ntoum -ou Clans	Total Study Area
Ekan	x	20	14	56	5	12	12	14	-	14	11	12
Essakaye	17	x	12	11	11	25	10	5	-	9	5	9
Essamendzane	21	17	x	22	20	12	16	2	-	-	1	12
Ebokaye	3	1	2	x	5	12	3	2	-	-	1	3
Eyanfok	11	14	19	-	x	25	11	2	-	9	4	9
Essakak	5	4	7	-	2	x	4	-	-	-	-	3
Essassoune	-	3	5	-	5	-	3	-	-	-	-	2
Ens. Clans Mvaye	**57**	**60**	**58**	**89**	**48**	**87**	**59**	**26**	**-**	**32**	**22**	**49**
Essamengone	5	6	-	11	5	13	5	x	47	14	13	7
Essambak	6	4	2	-	7	-	5	26	x	27	21	9
Essambira	16	9	14	-	25	-	14	16	18	x	12	13
Essakotane	5	-	5	-	5	-	3	7	6	-	5	3
Eba	2	-	-	-	-	-	-	-	6	9	4	1
Azok	-	-	-	-	-	-	-	6	-	5	9	2
Autres clans Ntoumou	2	3	7	-	-	-	3	12	24	9	13	5
Ens. Clans Ntoumou	**35**	**21**	**28**	**11**	**41**	**13**	**29**	**74**	**100**	**64**	**77**	
Divers clans -4	6	10	12	-	-	-	7	-	-	-	-	5
Divers clans Betti	-	6	-	-	5	-	2	-	-	-	-	2
Autres groupes ethniques	2	3	2	-	6	-	3	-	-	5	1	3
ENSEMBLE ZONE D'ETUDE	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Epouses Equato-Guinéennes	2	-	2	-	-	-	1	12	41	5	16	5

(1) The percentages are shown in column: For 100 women married to one man of a clan j, there are p_i women of clan i.

Explanatory notes of above Table:

Note: The matrix is shown in the following manner:

Number of women Xij of a clan i having married a man of a clan j (i line, j column). However, considering the existence of polygamy, the relation is not bi-univocal and Xij is different from the number of men having married a woman (or women) of clan i (this thus involves another different matrix).

- The sum of i in Xij represents the total number of women of clan i who are married in the study area;
- The sum of i, j in Xij represents the total nmber of women being married or having been married (widowed or divorced) as surveyed in the project area (all clans of origine of both women and men are mingled);
- The sum of j in Xij represents the total number of surveyed women who are married with a man of clan j.

(2): These are of cource patrilineal clans in both cases.

(3): Namely Embomane, Essandonne, Eyambiane.

(4) Namely Yebaye, Eyandzok, Eyebo'o, Essalane.

(5): Fang of Gabon, Kaka, Pygmies, Gakola, Bassa

Table 4: Socio-Economic influence zone close to the Project - Classification of hamlets by types of structural relations between families (strict patrilineage)

A. Mvaye Canton

Hamlet-Family (HF)	Hamlet-Extended Family (HFE)	Hamlet-Major Lineage (HL)	Hamlet -Monoclannish Composite (HC)	Hamlet-Mixed (MM)
Ndjo'op 1	Ndjo'op 2	Nyabissan village	Abem 1*	Nsobito Abeng 3
Ekouane	Nkolossong	Alen II.1	Melongo	Tom 2
Efon	Oding 1	Melen I (1+2)	Nhemeyong 1	Aseng 1
Nsebito I	Oding 2		Nhemeyong 2	
	Bedemba		Akom	
	Nkol-Melongo		Tom 1	
	Nlozok		Aseng 2	
	Ntebezok 1			
	Ntebezok 2			
	Ntebezok 3			
	Abem 2			
	Nhemeyong 3			
	Nhemeyong 4			
	Alen II.2			
	Nsebito-Abeng 1			
	Nsebito-Abeng 2			
	Nsebito-Bethel			
4 Hameaux	17 Hameaux	4 Hameaux	7 Hameaux	3 Hameaux
5 foyers	67 foyers	28 foyers	42 foyers	54 foyers
32 résidents	440 résidents	18,5 résidents	245 résidents	251 résidents
(3%)	(36%)	(15%)	(20%)	(20%)

B. Canton boucle du Ntem I

Hameau-foyer (HF)	Hameau-famille élargie (HFE)	Hameau-lignage majeur (HL)	Hameau composite monoclanique (HC)	Hameau mixte (MM)
Ohone Obéteu	Aloum I.2		Okeu	Aloum I.1
Nazarêth	Aloum I.3		Aya'amang	Ekouane
Bangangté	Engong			Bingokom
Nkoyem	Abou M'zok			
	N'kol N'sia			
	Monguène			
4 Hameaux	6 Hameaux		2 Hameaux	3 Hameaux
4 foyers	22 foyers	--	14 foyers	25 foyers
25 résidents	124 résidents		57 résidents	107 résidents
(8%)	(40%)		(18%)	(34%)

C. Village Ebenmeyong

Hameau-foyer (HF)	Hameau-famille élargie (HFE)	Hameau-lignage majeur (HL)	Hameau composite monoclanique (HC)	Hameau mixte (MM)
Ebenmeyong 1	Abeng 1		Abeng 2	Ebenmeyong 2 (3) Ovan
1 Hameaux 1 foyers 17 résidents	1 hameaux 2 foyers 8 résidents	--	1 Hameaux 3 foyers 4 résidents	2 Hameaux 6 foyers 25 résidents

ENSEMBLE ZONE D'ETUDE

9 Hameaux. 19 foyers. 5% de la pop résidente. 7,4 pers. par foyer. 1 foyer par hameau.	24 Hameaux. 91 foyers. 36% de la pop résidente. 6,3 pers. par foyer. 4 foyer par hameau.	4 Hameaux. 28 foyers. 12% de la pop résidente. 6,6 pers. par foyer. 7 foyer par hameau.	10 Hameaux. 59 foyers. 19% de la pop résidente. 5,2 pers. par foyer. 6 foyer par hameau.	8 Hameaux. 85 foyers. 24% de la pop résidente. 4,5 pers. par foyer. 11 foyer par hameau.

Explanatory notes of abobe Table:

- Hamlet-Family: 1 family occupies one separate hamlet.
- Hamlet-Extended Family: All the families in the hamlet identify themselves as belonging to a same family (maximum 4 generations: minor lineage).
- Hamlet-Major Lineage: The families in the hamlet identify themselves as descendants of the same encestor (of more than 4 generations) or belong to a same clan fraction (major lineage).
- Hamlet-Monoclannish Compsosite: None identified relationship between the families, except for their membership to a same clan.
- Hamlet-Mixed: A combination of HFE+HC or HL+HC within a same hamlet.

Table 5: Socio-Economic influence zone close to the Project - Distribution of taxable persons by taxation rate and administrative village (Chieftaincies) 1989-1990

Taxation Rate CFA per capita per year / Administrative Villages (clans)	A 4050		B 7800		C 11,550		D 15,150		Whole	
	NB	%	NB	%	NB	%	NB	%	NB	%
Nyabissan (Ekan+Eyanfof+ Essambira	13	62	4	19	4	19	-	-	25	100
Abem (Ekan)	10	45	8	36	3	14	1	5	22	100
Ntebezok (Ekan)	6	43	6	43	2	14	-	-	14	100
Alen II (Ebokaye)	9	90	1	10	-	-	-	-	10	100
Melen I (Essamendzane)	9	69	3	23	1	8	-	-	13	100
Nhemeyong (Eyanfok)	12	46	11	42	3	12	-	-	26	100
Nsebito (Essokaye)	45	78	8	14	2	3	3	5	58	100
Akom (Essakak)	6	55	2	18	2	18	1	9	11	100
Tom (Essamendzane)	?		?		?		?		24	100
Asseng (Eyanfok)	4	50	3	38	1	12	-	-	8	100
Ens. canton Mvaye-Ouest	114	62	46	25	18	10	5	3	207	100
Aloum I (Essamengone+ Essambak+Essambira)	12	86	1	7	1	7	-	-	14	100
Melen II (Essambak+ Essambira	9	36	14	56	2	8	-	-	25	100
Aya'Amang (Essamengone)	12	41	15	52	2	7	-	-	29	100
Canton Boucle du Ntem I (partim)	33	49	30	44	5	7	-	-	68	100
Eben meyong (Essamendzane+ Eyanfok+Essokaye).	?		?		?		?		14	100
Ensemble zone d'étude TOTAL arrondissement Ma'an	1092	64	392	23	185	11	37	2	1706	100

(Source: Sub-prefecture of Maan District)

ANNEX VII

SPECIFICATIONS FOR STUDY/EVALUATION OF PUBLIC HEALTH AND THE PROJECT IMPACTS ON IT

SPECIFICATIONS

SCOPE OF STUDY/EVALUATION

- Evaluation of the present health and nutritional condition of the population in the zone of influence of the project as defined in the preliminary analysis report on the initial environmental condition.

- Evaluation of health infrastructures, services and staff of the Nyabissan Developed Health Center and the Maan District Hospital.

- Evaluation of the impacts of the project on the vectors, parasitoses and other health aspects.

- Proposal of countermeasures for foreseeable negative impacts, and general actions for improvement of the condition of health services to the population (at feasibility level with estimate of costs and effects, and programming of actions).

CONCEIVABLE INVESTIGATION METHODS AND MEANS

- Reference to the existing material and documents, and study of the project features from the health viewpoint.

- Study and characterization of the parasitic vectors in the study area (field observations).

- Sampling and clinical checks of the population (sample survey of at least 1/3 of people selected by sex, age and geographical sub-areas to be determined according to the type of research/examination to be carried out):

  - Parasitology: Research on malaria, onchocerchosis, trypanosomiasis, bilharziosis and parasitosis through sampling of blood, stools and skin biopsies, according to the cases, and relevant clinical analyses.

  - Nutrional condition of children and investigation on the cause of infant mortality: clinical checks in the presence of the mother and interview of the latter, and inquiries to local and regional health agencies.

  - Research on infectious diseases: sampling, clinical examinations, inquiries to the population and health agencies (leprosy, tuberculosis, multiform diarrhea, sexually transmissible diseases and causes of sterility).

- Identification and etiology of other pathologies (field clinical examinations)
- Laboratory tests on samples, analysis of their results and those of field examinations.
- Evaluation by interviews and visits to facilities of the Nyabissan, Maan and Ebolowa agencies.
- Prospective reflections and concertation with MINSA's agencies (at provincial level and central level in Yaoundé).

STAFF AND WORKING PERIOD REQUIRED

- Two senior physicians (one specialist in tropical parasitology and one general practitioner with experience in tropical pathology).
- One entomologist specialized in parasites carrying vectors.
- Two experienced nurses.

- Field assignment period of the above team: 2 weeks
- Interviews, visits, document collection and meetings in Yaoundé and Ebolowa: 1 week for the 2 physicians
- Laboratory analyses: within 2 weeks
- Preparation of evaluation reports: 2 weeks x (2 physicians + 1 entomologist)
- Total period of execution of study/evaluation: 2.5 months

Remark:

The evaluation of health and nutritional conditions of the population will be done taking into account to the maximum extent possible the anthropological characteristics of behaviour of the population and their cultural references (See the preliminary report on the environment and the attached bibliography)

ANNEX VIII

SPECIFICATIONS FOR COMPLEMENTARY STUDIES ON ECONOMIC ACTIVITIES, HABITATION AND INFRASTRUCTURES

COMPLEMENTARY STUDIES ON ECONOMIC ACTIVITIES, HABITATION AND INFRASTRUCTURES

A) GENERAL SPECIFICATIONS

STUDY STAGES

- Complementary analysis of the initial condition of the sectors concerned.

- Study of the impacts of the project and its related works on the sectors and components concerned.

- Study of compensatory measures against the negative effects of the project and its related works, and promotion of economic and social development actions in the influence zone close to the project.

STUDY SECTORS

- Fishery
- Hunting
- Agricultural activities
- Habitation
- Infrastructures and village facilities (service paths, water supply, schools)

STUDY LEVEL

The studies will be conducted at the level of feasibility study and preliminary design for infrastructures and facilities, with estimate of costs and effects of each component, micro-economic justification in terms of project benefits, implementation schedule as well as definition of necessary organizational and institutional supporting measures.

B) PARTICULAR SPECIFICATIONS

I. DEVELOPMENT OF A FISHERY COMPONENT LINKED TO THE FUTURE RESERVOIR

1. Study of the present situation

- Hydrobiology of Ntem, Ndjo'o and Biwomé rivers: physico-chemical, hydrological and biological characteristics.
- Study of the ichtyofauna by investigation and sample catches - Sythesis of the aquatic ecosystems and the trophical chains.
- Study of the present fishing activities of the riverside inhabitants: scale, seasons, techniques and tools, rough estimate of catches, self-consumption, commercialization.

2. Study of the characteristics of the future reservoir from a hydro-biological viewpoint

- Future hydro-biological characteristics
- Potentials and limiting factors

3. Definition of a reservoir utilization plan

- Proposed fishing types and expected performances, stocks management plan
- Necessary equipment
- Supporting and follow-up actions for the sector and fishing activities, legal and institutional aspects
- Organization of fishermen
- Conservation
- Commercialization
- Training of fishermen and extension staff
- Creation of a small fishing center, if necessary

4. Definition of necessary development steps

- Before water impounding: exploitation of wood, creation of fishing corridors, construction of paths and landing places, etc.

- After water impounding: stocking with selected fish, assignment of extension staff, materials and equipment, organization of fishermen groups, construction of landing places, access paths, etc.

5. Detailed programming of the component, analysis of costs and economic effects

- Future operation budget of fisherman

- Total financial profitability of the fishery component

STAFF AND WORKING PERIOD REQUIRED

- A senior hydro-biologist expert specialized in the development of river fisheries in equatorial Africa: 1 month including 0.5 month of field assignment.

II. HUNTING AND AGRICULTURAL DEVELOPMENT

1. Study of the present situation

1.1 Hunting: This is to evaluate the quantity of catches by main categories of animals and their destination, by referring to the result of agro-economic surveys to be conducted for the agricultural development component. By this way, the economic value of hunting and its role in the feeding of the population will be assessed through comparison with, among others, the results of scientific researches conducted so far by a team of CNRS-ORSTOM-ISH [1].

1.2 Agriculture:

- Detailed study of different cropping patterns, especially food crops: kinds of crops, cycles, farming technique, associations, successions, rotation of fallow periods, yield per species and per equivalent area unit or per foot, work period and distribution of works by sex, harvesting, transportation, self-consumption, commercialization, etc.

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1) Cited in Bibliography in the preliminary report on initial environmental condition.

- Technical/economic parameters by cropping pattern or by kind of crops (if appropriate), value added/day, /area unit,/product unit.

- Micro-economic evaluation of incomes from agriculture by family (crop income, cash income)

- Evaluation of agro-foods balance by different types of families-farms.

- Estimate of total incomes for different types of farms, including incomes from livestock, forests (hunting, picking, etc.) and non agricultural incomes.

- Evaluation of agricultural extension programmes under way or planned, evaluation of extension services

- Evaluation of experience and knowledge acquired through agricultural researches available for improvement of food cropping systems in forest areas (visit to IRA station near Ebolowa).

- Delineation and estimate of cultivated areas for each cropping pattern through a 3-way approach:

  (i) agro-economic survey

  (ii) study of the topographic map on 1/10,000 scale which includes the habitation and cropping areas previously spotted out by topographic survey below the design elevation

  (iii) preparation of a land use map of complementary areas in the zone under direct influence of the project, using aerial photographs on 1/20,000 scale (1985) provided by SONEL (originally from ONADEF), with reproduction on the ONADEF topographic base map on a scale of 1/50,000 or on a scale of 1/20,000 by enlargement.

- Sounding the expectations of the population with regard to types of compensation for damages, participation to agricultural development activities, etc.

2. <u>Study of impacts of the future dam and related works</u>

- Trial forecast of wild meat demand for self-consumption as well as for commercialization.

- Estimate of areas and number of orchards which will be damaged, by each cropping system, and the population to be resettled.

- Estimate of new agricultural demands generated by the project and during its implementation period.

3. Definition of compensatory measures: indemnification, and proposal of a local agricultural development component

- Soil survey, determination of the land requirement for resettlement (including habitations; See below), and identification of possible resettlement areas.

- Definition of the types and standards of damages: cacao plantations, fruit trees, food crops.

- Conceivable supporting measures: creation of nurseries, "food for work" programmes of PAM for restoration of the damaged production potential.

- Definition of an agricultural development component: improvement of the extension services and research for profitable innovations at the producer's level, organization of producers (improved seeds, inputs, collective credit, commercialization), possibilities of intensifying animal productions, etc.

- Recommendations for better preservation of cynegetic resources in the future.

4. Economic and financial analysis of the component

- Summary and schedule of costs and construction works
- Effects on the producers
- Total profitability of the component
- Organizational and institutional supporting measures

III. HABITATIONS, INFRASTRUCTURES AND VILLAGE FACILITIES (SERVICE PATHS, WATER SUPPLY, SCHOOLS)

1. Complementary analysis of the present situation

- Topology of houses: materials, technique and standard unit costs (4 major types: traditional earth house on pegs, wooden house, odobe house (rare), cement brick house, with 3 main roof types: rapphia "tile", wood board, corrugated iron sheet).

- Study of the present condition of water supply to the population.

- Study of the needs for rural service paths for enclaved villages (and future resettlement areas)

- Study of eventual need for stengthening of educational infrastructures.

2. Evaluation of impacts of the project and related works and definition of compensatory measures and actions for improvement of living standard

- Residential areas to be relocated: types and conditions for compensation by house category (type and size, related facilities) and public buildings (customary "guard-houses", churches, etc.). Definition of resettlement areas (See above).

- Definition of possibilities of improvement of water supply condition: collective wells with manual pumps, operation plan for individual or collective tanks, etc.

- Definition of measures of improvement of rural service paths (including those for resettlement areas) and need for deviation of the paths which will be submerged.

- Proposal, if necessary, for strengthening and improvement of educational infra-structures.

3. Estimate of detailed costs by equipment, by action and by component. Summary and schedule of costs and construction works

C) ESTIMATED NECESSARY STAFF AND WORKING PERIOD
(FOR ALL 3 STUDY ITEMS I+II+III)

Staff	Total assignment period (month)	Field work
- 1 Senior Hydro-Biologist (see above)	1	0.5
- 1 Senior Agro-Economist with knowledge on cropping systems in forest areas	2 (*)	1
- 1 Senior Agro-Pedologist Expert	1	0.5
- 1 Senior Rural Engineer	1.25	0.5
- 1 Senior Geographer/Photo-Interpreter	0.5	0.25
- 1 Cartographer/Draftsman	0.75	-
- 1 Secretary	1	-

(*) The Agro-Economist will, besides his duties, be in charge of general coordination of the study works, compilation of the final report and checking of the "feasibility level" of other study components not undertaken by him.

• TOTAL PERIOD OF EXECUTION (until submittal of a tentative detailed report, subject to approval of the Consulting Environmentalist of JICA): 3 months from the date of receipt of the order to start the study works.

Remark:.

Conditions for timely start of the Study: Supply of the following basic documents: 1/20000 ONADEF aerial photographs on 1/20,000 scale; topographic survey of the basin on1/10,000 scale with indications of farmlands and habitations located below the maximum survey elevation (410 m?); Main features of the retained design alternative (elevation of highest water level, fluctuations of reservoir water level, discharges utilized/released, site and type of dam and power station, etc.).

FEASIBILITY STUDY
ON
MEMVE ELE HYDROELECTRIC POWER
DEVELOPMENT PROJECT

APPENDIX IV ENVIRONMENTAL ASPECTS

ANNEX II

SANITARY AND NUTRITIONAL CONDITIONS

ANNEX II SANITARY AND NUTIRITIONAL CONDITIONS

TABLE OF CONTENTS

SUMMARY

This study was carried out by :

- ***Professor SAME-EKOBO***
  Team Leader, Parasitologist
- ***Doctor Enyong Peter,***
  Entomologist
- ***Doctor TAKOUGANG Innocent***
  Specialist in Public Health and in Malacology
- ***Doctors Bassong Olga and MBANGUE Madeleine,***
  General Practicioners.

With the technical collaboration of:

- ***Mr. ENYENGA EYO'O,***	*Higher Technician*
- ***Mme TEMOLE Rosine,***	*Nurse*
- ***Mr. MINTYA Samuel,***	*Technician*
- ***Mr. ONGODO,***	*Technician*
- ***Mme NGANYU Emily,***	*Technician*
- ***Mr. TAKONE Jean-Marie***	*Engineer (SONEL)*

With the active parlticipation of the medico-sanitory staff of NYABESSAN AND MA'AN and the traditional leaders of the MVAYE AND NTOUROU communities.

The indirect collaboration of the following personalities :

- ***Doctor NGOUMOU Pierre***
  Epidemiologist, Ministry of Health - Yaounde
- ***Doctor NGOUFOR Georges,***
  Provincial Delegat for the Public Health, South Province
- ***Doctor EYANGO Jean-Luc,***
  Divisional Delegate for Preventive Medicine for NTEM

Computer typing was done by

Madame DONGMO Charlotte,
Secretary with CUSS Yaounde.

The illnesses diagnosed and listed in the registers of Health revises have more or less a high prevalences and variable degrees of morbidity according to the locality. They are represented by :

According to frequency :

- *Malaria* *(40.7%)*
- *Polymorphic* *(29.4%)*
- *Intestinal parasitises* *(65.6%)*
- *respiratory infection* *(20.4%)*

According to Level in public health :

- *Venereal diseases* *(17.6%)*
- *Loa Loa filariose* *(16.3%)*
- *Tuberculosis* *(0.03%)*
- *Leprosy* *(0.01%)*
- *Jaundice* *(1.4%)*

Meanwhile, the nutritional state of children below 5 years varies according to a continuous spectrum of the normal condition up to the syndromes of advanced malnutrition. Out of 102 children, 32 suffered from nutritional deficiency, making rate of 30.6% of prevalence; But for the majority of them (53.1%) it is the rough forms of MPE; the severe form was found among 15 children (14.7%). No difference appears on the ethnic nor on the geographical sphere. The main causes of nutritional deficiency are multiparity, family density, activities and the age of the mother and especially the habits and food taboos, as well as the poor vaccination status.

The other pathological states diagnosed are represented by arthralgies commonly called here as "Rheumatic", affecting 28.4% of individuals, anaemia (34%), ORL infections (0.1%) and skin diseases (23.7%).

On the vectorial scope, the catches showed a large spread of similes, Anopheles, Culex, Aedes, Tsetse flies and Chrysops, which are respective vectors for Onchocercose, Malaria, Ban-croft Filariose, Yellow fever, Trypanosomiase and Loa loa filariose. Dissections did not reveal any parasites in the similes, the culex, the aedes and the tsetse flies, whereas the other anthoropode gathered are mainly simple nuisances and not vectors for illnesses.

In the aquatic biotops, apart from the forms of insect larvas, 6 specimen of mollusc were sampled out, all of them the Lanist types; no mollusc that transmits bilharzias o distomatose had been identified.

As concerns the assessment of infrastructures, services and health staff, the first remark on the Nyabessan Developed Health Centre is the decay of the building and all the material.

Lack of basic drugs and the absenteeism of the agents who are not adapted to specific preventive medicine tasks, obstruct the conditions for functioning and efficiency required from a Developed Health Centre. At the Ma'an hospital this problem of infrastructure and staff is felt in a lesser degree than at Nyabessan. Meanwhile, drugs and materials are clearly insufficient and the rate of occupying the 10 beds of the hospital is reduced to 26%. It is should be noted that the hospital has neither a Doctor, a nurse, nor a laboratory technician.

The date of analysis of the project impacts in this sector are quite revealing at 3 levels : on the vectors, the parasitises and other health aspects.

On the vectors, development works will be necessarily accompanied with a certain degree of deforestation and reshaping of the soil through shivering away of earth while creating a succession of clearings interrupted by small islands of forests. These new biotops will offer supplementary lodgings for the existing species and new ecological nests for the other species. In the precise case of simulies, construction of the reservoir will transform the Ntem river with rapid running water of the catchment basis into a relatively stagnant lake; this modification will have for effect the reduction of lawa lodging for simulies and their numerous population, so much that there will be a considerable reduction in an eventual transmission of ochocercose. In all, although none of the 3162 dissected simulies was found infested, the risk of an occurrence of onchocercose in the region must not be formally left out. In effect, the efflux of riverside population that will follow the economic development of the sector after the filling of the reservoir could endanger this equilibrium while bringing onchocercose subjects from which simulies will be infested. This is also the case with Tsetse fly for which 224 species dessected did not reveal any try paosome in the saliva glands.

As for the malacological fauna, there is no risk for the installation of bilharzias and other trematodoses in the zone; because no "vector" mollusc of these diseases had been identified throughout the entire hydrographic network. As concerns parasitises and other health aspects, malaria and filarioses are the main prasitic diseases that may be amplified through the new hydrographic and environment data as shown by the project impacts on the respective vectors (cf. supra paragraph). On the contrary, the negative incidences on he other parasitises and on the entire medico-sanitory system will be reduced considerably due to the combined efforts of the availability of water near the villages ("Water is life") and the disenclavement that will bring about better socio-economic conditions.

In the light of these data, direct and indirect compensatory measures are essential vis à vis the negative impacts of the project; the cost of these measures would be taken into account by the Project and Ministries of Health, Education and Social Affairs.

1. Direct Compensatory Measures

1.a Medical Coverage: This will be exceptionally dense during site work, then progressively replaced by a permanent and stable health system. Its cost in material and personnel is estimated at 20.1 million F CFA; 50% of which will be borne by the project and 50% by the Ministry of Health.

1.b Restructuring of the personnel, is an answer to the necessity of educating and training the Health staff vis à vis the priority health problems in the project zone. This will cost 25.7 million to the Ministry of Health.

1.c A follow up of the vectors of transmissible diseases will comprise on the one hand of individual protection measures against arthropod bites and on the other part measures for health control of the population from foreign zones. This control aims at protecting the project zone against onchocercose, bilharzias, distomase and sleeping sickness. This follow-up will cost 10 millions Frs to the Project and 8.5 millions to the Ministry to which the coordination of all the activities of the zone should be added.

2. Indirect Compensatory Measures

2.a The rehabilitation and reinforcement of the Nyabessan HDC needs i n the first place the repair of the existing building and in the second place the construction of a supplementary building. These two phases are estimated at 21.75 millions F CFA for the Ministry of Health.

2.b Health education campaigns, while relying on the health infrastructures that will be set up, will also involve the prevention of dominating diseases in the sector and of the social control of the entire health system in a way to make it conform with their cultural and administrative traditions. Here, cost is estimated at 8.25 million F CFA of which 50% will be imputed on the Ministry of Health, 25% on the Ministry of Education and 25% on the Ministry of Social Affairs.

In conclusion, in spite of the poor sanitary and nutritional status of the population, the negative impacts of the project on the morbidity and mortality will be generally minor. The compensatory measures proposed reveal the political willingness of the decision-makers to vaporize the health system of the region and the social conviction of the autochtones to participate i n mass education to prevent diseases and combat against taboos. If these conditions are gathered, the positive impacts will overshadow the negative ones for the good of all.

INTRODUCTION

The present study comes after Lender no JMT/GM/SERAH/014028 of SONEL on the impact of the MEMVE ELE Dam vis à vis the population and the compensatory measures linked to health problem.

The reference terms proposed by SONEL give room for 3 specification:

- Evaluation of the present health and nutritional state of the population of the influence zone as defined in the preliminary analysis report of the initial state of the environment.
- Evaluation of infrastructures, services and health staff of the Nyabessan DGC and the Ma'an District Hospital.
- Proposition of compensatory measures vis à vis the foreseeable negative impacts and the general conditions for the improvement of health care conditions of the population (level of feasibility with costs estimates and effects, and programming of actions.

From these reference terms, the aim of the present study was put under the strict framework to know on the one hand diseases that prevail in the region, and on the other hand the main vectors of transmissible diseases in the sector. For this purpose, we had as objectives that reveal the knowledge of the area on its physical and human characteristic and their social context. These different aspects condition the choice of methodology and analysis of the impact of the plant on the population, and thus, the compensatory measures vis à vis foreseeable negative impacts.

PART I

MATERIAL AND METHODS

The data on the influence zone close to the project are presented here in a summarized way as geographical elements. Only the climatic, hydrographic factors and the economic environment are conceded. These data are from the preliminary analysis report on the initial state of the environment essentially, from BEAUVILAIN and al (1983) works, MELINGUI and al (1983) and the Atlas of Cameroon (1980).

1. PHYSICAL GEOGRAPHY

The sector studied is situated in the South-West of Cameroon i n the transition zone between the coastal plain formed by a low coast, cut out and rocky, and the central Cameroon plateau with hilly relief. Here, we are 50 km away from the Atlantic Ocean and 40 km away from the border with Equatorial Guinea, at the limit of the Campo reserve.

The soils are ferralitic, with sandy-clay texture, poor in acids. The soils lie on a metamorphic precambrian base ("Ntem complex") composed of crystalline rocks: migmatites, granites, gneiss and pyroxenites.

The climate is the equato-guinean type and records 1500 to 2000 mm of rains yearly, spread over 4 season 1 long rainy season from Sept. to Nov.; followed by 1 long dry season from Dec. to Feb., 1 short rainy season from March to May and 1 short dry season from June to Aug. The average temperatures and relative humidity vary respectively between 20°C and 28°C, and 62% and 98%.

The hydrographic network (Fig. 1 and 2) is represented by the Ntem and its tributaries, of lesser importance, but the outcropping of the ground water and the high pluviometer are the course of regular floodings in the region during rainy seasons. The Ntem, after the exit of Gabon leaves the "plateau" and heads for the ocean, along the border with Equatorial Guinea. It is on this section that it "marks" its falls before running into the ocean, at Campo, after a distance of 360 km having drained a basis of 31000 km^2. The waters are clair, rich in phytoplancton and in ichtyofour; but they are poor in mineral elements; PH is neutral.

Vegetation is characterized by elements of transition between ombrophile Atlantic forests and semi-caducifoliated continental forests. The demarcation zone between these two biocenoses is materialized at the level of the Ndjo'o through marshy bottoms where Raphia and Pandamus grow and hydrofoil herb formations exist.

2. HUMAN GEOGRAPHY

The socio-economic zone of influence close to the project corresponds to the two candours MVAYE-OUEST and BOUCLE DE NTEM I (they depend on the Ma'am district) and on the Ebienmeyong Village (which also depends on the Campo district).

It comprises of 56 hamlets distracted between 14 villages. (Table 1)

TABLE 1: Administrative distribution of villages, cantons, districts and divisions of the socio-economic zone of influence close to the project

DIVISION	DISTRICT	CANTON	VILLAGES*
Ntem Valley (Headquarter AMBAM)	Ma'an	Mvaye-Ouest	Nyabessan (6) Abem (5) Ntebezok (3) Alen II (2) Melen I (3) Nnemeyong (4) Nsebito (8) Akom (1) Tom (2) Asseng (2)
		Boucle du Ntem I	Aloum I (3) Melen II (8) Aya Amang (4)
	Campo	NkolElen	Ebienmeyong (5)

The Mvaye and the Ntoumou represent the most important ethnic groups. They occupy the Mvaye-Ouest canton, the Ebienmeyong village and the Boucle du Ntem I canton respectively. They are Christians or animists.

The total resident population has been estimated at 1599 inhabitants in 1991 (cf. Annex I). This population is unevenly distributed in the different administrative units. Rural exodus is accentuated by the poor sale of cocoa, this explains the more and more "evasion of the population".

Houses are built in line along the Ma'an-Nyabessan road. In areas without road, hamlets are scattered in the forest. In every case, they are small units with some tens of houses generally built with earth and quite close to each other.

The agrarian set up is centred on housing. Just behind the houses, there minor gardens, with plantain trees and latrines. The first real crop belt is represented by cocoa farms that have replaced the bushes that surrounded the hamlets; but them new cocoa farms are being

* The figures in brackets show the number of hamlets per village.

create deep, into the forest. After the cocoa belt there is that of food crops with farms and fallows. At the periphery there are parcels of land newly ploughed or under cleaning. The main food stuff from these farms are plantain, cocoyam, squash, cassava, groundnuts, a variety of green vegetable, sweet potatoe, yam, onion, pepper ...

Besides agriculture, the other economic activities are hunting (main source of animal protein), fishing and a few art work: commerce, attendance in site works, needlework ...

Health infrastructures are limited to the Nyabessan DHC with 3 agents, and the Ma'am Hospital with 7 agents. As for schools, there is high attendance as all over in Cameroon and unfortunately, here there is a numeric overload of pupils in the classes. Meanwhile, as concerns the behaviours of people on the environment, the profile of the population is dominated by 4 factors that influence in one way or the other, the parasitic diseases and certain pathological states: sedentary, profession, level of education and village situations in relation to the waterfalls and river Ntem.

1. Sedentary

Questioned in the light of the length of their stay in the area, subjects having stayed in the village for less than 1 year vary between 0 and 14 as against 125 people for between 1 to 5 years and 296 for more 5 years (Table C, Appendix A)

2. Profession and level of health education

57.9% of subjects of more than 19 anus of notre sample live essentially on agriculture, hunting and fishing, activities that are exposed to the bites of vectors of transmissible diseases. Other people are either small artists (0.5%) or scholars (40.7%).

The low level of health education of the residing population does not ease the practice and prevention attitudes and medical care against diseases in general and insect bites in particular. To this effect, we recorded only 103 persons who think that intestinal parasites are transmitted through dirty hands, 184 who know that machines is as a result of mosquito bites and 61 mothers who give meat to children below 2 years. On the contrary 20.9% of these people know that malaria and intestinal worms cause their major health problems, followed by stiffness (often wrongly qualified as rheumatism).

Meanwhile 14.7% only, of those questioned consult medico-health units in first intention, as against 65.5% who first consult traditional doctors who receive the majority of patients and 23% who have never consulted the nurses of the Nyabessan Developed H. Centre; others did not give any answers. These attitudes are also probably related to economic hardship, the enslavement of certain villages (AYA-AMANG, EBIENMEYONG, MELEN II ...)and especially to the fear of not getting any drug in the health centres.

3. The situation of the villages in relation to the hydrographic network

Houses are without any particularity, no matter the ethnic group; majority of houses are in mud or semi-concrete; only 51 houses and completely in concrete in the whole of the 14 villages visited.

The situation of the villages in relation to the river and the Ntem waterfalls permits to distinguish 2 major zones of influence (Table 3, App. A):

- The zone of the forefront villages, near the site which comprises of: Nyabessan, Abem, Aloum I, Ntebezok, Alen II, Ebienmeyong, Melen I, Melen II and Aya-Amang.
- The zone of second line villages relatively further away from the site than the first: Nnemeyong, Nsebito, Akom, Tom, Asseng.

The first line villages are situated at less than 9 km from Nyabessan-centre, situated itself at about 5 km (bird flight) from the waterfalls. These villages are thus more influenced by the waters of the reservoir and the environment of the dam than those of the second line, in retreat to more than 9 km from Nyabessan-centre. The first group of villages is moreover surrounded by a more dense hydrographic network than that of the second group (Fig. 2). On the contrary many elevations, below 450 and found in the second group villages.

3. METHOD AND MEANS OF INVESTIGATION

The methods and means of investigation are as follow:

- Considering the existing literature, and study of the characteristics of the project from the health point of view.
- Study and characterization of parasitic vectors i n the study zone.
- Sampling and clinic test of the population (sampling of 1/3 minimum with checking according to sex, age, and the geographical sub-zones considered according to the type of research and test carried.

a) PARASITOLOGY:

Research of malaria, onchocercose, trypanosomiase, bilharzias and parasitises through blood samplings, stool and skin biopsies according to the cases, with accompaniment clinic test.

b) CHILDREN'S NUTRITIONAL STATE AND STUDY ON THE CAUSES OF INFANT MORTALITY;

Tests, clinics in the presence of mother with she being interviewed, and investigations at the local and regional health services.

c) RESEARCH ON INFECTIOUS DISEASES AND OTHER PATHOLOGICAL STATES:

Samplings and clinic tests, investigation on the population and health services (leprosy, tuberculosis, multiform diarrhea, STD, and causes of sterility).

- Identification and etiology of other pathologies (field clinic tests).
- Laboratory analysis of samplings, exploitation of results as well as those of field clinic tests.
- Evaluation through interviews and visiting the structures of the services and health staff of Nyabessan, Ma'an and Ebolowa.
- Prospective reflexions and concentration with the services of the Ministry of Health (Provincial and Yaounde Central levels).

d) ENTOMOLOGY AND MALACOLOGY

- Gathering and trapping of vectors of medical interest.
- Identification through dissection of germs transmitted to man.
- Characterization of their biotops.

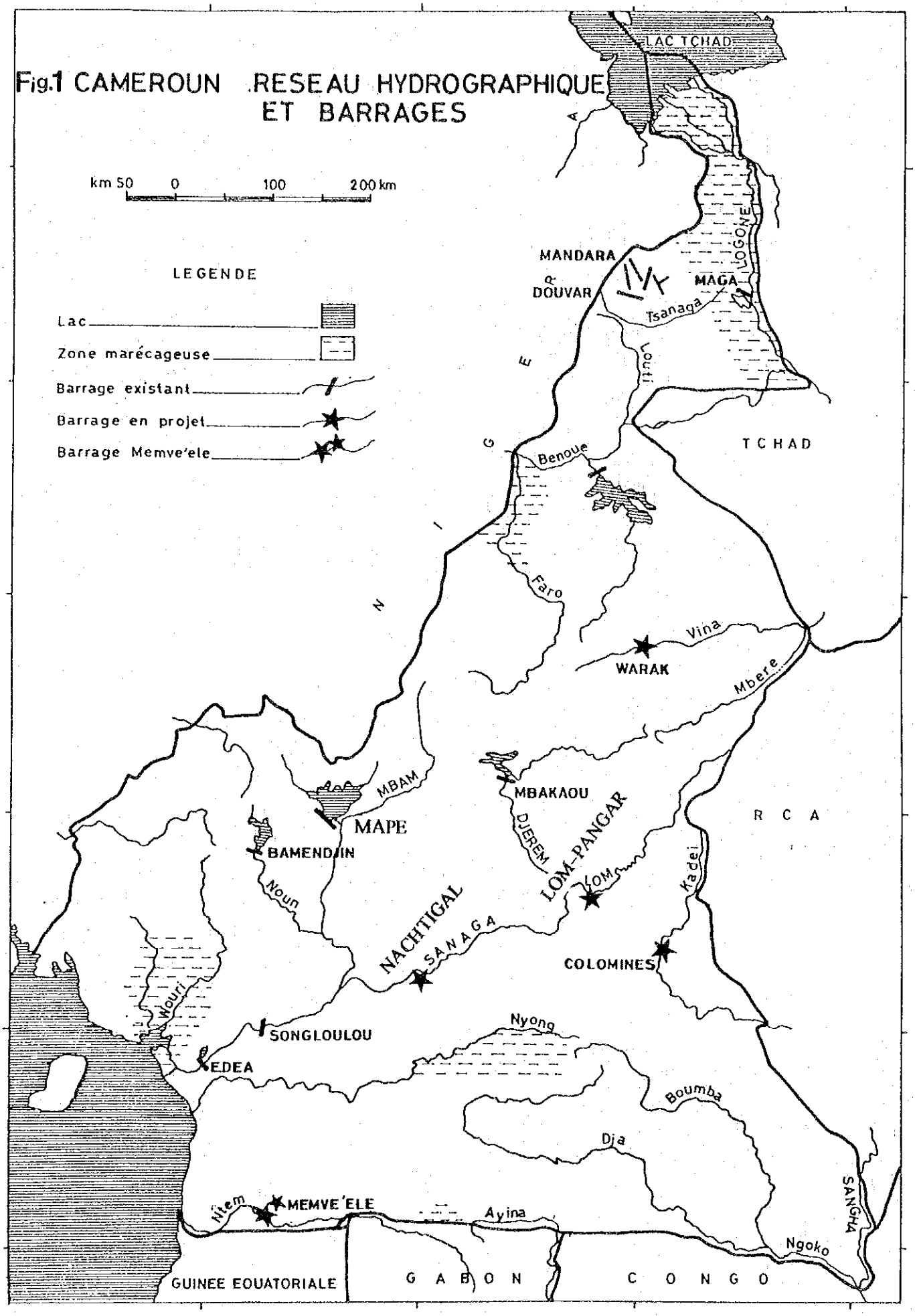


Fig.1 CAMEROUN RESEAU HYDROGRAPHIQUE ET BARRAGES
km 50 0 100 200 km
LEGENDE
Lac
Zone marécageuse
Barrage existant
Barrage en projet
Barrage Memve'ele
LAC TCHAD
MANDARA & DOUVAR
MAGA
LOGONE
Tsanaga
Louti
Benoue
TCHAD
Faro
Vina
WARAK
Mbere
MBAM
MAPE
BAMENDJIN
Noun
MBAKAOU
DJEREM
LOM-PANGAR
Kadei
R C A
NACHTIGAL
SANAGA
COLOMINES
Wouri
SONGLOULOU
EDEA
Nyong
Boumba
Dja
Ntem
MEMVE'ELE
Ayina
SANGHA
Ngoko
GUINEE EQUATORIALE
G A B O N
C O N G O

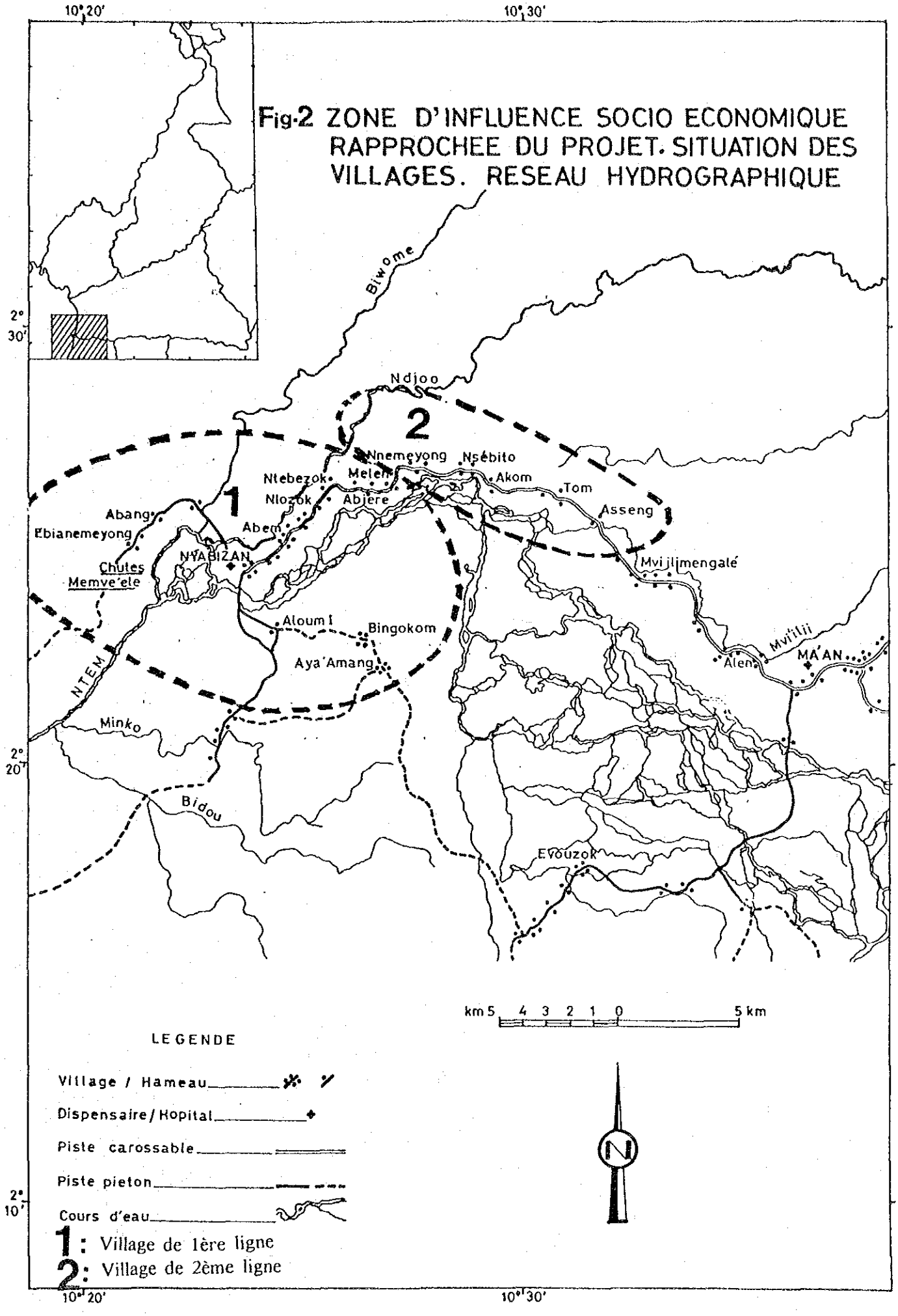


Fig-2 ZONE D'INFLUENCE SOCIO ECONOMIQUE RAPPROCHEE DU PROJET. SITUATION DES VILLAGES. RESEAU HYDROGRAPHIQUE

PART II

ANALYSIS OF THE INITIAL STATE

1. SAMPLE OF THE POPULATION TESTED

By the end of the investigation, out of the 521 people selected, 494 effectively participated in all the tests proposed, making a rate of 94.82% Among them 242 are male and 252 are female; this makes 48.9% and 51.1% respectively.

The general distribution of subjects in relation to age and sex for each village is represented by Table 1 and the histogrammes of ages (cf. Appendix A).

The age of individuals vary from 1 month to 88 years. Three sections of age were chosen:

- Children below 5 years;
- Big children and adolescents of 5 to 19 years;
- Adults of above 19 years.

TABLE 1: Distribution of Subjects Tested in Relation of Age and Sex

Age	Male		Female		Total	
	No.	%	No.	%	No.	%
0 - 4 years	53	10.7	49	9.9	102	20.6
5 - 19 years	85	17.20	100	20.3	185	37.5
> 19 years	104	21	103	20.9	207	41.9
Total	242	48.9	252	51.1	494	100

Results obtained after this sampling permitted us to weigh the level of health of the community tested, from the epidemiological view point; the results urge us to comment on three main factors in relation with the terms of specification fixed in the objectives of the study:

1°) The present health and nutritional state of the population of the influence zone close to the project;

2°) Infrastructures, services and health staff of the Nyabessan Health Centre and the Ma'an district hospital;

3°) Biology and dispersion of the entomological farm and molluscs.

2. THE PRESENT HEALTH AND NUTRITIONAL STATE OF THE POPULATION OF THE INFLUENCE ZONE CLOSE TO THE PROJECT

2.1 HEALTH STATE

Diseases identified and listed in the books of surrounding and central services have more or less high prevalences and variable degrees of morbidity according to locality. They are represented by:

- According to frequency:

Malaria	(40.7%)
Diarrhea	(29.4%)
Intestinal parasitises	(65.6%)
Respiratory infections	(20.4%)

- According to importance in public health

Venereal diseases	(17.6%)
Loa loa filariose	(16.3%)
Tuberculosis	(0.03%)
Leprosy	(0.01%)
Jaundice	(1.4%)

Diseases of PEV (Enlarged Vaccination Programme) that are under National regulation/WHO, are still subject to special supervision of the Disisional Service of preventive medicine with the support of SESA (Santé de l'Enfant du Sud et Adamaoua) supported by USAID.

Meanwhile it is important to note that the statistics recorded do not quite reflect reality; all the figures, in effect, are subject to spectacular variations from 1 month to another.

2.1.1. MALARIA

The menace of malaria is well present in the region and its gravity needs to be noted. It affects 40.7% of individuals (^able 2) and 59.8% of children below 5 years.

Malaria, be it alone or associated to anaemia and to pulmonary infections or digestive infections, is at the origin of half of infant mortality.

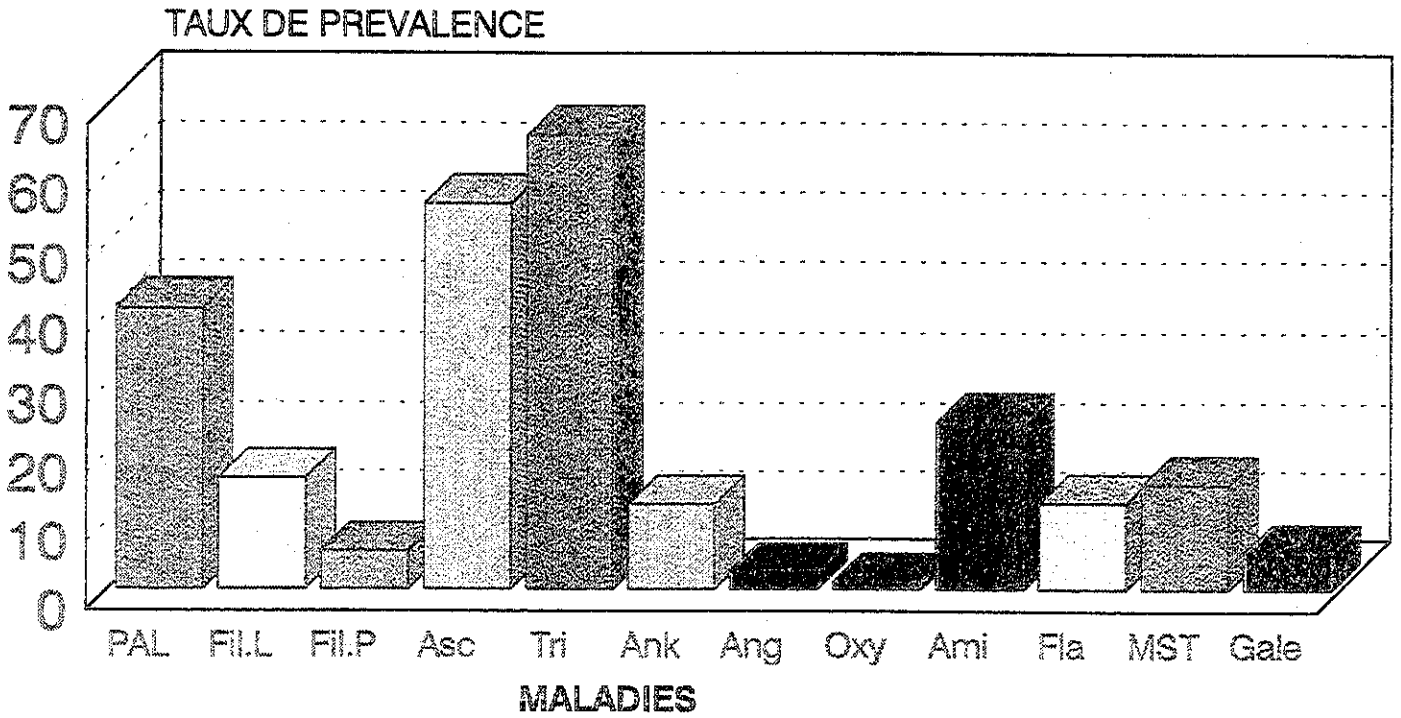
Meanwhile, the number of cases listed in the registers in the Nyabessan Health Centre and the Ma'an Hospital reveals that transmission is continuous all year long with recurrences during rainy seasons. The anaemias noticed among children below 5 years evolve in a similar manner. This parallelism undoubtedly proves that malaria is the first cause of anaemia among children in this region (Table 7).

Table 2: Parasitic Species Diagnosed and Rate of Prevalence of Corresponding Affections

MALADIES	ESPECES PARASITAIRES	TAUX DE PRE-VALENCE
Paludisme	Plasmodium falciparum	40.70
Filarioses	Mansonella perstans	5.6
	Loa loa	16.3
Helminthiases intestinales	Ascaris lumbricoïdes	55.7
	Trichuris trichiura	65.6
	Necator americanus	12.5
	Strongloïdes stercoralis	2.6
	Enterobius vermicularis	1.1
Amibiase	Entamoeba histolytica	24.6
Colite	Entamoeba coli	3.5
Flagelloses	Giardia intestinalis	8.6
	Trichomonas intestinales	2.5
	Chilomastix mesnelii	1.3
	Pseudolimax buchtlii	0.3
Urethrite et/ou vaginite	Trichomonas vaginalis	8.7
	Candida Albicans	6.7
Dermatoses	Sarcoptes Scabiei	5.4

FIG. 3 : TAUX DE PREVALENCE

DES MALADIES PARASITAIRES



PAL= PALUDISME
FIL. L = FILARIOSE/LOA
ANK = ANKYLOSTOMOSE
ASC = ASCARIDIOSE
TRI = TRICHOCEPHALOSE
GALE = GALE SARCOPTIQUE
ANG = AGUILLULOSE
OXY = OXYUROSE
AMI = AMIBIASE
FLA = FLAGELLOSES
FIL. P = FILARIOSE/PERSTANS
MST = MALADIES SEXUELLEMENT TRANSMISSIBLES

* Trichomonose et candidoses

It is similar with digestive problems (diarrhea and vomiting) that were recorded during the survey, associated to malaria, and which must not be wrongly attributed to other etiologies.

The morbidity of malaria is thus complex, and this is so because malarial access aggravates or engenders other predominating affections; this concerns pneumopathies (5.4%), gastro-enferites (33.6%) eruptive diseases (0.9%) particularly measles and chickenpox, ORL infections (13.5%) (Fig. 4).

Among the 102 children examined, 89, that is 87.2% are concerned with one of these affections associated to malaria.

These data correspond to those recorded in Equatorial Africa in general, and notably in the forest zone of Cameroon (RIPERT al. 1982). Malaria is in effect, mesoendemique, if not close to by-percendemicity just like in the valley of Sanaga where 42.2% of children below 10 years are beanies of hematozoid in their blood (MESSI, 1978).

2.1.2. MULTIFORM DIARRHEA

As we passed by, the number of persons suffering from either acute or chronic diarrhea rose to 125.

Acute diarrhea are one of the main signs of morbidity in children and they contribute to a large extent in malnutrition. In effect, among the 102 children below 5 years, 20 (19.6%) show episodes of acute diarrhea, with 12 (11.76%) are in the state of malnutrition (Table 3).

Chroic diarrhea are also quite frequent with children than adults, but here the difference is negligible than for acute diarrhea. Cases of malnutrition are equally high during chronic diarrhea (Table 17).

TABLE 3: Distribution of Cases of Diarrhea According Age, Type of Diarrhea and Frequency of Malnutrition in Proteino-Energy (MPE).

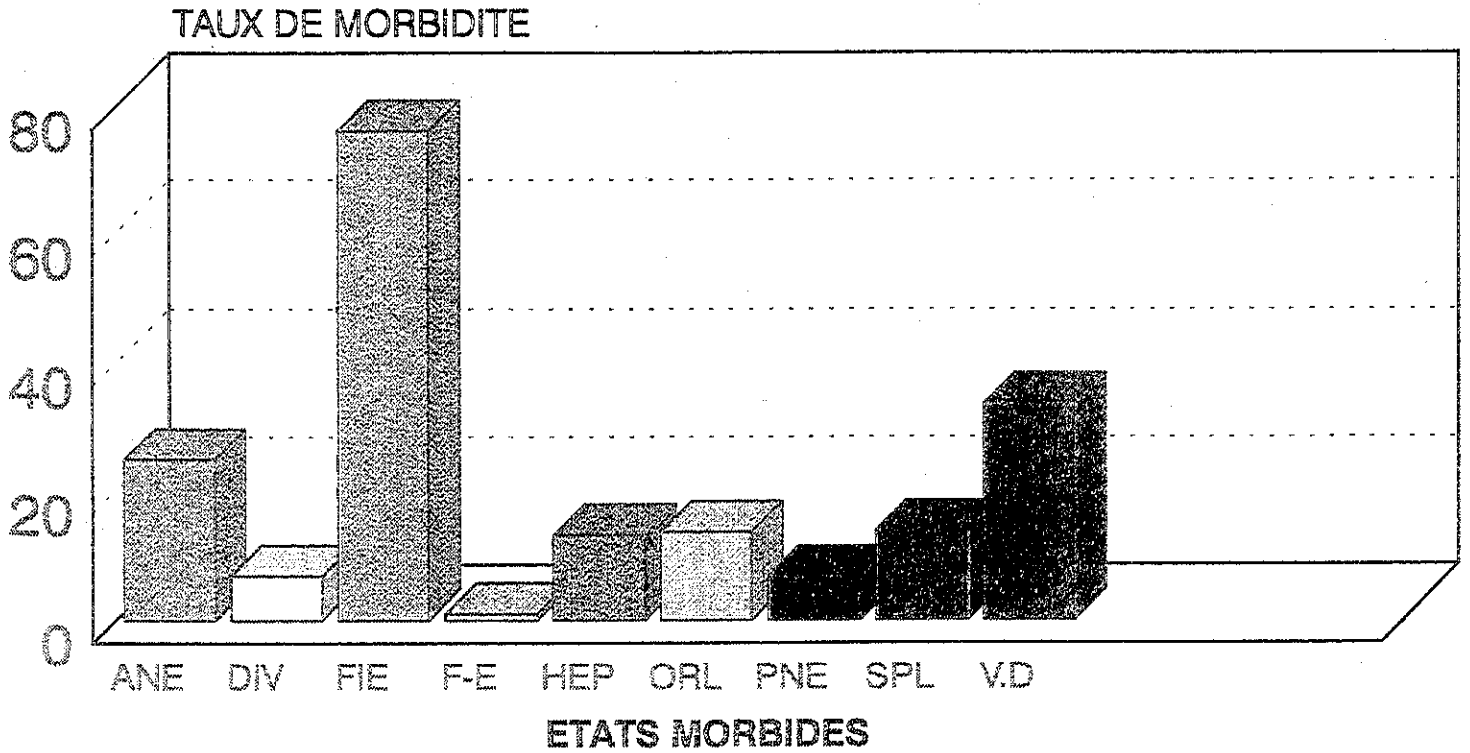
Age	Acute Diarrhea				Chronic Diarrhea				Total			
	No.	%	MPE		No.	%	MPE		No.	%	MPE	
			No.	%			No.	%			No.	%
0- 4 yr	20	19.6	12	11.8	17	16.6	10	9.8	30	29.4	22	21.6
5-19 yr	27	14.6	-	-	18	9.7	-	-	45	24.3	-	-
> 19 yr	29	14	-	-	25	7.2	-	-	54	26.1	-	-
Total	76	15.4	-	-	49	9.9	-	-	125	25.3	-	-

Causes found are in decreasing order of frequency:

- Parasitises 37.8%
- Proterio-energetic malnutrition 21.0%
- Lungs infections 20.7%
- Microbian intestinal infections (green stool) 17.5%
- Infections of ORL sphere (otite, rhuinite, pharyngite) 12%

Distribution of these cases in the different villages does not show any particularity of geographical nature. Front line villages do not present more cases of diarrhea than others.

FIG. 4 : DIAGRAMME DES TAUX DE MORBIDITE PALUSTRE



PNE = Pneumopathies (6,4%)
V.D = Vomissements et/ou Diarrhées (33,6%)
HEP = Hépatomégalie (13%)
FIE = Fièvre (76,2%)
ANE = Anémie (24,3%)

ORL = Oto-rhino-laryngologie (13,5%)
SPL = Splèmomégolie (13,6%)
F-E = Fièvres éruptives (rougeole + varicelle) 0,9%
DIV = Divers (6,7%)

2.1.3. INTESTINAL PARASITISES

Nematodoses, and in particular ankylostomiase are characterized by an anemo-carentiel syndrome which was diagnosed in all the villages. For askaris and trichocephale, the average rates of infestation are 55.72% to 65.63% respectively, whereas prevalence of anguillulose is low (2.83%) Table 2; Fig. 3). The peasant population does not seem to apprehend the relation between their intestinal parasitises which they know well and the fecal danger to disrupt the chain of transmission.

As for cestodes, their low rate of prevalence (0.5% for saginata tapeworm and 3% for Hymenolepis nana are explained by the simple fact of the feeding habits of the population who seldom consume cow meat as compared to bush meat and fish.

Lastly schistosomiase (u=urinary or intestinal) does no exist in the region, no case had been diagnosed in our samplings, nor was any case noted from the registers of Nyabessan or Ma'an. The cases noticed at the central level (5 cases for the whole divisions of Ntem and Muila) are seemingly "imported".

In effect, our malacological investigation (cf. Table 15) did not give evidence of the presence of molluscs, intermediary hosts capable of transmitting bilharzias. The malacological fauna of Cameroon (SAME EKOBO< 1984) does not admit the presence of bullies and/or planorbs in the Ntem.

2.1.4. PULMONARY INFECTIONS

The main lungs infections depicted are acute bronchitis (84 cases), influenza (11 cases), measles (6 cases) and whooping cough (2 cases).

Just like for diarrhea, pulmonary infections are especially the apanage of children apart from influenza that attains indifferently all the subject of all age (Table 4) and the pulmonary tuberculosis which was signaled only among adults of more than 30 years.

The frequency of lungs infections vary without any profile from village to village.

Their morbidity is characterized by a febrile table (96.4%) and the coexistence in 16% of the cases with an ORL infection.

TABLE 4: Main Lungs Infections Identified.

Age groups	Acute Brochette		Pneumonia		Broncho-Pneumonie		Influenza		Measles		Whooping Cough	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0- 4 yrs	34	33.3	9	8.8	17	16.6	2	1.9	5	4.9	2	1.9
5-19 yrs	17	9.2	3	1.6	6	3.2	6	3.2	1	0.5	0	0
>19 yrs	13	6.3	3	1.4	2	1.4	3	1.4	0	0	0	0
Total	84	17	15	3	25	2.2	11	2.2	6	1.2	2	0.4

2.1.5. VENEREAL DISEASES AND AIDS

They represent one of the dominating endemics in the region and need to be inscribed among public health priorities. They pose therapeutic problems as serious as the problem of the low purchasing power of the population.

Following our samplings, 87 persons, that is 17.6% of the population tested present a gonococcus o non-gonococcus venereal infection (Table 5). In a whole of 14 villages, 20.2% individuals of 15 year ans above are infected.

The monthly records at the divisional level show a noticeable increase of cases of syphilis (florid cutano-muguous injury) and of gonoccous. It should be noted 67 cases of AIDS discovered this year in the entire south province, name is from the zone of influence close to the project.

TABLE 5: Distribution of Sexually Transmissible Diseases Diagnosed in the Different Age Groups.

Age groups	Gonoccocus		Candidacies		Tricho-Monases		Syphilis		Soft Canker	
	No.	%	No.	%	No.	%	No.	%	No.	%
0 - 12 yrs	3	0.01	4	0.02	2	0.01	0	0	0	0
13 - 19 yrs	10	0.05	12	0.06	3	1.3	2	0.01	2	0.01
> 19 yrs	35	16.9	18	8.7	38	18.4	6	2.9	6	2.9
Total	48	9.7	34	6.9	43	8.7	8	1.6	8	1.6

2.1.6. FILARIOSES

They are frequent in all the villages with 16.3% infestation rate for Loa loa and 5.6% for Mansonella perstans (Table 2 Fig. 3). They are part of the daily pathology, a real endemic

spread in all the sectors. The majority of people suffering are from 14 years and above. The other varieties of filarioses, notably onchocercose and Bancroft filariose have not been identified among the diseases examined. Thus, the region cannot be considered as a home for onchocercose and cases of blindness and other visual problems observed should be linked to other etiology. The absence of onchocercose has meanwhile been confirmed by entomological studies which have given no evidence of microfilaria, onchocerca volvulus during dissections of the similes gathered.

2.1.7. TUBERCULOSES AND PIAN

Though our sample does present only 16 cases of persons who have bacilli acido-alcoolo-resiting in their spit, with 7 hemoptysies and alteration in general state, it cannot be said that this region is safe from tuberculosis. According to the data on 69 cases registered at Ebolowa, for the whole division its prevailing rate for the division would be low, 3.49%. It must be underlined that this low rate is due to a good series of vaccination by BCG effected since 1987; 1247 persons averagely were vaccinated each year at the Ma'an hospital; the incidence curve, in effect, shows a fall since 1990 with 17 cases lesser in 1991 as compared to 1990, and 5 cases lesser this year as compared to 1991.

As for pian, 3 persons were depicted as against 26 cases for the entire Mvila and Ntem divisions during the first eleven months of 1992 (cf. Appendix C).

2.1.8. LEPROSY

Only 7 patients were depicted during our survey. This low figure is because most of the lepers willingly go to live at the Leprosy Centre of Evidisi, near Ma'an. The divisional service of Mvila at Ebolowa courts 368 patients, a figure in progression as compared to the past, because of the fall in active detection and the slackening of curing services. For the same reasons, certain lepers get rid of therapeutic controls and return home; this constitutes a real danger and a factor of dissemination of the disease.

In effect, among the 26 new patients hosted at Evidisi in 1991, 11 were new lepers; the importance of the number of lepers is probably due to a poor detection of tuberculoid and undetermined forms that require serious examinations.

2.1.9. ICTERUS (JAUNDICE)

Under this, we gather affections determining "jaundice" of non determined etiology and with a gravity that has not yet been noticed (few deaths) no the epidemic speed (following available data). In the light of our clinic, blood and urine tests, results show that out of the 71 cases of jaundice listed, the causing diseases are:

- Viral hepatitis 12 cases
- Severe malaria 34 cases
- Cirrhosis and/or cancer of the liver 1 case
- undetermined etiologies 24 cases

Cases of jaundices exist in all the villages in children as well as in adults. In 73.2% of cases, jaundices is a serious cause of morbidity dominated by severe alteration of the general state because they are generally treated by traditional medicine that drains (receives) the majority of patients.

2.1.10. P.E.V.DISEASES (Extensive Vaccination Programme)

Apart from tuberculosis, the number of children, victims of measles, tetanus, poliomyelitis, whooping cough, that is diseases that can be prevented through PEV, is high following the months records of the divisional service of Ebolowa; but during our stay, few cases of each of these disease were detected (Table 4).

The reality is certainly higher as compared to the whole data because at the level of the province, the south registers only one vaccination coverage of 30% despite the significant support of SESA. The entire vaccination undertakings for 1992 is summarized in Appendix C. It can be thought, following these data that these fluctuations of figures for vaccination are due to administrative procedure (excessive centralization of vaccination programme) logistics (disrupt of the chain of cold) and psychological (lack of incentive for the staff).

Measle severely deals with the people under an endemo-epidemic mode, with severe swells in areas far from Nyabessan and Ma'an. On the contrary, few cases of poliomyelitis, of tetanus and whooping cough were registered during this year. In all cases, the totality of these diseases has not been valuably determined through the available data because on the one hand of the poor perception of the causes of deaths, and the absence of the declaration of serious measles cases whereby patients die at home.

We shall always be faced with there two problems so long as the existing methods of collection of statistical data are not improved upon (Appendix C).

2.1.11. QUARANTINE DISEASES

We have not detected any of these diseases; but the available data at the central level talk of 2 victims of cholera, 12 victims of cerebrospinal meningitis, at 4 victims of typhoid fever in the Mvila and Ntem Valley divisions. Their mortality is still high (Appendix C), but the number of patients has often been restricted and the majority of deaths has occurred among patients lately discovered.

2.1.12. OTHER PATHOLOGICAL STATES

Be they due to an infectious agent or not, the other diseases that require a keen supervision are: "Rheumatism" (or more exactly arthralgies or articulately pains) is spread in all the areas studies with a rate of prevalence of 28.4%. The difference of their morbidity according to age comes as a result of the variety of etiology. For the 7.2% of adults suffering from rheumatism, i is probably real rheumatism affections with its loose being one of the greatest suppliers. In effect, 19.6% of people above 30 years who complain about rheumatism are equally carriers of the Loa loa filaria. On the contrary, for youths, below 15 years, it is real rheumatism only in 5.3% of cases, and probably due to repeated streptococcic infections of the ORL sphere having provoked acute articular rheumatism. In the other cases of rheumatism manifestations among children below 15 years, it wold be essentially arthralgies episodes accompanying malaria access or influenza.

TABLE 6: Distribution of Cases of Manifestations of Rheumatism in the Different Age Groups in Relation to Ethological Contexts.

Age groups	Rhumatisme Articulaire AIGU (RAA)		Filaires		Acces Palustres		Grippe		PR*		Arthroses	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0-14yrs	11	7.9	3	2.1	66	47.1	3	2.1	0	0	3	2.1
15-30yrs	6	4.3	12	8.6	22	15.7	2.9	2.9	1	2.14	17	12.1
>30yrs	1	0.7	37	26.5	20	14.3	2.9	2.9	17	12.1	107	72.1
Total	18	12.9	52	37.1	108	77.1	7.9	7.9	18	12.9	121	86.4

*PR = Polyarthrite rheumatoid

N = Number of cases of manifestations of thumatism mature

% = Percentage in relation to the entire people suffering from "rheumatism".

2.1.13. GYNAECOLOGICAL AND OBSTETRICAL AFFECTIONS IN WOMEN

Besides sexually transmissible diseases that dominate the gynaecological pathology in the region, and which are responsible for the 32 cases of sterility observed, fibroma was noticed only in 5 women. No case of excision associated or not to infibulation was signalled. These traditional practices are however not the deeds of Christians or animist societies.

In the obstetrical sphere, it is stimulated in the reports of the Ma'an hospital and the divisional service that women are particularly menaced during pregnancy anaemia (20.8%) and intestrical worms (17%); during delivery the number of dystocies seems high (91 cases)

comparatively with the low rate of maternal mortality (deaths due to pregnancy complications, delivery and labour). Perinated mortality is particularly high: 66 per 1000 for the whole division, 55.5 per 1000 at Ma'an and 56 per 1000 at Nyabessan.

Meanwhile 5 cases of abortions were recorded at the Nyabessan health centre, 9 at Ma'an, 153 cases for the entire divisions of Mvila and the Valley of Ntem.

2.1.14. HEMOPATHIES AND ENDOCRINE DISEASES

Hemopathies are dominated by anaemia of diverse origins: carential (17.86%), ankylostomian (38.1%), malarian (54.1%) and drepanocytar (3.6%). No case of leucemy and of lymphome of Burkitt was found during investigation or in the registers.

The only endocrine diseases found in the region are sweet diabetes (9 cases) and goitre(6 cases). As compared to the number of cases noted for the entire division, the zone of influence close to the project does not seem to be particularly exposed to these diseases.

TABLE 7: Distribution of Cases of Anaemia according to age and Etiology.

Age groups	MPE		Pregnant Woman		Ankylos-tome		Malaria		Drepano-cytose	
	No.	%	No.	%	No.	%	No.	%	No.	%
0 - 4 yrs	30	17.9	-	-	21	12.5	38	22.6	1	0.6
5 - 19 yrs	-	-	13	7.7	15	8.9	29	17.3	5	2.9
> 19 yrs	-	-	22	13.1	28	16.6	24	14.2	0	0
Total	30	-	35	20.8	64	38.1	54	54.1	5	3.6

N = Number of cases of anaemia

% = Percentage in relation to the total number of anaemic subjects diagnosed in the sampling

2.1.15. ORL INFECTIONS, EYE INFECTIONS AND BUCCO-DENIAL PATHOLOGY

Oto-rhino-lauyugological infections are represented by otitis (17 cases), rum and/or rhino-pharyngite (36 cases). The affect 50% of children and only 9.7% of other individuals of above 14 years. It is the same with conjunctivity noticed among 27 persons (children) and 11 subjects of more the 14 years. The other ocular infections rather prevail among adults. They are karatite or blindness (5.6%). In any case no eye infection is associated with ochocercose.

The bucco-dental pathology seems to be menacing all the villages, with 205 cases of caries with or without gingivitis, 27 cases of sotmatitis, and 26 cases of peals, making a total of 258 cases of bucco-dental infections.

2.1.16. SKIN DISEASES

Their importance in the sector does not only result as a matter of high frequency (23.68% of the population sampled) but also as a result of the clinic figures. These concern, mycoses, skin bacterioses, and scabbies with the follow prevalence rates:

- Mycoses (pityriasis, dermatophytes, candyfloss) 31.7%
- Impetigo and prurigo 22.7%
- Sarcastic scabbies 5.5%
- Filaria scabbies 2.8%

Notice is taken also of little skin injuries probably due to arthropod bites, and to ritual scarifications on therapeutic scarifications. Three cases of cheloids observed are to be link to these scarifications. On the contrary, no injury attributable to bleaching (traditional or through modern comestics) was observed.

2.1.17. HYPER BLOOD PRESSURE

In our sampling, this affection was discovered in 8 persons as against 231 noticed in 1992 at the Divisional Service at Ebolowa, for both the Mvila and Ntem valley divisions.

2.1.18. MISCELLANEOUS

a) Sterility, Fecundity

The rate of fecundity and sterility noticed are largely tributary to STD, but also to the matrimonial costumes of the region, notably polygamy (13.9% of homes of our sampling are polygamous).

Out of the 143 women of above 14 years that we surveyed, 11 have reached the age of menopause (45 years) without children. 21 others of less than 45 years ar sterile despites their efforts to conceive; thus, 32 women out of 143 at the age of procreation, are sterile: 22.4% of barrenness (against a national average of 17.2%, 1992 IFORD source) comparable to other forest zones of central Africa (Gabon: 32%; Zame: 20.5%, RCA: 17.3%; Congo 20%).

Meanwhile the rate of fertility expressed per the average number of children per woman is 2.6 (national average 6.9: according to IFORD 1992).

Here, fecundity is low probably because of the high level of sterility; but the region is probably compensated from the social view point through the high rate of unmarried mothers (Annex I).

b) Birthrate, Infant mortality

These two parameters reflect on the one hand the general level of local demographic evolution, and on the other hand the efficiency of health structures of the region.

According to data of the Nyabessan Health Centre and the Ma'an hospital, the gross natality rate (GNR) for the first 11 months of 1992 amounts to 24.3 per 100.

Infant mortally according to the same sources would be 7.3 per 1000 children.

It has not been possible to validly appreciate the dominating etiology of child death. It however appeared that from 0 to 6 months the causes are obstetrical (prematurely, dystocies) which are the major source of mortality; from 6 months to 1 year, respiratory infections, EVP diseases (tuberculosis excluded) and malaria; from 1 to 4 years infant mortality is largely tributary to intestinal parasitise, to malaria and states of proteino-energetic malnutrition (PEM).

c) Tobacco Smoking

This intoxication does not create a problem of public health in the region. Tobacco smoking is related to male adults; in effect, 0.02% only, of less, than under 19 years people slay they smoke daily, as against 0.07% amount elderly persons. The most consumed cigarettes are manufactured; pipes, cigar or chewing tobacco are hard consumed.

d) Alcoholism

In spite of the rising rate of beer and liqueur consumption as testified by the abundance of alcoholic drink in the shops, alcoholism is not really implanted in the people's habits. It should be however noted that in 9 villages out of 14 there are 1 to 3 drinking spots per village.

2.2. NUTRITIONAL STATE

The present nutritional state of the population is assessed through interviews (of mothers and health professionals), clinic data, biological and anthropocentric data, related to children below 5 years. These data have enabled us to appreciate the main factors that influence the nutritional state noticed.

The results obtained concern firstly the parameters that have led to affirm the global state of children nutrition: weight, height and brachial and cranials (skull) perimeters. In the second place we shall present the different types of malnutrition and ethological analysis of the different states identified.

2.2.1. EQUILIBRIUM STATUS

The distribution of children into four age groups corresponding globally to the preceding periods and following the weaning time, shows that before the age of 2, boys have

an average weight superior to that of girls of the same age. This difference is statistically significant. On the contrary, from the age of 2, the difference is no longer significative as stands at about 0.05 (Table 8).

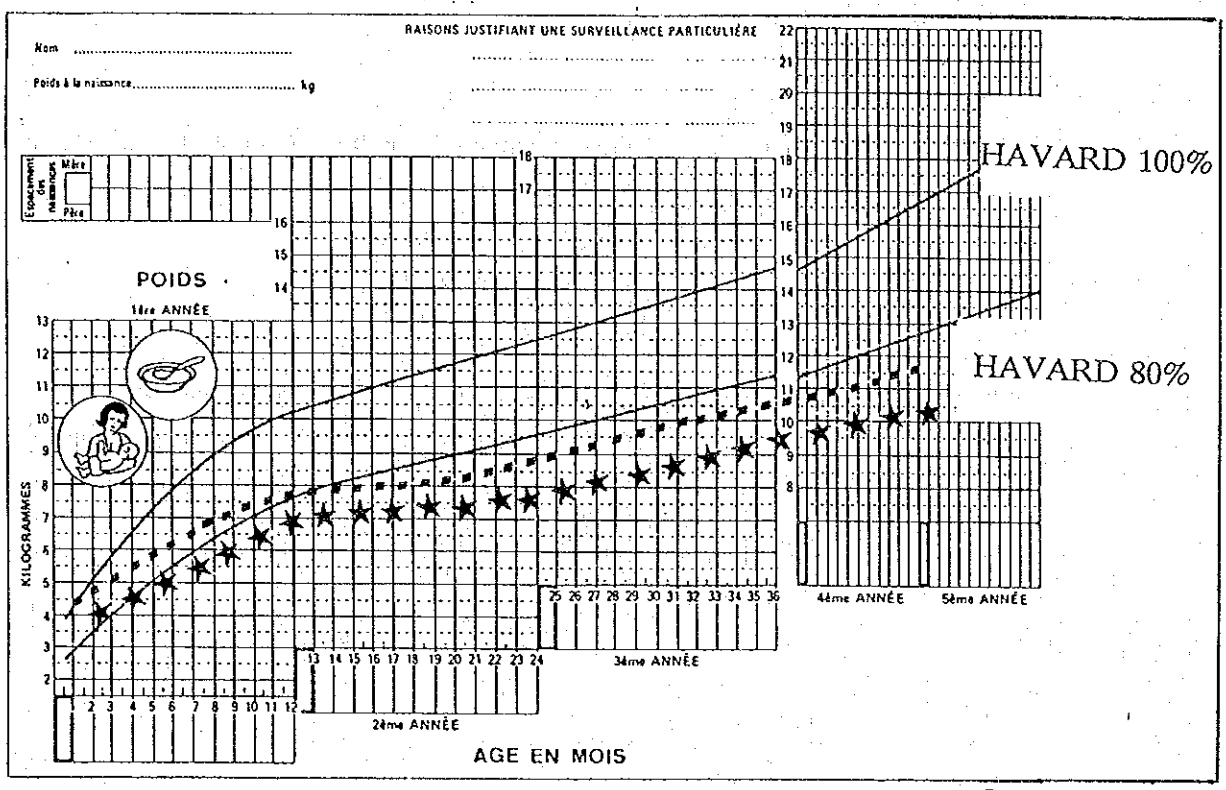
Meanwhile 3 stages are distinguished in the evolution of average weight: the fist is characterized by an almost-normal increase in weight for infants from 0 to 1 year, followed by the second stage with an inferior limitation to the normal; the third stage that whereby the equilibrium statute clearly separates from below the medium of normal children.

The diagram representing the weight status of children examined comparatively to 100% and 80% of Havard (Fig. 5) shows a weight deficit in the group of 1-2 years in relation to the 80% norms of Havard in the 2 age groups, for both boys and girls but the gap of one sex in relation to the other is not significant.

TABLE 8: Average Age in Kg per Age Group and per Sex of Infants below 5 Years Examined.

Age Group	Boys			Girls			Average Weight of Reference
	Pm	No.	%	Pm	No.	%	
0- 5 months	5.1	9	8.8	4.4	5	4.9	5.2
0-12 "	7.1	10	9.8	6.6	11	10.8	8.7
13-24 "	8.9	13	12.7	8.4	11	10.8	11.3
25-59 "	11.5	21	20.6	10.2	22	21.6	16.1
Averages		53			49		

FIG. 5: Havard diagram showing the equilibrium statute of children examined



Havard 100% : Reference curve of maximum weight for children in good health of 0-5 years

Havard 80% : Reference curve of minimum weight for children in good health of 0-5 years

▪ ▪ ▪ ▪ Boys

★ ★ ★ Girls

2.2.2. HEIGHT, AVERAGE BACHIAL PERIMETER, SKULL PERIMETER

Similarly to the weight status, the average height values, average brachial perimeter and skull perimeter for our sampling ar different from the reference figures from the age of 1, and moreso as children grow (Tables 9A, 9B, 9C).

TABLES 9A, 9B, 9C: Anthropocentric Status of Children below 5 Years following the Average Values of Their Height (T), Average Brachial Perimeter (Pbm) and Skull Perimeter (Pc).

Age Group	Boys			Girls			Taille de Reference
	No.	T	ET	No.	T	ET	
0- 5 months	9	59.3	2.961	5	57.1	3.982	58.3
6-12 "	10	67.2	2.755	11	67	2.596	70.5
13-24 "	13	77	4.514	11	77.7	3.128	81.8
25-59 "	21	89.4	5.134	22	86.9	5.29	107.9

A = ET =

Age Group	Boys				Girls			
	No.	Pbm	ET	Pb.R	No.	Pbm	ET	Pb.R
0- 5 months	9	12.9	1.315	13.3	5	12.3	0.986	12.7
6-12 "	10	14.8	0.819	15.9	11	14.1	1.030	15.2
13-24 "	13	15.4	1.145	16.4	11	14	1.482	15.9
25-59 "	21	15.24	1.470	16.9	22	15.5	1.163	16.5

B = Average brachial perimeter (Pbm)

Pb.R = ; ET =

Age Group	Boys			Girls			Perimetre Cranien de Reference
	No.	T	ET	No.	T	ET	
0- 5 months	9	38.7	2.491	5	38.20	3.155	41.2
6-12 "	10	43.7	1.756	11	43.4	3.047	48.2
13-24 "	13	46.6	0.884	11	47.5	1.231	50
25-59 "	21	48.3	1.104	22	49	0.906	50.6

C = Skull perimeter (Pc).

2.2.3. THE DIFFERENT TYPES OF MALNUTRITION

The 102 children examined, of less than 5 years, were classified in 3 groups according to the KANAWATT and Mac LAREN indication calculated following the value of the brachial perimeter report.

Skull Perimeter

In the first category, 70 children are classified (68.62%) who present a normal nutritional condition, with a KMC above 0.31. The second and 3rd category comprise of poorly nourished children (KMC < 0.31); they were 32 in number; among them 17 (16.7%) are in a moderate state of proteino-energetic malnutrition (KMC is between 0.28 and 0.31) and 15 (14.70%) in severe state of proteino-energetic malnutrition (KMC < 0.28). Distribution of these states in relation to age and sex is indicated in table 10 and by Fig. 6.

The difference noticed between sexes is not significant as it stands at 0.05.

TABLE 10: Distribution of the Number of Children in the State of Proteino-Energetic Malnutrition (MPE) according to Age and Sex.

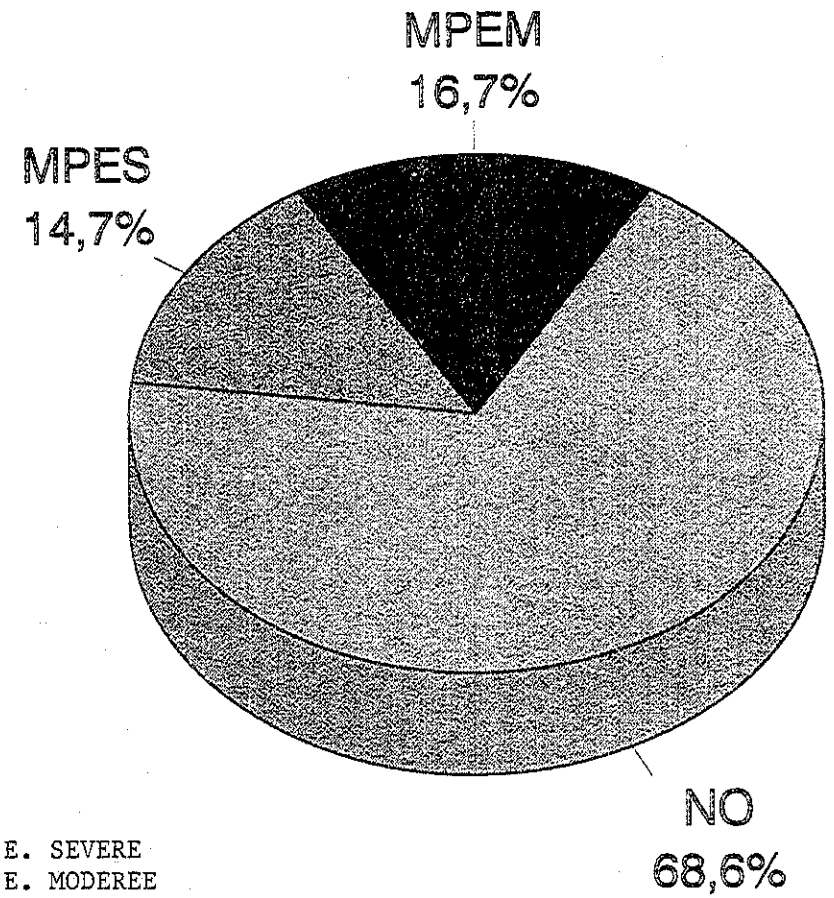
Age Group	MPE Moderee				MPE Severe				Total			
	Boys		Girls		Boys		Girls		Boys		Girls	
	No.	Ec	No.	Ec	No.	Ec	No.	Ec	No.	Ec	No.	Ec
0- 5 months	9	0	5	1	9	1	5	0	9	1	5	1
6-12 "	10	1	11	2	10	0	11	1	10	1	11	3
13-24 "	13	2	11	3	13	1	11	5	13	3	11	8
25-59 "	21	4	22	4	21	4	22	3	21	8	22	7
Total	53	7	49	10	53	6	49	9	53	13	49	19

N = Number of children examined in each age group

Ec = Number of deficient children (in state of MPE) in each age group

* MPE → Proteino-Energetic Malnutrition

FIG. 6 : REPARTITION DES ENFANTS
SUIVANT LE STATUT NUTRITIONNEL



MPES = MALNUTRITION P.E. SEVERE
MPEM = MALNITRUTION P.E. MODEREE
NO = ETAT NUTRITIONNEL NORMAL

It would appear that in these data, the moderate forms prevail among children of 24 months and above, and in the severe forms in the group of 13-24 months. In a whole, girls are frequently affected than boys.

2.2.4. ETHOLOGICAL ANALYSIS OF STATES OF MALNUTRITION

The liaison between the nutritional problems observed and certain diseases has been researched from the different morbid tables presented by the children, that is, the main clinic manifestation of the patients. By decreasing order they are:

- Equilibrium-status deficit 86.2%
- Conjunctive paleness 36.5%
- Digestive problems (diarrhea and/or vomiting) 27.1%
- Respiratory problems 16.2%
- Splenomegaly 16.4%
- Stigmatise and/or pearls 12.7%
- Phonier 11.5%
- Hepatomegaly 11.4%
- Apathy 10%
- Edema 46%
- Lunar facias 3%
- Chaplet costal 1.96%

These morbid manifestations are diversely associated among themselves and more often with the following affections:

- Infestinal parasitises 61.7%
- Malaria 33.7%
- Pulmonary infections 20.2%
- ORL sphere infections 12%

Other signs like stomatitis and/or pearls, chaplet costal and phaners problems evoke vitamin and food inefficiency in proteins (milk, eggs, fish, meat) found in the mode of food during the interviews with mothers. These states are also most frequently found in the numerous families (of more than 5 children), among young mothers (of less than 20 years) and at weaning age, than in the other conditions as shown in Table 11.

TABLE 11: Distribution of Frequencies of Cases of Proteino-Caloric Malnutrition in Relation to the Family Density, Age of the Mother and Weaning Period.

Nutritional Status	Family Size		Mother's Age		Weaning	
	< 5 c.	> 5 c.	< 20 yrs	> 20 yrs	(+)	(-)
MPE (+)	14	18	16	16	21	11
MPE (-)	32	38	29	41	42	28

c = Children
MPE = Proteino-energetic malnutrition
MPE (+) = Number of children in MPE state
MPE (-) = Number of children unhurt
(+) = Number of children under weaning
(-) = Number of children weaned without MPE.

3. INFRASTRUCTURES, SERVICES AND HEALTH STAFF

3.1. THE NYABESSAN DEVELOPED HEALTH CENTRE (DHC)

The first remark on the Nyabessan DHC is the decay of the building that has not known no modification and no maintenance since the Elementary Health Centre was raised to a Developed Health Centre in 1984.

The infrastructures of the building are primary and obstruct the functioning and efficiency expected from a developed health Centre. None of the 6 rooms of the building has quantitatively sufficient material, and the existing material is in a poor state, notably in the laboratory where no reagent is available, and where there is a damaged microscope. Delivery and care rooms are dilapidated, with no maintenance and deprived of the minimum material boxes, no goves and no antiseptic solutions. The pharmacy is empty with only a few antimalaria drugs as the essentials. The Centre has no water reserve, no electricity source, no pit for dirts; the immediate surroundings and latrines are not catered for.

The staff sent to the Centre is mostly insufficient qualitatively and quantitatively. In effect, with with one nurse, one nursing-aid and one matron, the services attributed to the Centre cannot be well executed. The mission of the DHC is to be multi-purpose that is to slay, carry out curative and preventive activities in its sector; but we notice have that apart from consulting pregnant women (46 cases in 1992), the Centre carries out no preventive medicine

activity, like vaccinations, detection campaigns for main endemics and hygiene. It does not coordinate actions against other affections largely spread like intestinal parasitises, bronchitis, malaria. On the contrary, the tendency here is to work like in an urban health service with a single individual vocation and essentially curative (Table C9 in Appendix).

It should however be recognized that the largely dispersion of the villages require important and specific means; and the maintenance of means which is an absolute necessity to ensure priority tasks implies enormous costs. This mean therefore that a Developed Health Centre cannot function with absurd means put at their disposal up to now. There must be a minimum of means in building, in material and in personnel.

3.2. MA'AN DISTRICT HOSPITAL

This hospital was built in 1983. The problem of infrastructure and staff less acute that at Nyabessan. Meanwhile, work on the construction of operation blow remain incomplete; essential drugs, technical material (for care and petit operation) and the reagents of laboratory are clearly insufficient. The hospital has no transport means to evacuate patients. In this context, the coefficient of occupation of the 10 beds that the hospital has in still to be desired (26%) if we know the density of medical needs in the sector.

Concerning the personnel, the services are ensured by 7 person (they were 10 in 1991); the hospital no Doctor, no mid-wife (or a delivery-nurse),no a laboratory technician. The SESA* project (Santé de L'Enfant du Sud and Adamaoua) based at Ebolowa and in charge off SSP lays as sine qua non condition the transfer of a doctor to this hospital before any collaboration.

But the biggest difficulties are met at the level of the different services that function moors as urban health services whereas their vocation is essentially rural. However, note is taken on the good execution of vaccination programmes (Tables C8 and C9 in Appendix C) and consultation of pregnant women, but the absence of a mobile team renders all campaign for detection of endemics inexisting and, as concerns hygiene, no action is undertaken to eradicate the danger of faeces and urine, even in the immediate surroundings of the hospital.

It is also worth-noticing that no coordination, though necessary, does not exist between this hospital and the Nyabessan DHC. The chief-nurse of the hospital no longer visits periphery dispensaries; in this way, the population concerned can no longer consult him in the nearest dispensary to their home.

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* *SESA = Santé pour l'enfant du Sud et Adamaoua*

(non-governmental American organization with the objective of national services in preventive medicine through health education, primary health care and maternal and child protection)

To summarize, the conditions of efficiency of the Ma'an Hospital are not met, neither in the curative, nor in the preventive domain. Like in Nyabessan, this state of things is closely linked to the insufficiency of structures and personnel put at the disposal of the Ma'an hospital.

4. BIOLOGY AND DISPERSION OF THE ENTOMOLOGICAL FAUN AND MOLLUSCS

4.1. ENTOMOLOGICAL DATA

The captures carried out in different placed have shown a large distribution of lS. dannosum in the sector. Meanwhile its density is variable, it reduces as one goes away from the Ntem river. Research on lawa homes has not been the subject of our investigate, thus this study ought to be deepened so as to better appreciate the dynamics of the simulidian population.

The examined sample was relatively low (Table 12); though no simulie was found infected, we cannot assume a total absence of onchocercose. Nonetheless, clinico-parasitological tests must throw more lights on this point.

Anopheles gambiae, major vector of malaria in sub-saharian Africa, is in a remarkable proportion in the region. It cohabits with An. nili whose presence is favoured by the ecological and climatic milieu. The investigation was done at the end of the rains in tropical forest blessed with many rivers (Ntem, Njo'o ...) with rapid flow (LE GOFF G., 1990).

With the advert of deforestation and water reservoirs, An. gambiae will increasingly establish at the favour of the creation of many propitious homes to its development.

The washing away of the homes by torrential downpour of irregular rhythm was permanent and the emergence of younger mosquitoes population explains the low rate of parturity.

As concerns culex, the appropriate homes are scarce due to lack of collection of water polluted with organic matters (SUBRA, loc. cit.). Apart from the latrines with deep pits constructed at the SONEL Camp, where there is a great population of mosquitoes, the degraded latrines pits of the local population are often dry and at times "maintained" by vagabond pigs. Nonetheless, mobilization of the population as well as the progressive urbanization of the region can favour the setting up of this specie, a source of nuisance in urban areas.

Results obtained through the prospection of tsetse fly enable to make an impression of uniform distribution of flies in the zone, except the case of the Ntem burden with 40.9% of

sample out 6 places of captures. As a whole, the low density can be equally related to that of coverage in assessment traps in the zone.

Glossina tabaniformis had been captured at the border of the river (Table 14). This area serves also as a crossing point by canoe from one bank to the other. This sector is full of mammals and the tropism of these flies for suidés is known. This specie of the Fusca group is more known for its vector role of trypanosomiase animals.

Glossina p. pallpalis (Table 14) representing 90.7% of the sampling is the main vector for THA in this region of tropical forest which stretches right to the open sea in Kribi and Donala.

In the absence of local cases of THA (African Human Trypanosomiase) in the sector, and of the negativity of results on dissection of flies, it must be noted that this zone is neighbour with the active homes of THA at Campo and the Equatorial Guinea.

4.2. MALACOLOGICAL DATA

Poverty of the local malacological fauna is to be noted (Table 16). Although the results obtained so far are not final. Lanists Ovum could have a wider distribution. The low representativity of this species cold be due to the fact that the prospection was carried out at the end of the rains which affects gathering in the sense that many molluscs are "diluted" in a high volume of water. Also, a considerable part of the malacological fauna is drained away by current which was useful during the investigation period.

It is possible for the acidity of water in this forest zone to be one of the main causes of the poor malaco-fauna. Embankment works, clearing, mobilization of the population, what will accompany the dam, with important ecological modifications, could become favourable to the setting up and to the proliferation of molluscs like Lymnea natalensis, bulins and planorbs, that are intermediary hosts of human trematodoses.

TABLE 12: Distribution of Simulies According to Points of Collection, Dissection and Parturity Rate.

	Collec	Diss.	Pairs	% parité	Parasitées
	Study Point A				
22 hours average/hr : 107 average/day : 1162	2324	813	309	38	néant
	Study Point C				
6 hours average/hr : 90 average/day : 990	538	460	105	23	néant
	Study Point D				
	300	142	20	14	néant
4 hours average/hr : 75 average/day : 825					
	Total				
average/hr : 99 average/day : 1054	3162	1415	432	31	néant

TABLE 13: Distribution of 2240 Mosquitoes Caught in NYABESSAN in Two Sessions According to Species and Capturing Homes.

Capturing Home	Culicidian Species			Total
	An. gambiae	An. nili	Culex quiquefasciatus	
No 1	627	439	34	1,100
No 2	582	536	22	1,140
Total	1,209	975	56	2,240

TABLE 14: Distribution per Trap, Specie and per Sex of Tsetse Flies According to the Different Catching Points.

No Piege	Point d'étude	G p. palpalis		G tabaniformis		Total
		M	F	M	F	
1 (camp (SONEL)	A	11	20	0	0	31
2 (NKOL-ESSONG)	A	14	20	0	0	34
3 (bord du fleuve)	A	14	33	6	2	55
4 (NNEMEYTONG)	C	12	11	1	0	24
5 (BEKOE)	C	12	22	3	8	35
6 (NKON-MEYOS)	D	11	24	0	0	35
Total		74	130	10	10	214

M = Male F = Female

The highest numbers were gather at the border of river NTEM (9 flies) near the NKOL-ESSONG village and river BEKOE (5 flies). These are bathing spots to the population and are covered by a forest shed.

TABLE 15: Distribution of prospected sites and results of the catches.

Villages ou Hameaux	No Sites	Nature of site	Utilisation du Site	Espèce trouvée
Nnemeyong	1	R. Ntem	Baignade, boisson	0
Allen II Bikoi	2	R. Abieté	Baignade, lessive	0
	16	R. Ndjo'op	Boisson, traversée	0
	17	Rivière	Baignade, boisson	0
Obiannemeyong	3	R. Ndjo'op	Boisson	0
	4	Marécages	Bains, boisson	0
	5	Marécages	Bains, boisson	Lanistes ovum
Ntebozock	6	Sources	Bains, boisson, lessive	0
	7	R. Ndjo'op	Bains	0
Nsebito	8	Rivière	-	0
	9	Marécages	-	0
Akom	10	Etang	Marche - enfants	0
Nyabessan	11	R. Ntem	Entrée et sortie pirogue	0
Aya' Amang	12	Source	Boisson	0
	13	Source	Pêche, traversée	0
	14	R. Avuè	Traversée	0
	15	R. Mongo Zoo	Traversée	0
Melen II	18	Source	Boisson	0
Tom	19	Source	Boisson	0
	20	Rivière	Bains	Lanistes ovum

Any prospecting carried out from July or August (short dry season) or during the long could give important complementary information.

The absence of intermediary host molluscs for trematods in the area is certainly an advantage, but requires a continuous longitudinal supervision i norder to prevent any endemic affection. The most visible affections in this context are urinary as well as intestinal bilharzias. Similar situations were recorded in Ghana, Sudan, Nigeria, Brazil and the Philippines (IAROTSI et DAVIS, 1981).

4.3. OTHER ARTHOROPODS COLLECTED

Other insects of medico-veterinary interest collected by the different methods during prospecting concern the main vectors of Loa-Loa filariose. In effect, two species were identified: Chrysops dimidiata and Chrysop Silaceca.

Lastly, STOMOXYS nigrans were identified; these are mechanical land trypanosome animal vectors.

TABLE 16: Other Arthoropods of Medical Interest Collected.

Arthropods	Potential Diseases
Chrysops dimidiata	Filariose Loa loa
Chrysops silacea	Filariose Loa loa
Tenebrio molitor	Hymenolépiase
Ixodes ricinus (Tique)	Rickettsiose
Boophilus sp. (Tique)	Rickettsiose
Pulex irritans (Puce)	Rickettsiose
Tabanus sp. (Taon)	Nuisance
Pediculus capitis (Pou)	Fièvre récurrente
Phtyrius pubis (Morpion)	Nuisance

PART III

PROJECT IMPACTS ON VECTORS, PARASITISES AND OTHER HEALTH ASPECTS

1. PROJECT IMPACTS ON VECTORS

The privileged biotops of vectors of potential complex pathogenes of the socio-economic influence zone close to the project are aquatic and periaquactic. The water of the dam and works of deforestation of the environment of the plant will thus play as important role in the repartition and transmission in space and time of parasitises, viruses and bacterian diseases.

The project must therefore take into account the modalities of transmission of vectorial diseases and the ecology of the vectors in a way to avoid multiplication of causes that favour their proliferation.

1.1. CULICIDES

Out of the five species of mosquitoes that were collected, only A. gambiae and A. nilii play a role in the transmission of malaria in the villages. A. gambiae is the dominating specie found in an adult state inside houses and its larvae proliferate in the peri-domestic homes as well as distant houses. These are collections of sunned standing waters. A nilii is less abundant; it affects in the faura state clean waters with abundant vegetation at the borders of streams and marshy zones of the river and its tributaries; the ideal type is represented by the flooding zones of NDJO'OP, AYA-AMANG and MELEN II.

The overflow and the bed of the river down the dam could favour the solar exposition stimulating, from the health point of view, both the growth of the larvae of A. gambiae and A. nilii, but also the development of an aquatic vegetation and favourable peri-aquatic vertical type that favour the colonization of the zone by new species, notably those of the Anopheles funetus complex. In effect, the species of the complex are easily introduced in the biotops of the deforested zones with a sparsely vegetal coverage.

Construction works are necessarily accompanied with a degree of deforestation and removal of soil through clearing, and will probably create a succession of little openings cut out by small forest islands, making many additional homes to the existing species and to new ecological nest to other species.

On the contrary, if the expected level of the reservoir is sufficiently high, it could, on the same site, avoid the development of an abundant aquatic vegetation. Since malaria is mesoendemic in the villages, he presence of the dam follows its impact on the increase in culcidian fauna, will not reasonably augment its effects.

As concerns other mosquitoes (Aedes and culex), there is a risk to see the appearance or applification of two diseases transmitted by other mosquitoes: yellow fever (jaundice) transmitted by Aedes and Bancroft filariose transmitted by Culex.

The nuisance is already intensive, due to the bites of the different mosquitoes, Culex and Aedes in particular, should also be considered, if will certainly increase with the advert of the new reservoir.

1.2. SIMULIES

Simulies caught around the borders of the Ntem and around the villages belong to the S. damnosum specie, vector of onchocercose. Out of the 3162 females dissected, none was infected by the onchocercous larvas. In the aquatic the preimaginal forms (larva and nymphs) are in the abundance on the immerged plants of the Ntem and its tributaries at places where current is fast; these are in effect phenophile species, adapted to well oxygenated waters.

The construction of the reservoir will however transform the course of river Ntem with rapid catchment basin into a relatively stagnant lake. This modification will have the effect to reduce the larva homes of simulies and, thus diminish the importance of the simulidian population; so much so that the eventual transmission of the onchocercose must be reduced. Similarly, the absence of parasited persons in the villages and the farness of onchocercose homes form the region (the nearest are found in the Dja ef Lobo Division) constitute as many factors that minimized the risk of any establishment of onchocercose in the socio-economic influence zone close to the project. However, the efflux of the population that will follow the economic development of the region after putting the dam into service, could compromise this equilibrium while bringing onchocerquian subjects that will form a reservoir of parasites from which onchocercose will establish in the region.

1.3. TSETSE FLIES

The collection of tsetse flies in 6 catching sites covering the zone of investigation, permits us to admit that out of the two species of tsetse flies identified, Glossina tabaniforms and Glossina Palpalis, only the latter constitutes a danger for the installation of "Trypanosomiase Humain Africaine" in the sector. The only vector of sleeping sickness in South Cameroon is, in effect, G. palpalis (Le Mao et al, 1986). Meanwhile, this species was collected in a proportion of 90.9% as against 0.1% for G. tabaniforms. Disections of 224 specimen caught did not find trypanosome in their saliva glands.

Nonetheless, the risk of implantation of sleeping sickness is not to be formally neglected due to the nearness of home of trypanosomiase at Campo (ENYONG, and al., 1984); moreso, the foreseeable attraction of population from Campo in quest of job can, facilitate the dissemination of the disease in the zone of influence close to the project, while increasing the man-vector contact, and this moreso as roads and deforestation will crease communication "Corridors" between Campo and the dam site.

1.4. CHRYSOPS, TABANUS, AND CULICOIDES

These are injects abundantly collected during the investigation i nall the localities. If their ecology is closely infeodated to hot and humid biotops (forests, hot/humid), they don't have, on the contrary with the exception of culicoids, no stage of development in the aquatic

milieu. Their population could meanwhile sustain reasonable fluctuations of influences of the dam to raise the reverences and the morbidity of diseases they transmit: loose by chrysops and mansonellose by culicoids. Also, the nuisance by painful bites of gadfly (Tabanus) will be probably increased in a significant manner in relation with the evolution of the hygrometry after the filling of the dam.

1.5. MALACO-FAUNA

In the construction sites of the dam, research on molluscs in a section as important as entomological prospecting because reservoir construction can bring about the proliferation of a malacological fauna comprising of intermediary hosts of billharzioses and hepatic and pulmonary distomatoses.

The collections effected in the entire hydrographic network of the region brought about none of the following molluscs, susceptible of transmitting bilharzioses and distomatoses: bulin, planorbe, limnée, potadoma.

6 specimen of prosobranches of the lanist type were collected; and they are not potential "vectors" of any human illness. Consequently, there is no risk of bilharzioses and distomatoses occurrence in the region; statistics show no homes for urinary bilharziose nor intestinal in the South Province. The home for pulmonary distomatose still active in the Province is at Enongal, near Ebolowa, at above 1000 km from our zone.

2. IMPACTS OF THE PROJECT ON PARASITOSES AND OTHER HEALTH ASPECTS

Parasitic diseases and other pathological states of the population of the immediate environment of the construction sites of resources in water form the complex pathologies with the different elements (man, causal agent and its vector) sustain mutual influences. Each element is submitted to the constraints of the milieu that determine a prise distribution i nspace and time for each disease.

2.1. PROJECT IMPACT ON PARASITOSES

Malaria and filarioses are the main parasitic diseases with prevalence and morbidity that may be increased by consecutive hydrographic modifications to the construction of the dam. These are in effect, diseases that have as vector an evolving agent during all or part of its cycle in the aquatic ilieu. ON the contrary, parasitises like amibiase and intestinal nematodoses (ankylostomiase exempted) diagnosed in the sector, although they are essentially transmitted by "dirty hands", will probably be diminished by the project because their modes of contamination are closely linked to deficiency and to dirty water spot. Certain skin parasitises and tapeworms will not be sensibly influenced.

2.2.1. MALARIA

Malaria is characterized in 14 villages studied by a high prevalence; if we the data of monthly records of cases of malaria entry received in the medico-sanitory units of Nyabessan and Ma'an, it can be said that there is an extremely intense and continuous from one season to another of Plasmodium falciparum, and that the intensity of transmission of malaria will no longer be modified by the construction of the dam.

2.1.2. FILARIOSES

The Prevalence of onchocercose is presently not in the region but the presence of Simulium damnosum, vector of Onchocerca volvulus, creates the risk of implantation of this filariose in the villages close to the Falls and the Boucle du Ntem (cf. Impacts on vectors).

On the contrary, the prevalences of Loa Loa filarioses and M. perstancs are quite high and of the same order of grandem (16% and 6% respectively) be they villages close to site of the future dam or further. This homogenise distribution is aussi felt by the inhabitants who have remarked that they are attacked by the bites of "Isun" (filaria flies: chrysops) and culicoid (vectors of Mansonella perstans) in the front line villages (close to Ntem) as well as in distant villages. The entomological prospectings confirm the presence of chrysops silacea, chrysops dimitia and culicoid grahami in all the villages, the valley and its environs (of Part II). The project impact will be quite important on these filarioses already spread in all the localities.

2.1.3. INTESTINAL PARASITOSES

The rates of infestation of ankylostomiase seem quite high in the front line villages than in the more distant villages from the river, probably because of a greater soil humidity linked to the levelling of the ground water to the surface of the cultivated farms; the spots of predilection of contamination of this parasitise (that is transmitted from the soil through the skin passage of larvas) are in effect the muddy marshy zones. The raising of the lkevel of ground water after the construction of the dam could increase the transmission of this helminthiase when the dam will be filled.

On the contrary, incidences of amibiase and other intestinal nematodoses will not be increased by the project; they may even reduce if water in the dam is well exploited.

In effect, the mastery of water resources that constitutes the reservoir lake of the future dam could be followed be a proper management of water through a water supply network, be it even dimentary. The first advantage of this system will be cut down of the transmission chain of intestinal parasitises and other bacterioses that are transmitted essentially in the region through the consumption of dirty stream waters and of wells and contaminated food by the dirty waters.

2.2. PROJECT IMPACTS ON OTHER HEALTH ASPECTS

Vis à vis other health aspects, the construction of the Memve Ele dam constitutes a main factor in the life of hte riverside population.

In short term, the impacts of the site with result to the promiscuity that will favour the mixing up of population on the socio-cultural sphere with its advantages and disadvantages, notably certain feeding habits, recreations and also STD (sexually transmissible diseases) that constitute one of the major result of mixing population.

To long and medium terms, the construction of the dam will increase the health coverage, resources in water and the whole social and economic conditions.

In effect, the relative importance of labour offer for the site and the expected economic situation will upset three order for data in the sense of improvement:

a) A better level of living for the inhabitants compared to the present state, due to the reduction of joblessness.

b) The availability of water in the villages and, thus, a better use of water points that will be easier to construct following elementary hygiene norms: coping wells and/or covered. Water that will thus be made available close to the inhabitants will ease the implantation of fountain-pipes;

c) Health and traditional feeding.

"Water is Life". The population will no longer use just any type of water for drinking and food, the risk of being exposed to disease of water origin (dysenteries and other diarrhea infections, cholera, typhoid fever and paratyphoid) will be minimized.

Meanwhile disenclavement will bring about monetary circulation improvement upon communication means that modify the feeding regime: sea fish will be consumed in the inlands, the local starchy food (cassava, and cocoyams notably) will fall back ahead of rice, beans and other food stuff whereas subsistence economy will regress. On the contrary, flooding of large areas of land by the stretch of water of dam may provoke a diminution of food crops at the benefit of coffee and cocoa.

PART IV

COMPENSATORY MEASURES AND GENERAL ACTIONS FOR IMPROVEMENT UPON THE CONDITIONS OF THE POPULATION'S HEALTH CARE

The data obtained in the different pathological and nutritional states and on vectors of transmissible disease in relation with the construction of the Memve Ele dam have led us to propose preventive measures in order not to multiply or simplify the factors that favour the diseases, and the proliferation of the vectors in the socio-economic zone of influence close to the project. These measures are from the technical and social, direct and indirect perspectives.

1. DIRECT COMPENSATORY MEASURES

1.1. TECHNICAL MEASURES

They concern the future reservoir, the plant and the construction of the bed of the Ntem into downstream dam.

1.1.1. THE RESERVOIR LAKE

The walls of the reservoir lake must comprise of rocky formations, not wide, with clear and abrupt slopes, deprived of aquatic vegetation favourable to aquatic mosquitoes and molluscs; the surroundings of the lake like its annexes, access will be prohibited to man and domestic animals to avoid fecado-urinary pollution and any form of dirty water link to the domestic activities of the population.

1.1.2. OVERFLOW (SPILLWAY)

The spillway will be constructed in such a way that there will be no permanent flow susceptible of forming larvas homes and nymphs for simulies.

Research of a type of spillway not favourable to the establishment of simulium damnosum has been subject to many works during the implantation of the dam in order to slow down the dynamics of these vectors (QUELENNEC, SIMONKOVICH, OWAZZA, 1968). It appears the spillway of low waters in an inclined form better responds to this subject than a spillway in staircase form, which is particularly propitious to preimaginal forms of simulies; the latter must be eliminated from the project. Besides, the spillway must function in an intermittent manner, and apart from period of utilization it will comprise of any spot of retaining stagnant waters favourable to the development of mosquitoes.

1.1.3. THE BED OF THE RIVER, DOWNSTREAM

Often neglected by the foreman, it should be treated as part of the plant: it must be maintained clean rectilinear as much as possible, and the valleys downstream will eventually be constructed and controlled to avoid the development of homes for mosquitoes, simulies or culicoids. The forest-galery must also be "open" in a way to render it improper for the proliferation of tsetse flies, chrysop and gadfly.

1.2. ECONOMIC AND SOCIAL MEASURES

They constitute a prerequisite to the general actions of improvement upon the health conditions of the population. Besides, they contribute to reinforce the epidemiological follow-up of the influence zone close to the project.

1.2.1. WATER INTAKES

Destined to the population's use, they will be constituted by fountains or wells supplied by the ground water. For a start by fountains can be (for economic reason) be situated near the dam and if possible through the intermediary of a display of simple filtration on sand or gravel.

1.2.2. EPIDEMIOLOGICAL FOLLOW-UP

This is ensured by the services of the local or regional health with their role that needs to be effective and reinforced as much as possible by a Prefectural or Governmental action. The oleo of these services should, in effect, be fully exercised before as well as during and after the works.

Before construction: Entomological and malacological health investigations should be repeated during the dry season in order to better appreciate the dynamics of certain pathological states and vectors that generally vary from one season to the other.

During works: Supervision will be eventually follow up with the putting in place of an insecticide treatment for the protection of workers at the site.

After construction: There should be a periodic control procedure of the different parts of the plant with the setting of a follow-up programme of the human population and the vectors in the different villages. A particular accent will be put on the detection of onchocercose and sleeping sickness that may gain the region, also on ankylostomiase that is found there already but with the probability of amplifying after the dam construction.

1.2.3. DISPLACEMENT OF THE UPSTREAM POPULATION

Subsequent displacement of persons from their lands and their resettlement must be viewed with keen attention. In 1976 tens of families were victims of floodings in the Ndop plain (North West province) following the construction of a dam (ATANGAWA et al, 1990). In Ghana, the (Akosombo Dam) resettlement of 90000 persons, that began only two years the filling of the dam did not satisfactorily solve the problem because 40% of farmers to who government had awarded new lands abandoned them. KASSAPU (1978). The same hazards were reported for the KOSSOU dam in Côte d'Ivoire.

In the precise case of this Memve Ele project, the sites and the dimensions of the main works and service roads, the maximum level of the lake water of the reservoir and its

characteristics being unavailable to no, we cannot propose any compensatory measures vis-à-vis the displacements of the population.

2. INDIRECT COMPENSATORY MEASURES

They aim at the amelioration of care-taking and the sanitary education of the population.

2.1 SANITARY EDUCATION

This must be the task of Primary Health Care Units (PHC) managed not by doctors, nurses or other health staff, but by auxiliaries and community health agents trained to that effect without whom no important action can be efficient. The PHC in the sector will benefit from being backed up by NGO and especially by the SESA project base at Ebolowa. This project is only waiting for the transfer of a doctor to the Ma'an Hospital before it covers the influence zone close to the project.

Actions to be taken concern the relation between population and sanitary state; they will be geared towards the traditional life style mainly, housing and the other factors that increase the frequency and mortality of transmissible diseases.

2.1.1. TRADITIONAL LIFE STYLE

Certain traditional habits are still largely responsible for the "man-pathogene agents", in the region. Thus, in all the villages, streams, rivers and wells are the only source of water for domestic purposes, and contaminations arise in many occasions (fecal danger, grooming of pets, bathing spots, laundry ...). Advice is thus given here for drinking water: wells must be situated, constructed and maintained according to precised hygiene norms.

Meanwhile, like the life of tsetse fly vectors, simulies, anopheles, culicoids ...) also essentially depend on the same water points and their surroundings; men, women and children who frequent the area are bitten many times a day. The population should be educated to dress when they go to the "water". It is the same with farm cleaning activities; while clearing, man creates access to vectors.

2.1.2. HOUSING

Promiscuity of the houses, small, dark, smoked, poorly ventilated, increases the frequency of ORL and respiratory infections. In effect, in many cases, cooking is done in the centre of a main room without window.

Latrines must be conveniently constructed, for away from kitchen garden, and their use must be effective in order to reduce he fecal danger, source of numerous digestive and general infections.

2.1.3. OTHER FACTORS THAT INCREASE THE FREQUENCY AND MORBIDITY OF TRANSMISSIBLE DISEASE

The lack of hygiene simultaneously conditions the dirty external milieu and the contamination of the population:

- Poor evacuation of used waters
- Urinary and fecal danger
- Telluric contact and geophagy among children
- Dirty hands
- Proliferation of flies over foodstuffs and kitchen utensile.

The lack of hygiene explains the high frequency of entero-bacterioses, main causes of diarrhea among children, of antero-virus and tetanos.

Certain costumes are often against the elementary rules of hygienes and aggravate usually minor diseases; febrile children put under diet, with diarrhea, who does not drink, are current examples.

Nutritional deficiency and prohibited meals among children; food deficiency is due to starchy regimes (cassava, sweet potato ...). Poor in proteins; they introduce disequilibrium in ration.

As per prohibited foods it is noted that children cannot eat eggs, nor much fruits, accused of causing diarrhea; and the non-supplementation of food to maternal milk from 6 months of age is a habit. These prohibitions that involve the most unlnerable fraction of the population concern foods that are rich in animal proteins.

2.2. THE ROLE OF LOCAL HEALTH SERVICES

Be it for the Nyabessan Centre or the Ma'an Hospital, the mission of the health services in the influence zone close to the project must be the effective execution of curative and preventive activities (fix and mobile). Conditions required for the success of these types of activities are in terms of the means, that's infrastructures, and the personnel from the point of view of quantity and quality. These means would permit to evaluate in long and medium term, within the context of the present study, the positive and negative impacts of the project on the health of the population and local environment.

2.2.1. THE ROLE OF THE NYABESSAN DHC

It is only through the sine qua non condition of offering this centre with minimum of supplementary means in terms of infrastructures and personnel that it can be viable:

- An additional Building of 4 rooms
- A non-restrictive endowment in drugs and materials of prime necessity
- A potable water reserve

- An additional nurse
- An additional nursing-aid
- 2 health auxiliaries
- little means of locomotion of the mobile staff.

Better still, the region deserves a Primary Health Centre whose situation will depend on the final site and service roads to the dam.

If these success conditions of a real rural health centre are fulfilled, the following line of activities can be envisaged.

Activity for curative medicine: consultation, care, (nor) little operation, primary laboratory tests, deliveries.

Activities for preventive medicine: consultation of pregnant women, family planning, PMI activities (consultation of infants and malnonrished children), vaccination coverage, detection of serious endemic (leprosy, tuberculosis, trypanosomiase, onchocercose ...) and sexually transmissible diseases.

The data expected from these activities correctly conducted will help to have reliable indications on the morbidity and mortality due to the local pathology. The domains of entomology and molluscs do not reveal the competence of the Nyabessan DHC; they will be a matter of the provincial Service for Preventative Medicine of the South Province, or better still to specialized research services.

2.2.2. THE ROLE OF THE MA'AN HOSPITAL

The state of the areas and structures of this hospital needs to be completed or improved at the technical bloc where works are suspended since 2 years, the water reserve and the cleaning of the surroundings of buildings. Essential drugs are terribly lacking, as well as operation and lab. materials. Lastly, 2 vehicles, if to 1 ambulance could help the mobile services (detection) to evacuate patients to Ebolowa, and those from Nyabessan to Ma'an.

From the staff view point, the baseness of a doctor is a crucial problem, just like the problem of a Lab Technician. In these conditions, only a reinforcement in appropriate means could uplift its identity as a real district hospital, and in still confidence in the users. Almost half of the 54 beds remain unoccupied throughout the year in favour of traditional doctors.

When these gabs will be filled, leading actions will cover, like in Nyabessan, the domains of curative and preventive medicine; it goes without saying that theses actions will be more elaborated than in DHC of Nyabessan. For example, real operation actions will be carried out, solution to difficult deliveries (dystocic pregnancies), and receive patients from DHC of Nyabessan. On the preventive sphere, the personnel will be required to apply, with the collaboration of the SESA project, the Extensive Vaccination Programme (EVP), and support health campaign education.

3. ESTIMATE AND COSTS BEARING

The foreseeable negative impacts previously described and the general actions for improvement on the conditions of sanitary health care of the population implies the allocation of a budgetary fund. This fund will be supplied by the Ministries of Health, Social Affairs, Education and the project as activities of starting the site are concretized; it will cover the direct and indirect compensatory measures, well defined in the whole zone of influence close to the project. Table 17 indicates the estimates of costs i n their totality and Table 18 shows, in a specific manner the costs that will be bored by the project, with the participation of the aforementioned ministries.

3.1. ESTIMATE AND THE BEARING OF DIRECT COMPENSATORY MEASURES

3.1.1. MEDICAL COVERAGE

In application of the principles mentioned above, the concerted efforts must be deployed in view of setting up in a start, a health system of "exceptional medical coverage" during site works. This coverage will be progressively replaced secondly by a lighter permanent coverage.

The exceptional medical coverage comprises of a health infrastructure that treats curative questions for the site personnel. The means the putting in place of minimum material and medical personnel; here the costs will be considered as compensatory measures, but being and integral part of the costs of work. (National and International Legislation for Labour).

Material :
- Rehabilitation of the Nyabessan Centre
- Pharmacy
- Testing tables
- Ambulance
- Minor operation material

Personnel :
- 1 temporal doctor
- 1 permanent nurse
- 1 nursing-aid
- 1 health auxiliary

As for permanent medical coverage, performance will consist of a combination of preventive curative care centre on the primary health of the individuals, families or

communities. Their costs will be equally shared between SONEL land the Health Ministry.

Material : - Rehabilitated buildings of the DHC of Nyabessan
- Essential drugs
- Minor operation equipment

Personnel : - 1 additional nurse to the present number
- 1 additional nursing-aid
- 2 health education auxiliaries.

3.1.2. RESTRUCTURING THE PERSONNEL

The Ministry of Health in collaboration with decision-makers of the project will take measures for the education and training of health personnels permitting them to carry out functions closely corresponding to priority health problems in the sector.

To this effect, the re-examining of the profile of staff in relation to the tasks will be undertaken by a retraining seminally and a follow-up sensitization of a training course for some.

3.1.3. FOLLOW-UP OF VECTOR OF TRANSMISSIBLE DISEASES

This embodies in the first place or minimum of individual protection elements against the bites of anthropoids and secondly the measures of health control of the migration of human population from external zones. In effect, the project being void of onchocercose, bilharziose and sleeping sickness, there is need to protect against any risk of contamination.

3.1.3.1. INDIVIDUAL PROTECTION MEASURES AGAINST ARTHROPOD BITES

Against Anopheles, it is especially the use of mosquitoes tents around the bed and windows that will be permitted. Supply of tents wetted with insecticides could be initiated by the project with the financial contribution of the population.

Against Aedes and Culex, essentially exophile insects, the inhabitant must protect themselves during in foreign habitations by wearing dresses that cover their whole bodies and by the use of repellents. The best solution remain the promotion by vaccination against yellow fever transmitted by Aedes, abundant in the region.

As for Glossines, (tsetse flies), the community will be trained for the use of Challier-Laveissiere traps in their forms and the surroundings of houses.

As for simulies, chrysops, Chrysops, Tabanus, Culicoids and other arthropods, the best solution is the wearing of adequate clothes and the use of repellents in cream or liquid.

All these measures will be initiated and followed within the frame-work of articulated mass education with the restructuring of the health personnel.

3.1.3.2. MEASURES OF SANITARY CONTROL OF POPULATION MIGRATION

They permit to preserve the sector from the introduction of external endemics, particularly bilharziose, onchocercose and sleeping sickness. This concerns specific measures using an appropriate technology and covering progressively all he population.

Three order of actions are envisaged:

a) Clinic and biological tests of all job seeker

b) Periodic test (1 time/yea) of a sample of the population to look for the 3 above-mentioned affections

c) Entomological and malacological survey, once a year to assess to eventual contamination indications of vectors and molluscs through parasites.

These action require the signing of an accord between authorities and CUSS to assess periodic situation.

3.1.3.3. COORDINATION WITHIN THE HEALTH SECTOR

To ensure the coordination of actions announced in the zone of influence close to the project, the parties involved will see into the establishment of a sound collaboration:

1) between DHC Nyabessan, Ma'an and divisional and provincial health services; the accord being based on the distribution of responsibilities and resources. The Ma'an Hospital will receive complex cases of illness from Nyabessan, whereas the divisional and provincial services will assist the sector in the domains of personnel training, vaccination of the mass and pro-pharmacy management;

2) between the DHC Nyabessan and the local community after accord on the distribution of tasks and resources, notably mass education and Primary Health Care (PHC).

3.2. ESTIMATE AND BEARING OF INDIRECT COMPENSATORY MEASURES

3.2.1. REHABILITATION AND REINFORCEMENT OF THE NYABESSAN DHC

The Ministry of Health must reconstruct the Centre by a repair of the existing building and add an additional building of 4 rooms. This will render it better to assume the role it will play in the new socio-economic conditions created by the project.

3.2.2. HEALTH EDUCATION CAMPAIGNS

They will jointly bored by the Ministries of Health, Education and Social Affairs.

In effect, immediately the health infrastructures will be put in place, mass education will concretely be engaged in the prevention of dominating diseases in the sector and to the social control of the entire health system in a manner that will be in conformity to their cultural and administrative traditions.

This is within the framework of restructuring of health personnel (parag. 3.2. above) in terms of cost, but also, it requires to resort to non-medical, notably school teachers, rural animators and other benevolents disposed to consacrete part of their time to the health sector. The place of traditional medicine will also be taken into account, notably in the field of mental health and pharmacopy.

TABLE 17: Estimate of the Entire Cost for Compensatory

Elements du Projet	Engagements (en millions de F CFA)	Prise en Charge (% of Costs Bearing)
1. DIRECT COM. MEASURES		
1.1. Technical Measures:		
- Medical Coverage	20.1	SONEL=50%, MINSA=50%
- Restructuring of personnel	25.7	MINSA=100%
1.2. Epidemiological Follow-up		
1. Anopheles		
. Bed Mosquitoe tent	1.7	
. Window lent	2	
2. Aedes:		MINSA=100%
. Yellow fever caccin	2.1	
3. Tsetse fly:		
. Traps	2.7	
4. Inflow control	4	SONEL=100%
5. Entomolo/malacol investing	6	
Sub-total 1	64.2	SONEL=30%, MINSA=70%
2. IND. COMP. MEASURES		
2.1 Rehabilitation and Reinforcement of the Nyabessan Centre		
1. Repair of building	4.25	MINSA=100%
2. Suppl. building	9	
3. Equipment		
. Microscopes (4)	2.4	
. Manual centrifuges	1	
. Reagents	2	
. Generator	1	
. Water Reserve	0.9	
4. Bikes/motors (2)	1.2	
2.2. Health Education Campaign		
1. Teacher	3.25	MINSA=50%
2. Rural animators	2.5	MINEDUC=25%
3. Community benevolents	2.5	MINASCOF=25%
Sub-total 2	30	MINSA=82% MINEDUC=9% MINASCOF=9%
TOTAL	94.2	MINSA=73%, MINEDUC=3%, MINASCOF=3%

TABLE 18: Estimate of

Elements du Projet	Engagements (en millions de F CFA)	Prise en Charge
1. DIRECT COM. MEASURES		
1.1. Technical Measures:		
- Medical Coverage	10.05	SONEL
1.2. Epidemiological Follow-up		
- Inflow control	4	SONEL
- Entomolo/malacol investing	6	SONEL
Sub-total 1	20.05	SONEL=66.6%, MINSA=33.4%
2. IND. COMP. MEASURES		MINSA, MINEDUC, MINASCOF
Sub-total 2	0	MINSA, MINEDUC, MINASCOF
TOTAL	20.05	SONEL

CONCLUSION

The construction of the Memve Ele hydro-electric dam on the Ntem is susceptible to bring about modifications on he health and nutritional state of the population, and on the vectors of transmissible diseases.

The data collected at the end of the prospecting effected in the field and form the local health services (DHC of Nyabessan, Ma'an Hospital), regional (divisional and provincial) and central (Ministry of Health) permit us to conclude on three major facts:

- *Despite the poor sanitary and nutritional status of the population in the sector, the negative impacts of the project over the morbidity and mortality due to local affections will be globally insignificant.*

- *The presence of simulies and tsetse flies, though not infected of parasites, represents a danger to be taken into account because the efflux of the populations that will be attracted by the economic progress of the region after the construction of the plant, could constitute a source of contamination of vectors and cause the explosion of onchocercose and/to sleeping sickness in the sector, while bringing onchocercous and/or trypanosomes subjects; the proximity of the home for trypanomiase of campo constitute in this light a real danger.*

- *Compensatory measures vis à vis the foreseeable negative impacts of the project and the general actions of improvement of the sanitary conditions of the population reveals on the one hand the political desire to vaporize the health structures of the region, and on the other hand the social conviction of the autochtones to participate in health education activities for the prevention of diseases and the hygiene of the milieu. If these conditions are fulfilled, the positive impacts will largely overshadow the negative ones for he general well being f the population of the socio-economic influence zone close to the project.*

PLANCHES HORS-TEXTES

1-a. Aspect typique des habitations de la zone d'influence socio-économique rapprochée du projet.

1-b. Village d'EBIENMEYONG.

2.a. Centre de Santé Développé (CSD) de NYABESSAN.

2-b. Entrée Principale de l'Hôpital d'Arrondissement de MA'AN.