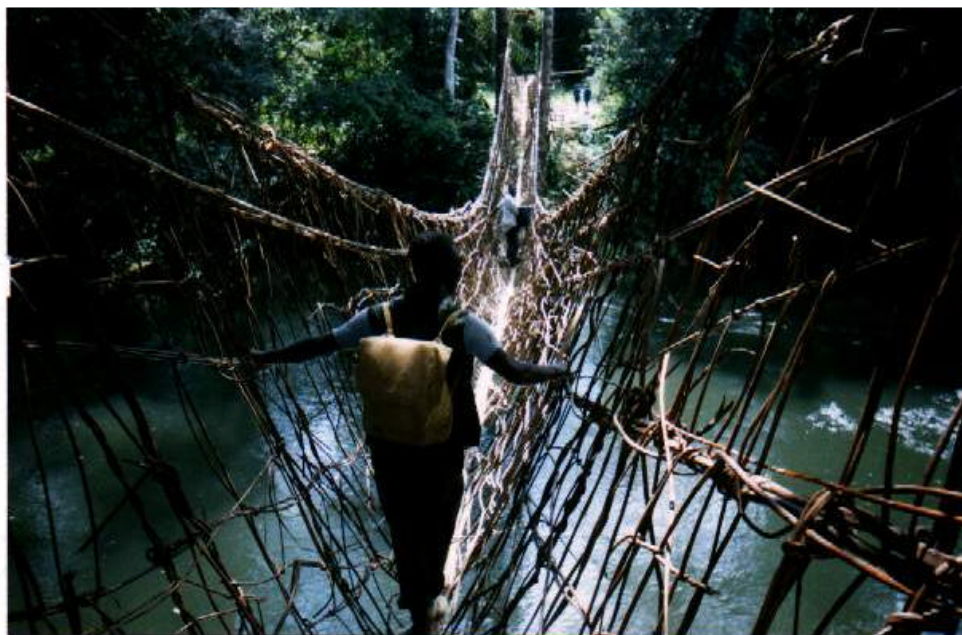


# REPUBLIC OF CAMEROON

Ministry of Public Works

Ministry of Environment  
and Forestry



**The Mamfe - Akwaya Road Project**



**An Environmental Impact Assessment**



## FOREWORD

The present report concerns the Environmental Impact Assessment study of the opening of the rural road Mamfe-Akwaya in Manyu Division, South West Province of Cameroon. The proposed road is to pass between two forest reserves: Takamanda and Mone. It should be underlined that the Ministry of Environment and Forestry has studied and formulated with the assistance of the German Development Cooperation (GTZ) a project called "Forest Protection Around Akwaya" aiming at biodiversity preservation through the elaboration of a participatory sustainable environmental management plan of the area. It was anticipated that the road project could have a serious impact on the biodiversity and the general environment of the area. In effect, although enforcement decrees to the law related to EIA are not yet enacted, the July intergovernmental discussion between Germany and Cameroon recommended that an EIA should be carried out for the road project. The objective of the study is to devise an appropriate framework, capable of reconciling the socio-economic advantages of the proposed road project and the sustainable use of resources.

The EIA was carried out by a multidisciplinary team (see presentation of the team on page XX) from Friday November 5th to Friday December 3rd 1999.

The team would like to thank all those who made their work possible in particular the GTZ for their financial and logistical support, the populations along the proposed Mamfe Akwaya road who offered their hospitality and actively participated to the study, all divisional government services headed by the senior Divisional Officer, with special notice of the Sub-Division of Public works and of the Divisional Delegation of Environment and Forest who were an integrated part of the study team.

The team would also once more like to extend their sympathy to one of their colleagues, who heard about the death of her Husband just as they were back from the 05 days survey by foot of the about 105 km to be followed by the road project. May she hereby be assured of their constant solidarity.

The Team Leader

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## Abbreviations

MINEF:	Ministry of Environment and Forestry;
MINCOM:	Ministry of Communication;
MINDEF:	Ministry of Defence;
MINCULT:	Ministry of Culture;
MINAGRI:	Ministry of Agriculture;
MINEPIA:	Ministry of Animal Husbandry Fisheries and Animal Industry;
MINTP:	Ministry of Public Works;
GOC:	Government of Cameroon;

CPE: Environmental Protection Unit of the Department of Roads in the Ministry of Public Works;  
PNVRA: National Agricultural Extension and Reassert Program;

## EXECUTIVE SUMMARY

An Environment Impact Assessment (EIA) Study of the proposed Mamfe-Akwaya Road Project (figure 1), was carried out from November 5<sup>th</sup> 1999 to December 3<sup>rd</sup> 1999.

The road is to pass between two forest reserves: Takamanda and Mone (figure 2). The Ministry of Environment and Forestry, with the assistance of the German Development Co-operation GTZ, formulated a project called « Forest Protection around Akwaya », aiming at biodiversity preservation through the elaboration and implementation of a participatory sustainable environmental management plan of the area. Because it was anticipated that the road project may have a serious impact on the biodiversity and the general environment of the area, the July intergovernmental discussion between Germany and Cameroon recommended that an EIA should be carried out for the road project. The objectives of the study were:

- to devise an appropriate framework, capable of reconciling the socio-economic advantages of the proposed road project and the sustainable use of natural resources;
- to develop an exemplary pedagogic and sensitisation perspective geared at the establishment and consolidation of the collaboration between MINEF, MINTP and parties relating to road projects, based on the utilisation of sound follow-up indicators.

The study team was multidisciplinary including representatives from the Permanent Secretariat of the Environment, the Department of Wildlife in the Ministry of Environment and Forestry, the Environmental Protection Unit (CPE) of the Department of Roads in the Ministry of Public Works, the Divisional Delegate for the Environment and Forestry - Manyu, the Chief of the Subdivision of Public Works - Manyu, national and international consultants.

The study was carried out according to some guiding principles among which the following are the most important:

- the integration of principles of sustainable development ;
- the appropriation of the study by concerned parties ;
- the integration of induced and cumulative impacts ;
- the participatory elaboration of an environmental management plan.

The Mamfe-Akwaya road is an old dream of the early sixties when Nigeria and Cameroon became independent. Since then a lot of efforts have been made by various parties to make the dream come true. Some land marks in this direction include: the ferrying of the first Land Rover to Mamfe in 1964, the carrying out of a feasibility study on the Mamfe-Akwaya road by a Douala-based German Consultant Company Holfeder Plan Cameroon S.A. in 1981, the contribution of 5.1 million CFA by Eshobi people to rehabilitate the road from Mamfe to Eshobi Government Primary School.

In order to respond to the pressing demands of the population of the region and given the lack of funds, the Government of Cameroon decided in the first place, to simply open up an earth road. This led to the elaboration of a five phase programme by the Ministry of Public Works in 1997. Actually,

the road has reached Mbu at 43.5 km from Mamfe. In the heart of the dry season, the road is somehow accessible, but for most of the year, vehicles from Mamfe only reach Big Nyang, 32.5 km from Mamfe, because the construction of the bridge over river Mone is not yet completed. In fact, arrangements for bridge construction are not included in the five phased programme of the Ministry of Public Works.

The environmental situation of the Mamfe-Akwaya region are summarised in table 1 below, in terms of potentialities and constraints.

**Table 1: Summary of the environmental situation of the road project area.**

<b>FACTORS</b>	<b>POTENTIALITIES</b>	<b>CONSTRAINTS</b>
<b>PHYSICAL</b>	-Good hydrographic network -Climate favourable for wide variety of crops -Large space available	- Topography hilly - fragile soils.
<b>BIOLOGICAL</b>	121471 ha of forest reserves Rich biodiversity and high rates occurrence of endangered/endemic species	Population pressure on wild life and NTFPs.
<b>SOCIO-ECONOMICAL</b>	-Opportunity for Timber, NTFPs and bush meat exploitation Half product for agro-industries -Hard working population.	Poor access to Infrastructures.
<b>TRADITIONS AND CUSTOMS</b>	-Strong and active tradition & customs -Well developed indigenous knowledge & skills -Strong and active traditional councils -Gender balanced society.	
<b>NATIONAL INTEGRITY AND DEVELOPMENT STRATEGY</b>	-Strong national feeling -Opened options.	-Poor access to infrastructures

Given that poor access to infrastructures appears as one of the main constraints in the area, it can be anticipated that the socio-economic benefits from the road project would be very important, provided appropriate measures are taken to this effect. Table 2 summarises the principal potential impacts of the project with corresponding recommendations for enhancement of positive impacts and mitigation of negative ones. The main negative impacts are related to the increased pressure on wildlife and other forest product

**Table 2 : Summary of principal impacts and recommendations**

<b>ENVIRONMENTAL ELEMENT</b>	<b>IMPACTS</b>		<b>RECOMMENDATIONS</b>
	Positive	Negative	
<b>Physical</b>		Destabilisation of soils, Perturbation of hydrographic network and pollution	Respect of the prescriptions of MINTP/CPE pertaining to Environmental management
<b>Biological</b>		Increased pressure on wild life and other forest products	Ease the implementation of a participatory management of wildlife and other forest products

<b>socio-economic</b>	Contribution to poverty alleviation in the project area	Exposure to traders and settlers from other regions	Ease the establishment of a framework geared at the improvement of living conditions of the local population
<b>Traditions and Customs</b>		Loss of cultural identity and indigenous knowledge	Ease the promotion of cultural identity and indigenous knowledge
<b>National Integrity and Development Strategy</b>	Contribution to the security of national identity and base for the elaboration of a participatory development plan		Ease the production of a participatory master plan for the project area.

In order to contribute to the effective implementation of recommendations of the EIA, a participatory environmental management plan was elaborated. The plan specifies objectives, results, activities, timing, responsible parties, capacity building, estimated costs and sources of funding.

Considering the particular importance of biodiversity in the project area, and although it has been considered through out the report, a specific section has been dedicated to the relations between the project and biodiversity.

Indicators and measurement methods of impacts are presented to help monitor the whole process.

It can be concluded that the sustainability of the project depends on two major aspects:

- i. the proper planning and financing of the road project and
- ii. the effective implementation of the environmental management plan here presented.

The way work is planned and executed now raises questions on the outcome of the project, the actual contractors do not follow any framework for their work. After three years, piers to support the first bridge are not completed where as there is a minimum of six bridges of the same size to build before the road is completed.

The proposed environmental management plan of the road project takes care of the maintenance of the road as well as its harmonious integration into its host environment. If implemented, the overall region may take the path of sustainable development.

## SOMMAIRE EXECUTIF

Une étude d'évaluation et de suivi d'impacts environnementaux ci-dessous désignée (EIE) du projet d'ouverture de la route rurale Mamfé-Akwaya, a été menée du 5 novembre 1999 au 3 décembre 1999.

La route devrait passer entre deux réserves forestières : Takamanda et Mone (voir figure 2). Le Ministère de l'Environnement et des Forêts, avec l'assistance de la coopération technique allemande (GTZ), a formulé un projet appelé « Protection des Forêts autour d'Akwaya », avec pour objectif la préservation de la biodiversité par l'élaboration et la mise en œuvre d'un plan de développement durable de la région. Etant donné qu'il était anticipé que le projet de route pourrait avoir des impacts sérieux sur la biodiversité et la situation générale de l'environnement de la région, la discussion intergouvernementale de Juillet dernier entre l'Allemagne et le Cameroun a recommandé la conduite d'une EIE pour ce projet de route. Les objectifs assignés à cette étude étaient :

- la proposition d'un cadre capable de faciliter la réconciliation entre les avantages socio-économiques attendus du projet de route et la gestion durable des ressources naturelles ;
- le développement d'une perspective sensibilisatrice et exemplaire visant l'établissement et la consolidation de la collaboration entre le MINEF, le MINTP et les parties liées aux projets routiers, basée sur l'utilisation appropriée d'indicateurs de suivi.

L'équipe responsable de l'étude était multidisciplinaire et comprenait des représentants du Secrétariat Permanent à l'Environnement (SPE), de la Direction de la Faune et des Aires Protégées (MINEF-DFAP), de la Subdivision des Travaux Publics et de la Délégation Départementale de l'Environnement et des Forêts de la Manyu à Mamfé, ainsi que des consultants.

L'EIE a été conduite suivant un certain nombre de principes dont les plus importants sont :

- l'intégration des principes de développement durable ;
- l'appropriation de l'étude par les parties concernées ;
- la prise en compte des impacts induits et cumulatifs ;
- l'élaboration participative d'un Plan de Gestion Environnementale (PGE) de la route.

La route Mamfé-Akwaya est un rêve qui date de début des années 60, à l'indépendance du Nigéria et du Cameroun. Depuis lors, beaucoup d'effort ont été déployés par les parties concernées pour que ce rêve devienne réalité. Quelques repères dans cette direction incluent : l'arrivée de la première Land Rover à Mamfé en 1964 ; la conduite d'une étude de faisabilité de la route par le Bureau d'étude allemand Holfeder Plan Cameroun S.A. en 1981 ; la contribution de 5.1 millions de FCFA des populations d'Eshobi pour la réhabilitation de la route entre Mamfé et Eshobi-Ecole Publique.

En vue de répondre aux demandes pressantes des populations de la région, tout en tenant compte des aspects financiers, le Gouvernement camerounais a, dans un premier temps, décidé l'ouverture simple de la route. Ceci a fait l'objet de l'élaboration d'un programme en 5 phases par le Ministère des Travaux Publics en 1997. Actuellement, les travaux d'ouverture ont atteint Mbu, à 43.5 km de Mamfé.

En pleine saison sèche, la route est quelque peu carrossable sur tout le long, mais la majeure partie de l'année, les véhicules en provenance de Mamfé ne parviennent qu'à Big Nyang à 32.5 km de Mamfe, car la construction du pont sur la rivière Mone n'est pas encore achevée. En fait, les aspects liés à la construction des ponts font l'objet des contrats séparés de ceux liés à l'ouverture de la route.

La situation de l'environnement dans la zone du projet est résumée dans le tableau 1 ci-dessous en termes de potentialités et de contraintes.

**Tableau 1 : Résumé de la situation de l'Environnement dans la zone du projet**

FACTEURS	POTENTIALITES	CONTRAINTES
<b>Physique</b>	<ul style="list-style-type: none"> <li>- bon réseau hydrographique</li> <li>- climat favorable à une large gamme de production</li> <li>- grands espaces disponibles</li> </ul>	<ul style="list-style-type: none"> <li>- topographie accidentée</li> <li>- sols fragiles</li> </ul>
<b>Biologique</b>	<ul style="list-style-type: none"> <li>- 121 471 ha de réserves forestières</li> <li>- riche biodiversité avec un fort taux d'endémisme et d'espèces menacées d'extinction</li> </ul>	Forte pression sur le gibier et les autres produits forestiers
<b>Socio-Economique</b>	<ul style="list-style-type: none"> <li>- opportunités pour l'exploitation forestière, les produits forestiers non ligneux, la chasse, l'industrie de transformation.</li> <li>- populations laborieuses</li> </ul>	Accès limité aux infrastructures
<b>Traditions et Coutumes</b>	<ul style="list-style-type: none"> <li>- traditions et coutumes fortes et actives</li> <li>- savoir-faire traditionnel bien développé</li> <li>- conseils traditionnels forts et actifs</li> <li>- équilibre des genres</li> </ul>	
<b>Intégrité National et stratégie de développement</b>	<ul style="list-style-type: none"> <li>- fort sentiment d'appartenance nationale</li> <li>- options de développement encore ouvertes</li> </ul>	Accès limité aux infrastructures

Etant donné que le faible accès aux infrastructures de services apparaît comme la principale contrainte de la zone, il est anticipé que les bénéfices socio-économiques induits par la route seront très importants, à condition que les dispositions appropriées soient prises à cet effet. Le tableau 2 résume les principaux impacts potentiels du projet avec les recommandations correspondantes pour l'optimisation des impacts positifs et l'atténuation des impacts négatifs.

**Tableau 2 : Résumé des principaux impacts potentiels et recommandations**

FACTEURS ENVIRONNEMENTAUX	IMPACTS		RECOMMANDATIONS
	Positifs	Négatifs	
<b>Physique</b>		Déstabilisation des sols, perturbation des cours d'eau et pollution	Appliquer les directives du MINTP/CPE relative à la gestion de l'Environnement

<b>Biologique</b>		Augmentation de la pression sur le gibier et les autres produits forestiers	Faciliter la mise en œuvre d'un plan participatif de gestion du gibier et des autres produits forestiers
<b>Socio-économique</b>	Contribution à la diminution de la pauvreté dans la zone de projet	Exposition à des marchands et autres migrants véreux	Faciliter la mise en place d'un cadre favorable à l'amélioration des conditions de vie des populations locales
<b>Traditions et Coutumes</b>		Perte de l'identité culturelle et du savoir faire traditionnel	Faciliter la promotion de l'identité culturelle et du savoir-faire traditionnel
<b>Intégrité nationale et stratégie de développement</b>	Contribution à la sécurisation de l'intégrité territoriale et l'élaboration d'un plan participatif de développement pour la région		Faciliter la production d'un plan participatif de développement pour la région

En vue de contribuer à la mise en œuvre effective des recommandations de l'EIE, un plan de gestion environnemental participatif de la route a été élaboré. Ce plan comprend : les objectifs, les résultats, les activités, la période, les parties responsables, les besoins en renforcement des capacités, les coûts et les sources de financement.

Pour tenir compte de l'importance particulière de la biodiversité dans la zone de projet, et bien qu'elle ait été prise en compte tout au long de l'étude, une partie traite spécifiquement de la relation Projet-biodiversité.

Les indicateurs et les méthodes de mesures des impacts sont donnés pour aider au suivi de tout le processus.

On peut conclure que la durabilité du projet de route repose au moins sur deux aspects :

- i. la planification et le financement adéquat du projet de route ; et
- ii. la mise en œuvre effective du Plan de Gestion de l'Environnement proposé dans cette étude.

La manière dont les travaux sont planifiés et exécutés actuellement laisse planer des inquiétudes sur l'aboutissement du projet : l'entrepreneur en charge des travaux fait pratiquement de la navigation à vue, car ne s'appuie sur aucun schéma de construction, malgré l'existence depuis 1981 d'une étude de faisabilité détaillée. De plus, après pratiquement 3 ans, la construction des piles devant supporter le premier pont sur la rivière Mone, n'est pas encore achevée, alors qu'il y a au minimum six ponts d'au moins la même importance à construire avant Akwaya.

Le Plan de Gestion Environnementale de la route proposé prend en compte, non seulement les aspects liés à la bonne tenue de la route tels que sa maintenance, mais aussi la nécessité de l'insertion harmonieuse de la route dans son environnement d'accueil. S'il est mis en œuvre, la région du projet est susceptible de prendre le chemin du développement durable.

## 1. CONTEXT AND JUSTIFICATION OF THE STUDY

The debate around the direct and indirect impact of roads on the environment in Cameroon has been boosted during the last months as a result of allegations of NGO's from Europe about the road maintenance programme supported by the European Union. These allegations mentioned the fact that there was an increase in illegal poaching and forest exploitation as a consequence of the upgrading of the Ampiel-Lomié Road project. It was among other things regretted that the programme was not preceded by an EIA that would have prescribed measures to mitigate such negative impacts.

In this context, the project of the opening of the Mamfe-Akwaya rural road passing between two forest reserves: Takamanda and Mone where increase poaching activities as well as the non-controlled exploitation of *Prunus africana* have been noted deserves a particular attention.

The Ministry of Environment and Forestry has studied and formulated with the assistance of the German Development Co-operation GTZ a project called "Forest Protection Around Akwaya" aiming at biodiversity preservation through the elaboration of a comprehensive participatory sustainable development management plan of the area. It is indeed anticipated that the road project could have a serious impact on the biodiversity. In effect, although enforcement decrees to the law related to EIA are not yet enacted, the July intergovernmental discussion between Germany and Cameroon recommended that a study of the evaluation and follow-up of the environmental impacts should be carried out for this road. The objective of the study is to devise an appropriate framework, capable of reconciling the socio-economic advantages of the proposed road project and the sustainable use of resources.

Also, some months ago, the Permanent Secretariat for Environment (PSE) really started up its activities with the approval by the PNUD of the project assisting in making use of the permanent secretariat. One of its priority actions shall be the consolidation and making use of the executive staff of the Environmental Impact Assessment (EIA). As concerns the environmental management of roads, an Environmental Protection Unit (EPU) was created in the Department of Roads in the Ministry of Public Works. Taking into account the actual weakness of the capacities of existing structures in EIA, it is important to expose them to adapted examples respecting the norms. Specialised structures like these are equally concerned with this study. It should offer to them some concrete reference points. More globally, the process of EIA capacity building envisages to involve the decision makers and state officials as well as economic operators, councils, NGO's, and the population.

From this later perspective, the challenge of this EIA has two purposes:

- To serve as the basis for a model of environmental management (planing and follow-up according to the most recent standards in the domain;
- To develop an exemplary pedagogic and sensitisation perspective geared towards the establishment and the consolidation of collaboration between MINEF, MINTP and parties relating to road projects, based on the utilisation of sound follow-up indicators.

## **2. METHODOLOGY AND GUIDING PRINCIPLES OF THE EIA**

### **2.1. Methodology**

The team worked with various documents including existing ones supplied freely by the Community Development Office Mamfe town, the Subdivision of Public Works Mamfe, the Divisional Delegation for the Environment and Forestry. The team also conducted interviews with the present contractor CWEPR (China Water and Electricity Co-operation) based in Mamfe as well as with the population on the path to be followed by the road from Akwaya in the North passing through Tinta, Atolo to Eshobi to the South.

During the field trip, questions on impacts as well as mitigation and enhancement measures were posed to concerned parties.

### **2.2. Guiding Principles**

The study was carried out according to some guiding principles amongst which the following are the most important:

#### **2.2.1. Integration of principles of sustainable development**

Sustainable development aims at satisfying our actual needs without compromising the resource base of future generations.

It is therefore based on the principles of equity not only towards future generations but also towards the present generation, notwithstanding their place of origin. Its three objectives are: the safe-guard of the integrity of the environment, the improvement of social equity and the improvement of economic efficiency. Any action or activity meeting these three objectives is more susceptible to better satisfy the essential needs of the population, be they situated in the vicinity of the project or distant. The study considers these principles as well as the international conventions pertaining to environmental interest ratified by Cameroon. In particular those related to biological diversity, the fight against desertification, climate change and the protection of ozone layer.

#### **2.2.2. Appropriation of the studies by the concerned parties:**

The study was conducted in such a way that the principal concerned parties should feel that they are owners of the EIA and its recommendations. This was as a contribution to the future effective implementation of those recommendations. To this effect, there was room for active participation of concerned parties, specially in the following key stages of the study:

- the determination of the importance of impacts;
- the determination of mitigation and enhancement measures;

- the elaboration of the environmental **management** Plan.

### **2.2.3. Integration of induced and cumulative impacts**

The study clearly considered induced and cumulative impacts which is one of the weak point of previous similar studies. In particular, a specific section deals with the relation Project-Biodiversity

### **2.2.4. Participatory elaboration of environmental management plan**

A participatory Environmental Management Plan (EMP) was elaborated to provide an appropriate framework for sound integration of the project in its host environment. The EMP included the budget, the responsible parties and the proposed source of founding . It should be noted that the lack of an EMP has hindered the implementation of recommendation of many previous similar studies.

### **3. PRESENTATION OF THE PROJECT**

#### **3.1. Historical Background**

In the German colonial era Mamfe became a doorway to the grassfield-region, while Akwaya due to its remote location close to the border of British Nigeria, received very little attention. At the end of the first world war the league of nation decided that Britain and France should rule Cameroon. The western part in which Mamfe and Akwaya are located fell under British rule and became known as southern Cameroon a part of British Nigeria. Mamfe therefore became a major town on the only road which linked western Cameroon with the industrial and administrative centres in neighbouring Nigeria, while Akwaya remained enclaved. Under the British rule, the northern part of what is now called Akwaya sub-division, was served by footpaths from Obudu (in Nigeria) which was already by that time connected by easy accessible roads to all major towns within British Nigeria. This connection was seen as good, because none of the villages were more than one day trekking away from the nearest road. On the prospected road Akwaya, Meyerem, Makomono, Otyango and Tinta were connected to the outside world through that footpath. The southern part of Akwaya sub-division - at that time known as "Mamfe overside" - was served by footpaths from Mamfe. At the major rivers (Cross-river, Mone and Munaya) hanging bridges were installed in the early forties to speed up and secure transportation. Eshobi, Mukoyong, and Nyang on the existing road towards Akwaya were connected in the colonial times to the rest of the world through Mamfe in one-day trekking. The villages in the centre of the Akwaya region - known as Mbulu at that time - had the chance to cross the Takamanda forest reserve and reach the road-connected Okwa village in one day. The villages of Mbu, Akwa and Basho I is on the prospected Mamfe-Akwaya road used in the colonial times this footpath to the "developed world" - also a one day trek.

The need for a road from Mamfe to Akwaya arose only in the early sixties, when Nigeria and Cameroon became independent. Southern Cameroon decided in a referendum not to stay a part of Nigeria, but to become a sovereign state as part of the Federal Republic of Cameroon. Akwaya was still served economically from Nigeria, but became administratively, militarily and juridical an enclave three days trekking distance away from the next road inside the Federal Republic of Cameroon. In 1964 the West Cameroonian Ministry of Co-operatives and Community Development ferried a Land Rover into Mamfe overside (see picture 1) and in that same year the local administration under the District Officer Colonel Valentine started to construct a road towards Akwaya. In June 1966, 18 miles (20.8 km) were accessible by Land Rover! (Appendix 1) In 1966 also, detailed plans were made to continue with the road towards Akwaya. In five years (1967-1972) youth volunteers and the local communities in co-operation with the West Cameroonian authorities were seen to be able to fulfil this ambitious plan (Appendix 1, 218). According to Mr. Sunday - who was working on that project in the sixties - the project never took off, because the Federal Government refused to contribute. In the following years one bridge after the other collapsed and in 1970 the road became so bad that all goods had to be carried manually the whole way again. In 1981 the Cameroon Ministry of Equipment, Department of Roads asked the Douala based company HOLFELDER PLAN to carry out feasibility studies of that road. A technical report and a detailed map were delivered, but no action followed. In 1986-89 SATOM constructed a solid bridge over the cross-river.

In 1990, the ministry of public work and Transport, through the provincial service of Earth Roads for

the South West in Limbe re-opened the road from Mamfe to Eshobi. The village of Eshobi contributed financially (minimum 1000 FCFA per male and 500 FCFA per female) to the tune of 5.100.000 FCFA and rehabilitated the road from Mamfe to Eshobi. In 1993 the timber company Société Forestière de la Sanaga (SFS) received a logging commission north of Eshobi. In 1994 they pushed the road towards Nyang to exploit the timber. They established 23 km of road and constructed a number of wooden bridges, which are still in use today. They also constructed a road to Keshem, Bache and Okpamba. After three years of exploitation in that region they did not extend their logging commission after armed conflicts with the local population and left the region.

The villagers used witchcraft and even set a Bulldozer on fire to stop SFS from further activities in the region, because - according to them - the company exploited the region heavily without fulfilling their promises on road construction and general development

### **3.2. Description of the project**

The project consist of the construction of the rural road MAMFE-AKWAYA situated in Manyu Division, in the South West Province.

#### **3.2.1. The Holfelder Plan Feasibility study**

In 1981, The Cameroon government asked a Douala, based German firm called HOLFELDER PLAN Cameroon S.A to carry out technical studies pertaining to the elaboration of the execution project of the disenclavement of Akwaya subdivision. The studies were carried out in three distinct phases.

- Phase I : Reconnaissance studies
- Phase II: Technical Estimates
- Phase III : Execution Project

At the end of the studies, three different options were initially proposed for the realization of the project whose total length was 104 km

1. Partially paved roadway at steep slopes  
Estimated cost: 29,3 Billion FCFA
2. Completely paved roadway  
Estimated cost: 31,3 Billion FCFA
3. Roadway unpaved with retaining walls in Gabions  
Estimated cost: 26,1 Billion FCFA

Following the conclusions of the reconnaissance studies, the proposed principal trace of the road was as follows:- MAMFE- MELALA –BERORE – ESHOBI I – BOMBE – MUKOYONG – BIG NYANG – MBU – AKWA – ESHOBI II – MAKWE – BOKA – ATOLO – TINTA – MAKOMONO – MEYEREM – AKWAYA - NGALI - RIVER AMELE.

#### **3.2.2. The Ministry of Public Works' initiative**

In 1997, the Ministry of public works elaborated a five-phased programme for the opening of the Mamfe-Akwaya Road scheduled as follows:

- Lot 1: from km 20,00 to km 38,00
- Lot 2: from km 38,00 to km 58,00
- Lot 3: from km 58,00 to km 78,00
- Lot 4: from km 78,00 to km 98,00
- Lot 5: from km 98,00 to km 105,00

The estimated cost for the execution of the whole project was evaluated at 2 Billion FCFA, not including bridges. The consistency of the work included:

- Installation of base-camps, bringing in and the withdrawal of equipment, construction of offices and residential quarters, and temporal signalisation.
- Bush clearing on the right of the way.
- Tree felling and stump removal on the right of the way.
- Cuts and fills.
- Regravelling with good quality laterite.
- The creation of a platform width of 7,00 m and two shoulders of 0,5 m each.
- The putting in place and the compaction of the bottom layers of the road.
- The creation of earth lateral ditches.
- The creation of off-shoots.
- The construction of triangular concrete ditches as the need may be and following the directives of the follow-up Engineer.
- The supply and installation of drainage structures and the construction of culvert heads.

### **3.2.3. The actual situation**

In September 1997, a contract of 400 million FCFA was signed between the Ministry of Public Works and the CHINA INTERNATIONAL WATER AND ELECTRIC CORPORATION – PROJETS ROUTIERS (C.W.E.P.R.) for the execution of the bulldozing of the road MAMFE – AKWAYA over a distance of 18 km consisting of the first phase of the above five-phased programme. Since the award of the first contract in 1997 three additional bills have been signed and executed to the realisation of the continuation of works on the MAMFE- AKWAYA road project. Actually, the road has reached MBU village km 43.5) and in the heart of the dry season it is accessible all through, but for most of the year, vehicles are only able to reach Big NYANG (km 32+500) because the construction of the bridge over the river has not yet been completed.

From Big Nyang, therefore, to Mbu where the road ends (a distance of 11km), the road exists but it can only be used by pedestrians. The first twenty Kilometres from the origin of the project are highly degraded and almost impracticable to vehicles without a 4 –wheel drive mechanism and so rehabilitation work needs to be carried out on this road section. Even though the bulldozing so far is completed, only a few culverts have been effectively installed. Some already mounted ARMCO culvert rings can be seen along the roadside near their position of ultimate installation.

In April 1999, the Ministry of Public Works signed two contracts relating to the construction of the

bridge over the river at Big Nyang with two Cameroonian based companies; “SOCIETE LA CONFIANCE” and “SOCIETE ARIZOLA”. The first company was assigned to construct three piers (central pillars) while the second company was charged with the construction of the Akwaya – end Abutment including the back-filling. As of now only one pier has been constructed at 20% realisation.

The fourth additional bill for the bulldozing of the Mamfe –Akwaya road was signed in May 1999 with the C.W.E.P.R. covering a total distance of 26.5 km (43+500 to km 70+000) for a period of twelve months. However, the notification letter to the Chinese company has not yet been issued.

#### **3.2.4. Technological presentation**

Because of financial constraints, none of the three options initially proposed by the technical studies of HOLFELDER PLAN Cameroon S.A. pertaining to the elaboration of the execution project of the disenclavement of Akwaya Subdivision was adopted. In order to respond to the pressing demands of the population of the region, the Cameroon Government decided on a fourth option, that is, to simply open up an Earth Road. The total cost of this fourth option being much inferior to any of the three original options. The present road to Akwaya, as it is being dug, follows to a maximum the principal trace adopted by the technical studies thus disenclaving many villages.

#### **3.2.5. Infrastructure to be put in place**

Since the beginning of the bulldozing no installations for the base-camp have been put in place even though it is included in the contract. This is because the project zone was still close to Mamfe town where the C.W.E.P.R. already had their base camp. However, for the execution of the fourth additional bill from km 43+500 to km 70+000 and subsequent additional bills, the construction company must have to erect base camps where by directives pertaining to environmental protection will be closely applicable, namely: -

- The concreting of storage areas for toxic products
- The construction of houses and pit latrines for the personnel
- The base camp must be at a distance of at least: 30m from the road, 50m from the nearest stream, and 50 m from living quarters;
- The site for the base camp must be chosen outside sensitive zones (e.g. forest reserve, wildlife reserves, etc).
- Water reservoirs must be installed both in quantity and quality as need arises
- For borrow-pits and quarries, the constructing company must exploit rationally the materials available and to ensure that the site is rehabilitated at the end of the exploitation period. The removal of the surrounding vegetation should be proportionate to the volume of materials needed.

#### **3.2.6. Waste products and nuisance**

During the installation of the construction site, the execution of the roadworks, as well as the

exploitation phase after the completion of the road, the following waste products and nuisance can be identified.

- **installation of the site:**

- Visual nuisance arising from the excavation of vegetal soil for the construction of offices and living quarters.
- Sound nuisance arising from the noise of the equipment
- Dumping of filter elements and worn-out batteries.
- Pouring out of waste engine oil and fuel to the soil;
- Dust particles arising from the movement of vehicles and the equipment.

- **Execution phase of the work**

- Visual nuisance arising from the opening of access roads to the borrow pits and quarries.
- Sound nuisance arising from the noise of the equipment and that of explosives for crushing down large rock particles arising from the movement of equipment and the exploitation of borrow pits and quarries.
- Gaseous waste products arising from the exhaust pipes of moving vehicles and equipment.
- Solid waste products arising from various works (e.g. felling of trees, excavation at marshy areas, destruction of old drainage structures, etc)
- Liquid and solid waste products arising from the maintenance of the equipment (engine oils, oil filters, fuel filters, batteries, etc). And also from accidents resulting from moving equipment.

- **Exploitation phase of the road**

- Sound nuisance arising from the noise of vehicles
- Gaseous waste products arising from moving vehicles
- Road accidents (domestic animals, population)
- Vehicle remains arising from road accidents
- Dust particles arising from the movement of vehicles.

### **3.3. COMPARISON OF THE ROAD TRACE ALTERNATIVES**

The 1981 survey of the road came out with a number of alternatives for the road path from Mamfe to Akwaya. Further more the already existing Satom bridge has influenced the starting point of the actual trace of the road.

The study also gave reasons for the choice of the principal option. In most cases agreements were based only on technical feasibility of the road as well as socio-economic characteristics such as market related aspects, number of villages and population to be disenclaved. However, from the point of view of sustainable management of the resources, it is important to take into account variables related to the biological and ecological aspects of the road. One of them being the relative proximity of existing forest reserves (figure 2). The main characteristics of options are presented in table 3.

It appears that depending on the vocational orientation given to the area, there can be significant difference between the 3<sup>d</sup> option and the principal option chosen. Option 3 passes further away from the Takamanda reserve as compared to the principal option, while both are far from the Mone reserve.

If the preservation of the reserves is to be a priority, then option 3 will be preferable, but if on the other hand the project has to follow the actual population / land use patterns then the main option will best suit the purpose. In any case an appropriate plan should be put in place for sustainable environmental management.

**Table 3: Comparison of the road trace alternatives**

		OPTIONS OR ALTERNATIVES		
CRITERIA CONSIDERED	ACTUAL TRACE	1	2	3
Number of bridges	Less bridges (SATOM bridge)	one more bridge	Same	More bridges
Nature of terrain	Rocky steep	Rocky steep	More difficult	less difficult
Cost of realisation	Lower	higher	Less	higher
Cost of maintenance	More expensive rocky terrain	higher	Less	less
Number of villages to be disenclaved	Unchanged	unchanged	Less	less
Proximity to reserves	No influence	No influence	Better	Better
Socio- Economic potentials	Worse, because the difficult terrain will increase the cost of transport	Worse, because the difficult terrain will increase the cost of transport	Better, because it is closer to the Mbulu court area, with a lot of villages	Worse, because the major village of Tinta would not be disenclaved

## **4. DESCRIPTION OF THE ENVIRONMENT OF THE PROJECT**

### **4.1. Delimitation of the environment of the project**

For the purpose of this impact studies it is very convenient to limit ourselves to just two main zones. The 1st zone,  $Z_1$  immediately surrounds the total width of the road beginning from its centre. This zone constitutes the zone of direct impact on the natural and human environment. It will span about 500m ( $\frac{1}{2}$  km) from the middle of the road.

Next is the zone of influence  $Z_2$ , which flanks zone  $Z_1$ . It constitutes a peripheral zone on either side of zone  $Z_1$  and ranges from between  $\frac{1}{2}$  - 10 km wide. It is also the zone of indirect impact of the Mamfe-Akwaya road project.

A justification for defining the limits of these zones as stated above stems from two overriding characteristics of the study area. Firstly, the near-linear pattern of village settlements or hamlets situated on the average not more than  $\frac{1}{2}$  km from the road trace or from the road limits this zone. Therefore the proximity of settlements and to some extent the size of the settlement invariably influenced the decision on zone N<sup>o</sup> 1. The limit of zone number 2 was determined by considering the possible range of impacts due to human, civil engineering work, eco-physical; i.e. abiotic and biotic (ecosystem functions) factors, which interact with each other and consequently lead to either reversible or irreversible changes in the environment and its biodiversity (fauna and flora). However, other subsidiary factors were considered such as the land-use patterns and existing tenure system.

### **4.2. Baseline physical environment of the project**

#### **4.2.1. Location**

The project area is found within the following geographic co-ordinates (figure 1).

- Longitude  $9^{\circ} 18'$  -  $9^{\circ} 35'$  East
- Latitude  $5^{\circ} 45'$  -  $6^{\circ} 28'$  North.

The projected road, links Mamfe town to Akwaya in a South to North direction on a distance of 105 km.

#### **4.2.2. Topography**

The project region is found in a mountainous region to the North at Akwaya and the Mamfe (reformulate) plain to the South. It passes across several geographic regions of which the three principal ones are :

- The Mamfe plain with an altitude between 100 and 300 m;
- The intermediary zone (plain) with an altitude between 300 and 600 m;
- The high plateau, where the altitude gets to about 1200 m;

- The Akwaya plateau with altitudes between 600 and 850 m.

Steep hills like the Tinta (600 m) and Atolo hills (1200 m) characterise the high plateau.

#### **4.2.3. Climate and Meteorology**

Two seasons – the dry and wet seasons stand out very clearly.

- The rain start from mid March to mid November.
- The dry season starts from mid November to mid March.

Rainfall decreases from the South to the North of the project area. It is common to record 3000 – 4000 mm rainfall at Mamfé, whereas this drops to 2000-30000 mm at Akwaya and its surroundings.

Temperatures decrease with altitudes and Mamfe at an altitude of 152 m records a maximum temperature of 34<sup>0</sup>c in the month of March and a minimum of 18<sup>0</sup> c in the month of January.

#### **4.2.4. Vegetation**

The project zone passes through two distinctive types of vegetation, separated by a transitional one:

- Woodland savannah to the North around Akwaya and its surrounding right up to Meyerim.
- Rain forest from Tinta moving to the South;
- There is a transitional zone between Meyerim and Tinta mostly composed of woodland savannah and some gallery forest.

#### **4.2.5. Hydrography**

The project area runs through a watershed from where most rivers take their rise in the high plateaux. The principal rivers are the Rivers Mone, Baya, Makomono, Manfi, Mabe and Ebe, which are themselves tributaries to the Cross river in Cameroon and the rivers Nkoman, Ameli, which are tributaries to the river Katsina Ala in Nigeria.

The steepness of the surrounding slopes give rise to fast flowing river with devastating erosive effects.

#### **4.2.6. Geology**

This region is made up of ancient granite bedrocks recently affected by volcanic eruption.

During the Precambrian period the project zone was made up of Marine fossils on which considerable sediment especially of clay resulted. The sedimentary rocks have metamorphosed and now appear around the Mamfe area.

These metamorphic rocks include:

- Gneiss and migmatites

- Granite –diorites
- Phagioclastic gneiss
- And calco-alkaline gneiss presently series of sandy clay soil, laterites and alluviums are commonly found.

In general a geological cross section of the area will reveal

- Bed rock
- Rock that have changed in texture
- Zone of red clay
- Horizon of accumulation of iron Hydroxide noticeable between Eshobi and Mamfe town by the presence of compact lateritic cuirasses.

#### **4.2.7. Soils**

The great part of soils here have a clay to sandy clay texture. They are shallow on hill tops and steep slopes of the Akwaya plateau and relatively deep on the plain around Mamfe.

Under first cover, they are covered by a layer of organic matter which is readily wasted out as the area is cleared for human uses. This emphasises the need for soil protection measures as the land is converted to agriculture.

### **4.3. Biological Environment**

In general, the study area cuts across a variable environment from Savannah type (picture 3) of forest in Akwaya up to Meyerim and then by transitional forest-savanna type of vegetation including patches of gallery and fringing forests up to Tinta and there after, superseded by moist-evergreen tropical forest with some patches of degraded semi-deciduous forest derived from it. The moist-evergreen forest falls within the Guinea-Congolian central African Eco-region, sometimes designated as atlantic or biafrian forest (Letouzey, 1985) and as lowland afro-montane forest (White, 1983). The forests are very rich in species of plants and animals and the taxa Caesalpinaceae and to a lesser extent myristicaceae tend to dominate the forest, while the pongidae (Gorilla, drill and chimps) and cercopithecidae (Mona, Mangabey, Colobus and Putty-nosed monkeys), Guenons (such as preuss's guenon), cephalophidae (duikers) and suidae are inhabitants of this forest etc. An overview of the flora and fauna and the conservation status of some species is given below.

#### **4.3.1. Flora**

In the woodland savannah type of forest which covers much of Akwaya, the most abundant tree species include *Isobertinia doka*, *Burkea africana*, *Terminalia laxiflora*, *Terminalia macroptera*, *Combretum glutinosum*, *Piliostigma thonningii*, *Albizia spp*, *Daniella oliveri*, *Cassia spp*, and *lophira lanceolata*, etc. In general, the tree staturum vary from 10-20 m tall. Below this stratum are dense tussocky vegetation consisting of *Andropogon gayanus*, *Imperata cylindricum*, *Pennisetum purpureum* and *Loudetia spp*, etc. The herbaceous vegetation consist

mainly of the families gramineae (poeceae) and euphorbiaceae not more than 2 m tall and this is succeeded by a shrubby layer consisting of the species *Daniella Oliveri* and *Lophira laneceolata* ranging from 2-5 m tall.

In general, the forest continues to maintain its savannah character except on hillslopes where clearing for shifting cultivation or burning has exposed the fragile nature of the ferralitic soils to the negative effects of erosion. The savannah woodland ranges from Akwaya to the limit of Meyerim, at a distance of about 10 km.

The transition forest savannah begins after Meyerim. It consists of some forest species such as *Afzelia africana*, *Chlorophora excelsa*, *Triplochiton scleroxylon*, *Khaya senegalensis*, *Afzelia bipindensis*, *Khaya ivorensis*, *Bridelia ferrugina*, *Baillonella toxisperma* and *Alstonia boonei*, etc.

One major characteristic of the transition forest is the gradual increase in the height of the tree canopy i.e. 20-30 m tall as one progresses from savannah into the moist forest (picture 4). In addition, the forest canopy is unbroken along watercourses or rivers. The forest constituted along a watercourse is called a gallery forest and the portion bordering it on the hillside is termed fringing forest. This type of forest extends from Meyerim through Makomono up to Tinta about 20 km long.

The moist-evergreen tropical forest superseded the transition forest as from Tinta extending through the Atolo afro-submontane forest which is a primary forest and most probably dates to the Pliocene era about 5 million years ago, having escaped from glacial flooding and consequently retained its pristine nature until recently when human activity on the Nigerian border seems to threaten it (1960-1999) and down to the slopes where the villages Nchumba, Makwe, Basho 1, Tassomo, Akwa, Mbu, Nyang, Mukonyong and Eshobi are located around the Mamfe gulf. Over all, the canopy remains unbroken except in patches where human activity has degraded the forest such as around settlements or where rivers separate forest blocks and which some cases constitute a wildlife habitat barrier to migratory species.

The composition and structure of the moist-evergreen forest vary with altitude from 300-1200 m. Between Tinta and over much of the Atolo range and down to Makwe, the following species and their families are well represented. The tree species comprise: *Baillonella toxisperma* (sapotaceae), *Coula edulis* (olacaceae), *Bridelia micrantha* (Euphorbiaceae), *Canarium schweinfurthii* (Burseraceae), *Alstonia boonei* (Apocynaceae), *Enantia chloranta* (Annonaceae), *Khaya ivorensis* (Meliaceae), *Lophira alata* (Ochnaceae), *Eribroma oblonga* (Sterculaceae), *Poga oleosa* (Rhizophoraceae), *Pycnanthus angolensis* (Myristicaceae), *Oubanguia alata* (Scytopetalaceae), *Piptadeniastrum africanum* (Mimosaceae), *Turreanthus africanus* (Meliaceae), *Irvingia gabonensis* (Irvingaceae) and *Staudtia stipitata*, (Myristicaceae) etc. These are mainly timber species. Other small forest trees include *Cola nitida* (Sterculiaceae), *Cocus nucifera* (palmae) and *Elaeis guineensis* (Palmae), *Dacryodes edulis* (Burseraceae), *Garcina cola* (Clusiaceae), *Piper guineensis* (Irvingaceae). In general, the forest canopy ranges from 20-50 m tall and the older trees are estimated to be 150-500 years old. Gap effects tend to be wide spread especially on the Atolo hill. Gaps created by falling trees opened the forest canopy leading to vigorous competition among the recruits of the forest floor. Eventually one dominates and occupies the space suppressing the growth of the others. Gaps or « Chablis » occurred in well over 20 sites.

The fall of a tree is attributed to root-rot fungi attack which is then followed by windblow during a rainstorm. The forest also constitutes an efficient nutrient cycling ecosystem. Leaf litter is scarcely more than 1 cm thick and the spreading of lateral roots by a tree ensures that nutrients leached from the top soil which is shallow or about 5 cm thick is reabsorbed by the roots. Ecto-mycorrhizal association between saprophytic fungi (some seven species were observed) and the roots of nitrogen fixing species was common in the forest.

Between Makwe, through Akwa, Mbu and Nyang, some patches of disturbed forests could be observed. Generally, these are areas where farming, harvesting of timber and/or Non-timber forest products including hunting is carried out. There is also road construction between Mbu, Nyang, Mukonyong, to Eshobi near the Satom bridge. Along the roadsides can be seen secondary forests with the pioneer species *Musaga cecropioides* (Moraceae) which is very abundant (see picture 4). Where farm-land exist, the forest canopy is not continuous due to the clearing of the forest. However, secondary bush abound in such areas with the characteristic species *Cassia alata*, *Irvingia gabonensis* (bush mango), *Rhicinodendron heudelotii* (Njansang), *Alstonia boonei*, *Tetrapleura tetraptera* (Mimosaceae), *Poga eleosa* (shell nut) *Entandrophragma angolense* and *E. utile*.

#### 4.3.2. Fauna

The fauna of the study area is in general rich and diverse, but no reliable information exists on the distribution, home range and population densities of wildlife. The conservation status of many species in the project area is yet to be known.

An overview of the area of study reveals the presence of two forest reserves; the Takamanda forest reserve, covering an area of about 67,599 ha and gazetted in 1934 and the Mone (Mone) forest reserve covering 53,873 ha and gazetted in 1951 as production forests. Lying between the two reserves is a narrow corridor, which spans about 5 km wide from Akwa and Basho 1 (minimum distance of separation) and about 30 km wide between Eshobi and Takamanda.

In the middle of this corridor flows rivers Mabe and Mone which together merge, close to Okpambe (confluence) to form the river Munaya. This river to some extent constitutes a geographical barrier to the migration of wildlife.

During 1991-1994, a standing volume sales of timber was accorded to the logging company Société Forestière de la Sanaga (SFS) under licence n° 1810. They effected coupes in three contiguous blocks in, Mukoyong-Kesham area. After logging, it was discovered that most of the timber species were defective i.e. had holes inside the trunk. The company later abandoned the area when the new forestry law came into force and they failed to reactivate the concession.

The wildlife species frequently encountered and reported by the population and hunters include the following species:

*Tragelaphus spekei* (Sitatunga), *Cephalophus monticola* (Blue duiker), *C. ogilbyi* (Ogilbyi duiker) and *Thryonomys swinderianus* (cutting grass).

In the savannah woodland of Akwaya, the avifauna is also varied; the common scaly francolin (*Francolinus squamatus*), Pied crow (*Corvus albus*), Bearded bulbul (*Trichophorus barbatus*), Laughing love (*Streptopelia lugers hypopyrrhus*), Plantain eater (*Corythacola cristata*), Sunbird (*Nectarina pulchella*) and the Bronze-mannikin (*Lonchura cuculata*) are present. There are a host of other passerine birds whose home range are limited to a few kilometres (<10 km) from rivers such as the river Ameli at the Nigeria border.

In the transition savannah forest, the species represented include, the bush pig or red river hog (*Potamochoerus porcus*), forest buffalo (*Syncerus caffer nanus*), Sitatunga (*T. Spekei*), bush buck (*T. scriptus*), Cape clawless otter (*Aonys capensis*), Frutambo (*C. monticola*), Mona monkey (*Cercopithecus mona*), western white and black colobus (*Colobus polykomos*), Porcupine (*Atherurus africanus*), grass cutter or larger cane rat (*Thryonomys swinderianus*), Giant rat (*Cricetomys gambianus*) and chimpanzee, (*Pan troglodytes*). The bird list is similar to that of the woodland savanna.

Within the moist evergreen forest, the following species are well represented: the lowland gorilla (*Gorilla*), chimpanzee (*P. troglodytes*), drill (*M. leocophaeus*), mona monkey (*C. mona*), Putty-nosed monkey (*C. nictitans*), african civette (*Viverra civetta*) blue duiker or frutambo (*C. monticola*), bush buck (*T. scriptus*), red flanked duiker (*C. rufilatus*), brush-tailed porcupine (*Hystrix cristata*), common porcupine (*A. africanus*), larger cane rat, (*T. swinderianus*) and the giant rat (*C. gambianus*).

The herpetofauna of the moist forest zone consist mainly of the species python (*Python sebae*), gabonese, viper (*Bitis gabonica*), black cobra (*Naja nigricollis*), black mamba (*Natrix spp.*), green mamba (*Natrix spp.*), the giant toad (*Bufo camerounensis*) giant fresh water erab (*an amphibious cephalopod spp*). The presence of other reptiles were also noted such as the forest dwarf crocodile (*Osteolaemus tetraspis*) and the forest alligator (*Crocodylus spp.*). Equally important is the presence of the forest elephant (*Loxodonta africana cyclostis*) especially in the forests of Akwa and Mbu.

The avifauna of the moist forest consist of mainly passerine species such as the bush shriek (*Malaconotus cruentus*), the bare headed fock-fowl (*Picathartes gymnocephalus oreas*) which was identified on the Atolian montane forest near Takamanda forest reserve, the black casqued hornbil (*Ceratogymna atrata*), the grey throated bulbul (*Adropadus tephrolemus*) and the Pied crow (*Corvus albus*) etc.

#### 4.3.3. Conservation status of some species

Species can be regarded as being 1 = Rare ( R ), 2= Endemic (EN), 3 = Endangered (END) and 4 = Extinct (EX), for the purpose of this study. This characterization is similar to that used in most Red data books (Stuart and Collar, 1985) and other recent versions published by IUCN (Raab, 1984) and WCMC (Oldfield et al 1998). However, a more exhaustive assessment by the species survival commission (SSC) of IUCN considers more detailed criteria such as critically endangered (CE), Vulnerable (V) conservation dependent (CD), Low risk (LR), Data deficient (DD), Not evaluated

(NE) and Extinct in the wild (EW). This demands a more detailed evaluation through population census and inventory which could not reasonably be undertaken by us within the limited time available in the field. Therefore, this assessment is rather qualitative based on the response to the questionnaire and to direct observations made in the field.

To begin with, one of the most endangered species in the study area is the lowland gorilla (*G. gorilla gorilla*). The major threat to this anthropoid ape comes from commercial poaching along the frontiers with Nigeria where hunters enter in the Takamanda forest reserve without any control by the riverine villages nor the local forestry services (the Akwaya and Kekukisan forestry and wildlife posts are understaffed and not effective). Within the Cameroon border a gorilla was reported to have been killed some 10 months ago by a hunter from Akwa. The gorilla home range extends from Takamanda forest reserve to the montane forests of the village of Atolo where no gorilla was reported to have been shot in the past year. Hunters admitted that gorilla hunting was dangerous and only professionals who are well-armed could venture on this activity. Other studies in the Takamanda forest reserve reveal that it constitutes the last wildlife refuge centre for the highly threatened lowland gorilla of the western Cameroon highland plateau (Gartlan & Struhsaker, 1972), (Kingdon, 1989). There is currently some studies on the ethnobotany of the forest (Duncan, 1986) and the ecology of gorilla by two expatriate researchers (Duncan, 1988); one based in Nigeria (Mrs Caroline Efeka) and whose findings are not yet documented.

The next endangered species is the drill (*M. leucophaeus*). This species has a very limited home range within the natural or geographic boundaries such as the river Munaya that restricts its migration especially in the peak of the rainy season when the river completely separate the two forest blocks of the reserves.

Three hunters in one of the villages questioned admitted to have shot a drill among his kill and considering that about 10 villages were sampled during a hunting season, this gives 30 kill per semester. This amounts on the average to 60 individuals per year, which is high.

The chimpanzee (*P. troglodytes*) has become rare because it is also hunted and is scared by noise from the clearing of farms.

The royal python (*P. sebae*) and the dwarf forest crocodile (*O. tetraspis*) are also endangered species due to over hunting in the past for their skin and for food.

The forest buffalo (*S. caffer nanus*) has become scarce, and therefore rare. Similarly, the species rock fowl (*P. gymnocephalus oreas*) and the bush shriek (*Malaconotus gladiator*), a variant of *M. cruentus*, are endangered. The same is true for the grey parrot (*P. erithacus*) which is exploited for commercial trade.

Those species whose population trend to remain fairly stable are abundant and these include the bush pig, blue duiker, small monkeys (*Cercopithecines*) and rodents (porcupine, grass cutter and giant rat). These constitute the species most preferred in the flourishing bush-meat trade markets.

As concerns plant species, the endangered trees include Ebony (*Diospyros crassiflora*) and Pygeum (*Prunus africana*). *Prunus africana* seems to be the only endemic species known on the

slopes of Akwaya at Amassi above 1200 m. The exploitation of Ebony is forbidden by the forestry regulations while pygeum is only exploited with a license issued by the appropriate forest administration where this is grown or found as a natural population. An enquiry on the trade in pygeum revealed that much of this medicinal tree grows around the forest of Amassi, North West of Akwaya, some 70 km from Akwaya town. Dealers on Prunus bark are reported to come from the NW province via Njikwa subdivision (which has a forestry and wildlife control post). The produce transit through Ekpweri, Banya, Bakor, Konda and from here evacuated by road to Bamenda and to Mutengene (SW province) where PLATECAM can purchase them.

There is also a large trade in non-timber forest products (NTFP) across the Nigerian border: Ngongo leave, bush pepper, shell nut, Eru, Njansang, Kola nuts, bitter cola, chewing sticks, Njabe oil, honey and other agricultural products. The Nigerian border market of Amana is a major market for these products. If this continues without appropriate control measures, this will probably affect the status of many plant species and the biological diversity.

#### **4.3.4. Vulnerable habitats**

The habitats for wildlife and plant species will be affected by the Akwaya-Mamfe road project depending in the intensity and the proximity of the impact.

The lowland gorilla habitats are found in the Takamanda forest reserve and the periphery of the Atolian forest. The gorilla prefers nesting sites in pristine primary forest. It is evident that encroachment on the NE fringes of the reserve by village elites for palm oil cultivation will affect this habitat even though the extent was limited. The picture on the Nigerian border is reported to be even more serious due to lack of any control over the past 40 years.

The forest canopy which constitutes suitable habitats for the small arboreal primates, will be opened-up either due to road opening and bulldozing, or by increase in farm sizes of the local population, both indigenous and strangers (immigrants alike). The effect will be the separation of contiguous homogeneous forest blocks, and the connectivity of habitats to the wildlife corridor will be broken.

And in some cases, a severe degradation of the forest will lead to forest fragmentation and consequently to the isolation of some species.

The forest elephant habitat is the secondary forest where it feeds on Maranthaceae and Irvingiaceae spp. Elephants are reported present in the forest of Akwa although no elephant dung was observed. In contrast to the habitats preferred, elephants do not live in the primary forest such as at Atolo. They however, migrate seasonally in search of food and breeding sites. Therefore, secondary bush reconstituting itself should also be protected for these species.

The birds species black-casqued hornbill eats the seeds of *Staudia stipitata* and *Irvingia gabonensis* while parrots eat the nuts of *Elaeis guineensis* and grains of cereal (corn and rice). They aid in the dispersal of fruits and their seeds. Seeds when digested and dropped increase their success rate in germination. Therefore they play an important ecological function in the dynamics of the rainforest.

#### 4.3.5. Problem species

By virtue of the ecological role they play in the forest, some species can be distinguished as a nuisance i.e. crop damagers or agents of dynamic ecosystem equilibrium.

First, the rodents (Rodentia) porcupine, grass cutter and giant cane rat constitute a nuisance to the farmer as they cause considerable damage to rice, corn and palm oil seedlings respectively. They are therefore hunted or trapped by villagers to protect their crops.

Secondly, the forest elephant destroys crop (Plantains, banana, cocoa farm, etc.) in secondary forest even though it is listed as a protected species in Cameroon (class A). The hornbill, on the other hand, is an important agent for seed dispersal and pollination, and the same is true with the grey parrot, even though the latter causes considerable damage to crops. Monkey also cause damage to farm crops e.g. bananas. The bush pig and the forest buffalo cause damage to tubers such as *Colocasia spp* and cassava (*Manihot spp*).

#### 4.3.6. Commercial species

These are those that provide alternative sources of income to the population other than subsistent crops and livestock. They include the grey parrot which is well demanded in the international market but subject to trade restriction of the Washington convention on international trade in wild species of fauna and flora (CITES).

The locals catch the parrot in the wild and are sold at a cost of 5.000 FCFA to illegal captures. Pygeum is a species valued for economic reasons. The income from the sale of pygeum is considerable, a kg of pygeum bark at Amassi is estimated to cost 1000 FCFA.

Timber species in the region include framiré (*T. superba*), Fraké (*T. ivorensis*), Azobé (*L. alata*), Doussié (*A. africana*), Obéché (*T. scleroxylon*) and Ilomba (*Pyocanthus angolensis*) etc. These species were exploited by SFS in 1991-1993 around the Eshobi timber concession. The locals also use timber for building although wood transformation and Carpentry is not well developed. The local people also export NTFP as an alternative source of income generation.

#### 4.3.7. The situation of the Takamanda and Mone Forest Reserves

The Takamanda forest reserve covers a total area of about 67.599 Ha. It was created since the colonial times and gazetted on the 28<sup>th</sup> of August 1934. The highest elevation of the reserve goes up to 1700m. The resultant vegetation stretches from highland savannah in the north of Takamanda reserve to dense equatorial forest to the south. Mone forest reserve, which covers a total area of about 53.872 Ha was gazetted in 1951 and is found to the east of Takamanda forest reserve (see figure 2).

Both reserves were created for timber production. The right of way by bush paths, enclaves, and the

right to harvest forest resources and hunting were granted to the local populations living both within and around the reserves. Since independence little attention has been given to the reserves. Increasing populations, the quest for more virgin and fertile farmland, the increased need for bush meat by the local people and the market, the lack of alternative economic opportunities to employ the youths and women, the non demarcation of the reserve boundaries and the near absence of forestry officials in and around the reserves have all contributed to increase the level of exploitation of the reserves and forests around them through shifting cultivation uncontrolled fishing, hunting and trapping, the uncontrolled exploitation of most non timber forest products such as *Randia*, *Carpolobia*, *Gnetum*, *Irvingia*, *Rhicinodendron* and wildlife. This over exploitation is particularly marked along the footpath, which is very close to the road trace linking Mamfe to Akwaya.

The opening of the road between Mamfe and Mbu has already accentuated this overexploitation. Many more people now hunt, and harvest other forest produce to take to the market at the road terminus at Nyang. There is a lucrative bush meat market, which in turn encourages poaching. Many more youths returning to the villages are opening larger farms using extensive shifting cultivation, slash and burn methods which have a very negative impact on the environment and bio-diversity.

Better housing requiring wood also puts more pressure on the wood lot of exploitable species.

The exploitation of pygeum (*Prunus africana*) by some non indigenes was reported to the north east of the Takamanda reserve about seven kilometres away from the village of Tinta around the villages Ntamale, Ame Amaiyo, Otongo and beyond. The population of the villages living around the reserves could not identify prunus and could not tell us much about prunus.

*Prunus africana* is a medicinal plant with restricted distribution in Cameroon. It is present in sub-mountainous and mountainous forest of the North West and mountainous forest of the West and South West Provinces. The zone of the project is a potential distribution belt of this plant since this area has a mountainous and sub-mountainous forest. The bark of this plant is a very important in medical science. It is used in the manufacture of a drug which is used for curing prostate problems. His husbandry is not easy and one will have to wait from fifteen to twenty years for a tree to become profitable. This discourages any attempt to plant, thus the necessity to rationally manage of natural populations. Cameroon is the first producer of this plant.

*Prunus* seems to be illegally and unsustainable harvested in the north of Akwaya and to the north east of the Mone forest reserve along the areas bordering the North west province. It is reported that the harvested barks are transported by head load through the North west Province and carried down to Plantecam in Mutengene in Fako division. This uncontrolled exploitation of prunus barks is sometimes done by cutting down whole trees before debarking. This is a very destructive and unsustainable manner of harvesting prunus.

#### **4.4. The socio-economic and cultural environment along the prospected road from Mamfe to Akwaya**

Generally one has to consider, that the people of the Akwaya subdivision are living in poverty (see figure 3). Structural poverty - such as insufficient health care, education, access to clean water, etc. -

is linked with unsatisfying income opportunities.

The villages along the trace of the prospected road have are assembled of hunters and gatherers. They only farm on subsistence farms, where they plant and harvest according to the method of shifting cultivation. Only the villages close to Mamfe and those in the grassland between Akwaya and Tinta have farms of reasonable size. Only these villages assemble a population above 1000 inhabitants each, mostly because settlers moved into the area. Drinkable clean water is nowhere a real problem. Only villages, which are accessible by road received development assistance, such as water projects and crop nursery, but they are also the only villages, which need tap-water, because of pollution caused by their intensive farming. Primary Schools are found nearly in all major villages along the prospected road, but secondary school exist only in the more developed areas around Akwaya and Mamfe. The inhabitants of the region face the same situation concern health and medical service: only Mamfe and Akwaya have "hospitals" and vaccination teams and medical inspections are said to prefer places, which are accessible by road.

The culture, traditions and customs are stronger in the area, which is not accessible by road, but in the perception of the construction of a road, the conservation of their tradition and customs is not seen as a major goal. The people are from different tribes. From Mamfe coming one passes the Bayanga, Anyang, Boki, Manta and Assumbo tribe area. a concern numbers, Manta and Assumbo people are most common alongside the prospected road, but all tribes are split again in different clans. In all these tribes and in opposition to most cultures in the Southwest Province, the position of the chief is quite strong. The elders are consulted by the villagers in all perspectives and the decision delivered by the chief, but made by the elders is mostly accepted. Settlers are only found in number in the area around Akwaya and along the road towards Nyang. They are respected, since they involve themselves into the indigenous society and pay tribute to the traditional authorities.

In the first villages coming from Mamfe the settlers, who are found in quarters, are already the majority and their number is said to increase very fast. The societal changes caused by the construction of the road are tolerated, since the villagers focus in their perception on the economic advantages, which could arise from the road. The perception changes from village to village, but in general, we have to consider that the construction of the road is a major aim of the entire population along the prospected road. The villagers who have already experience with the road realised some negative impacts, but in their perception, the positive aspects dominate by fare.

Sustainable management of the natural resources is a unknown concept for the villagers. Most of them are aware of the existence of forest reserves, which are called "government forest", but they hardly understand their meaning. They consider hunting as a mean of subsistence, because they can feed themselves and make money out of it, but also because it help them to fight against the "destructive impact of wildlife" on their farms.

The area of direct social-economic impact (500m to both side of the road) will effect, when the road is completed nearly 20.000 people. It is already effecting the life and the culture of 7.500 people. The indirect impact will reach people from all over the Akwaya subdivision and will effect the lifestyle of approximately 50.000 people. There are no up-to-date surveys on the population existing, but the village-dictionary from 1967 gives the number of 27.703 for the whole subdivision. The 1987 census stated that 38.916 people are living in the area (cf.: Foncham 1999, 2) so it can be expected that the

Akwaya subdivision has at least 50.000 inhabitants. Because it was impossible to visit all villages in the region the socio-economic and cultural impacts in the zone of indirect impact are unknown, but it can be expected, that they are similar, only slower and lighter than along the road.

The description will follow in the first place the existing road and than the main trace proposed by HOLFELDER PLAN in 1981. In the description we will focus on the existing part of the road, because in this area the road already generates impacts. It seems logic, that in a similar environment the other villages will be effected by the same impacts in the same way, if the road connect them with the rest of the world.

#### **4.4.1. Keshem 1 (km 0,5)**

On the hill at the end of the bridge over the Cross-river the government is building a bilingual secondary school (Lycee) to enlarge Mamfe town.

#### **4.4.2. Mbe - a quarter of Eshobi (km 3)**

Mbe is a small village mainly inhabited by settlers from the Northwest Province and Nigeria. The people live from cocoa, plantain and palm plantations. They sell their products on the Mamfe market. Mbe is a fast growing place since it is accessible by road.

#### **4.4.3. Bororo - a quarter of Eshobi (km 5-6)**

As Mbe Bororo is a settler village, which is relying on farms and plantations. They also produce large amounts of cassava.

#### **4.4.4. Eshobi (km 9-10,5)**

Eshobi is one of the major villages along the road. It has different quarters and a overall population of more than 4000 inhabitants. Eshobi is mainly inhabited by Lower Bayanga people, which are also the indigenous inhabitants of Mamfe and the region around Mamfe, but the village authorities state that the number of settlers from the Northwest, Nigeria and the Akwaya subdivision is faster increasing than the number of Bayanga people. It is said that soon more settlers, which mostly lodge not in the main village, will live in Eshobi than indigenous people. The chief of Eshobi is still wily to welcome more settlers as long as they follow the traditions and accept his authority. Due to the fact that Eshobi is accessible for nearly ten years by road it received some development assistance from SNV, the US Embassy, the EU and some international health NGOs. While their primary school was constructed in the sixties assistance only reached Eshobi in 1991 after the road to Mamfe was constructed. Today they have tap-water, a crop nursery and a health centre under construction. Shops and bars are found in all quarters of Eshobi and the people seems to be quite satisfied with their live.

The Friday market in Eshobi is an event, which attracts traders from the whole region. Crops, NTFPs and bush-meat farmed, gathered and hunted by people from Eshobi and from villages within a area of one day trekking is exposed to traders and consumers on large scale. Buyers from the whole Manyu-Division appreciate the market because of its good quality and its low prices.

Farming is the main occupation of the villagers. It seems as if only cocoa is exported. Between 100 and 200 t is said to be transported each year to Nigeria for sale. Cocoa is the major cash crop of the Eshobi villagers. But they also sell Coffee (less than 2 t a year), Akpu (1 t), bananas (15.000 bunches), maize, gari, plantains, cassava, cocoyams, groundnuts, and melons. The market-women of Eshobi, who are responsible for selling the crops, appreciate the road since it is possible to transport large amounts to the Mamfe market. They criticised the poor quality of the road, which makes it in the rain season difficult and expensive to reach the markets (see picture 2). A common replacement is the sell of dried bush-meat in times of bad roads, because it is easier to transport it by foot and easier to store than crops.

The NTFPs bush-mango, njansa, erru and country onion are very commonly harvested. The men and women who harvest these NTFPs state, that it becomes more and more difficult to find them in the forest. Kanda-stick and king-stick and other medical plants are still only collected for private consumption, but a survey team from Plantecam visited the village in 1999. One man stated that he received a licence to log each week one tipper of timber from MINEF and the village council. He sells the timber for 200.000 FCFA in the Mamfe region. To have a forest is seen as important, since it is a main source of income. They are aware of the Mone forest reserve, but some people state, that they do not care where they harvest and hunt, since they see the whole area as their property. While the chief appreciates the approach to reduce hunting, his subjects do not agree and want to continue with these activities. They state that animals are dangerous for their farms, so that shooting and trapping is a necessary act of self-defence.

Bush-meat mainly monkeys, deer, and cutting-grass is hunted with traps and guns for sale. One hunter stated that "as long as no other jobs are available hunting can neither be reduced nor stopped. But hunting is not a good form of income, because it is already difficult to find animals." The average income from a one week hunting trip is 10.000 FCFA, but the hunters agreed that the wildlife population is reducing rapidly in the last years. The road seems to have no influence to that development, since Mamfe is very close. The sell is organised by women, who sell bush-meat worth 20-30.000 FCFA on a market day. The women criticised heavily the strict policy of MINEF and fear their inspection teams. They said that they would not mind to reduce the bush-meat trade, but as long as no all year road reaches the village, they claim to be unable to do so.

Fishing is only carried out occasionally or for private consumption. The production of palm wine and trading are the only other sources of income.

While the road in the sixties and early nineties followed the direct footpath, the track of the recent road was chosen by SFS. The company followed the instructions of the villagers to construct deviations around some secret places and trees, which are used for traditional medicine. The village authorities appreciated this approach.

The villagers see themselves as the owner of the road, but state that the maintenance should be

funded by the government. The authorities agreed with the former governor, that no compensation should be paid for the damages caused by the road, since the advantages from the road are bigger than the losses by destroyed crops. As advantages the better access to the markets and to the health facilities in Mamfe is seen, while the increase of products for sale in the village is seen critical, because more money is necessary to enjoy life. As said before, the reduction of wildlife and NTFPs is not seen as an impact of the road. They don't fear any negative impact on their rituals and traditions. Since Eshobi is less than one hour by foot from Mamfe, it is obvious that even in times before the road was existing or in times, when the road was of poor quality, the people of Eshobi were oriented towards their relatives at the other side of the Cross river. They actively contributed to the road construction in the sixties and early nineties, so it seems fair, to take their wishes towards an improved roads into consideration. Overall the positive impacts caused by the road dominate.

#### **4.4.5. Bombe** - a quarter of Eshobi (km 13-14)

Bombe is inhabited mostly by settlers from the Akwaya subdivision. It was the last village, which was accessible by road in the sixties. The socio-economic situation is similar to the one of Eshobi.

#### **4.4.6. Chemata** - a quarter of Mukonyong (km 16-17)

As all quarters on the way Chemata is a settler-village. The only difference to the other settler-villages on the road, can be seen in the fact, that Chemata has its own primary school. The road constructed by the timber company SFS reached Chamata in 1995.

#### **4.4.7. Mukonyong** (km 18-19)

In opposition to Eshobi the inhabitants of Mukonyong are Anyang people, while the different quarters are inhabited by settlers from other parts of the Akwaya subdivision. The relation between indigenous people and settlers is claimed to be good, but land use conflicts are said to be on increase since the road opened up the region. The inhabitants of Mukonyong are subjects of the Akwaya subdivision, while Eshobi falls under the Mamfe centre subdivision. Including the different quarters Mukonyong, which is also known as Small Nyang, has a population around 2000 inhabitants. Mukonyong is a very active place with five bars and even a boutique. While the primary school was established 1981, health care only started to improve when the road was constructed. A vaccination team visits Mukonyong now regularly and the fast transport to the hospitals in Mamfe is claimed to have saved more than 50 lives since the road reached the village in 1995.

The main economic activity carried out by the villagers is hunting. All men with an average age go hunting at least once a week. They agreed, that they hunt everything and everywhere for sale. The problem arises from the fact, that Mukonyong is located very close to the boundaries of the Mone forest reserve, which they also use for hunting and gathering. The only animals in the region, which are not hunted by them are elephants, gorillas and buffaloes, because the villagers do not have guns of that kind, but they stated, that hunters from other villages are hired from time to time to shoot that game.

They all use traps and guns and agree, that hunting is very lucrative. 10-15.000 FCFA is seen as an average weekly income. While the hunting is carried out only by men the bush-meat trade is mainly organised by women. Both groups involved in hunting do not agree with the concept of conservation and state, that they would only reduce hunting, if the government compensate them. They claimed up to 2.000.000 FCFA a month. They said, that the road has increased the demand for bush-meat by opening up new markets. They agreed, that the wildlife population is reducing, but for them, it is not important to have an entire forest with wildlife. A common justification for hunting was the complain about the damages to their crops, caused by animals. "We have to kill them all. It does not make sense to start a farm as long as animals destroy the crops."

Nevertheless farming is on the increase. Nearly everybody has a private farm with cocoa or/and palm-oil, but the outcome is small. The distribution of land is organised by the village council and it is said, that land use conflicts only exist with the settlers, but they are not seen as serious. The main purpose for farming is local consumption and only around the settler-quarters professional farms can be found. As reason for the economic preference, the villagers state that farming is not as lucrative as hunting.

Harvesting of the common NTFPs is carried out, but not on large scale. Medical plants are only harvested for local consumption. Also fishing is mainly done for the own consumption. Due to that they hardly use gamalin, or any other poison. The only other income generating activity is tapping of palm-wine and trading. The forest is seen as community property, but they did not mind, that SFS logged heavily in their forest area. They only complained that the timber company did not fulfil its promises, such as health centre and job opportunities.

The road is general appreciated, but it is seen as a government business to maintain it, because the authorities constructed it and based on that, own the road. They said, that they wanted to ask for compensation, but they were afraid to ask the government. They realised the impact of the road on their lifestyle, but they seems to appreciate all dimensions of change. They agreed that traditions, such as traditional medicine, secret societies and traditional laws, will change in the future, but none of our respondents feared that change. Overall the main negative impact has to be considered in the increasing hunting pressure - especially inside the forest reserve -, which seems to overshadow the positive impacts. The authorities should use their different departments and ask NGOs and international development assistance to find ways and means to reduce this negative impacts. The EIA-team agrees that this should not be done by force, such as game guards and bush-meat confiscation, but by introducing the population of Mukonyong to the long term advantages of farming and a sustainable use of their natural resources.

#### **4.4.8. Taweagem - a quarter of Mukonyong (km 23)**

Taweagem was in the past a small settler-village. Since the "timber road", which ended here, connects it with the markets in Mamfe and beyond, more and more settlers from the Asumbo court area in the Akwaya subdivision settled down in Taweagem. The villagers of Taweagem carry out the same income generating activity as Mukonyong: hunting. The main problem arise from the fact, that Taweagem is located directly at the boundary or even inside the Mone forest reserve.

#### **4.4.9. Manjkeku - a quarter of Nyang (km 29)**

Settlers from the Asumbo court area in the Akwaya subdivision are the main inhabitants of Manjkeku. As the other villages in the region they are hunters, but the negative impact of the road - the increase of hunting - is not as problematic as it is in Taweagem, since the forest reserve is not very close to Manjkeku and a hilly area has to be crossed, before one reaches the Mone forest reserve.

#### **4.4.10. Nyang (km 32)**

Nyang has an overall population of around 1200 inhabitants. They are from the Anyang tribe and very close relatives to the people of Mukonyong. Since 1965 they have a primary school in town. Nyang used to have a metal hanging bridge, constructed in the early forties, but it collapsed in 1989. From that time on it is replaced by a traditional hammock bridge, which has to be reconstructed each year. The reconstruction at the end of the dry season became an important cultural activity, which assembles representatives and workers from all villages, which use the bridge, for one week in Nyang. The modern bridge, which is still under construction, will destroy this tradition, but secure the transport from and to Nyang. Since the road reaches Nyang the health care has improved: vaccination and medical teams are visiting the village now from time to time.

The main income generating activity is hunting, which is carried out on large scale. They use guns and traps. An average income from hunting is said to be 7000 FCFA a week and small animals like deer, porcupine and bush-pigs are the main targets. They state that they hardly hunt in the Mone forest reserve, because bush-meat is available in numbers in closer locations. The villagers of Nyang agreed that the increase of hunting is the major impact of the road. They realised, that due to this increase the wildlife population reduces rapidly. They do not appreciate the perspective of a forest with little or no animals, but they state, that hunting is easy earned money or that they have no other way to earn money, because they have not enough land to increase their farms. Another justification for hunting is seen in the damages caused by the animals. They would not mind to stop hunting, if the government offers them other options to earn a lot of money with not to much work.

Farming is already the second most important economic activity. A average farmer produces about 300-500 kg of Egusi and 50-100 l of palm-oil a year, which gives the family 3000 FCFA a week. They would love to increase their production, but they state that the expensive transport due to the bad road (2500 FCFA to Mamfe) and the lack of modern farming tools slow down this increase and force young men to hunt for living.

Fishing is seen as another important source of income. The Mone offers fishes of different kind, which are fished mainly with nets and not with poison, because the river is flowing to fast for the use of poison. A normal income seems to be 2500 FCFA per week from fishing, but - due to the heavy changes in the availability of fish - fishing for sale is only carried out at the end of the rain season on large scale. Harvesting of NTFPs seems to be in Nyang a minor aspect of live, mostly done for private consumption with the exception of Eru, which is sold on large scale on the different markets

in the region.

The road is seen as a "giant step ahead". They appreciate the easier access to the markets, the better communication and the improvement in the standard of living. Damages caused by the road to farms and houses were compensated to the satisfaction of the villagers. In the future, they are prepared to contribute to the maintenance of the road, which they see as the "property of the people of the Akwaya subdivision." Two issues were heavily criticised: The slow progress of the bridge construction and the fact, that the road passed through an area of shrines and other cultural heritages. The second issue was seen as closely related to the lack of professionalism and communication from the side of the Chinese Water and Electricity Co-operation.

Overall the positive impacts seems to dominate the negative impacts as it seems possible to promote the idea to increase farming and reduce hunting. The EIA-team knows that this can only reduce the increase of the hunting pressure towards the wildlife population, but it can be seen as a first step towards a sustainable management of the natural resources in the region.

#### **4.4.11. Mbaya - a quarter of Nyang (km 33)**

Mbaya is a quarter, which assembles settlers from the Mbolo court area in the Akwaya subdivision. It has the same socio-economic structure as Nyang. The only difference is the collective effort to plant oranges, since the road reached Nyang in 1997. They sell this oranges in the villages along the road or to traders, who take the oranges as far as Kumba and Douala. Because the orange-business is a women's enterprise the expected increase seems to have no impact on the increasing hunting activity in that region, but it can serve as an example for the fact, that in the long run farming is securing a sustainable flow of income towards the villages in that region.

#### **4.4.12. Mikwempo - a quarter of Nyang (km 35)**

A small quarter, which is very similar to Mbaya. The inhabitants are also settlers from Mbolo court area and moved to this settlement, because of the expected economic advantages.

#### **4.4.13. Mbu (km 41 - two hours by foot from Nyang)**

Mbu marks the end of the dry-season road constructed by the Chinese Water and Electricity Co-operation from 1997 - 1999. Some 400 inhabitants are living in Mbu. The majority belongs to the Manta tribe and only a few settlers found their way to Mbu. They have a school up to class five, while the older children have to walk to Akwa.

The major source of income is hunting, but also farming and gathering of NTFPs is quite common. They said that they increased their hunting activities, since the road reached Nyang, because of the easier access to markets. They even started to introduce an own market in Mbu, but due to the fact, that in the rainy season, cars are unable to cross the Mone, it is still a limited market. The insufficient bridge is claimed to be the main reason, why they increased their hunting without increasing their

farms. They said, that if the road is able to bring cars the whole year to Mbu, they will increase their production of palm-oil and even promised to reduce hunting.

They agreed that their intensive hunting is reducing the wildlife population and understand to some extent the idea of conservation, but they state that the economic pressure force them to continue hunting. Another interesting phenomenon related to the forest can be seen in the fact that they realised that NTFPs are disappearing within their community forest, so that they have to walk far to find them. Our respondents said, that they also carry out gathering of NTFPs and hunting in the Mone forest reserve, which just start at the one end of the village. Mostly this pressure on the natural resources within the forest reserve can be seen as the negative impact in Mbu, but - as said before - the villagers showed interest to change their economic habits and base their life in the future on farms. It is quite clear, that they will never totally stop hunting - neither outside nor inside the forest reserve - , but if this problem is seen as a common effort of the authorities, the villagers and development assistance in is maybe possible to enable the Mbu villagers to use their natural resources in an sustainable manner.

In concern of the layout of the road, the village was not consulted, neither did they got involved in the construction itself. So it seems no wonder, that they do not feel as the owner of the road. The road in the eyes of the Mbu people is a good thing, which they appreciate a lot, but it is owned and should be maintained by the Cameroonian government. As long as they see the positive impact towards health-care and the economy, they are prepared to contribute through their village council to the maintenance. They appreciated the payment of compensations to farmers, whose crops were destroyed by the road construction. They criticised the road as to narrow and not properly made, especially the slow construction of the bridge in Nyang arose a lot of criticism.

#### **4.4.14. Akwa (km 48 - two hours by foot from Mbu)**

Akwa is a small village at the side of the river Munaya, which is less than 100 m away and is used as the main source for water supply. The overall population is said to be around 600, most of them are from the Manta tribe. They have a primary school with two teachers. It is said, that this is the only place where qualified teachers are working. The situation in the sector of health care is not good at all, but in the dry season a vaccination team passed the village.

The main income generating activity is hunting, but they increased - in view of the soon coming road - their farms to be ready to supply huge amounts of palm oil and plantains, when the road reaches the village. Akwa is the only place, where we found livestock to be a major form to earn money. Chicken, goats, pigs, rabbits and dogs are kept in numbers to be sold on the markets in Nyang and Mamfe. The trading and the gathering of NTFPs is seen as a women's activity, while hunting is a pure men's activity. Farming is carried out as joint effort by men and women and on land owned by the families.

Their perception of the road is already very positive, since it reduces the travel time to Mamfe from two days to one. As the other villages in the region, they focus solemnly on the expected positive impacts (easier access to the markets, better health care and better education opportunities), while they see the negative impacts (change of traditions etc.) as not so important. As Mbu Akwa is

situated directly at the boundary of the Mone forest reserve, the villagers use the reserve for their hunting and gathering activities. So the recommendations, which were given in the case of Mbu are also recommended in the case of Akwa.

#### **4.4.15. Basho I (four hours walk from Akwa)**

Basho I is a small village with a population below 300 people from the Manta ethnic group. Nevertheless Basho assembles six quarters, while the numbers of settlers is quite low (4 farmers). The water supplying stream, which is nowhere more than 200 m away is quite clean and offers good water. They have a seven class government school, where 219 children from all villages in the region are enrolled. The health care is not good, even though Basho I is visited occasionally by medical staff from Akwaya.

The main income is generated through hunting, which offers around 90.000 FCFA per annum and per person. Around the same amount is received from the gathering of NTFPs (bush pepper, bush mango, njakanga and bush pepper). Some villagers have oil plantations, which give them an income of 120.000 FCFA a year. Cocoyam, plantains, cassava and okra is mainly farmed for private consumption. Fishing is only carried out in the dry season and on low scale. They have to walk at least two days to reach a market, either in Amana (Nigeria), Akwaya or Nyang, since Basho I is half way between the last accessible road point from Mamfe and Akwaya.

They have high expectation related to the construction of a road: Easier access to the markets of the region and the opportunity to choose a market for their products with the intention to realise better prices. These economic advantages are expected to be the short term impact of the road. In the long run they even expect to create a market place in Basho I, where the women can sell cooked food, while the men start to farm cocoa on large scale. At the moment they could not believe, that a road has also negative aspects. They state that they would not ask for compensation, if their crops are destroyed by the road, because they do not want to slow down the process of construction.

#### **4.4.16. Makwe (two hours from Basho I)**

Makwe is another small hunter-village. Around 250 people are living there. They are from the same tribe (Manta) as the people in Basho I, but from a different clan (Balumbi instead of Banchu Acho). The main water supplier is a spring 500 m from the village. There are 15 settlers from Nigeria in the village, but no conflicts are reported. In the past they had land-use problems with the neighbouring villages mostly in relation with stolen crops, which were solved by the traditional councils. They fear that these problems arise again, when the road is constructed. The health care is not too bad, since a medical team from Akwaya visits the village from time to time.

As all villages in the that region their main activity is hunting, which offers them around 50.000 FCFA of monetary income per annum. As in the other villages without a road connection, income generating activities are only carried out beside the main occupations: hunting and subsistence farming. Hunting is the main money producer, because dried bush-meat is easier to store and to transport than crops. So it seems logic, that the income from farming (mostly palm-oil) is said to be only around 20.000 FCFA, while mostly women generate around 30.000 FCFA per annum from the gathering of

NTFPs (bush mango, njasanga, bush pepper, country onion, ngongo leave and cane rope). For their private consumption they grow rice, bananas, cassava, peanuts and cocoyams.

They are able to choose, which market they want to use, since Nyang and Akwaya are nearly at the same distance - two days.

Their perception of the prospected road is very positive. They state that the road will enable them to cultivate more palms and even allow them to start with cocoa farming. Both will make them rich - at least in their wishes. In the long run they believe that their houses will improve and more children have the chance to attend school, since there is no school in the village yet. But in opposition to other villages, they also realise the negative impacts: "The road will destroy our traditional hierarchy and the youth will no longer have respect." "Other people will come and steal our land." But in general the villagers of Makwe think, that the expected positive impacts dominate the negative impacts and they state, that they even would organise a compensation system within the village for the destroyed individual owned crops.

#### **4.4.17. Atolo** (ca. km 86; three hours from Makwe and seven hours from Akwa)

Atolo, which is located at the edge of the grassland is quite different from the villages in the dense rain forest. It is with a population of around 300 (mostly Assumbo-people) also small, but the difference can be seen in the fact that their main activity is farming. The water supply is good with a fast flowing stream 300 m away. They have a small primary school, where 48 children are enrolled under one teacher. There are around 15 Cameroonian settlers in the village, who are highly respected. The people of Atolo would not mind to have more settlers, if they pay tribute to the traditional authorities and contribute financially to the village council. They have quite a lot of problems with the neighbouring village Mchemba - which is already at court level - and hunters from Nigeria, who enter the area without permission. As in the whole Akwaya region the Cameroonian "forces of law and order" - due to the distance to the Cameroonian administrative centres - are said to be unable to defend the interest of the Cameroonian citizens against Nigerians, who cross the border to carry out all kinds of activity. The health care is not as bad as in the villages inside the forest, but still a lot of improvement is expected from the construction of the road.

As said before the main income generating activity is farming, which offers an income of around 100.000 FCFA per annum from cassava, cocoyam, beans, plantains, bananas, potato and pineapples. Hunting is also carried out and generates an income of 80.000 FCFA a year. The same amount is received from the sell of NTFPs like bush mango, njasanga, bush pepper, country onion, bitter kola, cane, honey, limestone and mushrooms.

Their awareness as concerned with positive and negative impacts of the construction of a road is quite high. As advantages they see the expected better opportunities for income generating activities, the better transport to Mamfe, the better health care and the reduction of witchcraft. The last point is quite interesting, because normally the fact, that a road weakens the traditions is seen as a negative impact. It seems as if witchcraft is carried out in Atolo to an extent, where the population can hardly appreciate it. Another interesting point is, that they see the better access of Cameroonian authorities, such as gendarmes and police as advantage, because normally the reputation of these institutions is

not very high. As negative impact they fear the increase of land use related problems with settlers.

#### **4.4.18. Tinta** (ca. km 98; three hours from Atolo)

The 3500 inhabitants are from the Assumbo tribe and even from the same clan as the inhabitants of Atolo and Makomono. As a major place in that region Tinta has a seven class government school, in which 320 kids are enrolled. Quite a number of settlers from other parts of the Akwaya subdivision, but also from Nigeria farm around Tinta. The relationship is said to be good and the traditional council is seen as able to solve problems, which could arise, if more settlers arrive. The health care situation is quite good, since there is a Baptist health centre in Tinta and a hospital in Akwaya. Even the Bamenda based Helicopter Mission visit Tinta occasionally.

The main activity is farming of rice, peanuts, maize and beans. Hunting is also carried out on large scale and Tinta is the main bush-meat market for the whole region. The buyers come mostly from Nigeria and the prices are high, but it is seen as a not very lucrative income generating activity, because the wildlife population was reduced in the last years to an extent, which makes it difficult to find animals nowadays. Fishing and gathering of NTFPs is also carried out, but on a small scale. Weaving and palm-wine tapping are other activities, which generate some income.

The expectations towards the projected road are high. They think the road will offer them better houses, easier transport of their goods and related to that, bigger farms and more income. Due to these advantages, they seem to accept the expected negative impacts, such as the increase of settlers and an increase of control through the Cameroonian authorities.

#### **4.4.19. Makomono** (one hours from Tinta)

Makomono is a small village with a population below 200. They have to track only 500 m to a spring with excellent water. Makomono does not have a school, so the children have to track everyday to Tinta. As the other villages around Akwaya the health care is not too bad and a medical team from Akwaya comes regular for vaccinations and consultations.

The main activity is farming of rice, cassava, peanuts, oranges, vegetables and coffee, while hunting is seen more as a special activity for times of financial emergencies. A speciality of Makomono is the huge amount of honey which is collected and sold.

As concerns the road their expectations are beside the common economic argument (better access to markets) quite abstract: "The road will bring us development". They realise that negative impacts can be differentiated in short term (crops will be destroyed) and long term (more control and taxation) problems, but as all other villages they believe that the positive aspects will dominate. An interesting aspect in the grassland seems to be that they do not expect any impact of the road on their believe system and social habituates.

#### **4.4.20. Meyerim** (one hours from Makomono)

The 300 inhabitants of Meyerim are as all people around Akwaya from the Assumbo tribe, but from a different clan (Ochebe) than those around Tinta (Okus). They have no school or health centre and are strongly related to the infrastructure and the market in Akwaya.

They carry out the same activities as the other villages in the region: farming on large scale, hunting and gathering of NTFPs (bush mango, eru, ngongo, raffia, canes and fuel-wood). The harvesting of *Prunus africana* seems to take place mostly in this region.

The people in Meyerim expect the road to contribute to the improvement of health care and education. They do not see any negative impact, which seem understandable, because they are very close to Akwaya, so that negative "habits" from the outside world already affects them, without the advantage of fast and comfortable transport.

#### **4.4.21. Akwaya (ca. km 113; one hours from Meyerim)**

Akwaya as centre of the Akwaya subdivision assembles quite a number of officials among its 3500 inhabitants. The function as capital of the subdivision offered Akwaya some development assistant by the Cameroonian government. Pipe borne water, a secondary school and a district hospital are highly appreciated by the villagers. The number of settlers is quite high, but land-use conflicts are said only to exist with other villages and not with the settlers. A special group are the Cameroonian civil servants, who work in Akwaya on a temporary bases.

The income generating activities are farming, hunting, gathering and trading. While they farm the same crops like the neighbouring villages (rice, peanuts, oranges and palm oil) special emphasis lies on the gathering of the NTFP eru, which is transported on large scale to Nigeria. The trade is quite intensive and the Nira is widely accepted on the markets in the region. Bush-meat is transported from the whole area in enormous amounts to Nigeria and Akwaya is used as first market, because it is quite difficult for Cameroonians to go to Amana ("settlements", bribes) while Nigerians are able to cross the border without any problem.

The road to Mamfe is seen as a big step towards development and away from the backwardness of the "hinterland". Another expected positive impact is seen in better market access since the people of Akwaya are solemnly dependent to the market in Amana - Nigeria. They state that the Nigerians rip them off and play tricks with them. Due to the lack of alternatives the people of Akwaya have to sell their products in Nigeria. Another problem, which is expected to be solved by the road is the criticised insecurity in the region. They are waiting for Cameroonian border posts to be installed in the region to stop Nigerian hunters, farmers and gatherers to cross the border and hunt, farm and harvest without permission or contribution to the traditional councils, or owners of the crops. The police forces in Akwaya (three men) are seen as ineffective and the road is expected to change that, because till now all officials only reach Akwaya through Nigeria.

#### **4.5. Description of the other projects in the region**

The enclavement of the region around the Mamfe-Akwaya road project has kept it away from the agenda of planners and development assistance. With the result that very few interventions have been noted here and very few plans concerning interventions in the area exist. Some of the actual and proposed projects of interest could be grouped into two:

- roads opening related project with the Akwaya-Amele, Akwaya-Wum and Mamfe-Njikwa road project ;
- the MINEF/GTZ « protection of forest around Akwaya » project.

#### **4.5.1. The Mamfe-Akwaya road project.**

This road project aims at improving the road to the Nigeria border. It should be noted that this road project is receiving increasing interest from the Government of Cameroon which disbursed 95 million FCFA for the participatory construction works. It is however clear that Mamfe-Akwaya road will lead to even more dependence of the area on neighbouring Nigeria.

#### **4.5.2. The Akwaya-Wum and the Akwaya-Njikwa roads projects**

These projects aim at connecting the region to the North-West Province. These projects most as well be planned in relation to the Mamfe-Akwaya road project.

#### **4.5.3. Protection of forest around Akwaya region project**

Takamanda and Mone forest reserves were established during the colonial period (1934 for Takamanda and 1951 for Mone) for timber production. Takamanda covers an area of 67,599 Ha while Mone covers 53,872 Ha. Both reserves have not been under any form of management. Thus they both face the serious threat of over exploitation of forest produce for commercial purposes. The over exploitation of NTFPs and wildlife by population in and around the reserves. Considering the serious threat posed on the resources in and around the reserves, the Cameroon government through the ministry of Environment and forestry (MINEF) with the assistance of the German Development Co-operation (GTZ) in Cameroon studied and formulated a project for the protection of the forest around Akwaya.

The project called protection of forests around Akwaya was studied and formulated in 1997 with financial contribution of GTZ.

The project has been designed into four phases:

- an orientation phase which begins from January 2000-december 2002 (3years) aims at putting up a concept for the protection of the Takamanda forest reserve and the sustainable management of natural resources of the surrounding area is elaborated in a participatory process with the populations.
- Implementation phase I scheduled to begin in January 2003 to December 2006 (4 years)

- implementation phase II; January 2007 to December 2010 (4 years)
- a complementary follow-up phase from January 2011 to December 2011(1 year).

#### **4.6. Description of the environmental evolution without the project**

In actual fact the Mamfe-Akwaya road seems to be the tract around which the disenclavement and the development of the area will take place. It is difficult to envisage sound action in this area without creating minimum condition of accessibility to market and other services. The impact of various interventions including that of the project for the protection of forest in the area of Akwaya could in such condition be very limited.

As for the other road projects, the one that is very likely to continue is that of the opening up of the Akwaya-Amele road towards the Nigerian border. This project is now receiving increasing support from the Government of Cameroon. It is however clear that finalisation of that project without the Mamfe-Akwaya road will lead to even more dependence of the area on neighbouring Nigeria

In such a context the evolution of the situation of the areas without the project as compared to that with the project is summarised in table 4.

**Table 4: Environmental evolution without the project**

<b>Environmental elements</b>	<b>Type of change</b>	<b>Type impact</b>
Physical	little change	positive
Biodiversity /biological	decrease in biodiversity	Negative
socio-economic	little change	Negative
tradition and customs	little change	Positive
National integrity	decrease national integrity	Negative
Development strategy		Negative

## **5. LEGAL AND INSTITUTIONAL FRAMEWORK**

### **5.1. General framework**

The 1994 constitution of Cameroon recognises the right of populations for a sound environment. It also considers environment protection as a collective responsibility.

EIA is prescribed by article 16 of the law N° 94-01 of January 20, 1994 to lay down forestry, wildlife and fisheries regulations for all projects, that can bring disturbances in forestry, or in the aquatic environment. More generally the master law N° 96-12 August 05, 1996 - related to environmental management - prescribes in its article 17 an EIA for all projects, that can cause environmental degradation.

A nation wide participatory exercise has been conducted to elaborate a National Environmental Management Plan, which try to achieve a sustainable development. This plan recommends EIAs as a mechanism to make sure, that the implementation of some projects does not negatively affect the environment.

The Ministry of Environment and Forestry (MINEF) was created in April 1992, with the mandate to elaborate, implement and follow up a national policy of the environment.

In October 1996 a decree reorganised the MINEF and established a Permanent Secretariat of Environment, with a department of sustainable development to ensure the effectiveness of EIA nation wide.

In general, the above legislative and institutional framework is not yet effective. To achieve this, the existing framework should be completed by application instruments. These application instruments should lay down the condition for carrying out an for validating environmental assessment studies, the role of each stakeholder, the norms for the quality control of the atmosphere, air, soil, in short all the receptors milieu. Also, approval and monitoring structures of impact assessment should be provided with adequate human and financial resources as well as equipment.

In practice, some studies have been carried out at the instigation of funding bodies for which they constitute a precondition for the funding of projects considered hazardous to the environment. The guidelines used are those of the donor institutions. In such a context, which lacks a national reference framework, it is not easy to assess the quality of EIA conducted.

### **5.2. Forest policy**

A forest policy was elaborated in 1992 in a broad-based consultation process and was finally approved by ministerial order in 1993. Subsequently a forest policy document on the national forestry Action programme (1994-1999) was produced. The forest policy stated that sustainable management of the Cameroonian forests through appropriate techniques, with the intention to minimise the negative impacts on the ecosystem and wildlife habitats, is a general objective of the Cameroonian government. Secondly all state-forests shall be located in the permanent forest domain

and shall cover at least 30% of the national territory and reflect the country's ecological diversity. Thirdly all state forests, including forest management units, under forestry exploitation licence must have a forest management plan. Such a management plan shall be elaborated with the participation and collaboration of the local population whose usufruct (users-rights) should be safeguarded as long as it does not compromise the biodiversity of the forest.

The GOC therefore enacted forestry law No. 94-01 of 20<sup>th</sup> January 1994 and subsequently its implementing decree No. 95/531 of 23<sup>rd</sup> August 1995 to provide the legal framework for the implementation of this policy.

### **5.3. Wildlife policy**

The wildlife policy of the GOC is still at the drafting stage. However, this does not mean non is being applied currently. The Wildlife Department has over the past 15 years implemented a de facto policy on protected area management and hunting though with some limited success due to the lack of a coherent policy document which is now taking root. A seminar on anti-poaching sensitisation was carried out from 10-11<sup>th</sup> October 1999 on which a strategy to deal with the problem of poaching was elaborated with the participation of all administrative, local, judiciary and the forces of law and other. A follow-up working group has been set-up.

The legal instrument of application of wildlife regulations is decree N 95-466 of 20 July 1999, and its orders which clarify certain issues not explained in the law. In addition to ministerial orders are ministerial decisions, and guidelines which explain the technical details involved in say wildlife management, hunting and preventive measures to protect and safeguard biodiversity. For example in order to ensure sustainable hunting the Minister shall upon advice open or close the hunting season in order to permit wildlife to reproduce. Another example is a contracted burning programme in some Savannah protected areas only.

As a policy, a participatory management plan is required for protected areas surround by populations. Hunting lists wildlife into 3 categories of protection A, B and C according to the pressure in the species and its conservation status.

### **5.4. Environmental management of roads**

The Cameroon Government in its framework of the politics of structural adjustment has put in place a general strategy of the transport sector.

The strategy of the transport sector has as objective, a better efficiency and a long-term development and coherence of the transport sector so that it could contribute to the economic growth of the country, to the reduction of poverty as well as to the protection of the environment. In order to put in place this strategy, the government has prepared a global programme called the "Sectorial Transport Programme"( STP) which has to be executed in many phases.

In the framework of STP, there is a specifically designed programme for the rehabilitation of the road

network and a programme for the maintenance of transport infrastructures with particular emphasis on the privatisation of work to be executed, the development of “Labour Intensive” techniques and the definition of a priority road network.

The necessity to take into account the environment in road works resulted to the creation in 1996 of the Environmental Protection Unit (EPU) in the department of roads in the Ministry of public work EPU went operational in 1997 and it is responsible for:

- The taking into account all aspects related to the environment, in collaboration with the ministries concerned.
- The elaboration and the vulgarisation of the directive pertaining to environmental protection issues, in collaboration with the other participants in the sector.
- The follow-up of the studies of the adaptation of the local eco-systems of the road infrastructures.

In 1997, the “ Directives for taking into account Environmental Impacts in Road maintenance” and “Studies of the Limitation plan of Environmental Impacts in Road Maintenance” by TECSULT consultant were published and authorised for use by the ministry of public works. These Directives are henceforth applicable to all allocations of road maintenance.

In 1998, an Environmental Evaluation of the entire Transport Sector was carried out by the consultant BUURSINK/RCM. this evaluation was financed by the World Bank.

As a consequence of these environmental dispositions, road maintenance works are becoming more and more the object of an environmental evaluation. Meanwhile, one observes a low cover of indirect and cumulative impact even though they are very important. Moreover, these studies do not give rise to plans of Environment Management of Roads which had to define the taking into account of the environment. Hence, the need to re-in-force the capacities of responsible structures as well as their degree of collaboration.

## **6. IDENTIFICATION AND CHARACTERISATION OF IMPACTS: MITIGATION AND ENHANCEMENT MEASURES**

### **6.1. Identification of impacts**

Identification of impacts was carried out using a matrix whereby the environmental factors were matched against project related issues. Table 5 presents the result of this exercise.

Table 5: : Identification of potential impacts

	Project related issues Environmental elements	HISTORY	PLANNING AND FINANCES	CONSTRUCTION	EXPLOITATION	POTENTIAL IMPACTS
<b>PHYSICAL</b>	<ul style="list-style-type: none"> <li>- Geology</li> <li>- Topography</li> <li>- Soils</li> <li>- Climate</li> <li>- Meteo</li> <li>- Underground-water</li> <li>- Water/surface</li> <li>- Air quality</li> <li>- Noise</li> </ul>		<b>X</b>	<b>X</b>	<b>X</b>	<ul style="list-style-type: none"> <li>- Soil erosion</li> <li>- Landslides</li> <li>- Soil inspection (impermeability)</li> <li>- Soil pollution</li> <li>- Air pollution</li> <li>- Surface water pollution</li> <li>- Underground water pollution</li> <li>- Noise</li> <li>- Perturbation of hydrological network</li> </ul>
<b>BIOLOGICAL</b>	<ul style="list-style-type: none"> <li>- Fauna</li> <li>- Flora</li> <li>- Biodiversity</li> <li>- Endangered species</li> <li>- Vulnerable habitat</li> <li>- Reserves</li> <li>- Hunting profile</li> <li>- Sites of interest</li> <li>- Commercial species</li> <li>- Ecosystem function</li> </ul>			<b>X</b>	<b>X</b>	<ul style="list-style-type: none"> <li>- Deforestation</li> <li>- Threat to wildlife species</li> <li>- Increased pressure on NTFP habitats</li> <li>-</li> <li>- Perturbation of wildlife habitats</li> <li>- Encroachment on forest reserves</li> <li>- Threat to special plant species</li> </ul>
<b>SOCIO-ECONOMICAL</b>	<ul style="list-style-type: none"> <li>- Population</li> <li>- Settlers</li> <li>- Land-use</li> <li>- Farming</li> <li>- Hunting</li> <li>- Fishing</li> <li>- NTFP gathering</li> <li>- Schools</li> <li>- Health</li> <li>- Market</li> <li>- Security</li> <li>- Courts</li> <li>- Government policy</li> <li>- Level of income</li> </ul>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<p><b>Easier access to:</b></p> <ul style="list-style-type: none"> <li>- Health</li> <li>- Water</li> <li>- Education</li> <li>- Government services</li> <li>- Markets</li> </ul> <p><b>Increase in income from:</b></p> <ul style="list-style-type: none"> <li>- Hunting</li> <li>- Farming</li> <li>- Harvesting</li> <li>- Trading</li> <li>- Fishing</li> <li>- Animal husbandry</li> </ul> <p>Exposure on traders Increase of settlers Change of land use</p>
<b>TRADITIONS &amp; CUSTOMS</b>	<ul style="list-style-type: none"> <li>- Social structure</li> <li>- Migrations</li> <li>- Belief system</li> <li>- Rituals</li> <li>- Local languages</li> <li>- Trad. knowledge</li> <li>- Trad. medicines</li> <li>- Gender</li> </ul>			<b>X</b>	<b>X</b>	<ul style="list-style-type: none"> <li>- Change in social structure</li> <li>- Loss of rituals</li> <li>- Change in belief systems</li> <li>- Loss of local languages</li> <li>- Loss of indigenous knowledge</li> <li>- Loss of traditional medicine</li> <li>- Women improvement</li> </ul>
<b>REGIONAL PLANNING</b>	National integrity Development strategy	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>	<ul style="list-style-type: none"> <li>- Contribution to the security of national identity</li> <li>- Availability of a base for the elaboration of participatory development plan</li> </ul>

## **6.2. Characterisation of impacts: Mitigation and enhancement measures**

Table 6 summarises the characterisation of impacts. On that table, impacts were weighed with characteristic including the type, the relationship to the project, intensity, extend, duration, frequency, probability of occurrence, importance and effectiveness of the mitigation or enhancement measures proposed.

Table 6: Characterisation of Impacts

Environmental elements	Impacts	Type	Relationship	Intensity	Extent	Duration	Probability of occurrence	Frequency	Effectiveness of proposed action	Indicators importance	
PHYSICAL	- Soil erosion	Negative	Dir/Indir	High	Wide	Continuous	Certain	Often	Less effective	Very important	
	- Landslides	Negative	Dir/Indir	High	Localized	Long-term	Very probable	Rare	Less effective	Important	
	- Soil inspection (impermeability)	Negative	Dir	High	Localized	Continuous	Certain	Often	Less effective	Less important	
	- Soil pollution	Negative	Dir/Indir	High	Localized	Continuous	Certain	Rare	Less effective	Important	
	- Air pollution	Negative	Indir	High	Wide	Continuous	Certain	Often	Less effective	Very important	
	- Surface water pollution	Negative	Indir	Low	Wide	Continuous	Certain	rare	Less effective	Very important	
	- Underground water pollution	Negative	Dir	High	Localized	Continuous	Very probable	Often	Less effective	Important	
	- Noise	Negative	Dir	Low	Localized	Short-term	Certain	Rare	Less effective	Very important	
- Perturbation of hydrological Network	Negative	Dir	Dir	High	Wide	Continuous	Certain	Often	Less effective	Important	
BIOLOGICAL	- Deforestation	Negative	Dir/Indir	High	Wide	Continuous	Certain	Often	Effective	Important	
	- Threat to wildlife species	Negative	Dir/Indir	High	Wide	Continuous	Certain	Often	Effective	Very important	
	- Increased pressure on NTFP habitats	Negative	Indir	High	Wide	Continuous	Certain	Often	Effective	Very important	
	- Perturbation of wildlife habitats	Negative	Dir/Indir	Medium	Wide	Continuous	Certain	Often	Less effective	Important	
	- Encroachment on forest reserves	Negative	Indir	Indir	Medium	Localized	Continuous	Very probable	Often	Effective	Important
	- Threat to special plant species	Negative	Dir/Indir	Dir/Indir	High	Localized	Continuous	Certain	Often	Effective	Very important
SOCIO-ECONOMICAL	<b>Easier access to:</b>										
	- Health	Positive	Dir/Indir	Medium	Wide	Continuous	Very probable	Often	Effective	Very important	
	- Water	Negative	Dir/Indir	Medium	Wide	Continuous	Very probable	Often	Effective	Important	
	- Education	Positive	Dir/Indir	High	Wide	Continuous	Very probable	Often	Effective	Very important	
	- Government services	Positive	Dir/Indir	Medium	Wide	Continuous	Very probable	Often	Effective	Important	
	- Markets	Positive	Dir/Indir	High	Wide	Continuous	Very probable	Often	Effective	Very important	
	<b>Increase income from:</b>										
	- Hunting	Positive	Dir/Indir	High	Wide	Continuous	very probable	Often	Effective	Important	
	- Farming	Positive	Dir/Indir	High	Wide	Continuous	Very probable	Often	Effective	Important	
	- Harvesting	Positive	Dir/Indir	High	Wide	Continuous	Very probable	Often	Effective	Very important	
	- Trading	Positive	Dir/Indir	High	Wide	Continuous	Very probable	Often	Effective	Important	
	- Fishing	Positive	Dir/Indir	Medium	Wide	Continuous	Very probable	Rare	Less effective	Very important	
	- Animal husbandary	Positive	Dir/Indir	Medium	Wide	Continuous	Very probable	Rare	Less effective	Important	
	- Exposure on traders	Negative	Dir/Indir	High	Wide	Continuous	Very probable	Often	Less effective	Very important	
- Increase of settlers	Negative	Dir/Indir	Medium	Wide	Continuous	Very probable	Often	Less effective	Important		
- Change of land-use	Positive	Dir/Indir	Medium	Wide	Continuous	Very probable	Often	Less effective	Very important		
TRADITIONS AND CUSTOMS	- Change in social structure	± ve	Indir	High	Wide	Continuous	Very probable	Often	Less effective	Very important	
	- Loss of rituals	± ve	Indir	Medium	Wide	Long-term	Very probable	Often	Less effective	Important	
	- Change in belief systems	± ve	Indir	Medium	Wide	Long-term	Very probable	Often	Less effective	Very important	
	- Loss of local languages	Negative	Indir	Low	Wide	Long-term	Very probable	Often	Less effective	Very important	
	- Loss of indigenous knowledge	Negative	Indir	Medium	Wide	Long-term	Probable	Often	Less effective	Very important	
	- Loss of traditional medicine	Negative	Indir	Medium	Wide	Long-term	Probable	Often	Less effective	Very important	
	- Women empowerment	± ve	Indir	High	Wide	Long-term	Less probable	Often	Less effective	Very important	
REGIONAL PLANNING	- Contribution to the security of national identity	Positive	Indir	High	Wide	Continuous	Probable	Often	Effective	Very important	
	- Availability of a base for the elaboration of participatory development plan	Positive	Indir	High	Wide	Continuous	Probable	Often	Effective	Very important	

## DEFINITION OF TERMS:

- Type:** States whether an impact is negative or positive
- Relationship:** gives link between the impact and the project:
- *Direct impact* means it is directly caused by the project and
  - *Indirect impact* mean the impact is induced by project.
- Intensity:** Measures the intensity with which the impact occurs. Three classes were distinguished :high, medium and low.
- Extend:** gives an indication of relative geographical coverage of the project; the relative number of village concerned by the impact, two classes were distinguished
- *limited:* concerns less than 25% of the factor interest
  - *Wide:* for more than 25% of the factor of interest.
- Duration:** indicates the temporal distribution of impact : three classes are distinguished here
- *short term:* to describe an impact that only occurs during the implementation of the project and just (less than one year) after;
  - *Long term:* describe an impact that appear later (more than one year) after the implementation of the project
  - *Continuous:* describes an impact that appears from the time of project implementation and goes on during the exploitation phase
- probability of occurrence:** This indicate the chances that the impact occurs: four classes were distinguished here:
- *certain* 90 - 100%
  - *very probable* 75 - 89%
  - *probable* 25 –74%
  - *less probable* < 24%
- Frequency of occurrence:** this indicates how often the impact is likely to occur. Two classes are distinguished:
- *often*
  - *rare*
- Effectiveness of mitigation and enhancement measures:** This indicates effective measures proposed for mitigation or enhanced could be two classes used were:
- *effective:* to indicate that the measure proposed could be than 50% successful;
  - *Less effective:* to indicate that the measure proposed could be less 50% successful.
- Importance :** determines the importance of the impact. It is a valued judgement supported by the characteristics of the impact, the domain or aspect affected etc. For example an impact related to health or the valorised elements of the environment such as protected areas would be considered important. Three classes were distinguished:
- *Very important*
  - *Important*
  - *Less important*

### 6.2.1. The impacts of history, planning and financing of the road project

The history of the road project has negative impact on the population because the period of waiting for this road has been long, making them to be frustrated. There is a general feeling by the population that they are abandoned to themselves. This has consequence on national integrity as population are forced to depend on Nigeria for their existence. Also this over shadows the prospect for having a sound development strategy.

Planning here relates to the way the proposed road is to be realised as well as the different stages and different time scales for the whole project. The road is presently conducted without adequate planning despite the fact that in 1981 a complete survey of the road was done. Different phases are handled by different contractors. More than one contractor are involved in the bridge to be constructed at Nyang. The consequence is that there is disorder and lack of co-ordination in management or project resulting in situations like the opening up of the Nyang-Mbu road without bridges and culverts.

The poor planning is due to, or aggravated by the financial situation of the project. The national policy as far as road are concerned i.e. Government priority now is on existing priority roads. This might explain why the Akwya road which being in-existent does not fall into the list of priority roads managed by Government. As for the moment the resources mobilised for this road seem insufficient and not guaranteed.

### 6.2.2. Impacts on the physical environment

**Erosion** results in removal of vegetation cover at the base camps, as well as areas of quarries and borrow-pits areas installed. Mindful of the soil texture at Atolo, erosion can cause landslides in that zone. Erosion can also affect courses of streams by silting their beds and also the turbid nature of water.

Between Mamfe and Mbu where the road is already bulldozed there is considerable erosion in some place due to very steep slopes. The road is cut into sections at most place due poorly constructed culverts and wooden bridges which were swept away by running water. This induces further increase erosion on both sides of the road.

**Landslides :** As noticed above, the texture of the soil can already prepare it for landslides. During excavation, the contractor has to obtain the coefficient of friction of the soil in the mountainous zone in order to decide on how to do his construction. During the exploitation phase material from landslide can obstruct the road and render it impassable.

**Impermeability of the soil:** This phenomenon results from the compaction of the soil on the surface of the road, which reduces the permeability of the road in what concerns underground water in areas that are localised. This phenomenon remains permanent during the exploitation phase of the road especially for the band used by traffic.

**Soil pollution :** This is observed during the opening up of the road as well as during the exploitation

phase of the road. During road construction this result from poor management of waste oil and toxic products. They also result from poor handling toxic products at base camp.

During the exploitation phase, pollution is caused by motor accidents transporting hydrocarbons and emptying of used oil on sidewalks.

This pollution does not only affect the soil but underground water too.

**Air pollution:** This results from dust particles during work (in quarries, moving vehicles in the site) and during the exploitation of the road. It may also be caused by gas emission (CO<sub>2</sub>, CO, PbO) from engines. These cause respiratory diseases like cold and Asthma in areas affected.

**Noise pollution:** This affects wildlife in the neighbouring reserves, and result from noise from motor engines during and after work. This noise causes wildlife to go further away and this leads to perturbation in their habitats.

**Perturbation of hydrological network:** This is a consequence of blocking or deviations of waterways, during construction or maintenance work. When appropriate bridges or culverts are not made available, the road itself may constitute a barrier to natural flow of rivers.

In some cases swamps develop on roadside making it unpractical. Deviations towards areas that are sensitive to erosion aggravate the phenomenon and induce big landslides. This phenomenon which is very frequent on steep relief in areas of fragile soil is of the time irreversible.

### 6.2.3. Mode of management

Commonly prescribed mode of management of the above impacts include:

#### 6.2.3.1. *During the installation of the site*

For visual and sound nuisance arising from the installation of the site, the following prescriptions are applicable:

- The chosen site must be at a distance of at least:  
30m from the road  
50m from living quarters.
- The site should be chosen in such a way as to reduce to a minimum the felling of trees. Trees of quality species must be preserved.
- The site should be chosen outside sensitive zoned (e.g. forest reserves, wildlife reserves, etc). For the management of slip waste products arising from the installation of the site, garbage cans should be installed near to the centres of activity. Such cans must be emptied regularly in a deep dug out for this purpose and which should be situated at least 50 m from the activity centres and not less than 100m from the nearest stream. Such a pit must be provided with a lid and adequately protected by a good drainage system. The solid toxic wastes shall be treated separately outside the installation site. At the end of the execution of work, the deep pit shall be filled with earth up to the level of the natural terrain.

For the management of dust particles, the access roads must be compacted and watered periodically.

All waste oils shall be kept in drums before being collected re-use for other purposes.

Waste oil removal areas and storage areas for toxic materials must be concreted in order to prevent any infiltration into the soil.

At completion, the entire installation site must be rehabilitated this effect must be attached to the report of the reception of work.

#### 6.2.3.2. *During the execution phase of the road*

For visual nuisance arising from the opening of access roads to the borrow pits and quarries,

- The borrow pit or quarry must be situated at least 50m from the main road
- There must be a road linking the main road to the borrow pit.
- The surface to be excavated must be proportionate to the volume of material necessary to do the work and taking into consideration the dumping area for the vegetal soil and the access roads.
- At the end of the exploitation, the sites must be rehabilitated by:
  - 1 The treatment of the desired material and the treatment of the vegetal soil
  - 2 The re-establishment of natural flows
  - 3 The maintenance plantation if stipulated. A dually signed report to this effect must be attracted.
- For sound nuisance arising from the noise of the equipment, the sound proof system of the machines must be regulated to a maximum.
- For sound nuisance arising from explosives, a quarry must be opened at a distance of more than 300m from residential areas. Just before the explosions, particular precaution must be taken in order to maintain a safety margin of at least 500m radius.
- For nuisance arising from dust particles, the access roads must be watered periodically.
- For gaseous waste products arising from exhaust pipes of moving equipment, the filter elements must be systematically replaced following the periodicity prescribed by the manufacturers.
- For solid waste products resulting from the execution of work, they must be deposited at specific areas confirmed by the controller of the work (supervising engineer) and in such away as not to disturb the natural flow of water.
- For liquid and solid waste products resulting from the maintenance of the equipment, it is recommended that all maintenance works should be carried out in the base camp where all precautionary measures have been taken. In major cases, precaution must be taken to avoid contamination of the soil.

#### 6.2.3.3. *During the exploitation phase of the road*

For sound nuisance, dust particles and gaseous by-products, it is recommended that all newly constructed residential settlement should be located at least 50m from the road.

For road accidents, it is recommended to put road-tumps after every 200m where the road passes through a town.

For the remain of vehicles along the roadsides they should be systematically removed by the competent services of the road safety campaign.

#### **6.2.4. Impacts on biological factors**

Part of this section is better developed under the chapter dealing specifically with the relation project and biodiversity. The Mamfe Akwaya road may have a positive impact on prunus given that the staff of Ministry of the Environment and Forestry in Mamfe could visit the areas of exploitation through Akwaya once the road gets to or nearer to Akwaya town. There is however an urgent need to investigate and address the prunus situation in Akwaya subdivision.

The present study aims at assessing the environmental impact of the construction of Mamfe-Akwaya road on the forest resources in the immediate vicinity of the road and within a secondary zone.

The immediate impact of the road would be felt within five hundred meters of the road trace. Within this area, the vegetation would be pushed down within eight meter of pavement of the road and to about fourteen (14) meters, of the seven meters to both sides of the road for clearing to allow sun light onto the pavement. A further eight meters, four on each-side of the road is expected to be disturbed by branches of trees that are pulled down from the bulldozing of the side clearing. Debris left in both sides of the road will constitute another major distinction. The study of the Biological aspects was the duty of our team, which had to dwell on forestry and wildlife and bio diversity.

Some of the impacts include:

- Total deforestation of a stretch of about twenty to thirty widens all along the 105 km of road to Akwaya. This will be followed by extension of farms along the road trace.
- The debris constituted by trees pulled down during bulldozing at the sides of the road would provide a suitable ground for the proliferation of secondary species such as musanga. Construction of wooden bridges economy felling of trees. These destroy some wood resources and biological diversity.
- The opening of the road as observed will increase illegal timber exploitation of various species with to kilometres on both sides of the road trace, on aspect which was observed along the sides of the road that has already been bulldozed up to Nyang village. This exploitation is encouraged due to the easy access and evacuation through the constructed road.
- The road will increase poaching which is already at a very high and unattainable level. Hunting and trapping are major activities for most adult males in the area down from Atoto to Nyang. Hunting of protected species is very rampant and without any form of control. Trapping is a destructive and indiscriminate form of hunting. Some young-men put up to 400 traps which are visited every four-days. The result is that most of the time

the catch is found in an advanced state of decomposition by the next visit and abandoned in the bush or only very little is recovered from such decomposed animals catch.

Total deforestation of a stretch of twenty five to thirty metres wide along the 38 km already constructed and a further 70-km from Mbu to Akwaya still to be constructed.

This is followed by extensive deforestation on both sides of the road for clearing to open up farms along the road. It is estimated that in the next few years following the opening of the road through to Akwaya, about 321 Ha will be affected by the road. Secondary vegetation will develop on more than two-thirds of this area in the next few years.

The greater impact will be from deforestation due to opening of more forest for farm along the road. Existing farm will be extended to produce more produce for the market. This is evident from the aspirations of the population met through out the road trace. Many more youth returning to the village will also need farm land to establish their own farms for subsistence and to produce for the market since evacuation will be made easier by the road.

Noise from the engines bulldozing the road will scare bigger mammals far from the habitat. The noise also makes elephants and buffaloes wild thus destroying crops on their way. However this could be also temporal as the wildlife return when noise subsides. The road trace passes very close to the Takamanda and Mone forest reserves, in some area. This is the case at Mukoyong, Nyang, Mbu and Akwa all very close to the Mone forest reserve and Tinta, Mbilighi, Basho which are close to Takamanda FR. There is the possibility of extending farms to gain much more income for agriculture, occasioned by the opening of the road leading to increased encroachment into the reserve the exploitation of NTFPS like randin capolobia, Gnetum, wingia, rhicnodendron would be on the rise. These could now easily be evacuated to Mamfe or Akwaya by the road.

#### *6.2.4.1. Some recommendations related to forest management during road construction*

Some recommendation related to forest management during the construction of the road include:

- 1- All felled trees or those pulled down during bulldozing should be carefully cut for fuel wood for the villages or road users.
- 2- Employees of the road Construction Company should refrain from exploitation of timber and wildlife. Non of their vehicles should carry either timber or wildlife.
- 3- Sensitisation carping should precede or closely follow the opening of the road to inform and educate the population on the probable means and methods of resources, timber, wildlife, NTFPs, fish
- 4- Any exploitation of resources within the corridor of the two reserves and even in the reserve should be done with in strict compliance with the regulation binding the forestry activities and only within the framework of a prior management plan drawn up participatory will all major actors and interested parties.
- 5- Road should avoid slopes of more than 10, as this will considerably increase soil erosion, which accelerates road degradation.
- 6- Most of the felled exploitable species are abandon be reserve for sale or for use of local

population immediately after filling.

### 6.2.5. Impacts on the socio-economic factors

#### Summary

If the prospected road from Mamfe to Akwaya follows the recommendations of HOLFELDER PLAN from 1981, it will effect the life of nearly 20.000 people in the area of direct impact (500m on both side of the road). This high figure (170 inhabitants per square kilometre) arise from the objective of the HOLFELDER PLAN proposal, to connect as many villages of the Akwaya subdivision as possible through Mamfe with the Cameroon territory. The road will indirectly change the lifestyle of all inhabitants of the Akwaya subdivision (around 50.000 people). Even villages, which are one or two days tracking away from the prospected road, will be effected by the road in their socio-economic structures, because due to the fact that no other road exists in this region, the Mamfe-Akwaya road will be their link to the rest of the world.

**The main positive socio-economic impact of the road can be seen in its contribution to the alleviation of poverty in the Akwaya subdivision.** Since poverty is a structural and individual phenomena, poverty alleviation has to take both aspects into consideration. The road is expected to offer better access to infrastructure like health care, clean water, education and government services and through that helps to reduce the structural dimension of poverty, while better economic opportunities - especially better access to markets - are expected to contribute to the alleviation of the individual dimension of poverty.

#### Easier access to infrastructure

The detailed descriptions of and judgements on the different socio-economic impacts, which are expected to arise from the construction of a road from Mamfe to Akwaya, has to be seen in this context of poverty alleviation. First the structural impacts - such as easier access to infrastructure, etc. - are discussed, before the individual impacts - better economic opportunities, etc. - are analysed. In the last step the expected negative impacts, which could arise from the exposure of the villagers to the outside world, are taken into consideration. Special emphasis will lie on the recommendations of our proposed road management plan and their ability to reduce the negative impacts and to strengthen the positive impact.

The **better access to health care** - such as hospitals, vaccinations, medical services and pharmacies - has to be understood as a positive impact of the road. In all villages the terrible health situation was seen as a direct impact of the non-existence of a road. The prospected road will influence the health situation in the villages directly and indirectly: The population around the basecamp will be able to receive in cases of emergency, first aid service from the contractors, or in other cases, a lift to the hospital in Mamfe. In general one can say, that each kilometre of accessible road reduces the distance, which a sick person has to track to see a doctor. These positive impact are - in our perspective - able to overshadow the negative impact in the area of health care and especially the introduction of sexual transmitted diseases through the construction workers, because this risk seems to be quite low. The CWEPR has strict rules for their workers in that perspective, with the effect, that the workers of CWEPR are known in the Mamfe region for their "monk"-lifestyle. The indirect impact will arise from the fact, that governmental medical services in charge of

vaccinations and community health care are said to prefer villages, which are accessible by road, than those which are far away. While at the moment tablets of dubious origin are spread all over the region, a road will allow the villagers or traders to introduce and import better pharmaceuticals products. Since the situation in such a sensitive area can never be the subject of dramatic changes, we characterise the intensity as medium, while the extent will be wide, because the whole region will be effected if no other road is accessible at closer range. As said in the description of the region and the perception of the road, the people are waiting for the road, because of the better access to health care, so it can be expected that this impact will effect the whole region continuously. From the above follows, that the impact will very probably occur. The villagers as well as the EIA-team understand the easier access to health care as a very important impact of the road. To support this positive impact, we propose the promotion of community based health care. We are of the opinion, that the training and sensitisation of the population in combination with the better access to hospitals and pharmacies, can be an effective method to reduce the disgusting health situation in the villages of the Akwaya subdivision. The management team of the road will be able to judge on the health situation and the effectiveness of the proposed activities, by consulting the health reports of the MINSANTE-representatives in the Akwaya subdivision. Another indicator could be the number of villagers from that region, who are attending the district hospitals.

The **easier access to clean water** can be seen as an impact of a bias quality, because at the moment the villagers along the road do not need access to manufactured or tap-water, because the streams offer superb and clean water. The increase of farming and the consumption of modern products caused by the road, will endanger this water quality, as we said in the description of the physical impacts. This negative aspect of the road effects on the one hand already the villages along the existing road to Nyang. On the other hand, the road makes it easier to transport manufactured clean water to the villages and even makes the village accessible for development assistance in form of water projects, etc.. Overall we have to say that the impact of the road towards the access to clean water will be more negative than positive, because without the road, the villages would not need access to manufactured clean water in the near future. The road project will have a direct and indirect impact on the water quality and the access to clean water, because not only the road construction itself pollutes the water, but also the increase of farming, which is another impact of the road. The intensity can be expected to be of medium intensity, but of wide extend, because on the one hand water pollution effects always huge areas and on the other hand villagers are prepared to carry clean water for hours to secure the life of their family. The medium intensity is related to the continues duration of the impact, because the need for manufactured clean water is closely linked to the increase of the pollution. While in the first years after the road construction, the water will be still drinkable, the pollution of water will once reach a point, where tap-water or wells become essential for the survival of the villagers. Due to the fact that most villagers stated to be interested in an increase of farming, the impact on the access to clean water has to be expected as very probable and will take place in most villages. The EIA-team characterises this impact as an important, but not very important impact of the road, because the road only speeds up an existing process. Village based water projects - one was established 1997 in Eshobi and granted by the US embassy - to secure the access to clean water is our proposed activity to reduce this negative impact. Indicators to measure the negative and positive impacts, related to water can be estimated directly from the number of existing water projects and indirect through reports on the quality of water in the region and water related diseases, which are part of the normal reports on the health situation of the Akwaya subdivision. We expect that the negative impact on the access to clean water, which arise

from the road construction, can be reduced, if our recommendations are put to practice.

The **easier access to education** can be seen as a positive impact, which will effect the life of the villagers directly and indirectly. The direct impact can be seen in the easier and more secure way to school. At the moment in some places the children are forced to swim through rivers or to use very dangerous bridges to reach the school in the next village. The indirect impact could be seen in the easier access for trained teacher and teams, which promote better and higher education. School books could be sold on the markets and replace the often hand-written copies of old books full of mistakes, which are used at the moment. The intensity of this impact will be high, because if the villagers are able to compare their teaching equipment, with the one used in towns, they will force the authorities to increase the quality and quantity of education in the region. The duration will be continuously, because the improvement of education, which arise from the easier access to it, can never finish. Based on that, it seems very probably, that the easier access to education will result from the construction of the road. The frequency will be high, because all villagers claimed, that education is important for the development of their children. The EIA-team understand the easier access to education as a very import impact of the road construction. The positive impact can be supported, if the population is sensitised on the importance of education and if the quality of teaching is improved. We also think that especially technical and adult education should be promoted. MINEDUC and NGOs are seen as main actors in the fight against illiterate villagers and poor educated teachers. Indicators of the impact and means of verifications for the effectiveness and our recommendations are the percentage of the literate population, the number of children enrolled in school, the number of students enrolled in institutions of higher education, the number of trained teachers working in the region, the number of school books available to pupils and teachers, the number of school buildings and the number of classes offered for adults. In the long run we expect these activities to be effective and as an important contribute to the development of the whole region.

The **better access to governmental services** such as police, court, social insurance and telecommunication are seen as a positive impact, because the villagers claim, that these services are important for them. However, it is worth to mention, that negative impacts could occur from the easier access of the governmental services, because most of the villagers are neither paying tax, nor having a licence to hunt, harvest or sell. The road has a direct and indirect impact on the access to governmental services, because the road itself makes it directly easier for the services to visit the villagers vice versa and the better connection of Akwaya will indirectly improve the services stationed there. After 40 years of stagnation, the changes can only be expected to have a medium intensity, but they will effect a wide range of villages and have a continuous duration. The impact will occur very probably and will have a high frequency. We think that this impact is not very important, but since the villagers said, that the easier access to the governmental services is important for them, we do not want to expose our opinion on them. The sensitisation of the population on the role of governmental services and the promotion of efficient and professional administration, which we propose, will contribute to the strength of this impact. Indicators could be seen in the perception of the governmental services by the villagers and the rate of satisfaction with the offered services. Our recommendations will effectively contribution to a better relation between government and the population and could even become a milestone in a process of democratisation.

The **easier access to markets** is an impact related to the structural sphere of infrastructure, as well as the individual sphere of economy. The easier access to markets will improve the lifestyle and the

income of the villagers and can be seen as a positive impact, because it helps to reduce the poverty in the region. The road will influence the increase of markets in the region directly - through the easier access by cars and trucks - but also indirectly, because the villagers of the whole region will come and sell their goods at the roadside. Till 1995 Eshobi was the main market for products of the Akwaya subdivision, but since Nyang is accessible by car, products of the whole region are carried to Nyang for sale. The intensity of this impact will be high, the extend wide and the duration continuously. As it already effects all villages along the road, the frequency of this impact will be high and it can be expected, that it occurs very probably. We see the easier access to markets as a very important impact of the road, because the whole concept of better economic opportunities is strongly related to the access to markets. An important indicator for the whole range of increased economic activities as well as the access to infrastructure, can be seen in the costs of transport. We think that the strength of these impact can be improved, if the population and especially the market women are trained and supported with technical assistance, etc.. The level of dispersion of markets, documented in reports, can be seen as another indicator for the expected effectiveness of our recommendations.

### **Better economic opportunities**

On the markets, which are easier accessible as a result of the road (see picture 5), the villagers will sell their products. As one can see from the description of the social environment, the main sources of income are hunting, gathering of NTFPs, fishing, farming and trading. As a result of the road, all these income generating activities will increase directly through the demand of the construction workers and indirect through the better accessibility. To secure this impact we recommend the establishment of a participatory forest management plan and the promotion of other income generating activities. For the whole set of economic activities the quality and quantity of products, which is documented in the reports of the different governmental services, can be used as an indicator for the effectiveness of our recommendations. We expect them to be effective.

The **hunting will increase** as a result of the road and has to be seen from the societal perspective as a positive impact, because it generates the financial sources to change the farming system. The increasing cash flow, related to the increase of hunting, can be understood as source of the primary accumulation of capital among the villagers. The hunting will increase heavily and effect a wide area. It will very probably and often occur, but it will be of short duration, because the wildlife will be reduced soon to an extent, where hunting is no longer an easy source of income. Because the increase of hunting is a short time impact of the road, it is not very important, but on the other hand it is quite important in its function as source for the creation of available cash. The positive short term impact of an increased monetary income lead to a quite negative long term impact: in the long run the increased use of the natural resources (wildlife and NTFPs) will reduce the income opportunities from these sources in the future to zero. In view of this danger, it is very important that the villagers are introduced to other income generating activities, sustainable forest management and professional forms of farming, while the road is still far away. Only than the increased hunting can become a contribution to a sustainable reduction of poverty in the region. If they spend their whole income from hunting on beer and consuming modernity, their "better life" will be of short duration and they will find themselves in the long run poorer than before.

The expected **increase of harvesting of NTFPs** has to be seen as a positive impact of the road construction, because it offers the population a powerful source of income. In opposition to the other income generating activities, harvesting is only indirect a result of the road construction, because all

villagers denied, that the construction workers buy NTFPs. As hunting, the increase of harvesting is a short term impact, with a high intensity and a wide extend. It will very probably and often occur. The increased harvesting activities will contribute to the monetary fond, from which the intensified farms can be sponsored, but in the long run and in relation to the other sources of income, it is not very important. It can become an important element of the alleviation of individual poverty, if our proposed concept of a village based natural resource management is put to practise.

The expected **increase of fishing** in the rivers along the road is another positive impact, which arise from the road construction. The villagers will sell their fishes to the construction workers, as well as on markets, which are now easier accessible, so that the increase of fishing can be seen as a direct and indirect impact of the road construction. In the discussion with the villagers, they said, that fishing is not a major source of income, which they want to increase in the future. Due to that it can be expected, that the intensity will be medium, but with a wide extent, because dried fish can be carried and stored for days and weeks. Due to the fact, that the intensity of fishing and the expected increase is not very high, fishing can be of continues duration and an element of a sustainable cash flow. It can only occur in villages, which have a river, so the frequency will be low, even though it is very probable, that it occurs in these villages. In view of the whole region and the overall process of development, the increase of fishing can be seen as a less important impact.

Another less important positive impact is the **increase income from animal husbandry**. It arises like all other economic impacts directly and indirectly from the road construction. The people are not yet aware of the chances to generate money from the sell of animals, so the extent can be expected to be medium, but of continues duration. The frequency will be due to the lack of interest low, but it seem very probably, that an increase of animal husbandry will occur. A training and promotion programme, which we propose in the road management plan, will be an effective instrument to introduce animal husbandry as a new and sustainable form of income generating activity.

In the sphere of economy the most important change related to the road, will be the **increase of farming**. It is an ongoing impact and will occur directly - through the installation of farms on the opened up land at both sides of the road - and indirectly - inside a forest, which is than easier accessible - as a result of the road construction. According to the different preferences and different forms of soil, some villages will plant cocoa, coffee or oil palms, others rice and some will use the easy accessibility to produce food-crops. In all villages the farming will increase, because in the places without a road connection, the people explained their low range of crop production, with the enormous costs of transportation. In some villages the men have already started to clear land for new farms to be prepared, when the road connect their village with the markets. The villagers will use the road to have easier and faster access to the markets and based on that, increase their production. Up to a certain level this will be achieved by opening up more land, but in the long run a system of intensified farming will occur in the region. A result could be, that the societies along the road transform in the long run from hunter and gatherer societies to peasant societies. The impact will be of high intensity, of wide range and continuous duration. Due to the fact, that the increase of farming will effect the whole society and is expected to happen often and very probably, it has to be seen as a very important impact of the road construction. The change from subsistence farming to intensified farming can only become an instrument of the alleviation of individual poverty, if the different governmental and non-governmental services assist the villagers in that change, as we proposed in the road management plan. The level of farm production could be used as an indicator for the change

in the farming system as well as a measurement for the effectiveness of the recommended activities. We hold the view that our recommendations are able to be an effective contribution to establish farming as the economic backbone of the villages and to replace hunting as main source of income in that region.

Another positive impact is strongly related to the establishment of markets: the expected **increase of income from trading**. Already during the construction of the road, the villagers will start to sell all kind of goods to the workers and use the villages along the road as supply stations for the hinterland. As the other activities, which generate income, the increase of trading, is seen as a positive impact, which results directly and indirectly from the road construction. It will be of high intensity and will effect a wide area, because in the villages along the existing road up to ten shops and bars exist already and villages up to five hours by food, are effected by this increased trade. Based on these experiences, we can say, that the increase of trading will very probably and often occur, when the road connects the villages with the outside world. It is a very important impact of the road, because it offers the villagers and especially the women, income from the consumption of modernity. It will be of great importance for the empowerment of women, which are carrying out most of the trade in the villages. In the sphere of trading, we recommend a programme to promote credit unions and trade organisations etc. The number of effective credit unions can be one indicator for the effectiveness of the proposed activities, but one has to realise, that trade can never contribute to the alleviation of poverty, because it does not generate goods. If the revenue of the other sources of income (hunting, gathering, farming and fishing) is not reinvested and secured through credit and saving unions, the traders will face a long term increase of poverty. One can see, that only a participatory development plan for the whole region, which takes all these different impacts and dimensions into consideration, seems to be able to secure the advantages, which arise from the road. The different activities, which we propose in our road management plan and which were discussed with the population, have to be seen in that perspective. As an ensemble they are able to use the road as an instrument to reduce the structural and individual side of poverty, but - as always, if one talks of human beings - the road could also increase the poverty of the region, if the positive impacts are not secured and the negative impacts are not reduced.

The road will force the villagers to **change their way of land use** from a system of shifting cultivation, to an intensified farming system. We see it as a positive impact, because it enables the villagers to generate more income from farming. On the other hand, they will need fertilisers and pesticides in the long run to farm effectively. The relationship to the road project can be seen as direct and indirect, because the villagers will use directly the opened up track to establish their farms and are indirectly forced to change their farming system by the better chances to sell on large scale. As the increase of farming activities, the change in the land use is very intensive and effects a wide area. It will be of continuous duration and will very probably and often occur. We see it as very import impact, because it effects not only the land use, but also the question of private ownership of land, installation and sell of land titles, etc.. The change of land use can be seen as an indicator of the change of society, which results indirectly from the road. While a hunter and gatherer society has no need for individual land titles, a peasant society is based on them. The increasing need for governmental services, such as courts, etc., can be seen in that perspective. The number of court cases on conflicts about land ownership is an effective indicator for the change in the land use. We recommend the promotion of community forests and community land use committees to secure, that the land use titles stay inside the villages and are not soled by individuals, but by the communities.

This recommendation is seen as an effective instrument to promote the change of land use and to secure a harmonic land ownership system.

### **Negative Impacts**

A negative impact, directly and indirectly related to the road, is the **exposure of the villagers to foreign traders**, who blackmail the cash, which is generated by the increased economic activities in the villages. It is quite common, that traders occur in villages to sell useless things for enormous amounts and pay less than nothing for the products of the villagers. The transport fee from and to the villages already connected to Mamfe by road can be seen as an illustration of the negative impact of traders to the village: the drivers and owners of the cars, which are not indigenous of the region, take 2500 FCFA for the transport of one person without luggage to or from Nyang. For a 50 l container of palm oil, they take another 2500 FCFA. Normally a short wheel based Land Rover carries up to 15 people and in addition up to one tone of goods, which gives the non-indigenous "trader" 87.500 FCFA for a 32 kilometre trip! It is not the intention of the EIA-team to criticise these drivers, owner of cars or traders, but we have to underline the fact, that through this forms of overcharging, the positive individual impacts of the road are blackmailed to support the individual wealth of the urban population. One could say, that the transfer of surplus from villages to towns is a normality, but we are of the view, that developments are able to be controlled and directed. Another negative impact related to traders, is the increase of sexual transmitted diseases. In the closed social environment before the existence of the road, sexual transmitted diseases are hardly found, but shortly after a village is exposed to the outside world and especially to traders, who pass from village to village, they become quite common. This "invention" of traders can be expected to be of high intensity and to have a wide extend. It will in most villages very probably occur. We see it as a very important impact, because if it is not controlled, all positive economic impacts, generated by the road, will end in the pockets of traders. Quite a number of villages in the region lost their chance to invest their increased income from hunting and harvesting into an intensified farming system and suffer now, where wildlife and NTFPs are hardly found, more than before.

Due to that, it is very important that the recommendations of the road management plan are taken into consideration, because otherwise the whole road project will miss its societal goal. It will increase the poverty and not reduce it. To secure the indigenous population against the negative impact, which could occur from foreign traders and settlers, we propose the promotion of the empowerment of the local population, through the empowerment of their traditional councils. The percentage of villagers satisfied with the situation and their relation with foreigners can be seen as an indicator for the expected effectiveness of the action we recommend.

The **increase of settlers** in the region is seen as another negative impact, which could arise directly and indirectly from the road project, because the opened up land attracts not only people from other regions in Cameroon, but also from Nigeria, to use the economic opportunities offered by the road. As one can see along the existing road, these impact will effect the region with high intensity and cover a wide extend. Settlers will often and continuously use the opportunity to enter the opened up land. In the description of the social environment we pointed out, that the villagers do not fear settlers and that in some villages, they all live in peace and harmony. Based on that, we do not think that this impact of the road is very important for the social and economic situation, but in the long run settlers are known to have a very negative impact on the social structure and on the culture of a given region, so that we have to characterise this impact as important. We think that the empowerment of the

traditional councils through the introduction of community forest and community land ownership - as it is proposed in the road management plan - can be an effective instrument to reduce the negative aspect of the increase of settlers.

#### 6.2.6. Impacts on traditions and customs

##### Summary

While the description of the impacts in the sphere of traditions and customs is not a major problem, the judgement is difficult, if not impossible. One example: In the societies along the road, men are dominating the administration and the political sphere, while the women dominate the economy. Because of that and based on the rate of satisfaction among the population, we said, that it is a gender balanced society. It is seen by the villagers (men and women) as harmonic, so the separation between men and women and their limitation to different spheres of society is seen as good and as a positive traditional heritage. The influence of the road will effect this relation: men will start to become more active in the area of economy, while successful business women will start to use their economic power to become more active in politics, traditions and customs. Is this change - the social scientist call it modernisation - a positive or negative impact of the road? The same problems occur in concern of rituals and belief systems. In a focus group discussion, the female elite of one village stated that the circumcision of girls is a very useful and important ritual. They realised that, as an impact of the road, this tradition will be abandoned soon. They said, that it will have a very bad influence on the relationship among the women, because this relationship is created and related in and around this ritual, but women empowerment activists all over the world will claim that the fight against female circumcision is an important and very positive impact of a road. As one can see, it is impossible to judge in these fields, while it is possible to judge on the expected loss of indigenous languages, indigenous knowledge and traditional medicine.

Overall we state that the **prevention of indigenous knowledge and tradition** is the aim of the proposed road management plan. This can only be achieved in close co-operation with the villagers. The region has a strong and active culture, but we have to be pessimistic in view of the long term influence of modernity. It is possible that the villagers appreciate the disappearance of their culture, but the aim of the management plan in that perspective is, to enable the villagers to decide themselves about the future of their traditions and customs. To secure that, we propose actions to preserve their traditions and customs.

##### Details

The road will have an indirect impact on the **social structure** of the village societies, mostly transmitted through economic changes, like increased individual income and access to information from the outside world. Most of the villages without a road are totally based on traditional structures, while in the villages along the road, wealth is already on its way to become the key-criteria for the societal ranking of an individual. Prestige and power does no longer arise from traditions, the performance of believe systems and secret societies, but from cash. This impact is of high intensity and has a wide extent. Due to the fact that social structures are quite solid and not changing from one day to another, the road will only effect the societies in the long run, but we are quite sure, that the change of social structures will occur everywhere. The impact of the road on the social structure is very important, because the social structures used to be the framework of a society. If they are

changed the society will change. Due to that and based on experiences in other regions, we do not trust our recommendation in this field (empowerment of the traditional councils) and expect it to be less effective. Surveys on the social structure will give evidence but direct indicators are rare. Because a change in the social structure will result in a more formal way of conflict resolution, the files at the courts of the region, can be seen as an indirect indicator for the change in the social structure. If the number of problems reported to the courts increase, it will show that more and more villagers do not trust the traditional institutions and structures any longer and prefer a modern way of conflict management.

The road will have an influence on the **rituals** carried out in the villages. If this is positive or negative we can not say, but we can expect that it will be only of medium intensity and indirect relation. The low estimate of the intensity is related to the fact that even in societies, which are in contact with foreigners for more than hundred years, rituals are carried out. In the case of the Bakweri of Buea, which are in direct contact with foreigners since 1885, dogs have replaced slaves as sacrifice on a chiefs funeral, but everything else is quite close to the rituals, which are documented from the begin of the century. The expected loss of rituals will effect a wide extent, but become only effective in the long run. Examples from other regions show that the road will very probably lead to a loss of rituals in most villages. Since rituals are the fundament of the traditional society, the impact can be seen as very important, but again we do not know any way to stop that tendency and expect our recommendation to be less effective.

The impact of the road on the **belief system** of the villagers is closely related to the impact on the rituals. All figures and even arguments are the same. The main difference can be seen in the fact, that all villagers were already subject of an evangelisation and all interviewed persons included in one way or another the Christian god in their belief system. The actions we recommend - promotion of cultural identity - can be expected to be less effective.

In contrast to the other spheres in the area of traditions and customs the **loss of knowledge and use of the local languages**, can be judged as a negative impact. The loss will arise indirectly from the road project mostly through the influence of other cultures. Examples from other regions underline, that the loss of local languages will probably and often occur, slowly and in a wide extent, but as a long term impact, it has to be seen as very important. The recommend action - promotion and documentation of local languages - can only reduce the speed of destruction of the indigenous languages, but never stop it totally.

The **loss of indigenous knowledge** as a result of the road construction, has to be seen as a very important negative impact, which will very probably occur. An example is the hammock-bridge in Nyang. Since the metal bridge, which was constructed by the British colonial administration in the forties, collapsed 10 years ago, inhabitants of all villages using the bridge come at the end of the dry-season together to reconstruct with local material (cane) the bridge over the Mone river. It is a significant example of indigenous knowledge, but it will disappear on the day a solid bridge over the Mone is completed. Examples from other regions put emphasis on the hypothesis, that in 20 years the villages will have lost the knowledge to construct such a bridge. The intensity can be seen as medium, but the extent will be high and effect the societies mostly as long term and indirect impact. The activities we recommend are related to the idea of promotion of indigenous knowledge, like the installation of cultural festivals and sportive events related to the topic. We can hardly expect from

these activities to be effective, but the problem in the whole area of traditions and customs is mostly related to the fact, that the villagers do not care, if their culture is destroyed. They only realise what they have lost, when it is lost for ever. A documentation and preservation of the abstract knowledge of the region could be secured through foreign researchers, but a book on traditional knowledge in the Akwaya region can never replace the active use of this knowledge.

The only topic within the range of tradition and culture were we think that our idea to promote the indigenous knowledge and culture can be effective in the way, that it stops the loss, which we expect to occur very probably from the construction of the road, is the **knowledge of traditional medicine**. We think that the growing market of "natural" medical treatments support our aim to sensitise the villagers on the value of their knowledge in the area of medicine. If the villagers realise, which amount of money can be generated through traditional medicine, they will secure their knowledge. We think that the loss of traditional medicine is an indirect impact of the road, with a medium intensity, which effects continuously a wide area. It will very probably and often occur and we see it as very important, but - as we said - we think that this tendency can be stopped. We have mentioned that PLANTECAM, which is harvesting medical plants, is already active in the region. NGOs and governmental services should promote the awareness of the villagers in concern of the value of these products, so that they receive the world market price for the different plants and NTFPs, like *Prunus africana* etc. We expect that an additional income generating activity could arise from the knowledge of traditional medicine, if the villagers are aware of its value. Indicators could be the price for the different medical products, the rate of satisfied consumers and the people living from that profession.

The **empowerment of women** in the region is again an impact, which is impossible to judge on. On the one hand it is seen as good, if women are promoted to receive a more important stake of the societal functions, but on the other hand it destroys the traditional society. Women empowerment is an indirect impact with a high intensity. It will effect continuously a wide range of villages, occur often and very probably. It is mostly related to the dominant economic position of the women in the villages. Their influence will grow and we see these impact as an important contribution to the prevention of the development of a gender stratified society in the region. We propose a sensitisation programme for the empowerment of women in all fields of the society. The numerous active NGOs, which are working in that perspective in and around Mamfe, should be able to secure that. The effect can be measured through the rate of satisfaction among the female population in the villages.

### 6.2.7. Cumulative impacts analysis

A project on its own might not have a significant impact on the environment, but if associated to other projects of the same or different nature it could contribute to a significant impact. This analysis of the impact of a project in relation to other projects is known as cumulative impact assessment.

As it has already been pointed out , the enclavement of the region around the Mamfe-Akwaya road has kept it away from the agenda of planners and development assistance. The result is that very few interventions have been noted and very few plans concerning actions in the region exist. Some of the actual and proposed interventions that could in association with the Mamfe- Akwaya road project significantly influence the degree and type impact are:

- The Akwaya Amele road project,
- The Akwaya-Wum road project,
- The Mamfe- Njikwa road project

The effective opening of the Mamfe-Akwaya road would surely booster the development of the area by contributing to the increase in human activities and access to infrastructures and services. It can be said that the road together with better services (governmental or non-governmental ) as well as proposed project such as MINEF project of forest protection around Akwaya would surely lead to an overall improvement of the environmental and human conditions in the area. For some of the other project mainly related to road development infrastructure, much will depend on the way they are planned.

## 7. ENVIRONMENTAL MANAGEMENT PLAN OF THE ROAD

TABLE 7: Environmental management Plan

**Overall Objective:** Reconcile socio-economic advantages of the road with sustainable resources management

**Overall Result:** Socio-economic advantages of the road and sustainable Management of resources are reconcile

Objectives	Results	Activities	Timing	Responsible	Capacity building	Estimated cost	Sources of financing	Indicators	Means of verification
<b>PHYSICAL ASPECTS</b>									
Reduction of the impact of engineering works on the soils of the area	Impacts of engineering works on the soils of the area reduced	Sensitisation of contractors on the implementation of the environmental prescription of MINTP	Before and during the implementation	Chief of the Subdivision of Public Works/ CPE	Training of staff of Sub-division on environment aspects of road management	5 million FCFA	Contractor MINTP	No of visits and reports No of visits for sensitisation and report of sensitisation	Report and site visits Report
		Supervision and control of the implementation of the prescription of MINTP	During implementation	MINTP		700.000 FCFA	MINTP	No of visits and controls - at least 12 per year	Reports of supervision and control mission
<b>BIOLOGICAL ASPECTS</b>									
The sustainable management of the forest and wildlife in area	Wildlife and forest are sustainably managed	Supervision and control of norms	During and after the construction or opening up	MINTP/Sub-division of public works CPE	Training of staff of the environmental aspect of road management	See budget above	Contractor MINTP	No of visits and reports	Reports
		Sensitization of the population on forest use (Farming, timber harvesting NTFP, livestock's, bush fires)	Before, during and after the road construction and opening up	- National agricultural extension and research programme (PRVRA) - MINEF (DDEF) - GTZ-Akwaya -local population	- Training of concerned GOC staff, population and NGO together - Logistic support to those in need (DDEF, PNVRA, NGO)	20 million FCFA	GTZ/Akwaya MINCOM	No of effective visits	Reports



Objectives	Results	Activities	Timing	Responsible	Capacity building	Estimated cost	Sources of financing	Indicators	Means of verification
		Promotion of forest management committees at the local and regional level	First 3 years	GTZ/Akwaya project MINEF, NGO, Village traditional, council	Training and equipment MINEF, DDEF, NGO Traditional council	50 million	GTZ/Akwaya	No of effective village committees Effectiveness of regional management forest committees % of the area covered by management committee	Reports and site visits Reports and site visits Reports and site visits
		Forest monitoring evaluation	Ongoing	MINEF GTZ/Akwaya	Training of MINEF/DDEF	5.0 million per year	MINEF	Monitoring reports	Report available
		Reinforcement of control	Ongoing	MINEF	Personne, logistics	30 million FCFA	MINEF	No of effective control carried out per year No of infringements apprehensions brought to court	Report and visit Reports and visit
		Development and dissemination of appropriate land-use methods	Ongoing	PNVRA MINEF/DDEF NGO	Training of NGO, Personal	40 million FCFA	CFDP PNVRA Local population	No of communities accepting to implement the recommended advice	Reports and visit
		Sensitization of constructors of the constant technical checks on their engines to reduce the noise scaring wildlife	Before, during construction	MINTP/CPE	NIL	cf.	MINTP/CPE	No of controls	Report
		Sensitization of contractor on bush meat control and supervision		MINTP/CPE MINEF	NIL	cf.	MINEF	No of controls	Reports
		Sensitization of populations		MINEF	NIL	cf.	MINEF	No of effective meetings held	Reports



Objectives	Results	Activities	Timing	Responsible	Capacity building	Estimated cost	Sources of financing	Indicators	Means of verification
<b>SOCIO-ECONOMIC ASPECTS</b>									
Easier access to infra-structures and better economic opportunities to contribute to poverty alleviation	Easier access to infrastructure and better economic opportunities achieved	Organization of regular community road with the traditional and rural councils	Ongoing	MINTP Traditional councils	Training at council and logistics	20 million FCFA	MINEF NGO Population	No of community road work organized  State of the road end of the dry and rainy season	Report and visits  Report and visits
		Promotion of a maintenance committee for the road	Ongoing	MINTP Population NGO Councils	Training on the management of the committee	10 million FCFA	MINTP NGO Population	State of the road at the end of the rainy season	Reports
		Promotion of maintenance fund	Ongoing	MINTP Population NGO Councils	Training on the management of the found			Report on the effective operation road maintenance committee and funds	Reports
		Promotion of community based health care	Ongoing	MINSANTE NGO	Training of health personal	5 million FCFA	MINSANTE NGO	No of patients attending the district hospitals	
		Promotion of community based water projects	Ongoing	MINSANTE SNEC NGO	Training of technical staff to establish and maintain the water systems	5 million FCFA	MINSANTE SNEC NGO Population	Quality of water  No of water related diseases	Reports  Reports



Objective	Results	Activities	Timing	Responsible	Capacity building	Estimated cost	Sources of financing	Indicators	Means of verification
		Sensitization of the population on importance of education	Ongoing	MINEDUC NGO	Nil	Nil	NIL	Percentage of population that is literate	Reports
								No of children enrolled in school	Reports
								No of students enrolled in institution of higher education	Reports
		Improvement of the quality of education including environmental aspects	Ongoing	MINEDUC NGO	Training of staff personnel and logistic	15 million FCFA	MINEDUC NGO Churches	No of trained teachers	Report (of inspector of education)
								No of school buildings constructed	Reports
		Promotion of technical education						No of school books available to pupils and teachers	Reports
		Promotion of adult education	Ongoing	NGO Churches	Training of staff personnel and logistics	2 million	MINEDUC NGO Churches	No of children enrolled in technical schools	Reports
								No of trained teachers in adult education	Reports
								No of classes for adults constructed	Reports
		Sensitization of the population on the role of Government services	Ongoing	MINEF/DDEF PNVA SED (Gen. Security Forces)	Training of NGO	5 million FCFA	MINEF, PNVA MINDEF	No of sensitization meetings/activities held	Reports
								Percentage of population with positive comments on Gov't services	Public opinion
		Promoting the efficient the performance of Government	Ongoing	MINEF/DDEF PNVA SED	Training of personnel logistic	15 million CFA	MINEF MINDEF	Percentage of satisfaction	Public opinion



Objective	Results	Activities	Timing	Responsible	Capacity building	Estimated cost	Sources of financing	Indicators	Means of verification
	Economic activities one improved	Promote the establishment of better markets	Ongoing	PNVRA NGO Councils		1 million FCFA	Councils NGO	Level of dispersion of markets	Regularity of market attendance
		Promotion of better income generating activities (IGA)	Ongoing	PNVRA NGO MINEF/DDEF SOWEDA	Training of NGO and population	5 million CFA	PNVRA Population NGO, MINEF SOWEDA	Quantity and quality of produce	Reports
		Promotion of better trade, credit and savings unions	Ongoing	PNVRA NGO SOWEDA GTZ-Akwaya	Training of union leaders	3 million FCFA	PNVRA NGO SOWEDA	No of credit and saving unions	
	Indigenous population secured against negative impact of settlers and foreigners	Promotion of the improvement of tradition councils	Ongoing	Government authorities	Training of traditional councils	1 million FCFA	MINAT	No of conflicts	Reports
<b>TRADITIONS AND CUSTOMS ASPECTS</b>									
Preservation of indigenous traditions and customs	Indigenous traditions and customs preserved	Promotion of cultural identity	Ongoing	NGO Traditional council	Training and logistics in organization	5 million FCFA	MINCULT councils	Percentage of indigenous population satisfied with the situation	Radio reports Video reports TV reports Documentary
		Promotion of indigenous traditions	Ongoing	CABTAL population MINCULT	Production of documentation	5 million FCFA	CABTAL MINCULT	No of tradition festivals held No of document produced	Documentation available
		Promotion of indigenous knowledge	Ongoing	GTZ/Akwaya MINCULT MINSANTE	Training of local populations	10 million FCFA	GTZ/Akwaya NGO/MINEF	No of documents produced Percentage of satisfaction of local population in use to traditional medicine	Reports Report and site visits

Objective	Results	Activities	Timing	Responsible	Capacity building	Estimated cost	Sources of financing	Indicators	Means of verification
<b>NATIONAL INTEGRITY AND DEVELOPMENT STRATEGY ASPECTS</b>									
Secure the territorial integrity  Production of a participatory master plan for the development of the region	Territorial integrity is secured in the region of Akwaya	Promote border control via check points	Ongoing	MINDEF DGSN MINAT	Logistics and personnel	p.m.	Government	No of check point and border posts	p.m.
		Promote customs at border trade	Ongoing	MINEFI MINEF	Logistics Personnel			No of custom posts  No of forestry and wild life control posts	Reports and visits
	A participatory master plan for the region is elaborated and implemented	Carry out evaluation	2 years	MINSUP/UDS GTZ/Akwaya	Nil	60 million FCFA	GTZ/Akwaya	Land evaluation reports	Reports and visits
		Carry out zoning of area according to the vocation	3 years	MINEF MINAGRI MINDAT MINEPIA Population	Nil	10 Million	GTZ/Akwaya	Zoning maps produced	Maps available
	Promote the use of land according to zoning plan	4 years	NGO GTZ/Akwaya MINAGRI MINEF Population MINAT MINEPIA	Training of the population	10 million FCFA	GTZ/Akwaya	No of effective micro land use plans operational		

Estimated total costs 253 Mill. FCFA

## 8. RELATIONS BETWEEN THE PROJECT AND BIODIVERSITY

### 8.1. Introduction

The relations between the project and biodiversity of the area will be examined from two broad perspectives. The first being the current impacts on the zone of direct impact Z1 and the second is the long-term or cumulative impacts of the road project on the ecological integrity of the ecosystems function of the forest in Zone Z2, the Zone of indirect impact. In other words, there is need to assess the full range of threats and possible future threats to the existence of the biological diversity (biodiversity) by the construction of the Mamfe-Akwaya road and its long-term regular maintenance by community participation.

In order to determine the scale and the scope of an impact on the biodiversity of the area, we can only make valued judgements which are more probable at observable terrestrial scale. However, at molecular level, we can only make a probable prediction on how this might occur. We must therefore define what is biodiversity in our context.

Biodiversity (biological diversity) can be defined as the full range of variety and variability within and among populations of species living in a community and interacting within themselves, permitting gene pool flow. Thus the term biological diversity or biodiversity shall comprise the variety and variation within and among populations of species (the smallest recognizable taxonomic group; sub-species, semi-species and chrono-species etc. are not included because of the controversy in the scientific circles), including their habitats and the ecosystems created by the various communities, and the possible changes due to genetic recombination through gene flow.

The criteria used for the characterization of the impacts on the biological environment (flora and fauna) appear to be linked to, or are in fact directly or indirectly connected to impacts from the physical or socio-economic environments. The criteria for assessing the value of a site are characteristics which are then either directly or indirectly derived from data on the ecosystems (Dahdouh-Guebad et al 1998). And each criterion is then subdivided into a number of indicators which are directly observable characteristics in the field and which take a measure of the ecological criterion. An ecological criterion when combined with other criteria make up an ecological principle. It is therefore useful to first state the principle, followed by a criterion and the indicators.

- **Ecological principle n° 1:** The forest ecosystems of the zones of direct and indirect impact tend to adjust to impacts in a direction which will offset the loses in biodiversity thereby shifting the dynamic equilibrium of the ecosystem function to the direction which favours a gain in biodiversity. (A corollary of this principle is that a gain in biodiversity will shift the equilibrium to a position of slight loss).
- **Criterion:** The ecosystem function will be initially destabilized, and then slowly reversed.
- **Impact n° 1=** Deforestation threats:

**Indicators:**

- 1) Percentage of surface area cleared due to:
  - Road opening by bulldozing directly;
  - Cultivation of land alongside the opened road by villagers and distant-farming up 10 km from the road;
  - The use of bush fires for farming and grazing of cattle.
- 2) A change in the vegetation structure and species composition of the forest due to the emergence of secondary forests and an equivalent or corresponding faunal population well-suited for or unadapted to new conditions of the habitat created.
- 3) Increase in competition for light, water and soil nutrients for plant species, and consumption for mate, shade, niche, water and food for wildlife species.

A degraded forest or landscape could result from the interaction between deforestation above and soil erosion, land slides, surface water pollution, perturbation of the hydrology and air pollution. The combined effect is cumulative and therefore constitutes a serious threat to plants and the wildlife and hence the biodiversity.

## 8.2. Potential impact of deforestation to the region's biodiversity

One of the major threat to the biodiversity of the zones of impact comes from the degradation of the forest. As mentioned in (4) above it is due to a combination of impacts deriving from the physical, biological and socio-economic. The overall impact is negative, direct and indirect (due to anthropogenic forces) and is high in intensity wide in extent continuous in duration, more often, and certain to occur and of significant importance. It could in the long-term be measured through a survey or by mapping out sample plots and the mitigation or enhancement measures are probably loss effective. The consequence on the biodiversity is the extinction of endangered and endemic species of plants, eg. Pygeum (*Prunus africana*) and wildlife eg. the lowland gorilla (*Gorilla gorilla gorilla*) in the project if adequate protection is not given them. Deforestation also has the potentials of making the bird species rock-fowl (*Picarthartsoreass*) becoming extinct. Already the carnivore leopard (*Panthera pardus*) is now reported to be extinct.

And several others including the drill (*Mandrillus leucophaeus*), preuss's red colobus (*Colobus badius preussi*), guenon (*Cercopithecus erythrotis*), the mangabey (*Cercocebus torquatus*) and even the chimpanzee (*Pan troglodytes*) are rare, being seriously threaded. They prefer pristine or undisturbed forest as their habitats. A gorilla was shot around Akwa some ten months ago.

In general, deforestation leads to an abrupt decrease in the population size of species in its community, and hence the variety and variability of its population given that the total number of genes of its parent population in the gene pool is reduced by mortality under unfavourable environmental impacts. This means that the botanical and faunal diversity is reduced.

**Criterion:** Wildlife species become rare, endangered, endemic, vulnerable and extinct.

**Impact n° 2 = Wildlife species threats:**

**Indicators:** Abundance index.

This can be calculated for every species depending on the method of census used. It is a very useful way to compare, the population densities and distribution patterns of most mammal species. It can be expressed as the number of counts per sample of the transects surveyed. Transects are conveniently selected at regular intervals or in a systematic manner so as to obtain the best estimate while minimizing the error, due to direct or indirect observations.

**Impact n° 3 = Perturbation of wildlife habitats**

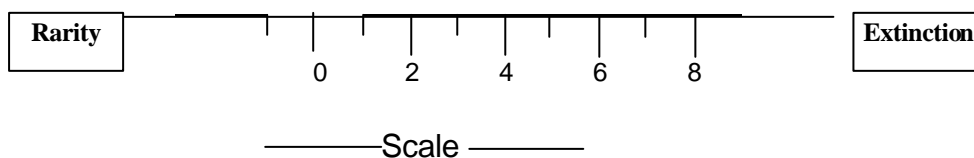
**Indicators:** Presence of key wildlife species.

The abundance indices of various wildlife populations vary according to its distribution pattern and the degree of visibility for a direct sighting and the use of vocalisation, nesting sites, foot-prints, and odour in identifying the species.

A species whose habitat is more deserted and has a low abundance index is said to be rare when compared to others on a scale rated with score ranging from 0-4 i.e extinct 0, rare 1, endemic 2, endangered 3, and vulnerable 4. Similarly a corresponding scale for habitat types, ranging from degraded forest 0, close-and opened (secondary) forest with gaps 1, undisturbed forest (pristine) 2, disturbed transition forest (gallery) 3 and forest threatened by bush fires (savanna woodland) 4.

**Table 8 (A Leopold matrix used to assess the threats to wildlife in the project zones and the scale for measurements).**

	EX	R	EN	END	VUL
DEGF	0	1	2	3	4
SF	1	x			
PF	2		x		
DF	3			x	
SW	4				x



Notation used: DEGF = Degraded Forest, SF = Secondary Forest, PF = Pristine Forest (undisturbed forest), DF = Disturbed Transition Forest (gallery forest), and SW = Savanna Woodland (threatened by bush fires).

To illustrate better the use of the above scale which ranges from zero, degree of rarity of species to 8 extinction of species, we consider the threat to the gorilla, score END=3, adding to its preferred habitat PF=2 gives  $3+2=5 < 8$  the extinction limit. This implies that although the lowland gorilla is still under threat, it has not yet attained the extinction limit. Consequently there is a good chance of protecting this endangered species before its population rapidly declines due to poaching and forest canopy opening and fragmentation.

We now take the example of *prunus africana*, END=3 and habitat type SW=4. The corresponding total score is  $7 < 8$ . Therefore *prunus africana* on the Amassi hills is under a serious threat of extinction and since  $5 < 7 < 8$ , it is evident that *prunus* is under a more serious threat of extinction than is the gorilla in the project area. Let's compare the situation of the bush pig (*Potamochoerus porcus*) which is widely and intensively hunted through out the project area and yet seems to be very abundant. For the bush pig the villagers described it as becoming rare therefore R=1 and its preferred habitat type is SF=1 and the total = 2.

We can conclude that the bush pig is not seriously threatened and is in fact abundant in the secondary and the transition forests (score = 4). In a similar manner we can make a valued judgment of the conservation status of any species observed within the project area. The probability of the outcome to be a real result from a census of its population in the wild is certain and significant (see table 10).

**Criterion:** Increased pressure on Non Timber Forest Products (NTFP) reduces the potentials of forest to regenerate naturally.

**Indicator:** The volume of off-take (levels) are high.

**Potential impacts of NTFP harvesting on the botanical diversity of the forest:**

In general the impacts are negative, indirect, high in intensity, wide in occurrence, continuous in duration, often in frequency and probably certain and very important (see Table 6 On the characterization of impacts). It can be measured by field surveys and a mitigation or enhancement measure effectively proposed. The threat to botanical biodiversity stems from the current unsustainable harvesting methods used by villagers for products such as eru (*Gnetum africanum*), bush mangoes (*Irvingia gabonensis*), Njangsa (*Rhicinodendron heudeloti*), Njabe oil (*Baillonella toxisperma*), Chewing sticks (*Capolobia spp*), Congo leaves (*Musa spp*) and Bitter cola (*Garcinia kola*).

In this sector women and children play a prominent role. A woman harvests about 50 kg of gongo leaves per week which is sold at the border market of Amana. Some 200 women export this product every week i.e. a total of 10,000 kg or 10 tons is exported per week or approximately 40 tons per month. Thus in a year about 1440 tons are exported which is a high volume off-take per annum. The trend for the other products is similar, in particular for eru. Bitter cola and chewing sticks are also exported but in much reduced quantities, about 50%. It is evident that when the NTFP trade is not well controlled this could lead to a decline in the botanical diversity of the forest (see table 9).

**Criterion:** Encroachment on forest reserves thereby reducing the percentage cover of representative biological reserves.

**Indicator:** Percentage of area of encroachment

**Indicator:** Percentage of forest corridor encroached upon which links the two forest reserves.

The potential impacts of encroachment on the two forest reserves of Takamanda and Mone river and on the corridor between them.

In general encroachment by creation of farms along the borders of these reserves is negative, indirect, medium, localized and continuous in duration. The frequency is often and very probable and important if this is not prevented. However, there is proposed an effective enhancement measure.

The farms are usually for the planting of food crops (in the short term), but cash crop including palm and cocoa cultivation follow the next rotation of subsistent crops. It is estimated that some 30-40% of Takamanda forest has been encroached upon on the Nigeria side of the border. Besides there are some enclaved villages living in the reserves at least 3. The situation for Mone is about 25%. Between the two reserves is a forest corridor about 5-30 km wide and some 15 km long and through which a river, the Munaya (Mabe) passes through. Encroachment in the corridor is more intense given that there are villages living there.

This corridor historically connected the two forests and it appears it at one time served as a conduit, allowing the migration of species except for those such as the lowland gorilla not able to cross the river barrier and so is absent from the Mone forest reserve. All other primates seem to occur in both forests. The corridor is therefore instrumental in the connectivity of the two reserves. Encroachment in general leads to habitat destruction and therefore threatens biodiversity.

**Criterion:** The replaceability (renewability) of economic tree species.

**Impact:** Threat to special plant or tree species due to over exploitation.

**Indicator:** The volume of off-take levels

**Indicator:** The logging intensity.

The renewability of the existing stock or standing volume of some economic species is of paramount interest in sustainable forest management, and the impact can well be felt at the global level. There is now on increasing global concern for climate change and the Ozone layer depletion. And tropical forests are considered to play a vital role in reducing the green house effects which leads to a rise in global surface temperatures.

*Prunus africanus* is an endemic species occurring on the hills of Amassi above 1800 m. The bark of this plant is often harvested at high intensity and its population is very localised and the exploitation is continuous. Its occurrence in the area is probably certain, but off-take levels are high

and the method of measurement is by survey. The enhancement measure proposed will be effective provided that a participatory management plan for its harvesting is elaborated and implemented. However its population is still under threat from illegal exploitation.

The logging of timber in the project zones started in 1991-95 when SFS was granted a standing sales in the area around Eshobi. They opened a forest road from the Satum bridge to Kesham and from Satum to Eshobi, Bombe, Mukoyong up to Nyang. They exploited an area of about 2500 ha, west of Eshobi and Mukoyong. The timber exploited included the following check list of timber trees (Table 8).

**Table 8: Check list of commercial timber species**

COMMON NAME	Species	Taxonomic group/family
Fraké	<i>Terminalia superba</i>	Combretaceae
Bubinga rouge or Essingang	<i>Guiboutia tessmannii</i>	Caesalpinaceae
Besse clair	<i>Guarea cedrata</i>	
Azobé/Iron wood	<i>Lophira alata</i>	Ochnaceae
Doussié rouge/ african mohogang	<i>Azelia africana</i>	Caesalpinaceae
Doussié blanc/Mbanga	<i>Azelia bipindensis</i>	Caesalpinaceae
Iroko	<i>Chlorophora excelsa</i>	Moraceae
Koto	<i>Pterygota bequaertii</i>	Sterculiaceae
Iloba / Calabot	<i>Pycnanthus angolensis</i>	Myristicaceae
Bilinga / Opepe	<i>Nauclea diderrichi</i>	Rubiaceae
Sipo	<i>Entandrophragma utile</i>	Meliaceae
Acajou	<i>Khoya iverensis</i>	Meliaceae
Moabi / Njabe	<i>Baillonella toxisperma</i>	Sapotaceae
Movingi	<i>Distemonanthus benthamianus</i>	Caesalpinaceae
Ekop evolet	<i>Brachystegia spp</i>	Caesalpinaceae
Aiele	<i>Canarium schwein furterii</i>	Bunseraceae
Framiré / Iloba	<i>Terminalia ivorensis</i>	Combretaceae
Mukulungu	<i>Autranella congolensis</i>	Sapotaceae
Tali	<i>Erythropheum ivorense</i>	Caesalpinaceae
Makoré	<i>Tieghmella africana</i>	Sapotaceae
Eyoung	<i>Eribroma oblonga</i>	Sterculiaceae
Zingana	<i>Microberlinia biscalcata</i>	Caesalpinaceae
Bahia	<i>Mitrogyna cileata</i>	Rubiaceae
Bibalo / Dibétou or African walnut Tiama	<i>Lovoa trichilioida</i>	Meliaceae
Padouk rouge	<i>Etandrophragma angolense</i>	Meliaceae
Padouk blanc	<i>Pterocarpus sayauxii</i>	Papilionaceae
Dabena	<i>Pterocarpus mildbreedii</i>	Papilionaceae
Ebong / African green heart	<i>Piptadeniastrum africana</i>	Mimosaceae
	<i>Diospyros crassiflora</i>	Ebenaceae

Timber exploitation in this concession was limited. The SFS after effecting the first coup found out that much of the timber felled were defective ie had holes inside the trunks and logging was therefore abandoned. In addition timber exploitation appeared to be unprofitable given that the inaccessibility of the road in the peak of the rains posed serious problems in removal of timber and its transportation. Shortly after the 1994, the forestry law was promulgated the concession had to be

applied for under a three year provisional contract during which an inventory and management plan must to be drawn up before the contract can be permanently granted. The concession would have to become a forest management unit. The owners left the concession and have since then not returned.

In general, logging disturbed the forest especially during extraction when skidders were used. Gaps were created and the forest structure and composition has changed. The forest is now a secondary forest. The biodiversity was therefore impacted upon. Elsewhere at a local scale, the forest service has issued individual felling authorizations to fell trees for local use. This is provided for in the forestry law.

The only timber species which is strictly protected by law is Ebony (*Diospyros crassiflora*). No felling is authorized for this list I CITES species. However, the forestry Department has a policy of promotion of the use of other potential commercial timber species unknown to the world timber trade markets, other than same 19 species already established. But following the expiring of the moratorium of the Government on timber exportation of June 1999, - forest exploitation in concessions must transform timber upto 70% of the volume cut - according to the forestry law of 20<sup>th</sup> January 1994.

**TABLE 9: CHECK LIST ON THE UTILIZATION OF NTFP / PLANTS**

Common or local name	Scientific name	Utilization
Bush mangoes	<i>Irvingia gabonensis</i>	- Edible fruits, seeds used as a spice for soup
Njansang	<i>Ricidodendron heudeloti</i>	- Seeds used as a spice for soup
Shell nut	<i>Poga eleasa</i>	- Nuts eaten as food
Bitter cola	<i>Garcinia cola</i>	- Seeds eaten as a medicinal cure for stomach disorders, liver troubles, etc.
Kola	<i>Kola edulis</i>	- Seeds eaten as food and is reported to increase appetite in diet and reduces sleepiness
Cassia	<i>Cassia alata</i>	- Used for its medicinal properties for the cure of jaundice and stomach disorders including gastric problems. A decoction of the plant is obtained after boiling in water and this is drunk when measures in half a glass.
Pygeum	<i>Prunus africana</i>	- Tree bark is harvested and sold to Plantecam in Mutengene, cures prostate gland
Achu tree	<i>Tetrapleura tetraptera</i>	- A tetrapod woody pad species used as spice for cooking achu food
Bush pepper	<i>Piper guineensis</i>	- Seeds small and spherical and used as spices for soup
Eru	<i>Gnetum africanum</i>	- A closed canopy forest-dwelling liana whose small tough leaves are consumed as vegetable with water fufu which is made out of cassava

Njabe oil	Baillonella toxisperma	- The seeds of this hardwood timber species is often crushed to extract the oil used for its highly priced medicinal properties. The tree leaves are also used for fish poisoning in rivers to catch fish
Chewing stick	Carpolobia spp	- A pole size tree used in making chewing sticks for local use and for exports
Quinine tree	Enanthia chlorantha	- The yellow bark of this secondary forest timber species is used for the cure of malaria. After boiling, the decoction is drunk with pawpaw and fever grass in a glass at regular intervals
Munyanga (kernel nut) oil	Elaeis guinensis	- The oil is extracted from the nuts of the oil palm tree, used for deactivation of oral poisons taken in and against skin infections and insect bites
Alsloma	Alstonia boonei	- Bark of tree used for its medicinal properties
Bamboo	Arabicadida spp	- Used for roof decking in thatch roofs

**TABLE 10: CHECKLIST OF SPECIES HUNTED AS A SOURCE OF BUSHMEAT OR FOR TRADE**

Common or local name	Scientific name	Class or legal status	Conservation status Level of threat				
			R	EN	END	VUL	AB
Lowland gorilla	Gorilla gorilla gorilla	A			+		
Drill sumbo	Mandrillus leucophaeus	A			+		
White and black colobus	Colobus polykomos	A	+				
Red colobus	Colobus badius preussi	A			+		
Chimpanzee	Pan troglodytes	A			+		
Mona monkey	Cercopithecus mona	C				+	
Putty nosed monkey	C. nictitans	C				+	
Forest elephant	Loxodonta africana cyclotis	A (ivory less than 5 kg), B	+				
Bwaft F. buffalo	Syncerus coffer nanus	B	+				
Bush pig/red river hog	Potamochoerus porcus	B					
Blue(ogilbys)duiker/frutambo	Cephalophus monticola	C	+				+
Bush buck	Tragelaphus scriptus	A	+				
Sitatunga	T. spekei	B	+				

Bush cat	Viverra civetta	B	+				
Red-flanked duiker	Cephalophus rufilatus	C					
Larger cane rat/cutting grass	Thryonamus swinderianus	C					+
Comon percupine	Atherurus africanus	C	+				+
Brush-tailed percupine	Hystrix cristata	C					
Giant rat	Cricetomys gambianus	C					+
Forest crocodile	Osteolaemus tetraspis	A			+		
Royal python	Python sebac	A			+		
Bare headed rock fawl	Picatherts oreas	A	+		+		
Grey parrot	Psithaeus erythacus	B					
Black casqued hornbill	Ceratogymna atrata	C				+	+
Pangolin (long tailed)	Manis tetradactyla	C	+				
Pangolin (giant)	Manis gigantea	C			+		+
Water chevrotain/water beef	Hyemeshus aquaticus	A			+		
Cape clawless otter	Aornys capensis	A					

### 8.3. Plan for the management and protection of biodiversity

The plan for the management and protection of biological diversity constitute part of the environmental management plan EMP already proposed in section.

A more detailed plan for the protection of biodiversity can be summarized as shown in the table11 below. This plan if well followed would most probably protect endangered and endemic species and contribute to the sustainable management of the biodiversity in the project zone and therefore lead to a complementary relationship between the road and the biodiversity and thereby offer a greater socio-economic opportunity to the people in the area.

**Table 8: Biodiversity management and protection plan.**

IMPACTS (- ve)	Criterion	Indicators	Timing	Enhancement or mitigation measures
Deforestation leading to degradation	Ecosystem function will be destabilized	% of forest cover in decline	Continuous	- Introduce enrichment planting on deforested sites - Control of soil erosion - Slope stabilization
Hunting	Scarcity of wildlife leads to species becoming endangered and vulnerable	Decline in the abundance indices of bush meat	Continuous	- Introduce game farming and ranching as alternatives to hunting - Introduce participatory

				sustainable wildlife management practices in hunting <ul style="list-style-type: none"> <li>- Introduce community based wildlife management hunting zones</li> <li>- Control of the bush meat trade via check points</li> </ul>
NTFP Harvesting	Increased pressure on NTFP leads to unsustainable harvesting methods	Large volume trade of NTFP products becomes noticeable	Continuous	<ul style="list-style-type: none"> <li>- Introduce sustainable harvesting methods for NTFP</li> <li>- Introduce community based forest protection of NTFP around villages</li> </ul>
Encroachment on forest reserves	Encroachment threatens wildlife habitats	% of the area of encroachment becoming significant	Continuous	<ul style="list-style-type: none"> <li>- Introduce effective land use cultivation methods</li> <li>- Introduce participatory forest reserve management including elaboration of a management plan</li> <li>- Introduce community based forest management</li> <li>- Control the use and access into the reserve</li> </ul>
Logging	The structure and composition of the forest will be altered	<ul style="list-style-type: none"> <li>- % change in the composition of the forest</li> <li>- Reduce logging intensity to 1 stems/ha exploited</li> </ul>	Continuous	<ul style="list-style-type: none"> <li>- Introduce enrichment plantings</li> <li>- Allow regeneration to start early</li> <li>- Careful selective logging without wasting</li> </ul>

#### 8. 4. The indicators and a plan for the monitoring of biodiversity

Such a plan considers the negative impacts and the indicators for measuring it, the timing and the means of monitor as shown in table 12 below.

**Table 12: Biodiversity monitoring plan.**

Impacts (-ve)	Indicators	Timing	Monitor
Deforestation leading to degradation	% forest cover decline	Continuous	Remote sensing and reports on field surveys
Hunting	Decline in the abundance indices of key wildlife species: Gorilla Chimps Drill	Continuous	<ul style="list-style-type: none"> <li>- Surveys on bush meat trade</li> <li>- Survey reports on abundance</li> <li>- Census of populations</li> </ul>

	Rock fawl etc.		
NTFP harvesting	Large volume trade in NTFP products become noticeable	Continuous	Surveys on NTFP trade
Encroachment on forest reserve	% of the area of encroachment becoming significant	Continuous	Field survey reports and remote sensing
Logging	% change in the composition of the forest Logging intensity < 2 stems/ha	Continuous	- Field survey reports - Timber harvesting control reports.

## 9. MONITORING PROGRAMME

**Table 13: Summaries of indicators and method of measurements of impacts**

ENVIRONMENTAL ELEMENT	IMPACTS	INDICATORS	METHOD OF MEASUREMENTS
<b>PHYSICAL</b>	Soil erosion Landslides Soil compaction (impermeability) Soil pollution Air pollution Surface water pollution Underground water pollution Noise Perturbation of hydrological Network	Quantities of soils displaced no of 9 miles Compacity rate (CBR) Top soil colour of state of vegetation Incidences of water borne related disease Bio-physico-chemical properties of water Noise intensity Number of deviation Incidence of air pollution related diseases (Quantity of dust film on vegetation)	Sampling and field observation Site observation Proctor test Site observation and soil analysis Medical reports, water analysis reports, field observation Medical reports, water analysis reports, field observation Audiometer / acoustic meter Filed work report, site observation Filed observation, road traffic, census Medical report, vehicle inspection report
<b>BIOLOGICAL</b>	Deforestation Threat to wildlife species Increased pressure on NTFP habitats Perturbation of wildlife reserves Encroachment on forests species Threat to special plant	% surface area cleared Abundance index Off-take level Presence of key wildlife species % of area of encroachment Off-take level, logging	Sample plots / Remote sensing Census Surveys Survey of key species Survey Survey
<b>SOCIO-ECONOMIC</b>	<b><u>EASIER ACCESS TO:</u></b> Health  Water  Education  Government services Markets  <b><u>INCREASE IN INCOME FROM:</u></b> Hunting Harvesting Farming Trading Fishing Animal husbandry  Exposure to traders  Increase of settlers  Change of land-use	Transport fares; No of patients attending the district hospitals; Health situation in the Akwaya subdivision  Quality of water; No of water related diseases  No. of water projects etc. No of pupils enrolled at school; No. of trained teacher; no of students at institutions of higher education; No of classes offered to adults Rate of satisfied inhabitants Transportation fee. No of markets organised in the region  Transport fares; Level of income from hunting Level of Income from harvesting Level of income from farming Level of income from trading Level of income from fishing Level of income through the sell of animals	Survey  Survey  Survey  Survey Survey  Survey  Survey  Survey  Survey  Survey
<b>TRADITIONS AND CUSTOMS</b>	Change of social structure Loss of rituals Change in belief system Loss of indigenous knowledge Loss of indigenous languages	Files at the courts of the region No. of rituals performed No. of church visitors No. of cultural events No. of people using the local language all the time	Survey Survey Survey Survey Survey

	Loss if traditional medicine Women empowerment	Rate of satisfied consumers Rate of satisfied female population	Survey Survey
<b>NATIONAL INTEGRITY AND DEVELOPMENT STRATEGY</b>	Security of National integrity  Base for the elaboration of a participatory master development plan	PM  A participatory Master development plan exists	PM  Master plan and surveys

## **10. PRESENTATION OF THE STUDY TEAM (see picture 6)**

Dieudonné Bitondo (Team leader): Agronomist, EIA specialist Lecturer at the University of Dschang;

Kai Schmidt-Soltau (Ph.D): Sociologist Independant Consultant;

Jacques Ntep: Civil Engineer, expert in environmental management of roads, Environmental Protection Unit of the Ministry of Public Works;

Humphrey Onya: Expert in tropical ecology: Department of Wildlife Protection in the Ministry of Environment and Forestry;

Francis Fonyé Wadt Zela: Expert in environmental management, Permanent Secretariat for Environment;

NgoKo Arrey Frida: Socio-economist, Korup Park project;

John Bita Tambe: Civil Engineer, Chief of the Subdivision of Roads for Manyu Division in Mamfe;

Raphael Ebot: Expert in environmental management, Divisional Delegate of Environment and Forestry for Manyu Division at Mamfe.

## **11. LIST OF PERSONS AND INSTITUTIONS CONTACTED**

- The Senior Divisional officer of Manyu;
- The Sub divisional Officer of Akwaya;
- The Sub divisional Officer of Mamfe Town;
- The Mayor of Akwaya;
- The subdivisional inspector of education of Awaya;
- The acting director of the District Hospital of Akwaya;
- Divisional and sud-divisional government technical;
- Ngansi Emmanuel: Controller of SCET/URBA;
- Margaret Niger-Thomas, researcher in sociology;
- Prince Agbor Sunday, Department of Communal Development;
- Akwaya 80 people;
- Meyerem 30 people;
- Makomono 40 people;
- Tinta 60 people;
- Atolo 30 people;
- Makwe 60 people;
- Basho I 30 people;
- Akwa 50 people;
- Mbu 30 people;
- Nyang 30 people;
- Mukonyong 20 people;
- Eshobi 30 people.

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## **APPENDIX**

- Terms of References;
- Interview guideline;
- Penetration of Mamfe oversee (File CDM 26/2 (1966) Vol. 2 from the Department of Community Development Mamfe)
- Agricultural Production of the Akwaya Subdivision
- List of NGOs working in the Akwaya region
- Opening remarks of the S.D.O. of Manyu at the local presentation of the draft report.
- List of participants of the local presentation of the draft report (Mamfe November 23<sup>rd</sup> 1999)