FOREST POLICY: FOREST LOSS AND

LAND USE COVER CHANGE IN CAMEROON

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INTRODUCTION

The state of the global environment is undoubtedly one of the most pressing issues on the international agenda. The last half of the last century witnessed remarkable increase in awareness of environmental degradation, especially in Western Europe and North America (Munn 1979). Concerns of environmental movements in these parts of the world, especially in the U.S. during the first half of the last century and earlier, focused on conservation efforts while environmentalism of the second half of the century was mostly concerned with environmental quality (Clark 1990; Powell 1998). This change in environmental concern was prompted by aggressive post World War II (WW II) rebuilding efforts and the proliferation of the petrochemical automation industry at the end of WW II (Munn 1979).

1.1 Africa's Environmental Evolution

Africa showed no substantial environmental concern and little petrochemical industrialization efforts during this period. The continent was engulfed in a set of socio-

economic and political imbalances that gained momentum in the early 1980s and cast the continent in the world's worst environmental conditions. When Europe, North America, and Japan (the so called Triad) were forging ahead with nation building after WW II, most African states were fighting for their independence. Following their independence in the 1960s most African nations have been experiencing social insecurity, political instability, economic instability, conflicts and war, poverty and environmental degradation. Experts in environmental sciences, economists and politicians from the continent as well as from other parts of the world, point to the following as Africa's prime environmental concerns: population pressure on resources and growth of urban areas, industrialization, water pollution, land degradation and deforestation, protection and sustainable forest use, and protection and management of biodiversity (Middleton 1997; Mol 2001; UNECA 1996).

These environmental concerns cannot be understood fully without an appreciation of both human and physical environments. Africa is a relative new comer to the modern world system and understanding the interaction between human activities and the natural environment has not been easy for a majority of Africans. From all indications, the rapid increase in human population, along with urbanization, rural poverty and rural-urban exodus, developments in socio-political and economic structures and policy-environment, have all combined to interact with the continent's ecosystems, creating most of the environmental problems facing Africa today. Although most of Africa's environmental problems have been blamed on poverty, ineffective economic and environmental policies of the past decades, such as the structural adjustment plan (SAP) and the market oriented

reforms of the 1980s and 90s (Bhagwati 1995) have been identified as major contributors to the problem. Most of these policies were drafted under foreign influence (World Bank and International Monetary Fund) to meet requirements for debt relief and loans, and to compete in the international market (Bhagwati 1995). These policies focused on economic growth and increasing food production, to the disadvantage of the environment, and without considering the long term well-being of the people they were meant to serve (IDS 1999).

1.2 Statement of the Problem

Cameroon is a country endowed with abundant forests. The southern part of the country constitutes part of the spectacular lowland rain forest of Central Africa that stretches across regions of Cameroon, the Central African Republic, Congo Brazzaville, the Democratic Republic of Congo, Equatorial Guinea and Gabon. For the past three decades, Cameroon has fast been loosing its portion of the rain forest.

The rain forest of Cameroon is located between latitudes 2º and 5º north of the equator, occupying about 70% of the country's land area. The forest constitutes a diversity of fauna and flora that has put Cameroon on the biodiversity map of the world. It is home to over 8,000 species of birds, close to 400 species of mammals, and more than 9,000 plant species, 150 of which are found nowhere else in the world (MCBCC 2002). The forest is also home to the indigenous (pygmies) peoples of the southern low lands of Cameroon, providing them with food, shelter, clothing, and their cultural and spiritual

survival. It is also an invaluable asset for water conservation and a "living laboratory" for education, scientific research and recreation. Cameroon's rain forest, therefore, constitutes a complex ecological system that is critical not only to the nation and the region, but most to the global community as well. If Cameroon's rain forest is going to be sustained; sustaining it will have to be important to the people of Cameroon.

Of Cameroon's estimated 22 million hectares of forest resources, 14 million are tropical rainforest. According to a recent African Development Bank (ADB) report, it is estimated that the forest sector of Cameroon contributes more than 3% of the gross domestic product (GDP) and accounts for 7% of total export (ADB 2003). Despite the economic importance of the rain forest to the country's economy, it has been disappearing at an average rate of 100,000 hectares per year (ADB 2003). This alarming rate of deforestation is due to increasing activities such as lumbering, shifting cultivation, logging for trade and for fuel wood, and road construction (Cameroon 1992). According to the ADB (1995), licensed logging companies in Cameroon were responsible for the lost of 64,550 km² of forest in 1994. Environmental groups in the country, such as Bird Life International, Global Forest Watch (GFW) and World Wide Fund for Nature (WWF) have continued to fight against the increasing number of logging companies in the country. According to a GFW report in 2000, between 1995 and 2000, the number of logging enterprises in Cameroon increased from 350 to 600, controlled by 25 logging companies (GFW 2000).

With increasing logging together with other land use activities, Cameroon's tropical forest is fast disappearing and national and international environmental groups (non-governmental organizations) fear at such a high rate of deforestation, the country's rain forest might cease to exist in a matter of a few years from now, if something is not done to remedy the situation.

Cameroon's forest is a vital resource to the Central African region given that it fulfils critical environmental, economic, social and cultural functions in the region. There is the need, to re-examine past forest policies in the country, determine their consequences on the environment, society and the economy, and develop/propose policies to protect the forest and promote sustainable socio-economic development in the country and the region as a whole.

1.3 Objectives

The objectives of this study are three fold: first, describe/measure changes in land use and forest cover. Second, correlate changes with colonial and domestic policies and third, develop/propose national policies to manage and conserve the forest resource. These objectives are achieved by:

- Analyzing and quantifying changes in forest cover through the use of remotely sensed data, ground photographs and thematic maps. Analysis is based on empirical statistical and spatial models;

- Identifying and estimating impacts of colonial and domestic environmental policies on forest loss and land cover change in Cameroon. The forest loss and land cover change parameters for this study include:

    - Political and institutional structures:

        i. Public/private sector scenario;
        ii. Informal sector scenario.

    - Demographic structures:

        iii. Population growth;
        iv. Urbanization.

    - Socio-economic structures:

        v. Agricultural development;
        vi. Income distribution and poverty.

- Estimating the implications of forest loss and land use cover change on:

    - The environment;

    - The economy;

    - The people at the community and national levels.

1.4 Organization of the Dissertation

This study covers seven major chapters besides the introduction and conclusion. Chapter 2 presents a brief review of Cameroon's history beginning with the arrival of the Portuguese in the late 1400s up to the British and French colonial rule in the 1800s and 1900s. Chapter 2 also gives an overview of Cameroon's geography, highlighting its climate and landscape distribution. This geographic and historic overview is essential for

understanding the evolution of natural resource policy in Cameroon. Understanding how Cameroon's natural resource policy has evolved over time is essential for the development of new policies. Chapter 3 takes a look at previous studies of land use and policies related to land use in Cameroon and elsewhere, and the impacts of these policies. The purpose of this chapter is to understand the nature of literature and methodology related to land use and forest policy in Cameroon, and to demonstrate the need for this study. Chapter 4 describes the methods used to achieve the objectives of this study while Chapter 5 presents a remote sensing model used to measure the rate and degree of forest loss in Cameroon over a sixteen year period. The remote sensing model is combined with an economic model to determine the driving forces behind forest loss in Cameroon. Chapter 6 provides a correlation of changes in forest cover to past and present policies. As noted by Smith (2003), one of the fundamental principles guiding decision-making in the public setting is the aggregation of individuals' perception on public issues into a collective or unified option. Therefore, Chapter 7 presents a practical model that employs ground thruthing methodologies for determining individual's concerns for forest loss and its environmental impacts. The purpose of this practical modeling exercise is to derive information from people experiencing actual conditions of forest loss in the field. Chapter 8 draws from the analysis of Chapters 5 through 7 to develop policies that will help conserve Cameroon's forest. The task of this chapter is to identify policy goals, constrains and objectives, and to select method(s) for identifying policy options. Finally, Chapter 9 provides general conclusions to the entire study and makes suggestions for future research.

CHAPTER II

A BRIEF HISTORY OF CAMEROON

Cameroon was founded by Portuguese explorers in 1472. The country was named by the explorers when they sailed up the prawn infested River Wouri into Douala. They called it *Rio dos Camarões*, meaning "River of Prawns." The Portuguese explored Cameroon in the late 1400s and early 1500s. In 1520 they set up the Trans-Atlantic slave trade network. Beginning in the late 1500's, Cameroon was settled by European traders and missionaries; Dutch traders in the 1600's, British missionaries and traders in the 1700's and early 1800's, and the Germans in the late 1800's. Cameroon became a German colony (Kamerun) with defined boundaries in 1884 (figure 2.1). Cameroon had its first development policies under the German administration. The German administration set up plantations throughout the colony and developed policies for the management of these plantations and other natural resources. When the Germans lost the First World War, their colonies were taken over by the winners of the war. The colony was divided into West and East Cameroons. West Cameroon was in two parts – Southern and Northern Cameroons and administered as a single colony by the British under the League of Nations mandate. The larger part of the colony, East Cameroon (Cameroun), was given a

mandate under the French (figure 2.2). Parts of German Cameroon became part of French Equatorial Africa at this time.

The system of governance evolved differently in West and East Cameroons. The French embarked on a system of "direct rule" (forced labor) while the British adopted a system of "indirect rule" (use of natives). The British favored a more conservative resource and land use policy while the French followed an approach that was more exploitative. Both colonies gained independence in 1960, and in 1961 English speaking West Cameroonians in the south voted in an infamous referendum (plebiscite) to join their French speaking brothers in East Cameroun while those in the northern part voted to remain with Nigeria. Southern Cameroon and East Cameroun were reunited in 1972 thus; the current international boundaries of Cameroon (figure 2.3) are as of 20th May, 1972 when the country became a United Republic.

Today, Cameroon occupies a total area of 475,440 Km² (297,150 sq mi). To the north it is bordered by the Republic of Chad. To the west it is bordered by the Federal Republic of Nigeria and the Atlantic Ocean. Its south neighbors are Equatorial Guinea, the Republic of Gabon, and the Republic of Congo. It shares a long border to the east with Central Africa Republic. The country has five geographic regions: the northern plains, the Adamawa plateau, the eastern low lands, the coastal low lands, and the western high lands. The country generally has a warm climate with slight variations due to altitude and distance from the sea. The weather is dominated by rainy and dry seasons. As one moves inland from the coast, rainfall reduces from 4318mm (170 inches) per year (over

seven months) to 813mm (32 inches) per year (limited to three months). Temperature also follows the same pattern as rainfall, reducing from an average of 26˚C (79˚F) at Douala along the coast to 19˚C (66˚F) at Bamenda which is at a higher altitude in the hinterland.

With these multiple geographic regions and differences in climate, Cameroon boasts of a multitude of ecosystems with major ones being; Sahelian savanna, Sudano-Guinean savanna, and Forest ecosystems. A vibrant rain forest and swamps cover the coastal belt, with the forest spreading inland in the southeast. These varieties of vegetation types also mean a diverse range of food crops and pastoral activities. Due to this natural diversity coupled with its cultural pluralism, Cameroon is often referred to as "Africa in miniature."

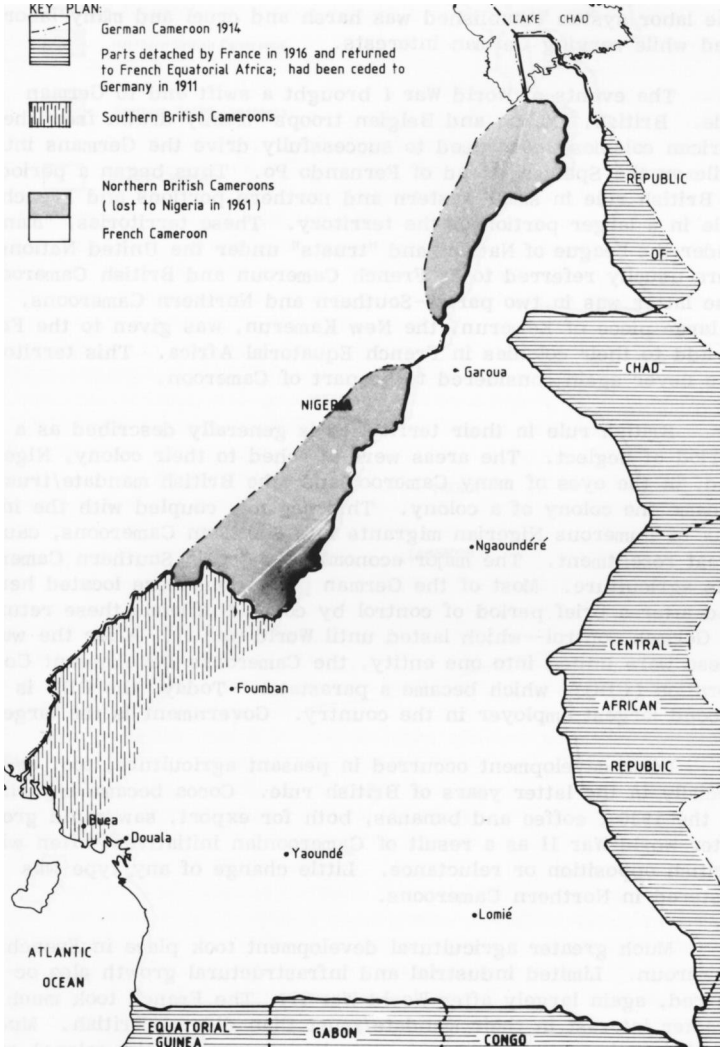


Figure 2.1: Map of Cameroon showing German protectorate boundaries (DeLancey and Mokeba 1990)

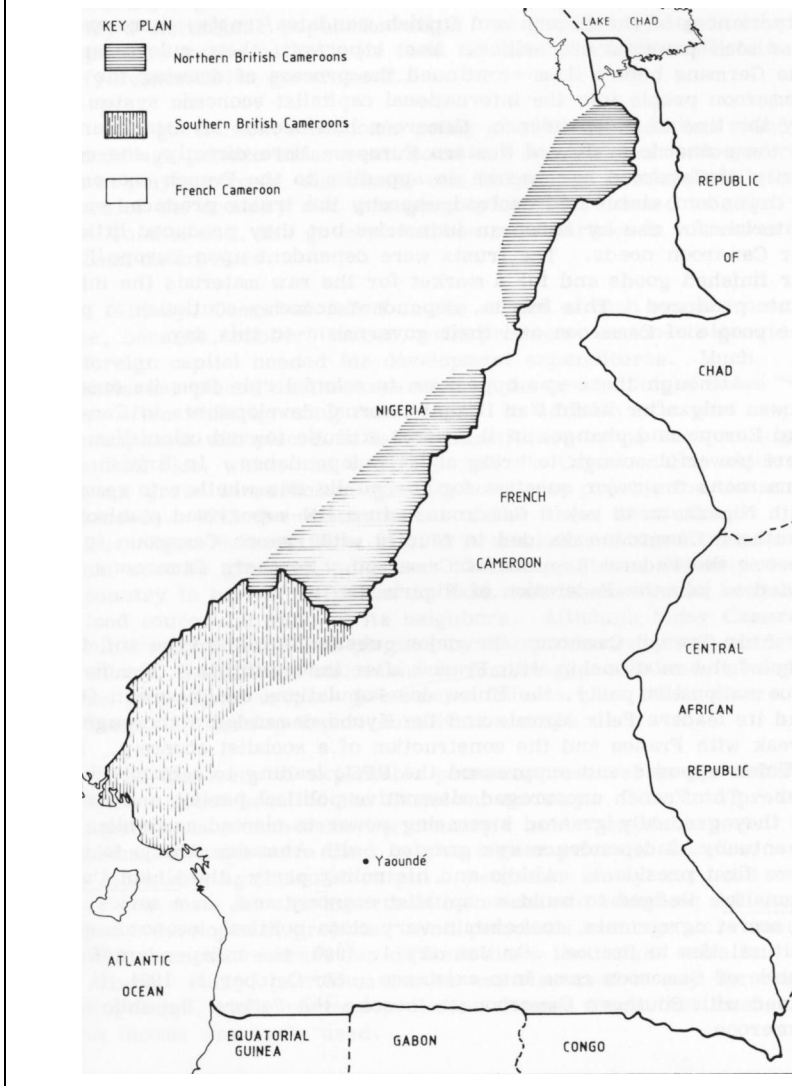


Figure 2.2: Map of Cameroon showing boundaries of British and French Cameroons (DeLancey and Mokeba 1990)

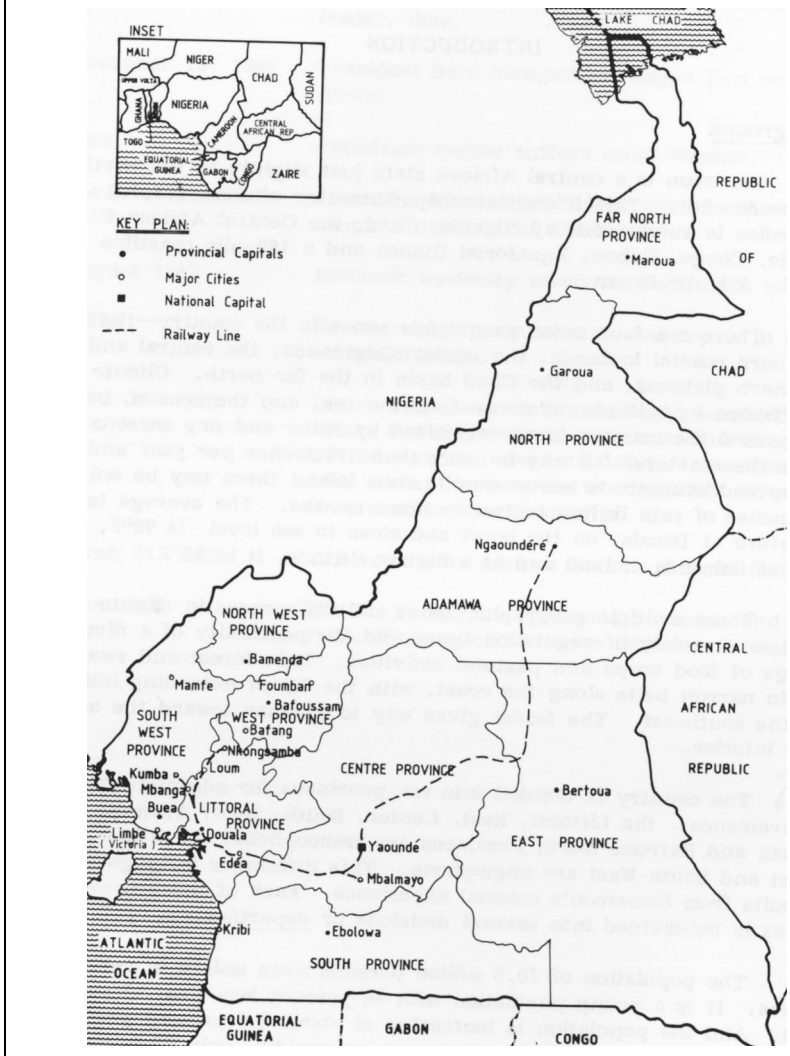


Figure 2.3: Map of Cameroon showing current political boundaries (DeLancey and Mokeba 1990)

2.1 The Evolution of Natural Resource Policies in Cameroon

Like most nations (Lowry 2003), environmental issues in Cameroon have gone through a number of stages. Until now, the country has experienced five distinct eras of environmental issues and natural resources policy. These eras can be identified as: "law of contract vs. law of status," "first colonial," "second colonial," and "post independence."

2.1.1 Law of contract vs. law of status era

Natural resource management in Cameroon is not a new thing. The art and science of managing resources precedes the nation itself. Before the institution of the "contract law" system of managing resources by the colonial administrations, the "law of status" was used by the indigenous people to regulate the use of what nature gave them. Hierarchy and regal ethics is the base of law of status. The paramount traditional ruler of the people (chief) had the overall say in every aspect of the life of his subjects including how they use village resources. This meant that management of natural resources was the responsibility of the chiefs. The chiefs decided when to go hunting, where to hunt, and what type of animal to hunt. It was a grievous crime for someone to venture into a forest to take any resource without the chief's knowledge. In fact, the extraction of resources was done collectively under the strict control of family heads, quarter heads, sub chiefs, and the chief. In short, natural resources belonged to and were managed by the people.

2.1.2 The first colonial era

When the first colonial powers, the Germans, arrived in the 1890's, and declared all natural resources state property, the law of status as a base for natural resource management began to erode away. A new system based on the law of contract was instituted as the new administration in 1892 set up the first natural reserve in the country; the Limbe Botanical and Zoological Gardens (still exists today) and began setting up plantations in the coastal areas of the country. Thus, formal forest administration in Cameroon began in the 1890s when the German colonial administration legally alienated communities from the vast majority of their land (Adeyoju 1976). In 1912 the German administration established the Forest Service (FS) and introduced provisions for timber harvesting concession. These provisions stipulated the improvement of logging and extraction techniques, the enforcement of minimum cutting diameters, and the execution of certain sivilcultural operations by the concessionaires (Adeyoju 1976).

2.1.3 The second colonial era

After the First World War, between 1918 and 1947, German plantations were confiscated by colonial protectorates Britain and France, and vested in the state to be leased and developed by the Cameroon Development Corporation (CDC) for the benefit of Cameroon society as a whole (Acworth *et al* 2001). The French and the British colonizers continued to manage the natural resources of Cameroon, though with different interests as shown by their system of management. Although the French colonizers in the 1930s began creating hunting reserves and educating the population on some basic

sivilcultural skills (Mengang 1998), it was all done for their interest and not for the interest of the people and their environment, as later seen from their "extraction" policies. While the British colonizers were more conservative in the management of forest resource in southern Cameroon, the French encouraged the expansion of logging activities in the eastern part of Cameroon (Adeyoju 1976). In the early 1930s, the British colonial administration established the Forestry Department and the Native Administration (NA), and used the concept of "indirect rule" to control all unoccupied land and forest resources (Jua 1999; Chilver 1963). In efforts to ease land and forest resource management for the Native Administrators, the Colonial Forestry Department established Forest Reserves in the 1940s and 50s.

2.1.4 The post independence era

When Cameroon was granted independence in October of 1961, management of forest resources became a shared responsibility of the Native Administration and the State Forestry Service (Acworth *et al* 2001). In the years following independence, the management of natural resources was the shared responsibility of a number of government ministries, including the Rural Development Secretariat, the Department of Tourism, and the Ministry of Livestock, Fisheries and Animal Husbandry. During these years, forest resources, water resources and agriculture were managed by the Rural Development Secretariat. In 1972 a Ministry of Agriculture was created taking the responsibility of managing forest and water resources, while park management was entrusted to the Department of Tourism.

In 1973, twelve years after independence, the State passed Land Ordinances, declaring all lands as national lands and putting them under its control (Acworth *et al* 2001). Inspired, by the colonial administration the state in 1974 and 76 passed Land Tenure legislations putting a stop to traditional land tenure systems. Forest exploitation and the management of land resources operated under the Land Ordinances of 1973 until 1994 when a new forestry policy was passed into law.

These four eras of resource management in Cameroon were characterized by fragmentation of the management process which made it difficult for the forestry administration to see the forest as an integrated unit. The management of natural resource elements like forest, water, parks, and wildlife by different ministries fostered the single-product use doctrine that puts emphasis on individual elements of the forest ecosystem and not on the entire ecosystem. Also, by declaring all forests public lands and alienating the local population from getting involved in the management process, the colonial administration created animosity and resistance within forest communities. This resistance led to illegal activities, notably illegal logging and consequently corruption within the Native Administration that acted as a link between the colonial administration and the local population.

2.2 Current Policies and Impacts

Even though the traditional tenure system has been relegated to the background of resource management since the colonial period and abolished in 1974, the tenure system

has persisted to the present. The management of forest resources remained the responsibility of the Ministry of Agriculture until 1992 when it was taken over by a new Ministry; the Ministry of Environment and Forest. Although forest resource management now has a separate Ministry, a number of its activities still reside with other Ministries.

The year 1992 saw a new beginning in the history of natural resource management in Cameroon. As a signatory to the Rio Earth Summit agreements on global warming and biological diversity, the Cameroon government was required to establish a Ministry of Environment which was to oversee the management of the nation's natural resources as well as protect the environment. To that obligation the government in 1992 brought together the forest and wildlife sectors in the Department of Agriculture and the Department of Tourism to form the Ministry of Environment and Forestry (MINEF). The creation of this Ministry precipitated institutional and legislative changes which had been in process since 1989. Two years after the creation of the Ministry of Environment and Forestry, the Parliament in 1994 tabled a new forestry policy and passed new forestry laws. Prominent in the new forestry policy is the Land Use Planning frame work (zoning plan), the National Environmental Management Program (NEMP) and the National Energy Plan. Together, these policy components are aimed at enhancing rural economic activities and fostering sustainable management of forest resources in the country (Mengang 1998). So far, this objective has not been attained. Environmental policy in Cameroon has done little to contain the malady of environmental destruction.

CHAPTER III

LITERATURE REVIEW

3.1 Previous Studies of Land Use and Environmental Policy in Cameroon and Impacts of these Policies

This section reviews the historical development of public forest management in Cameroon covering the pre-colonial, colonial, and post independence periods. It describes policies related to development, trade, plantations, and scientific exploitation, and how these policies account for the present forest management structure in Cameroon. No deforestation model existed during the pre-colonial and colonial periods hence a historical approach is used to illustrate resource use policies.

3.1.1 Pre-colonial period

Prior to the arrival of the first colonial administration in Cameroon, the management of natural resources was managed according to the people's law (i.e. law of status). Resource use was coordinated by the paramount chief with sub-chiefs given the

responsibility of protecting resources within their localities for the benefit of all members. Resources were extracted and used on a collective base, with every individual or family receiving resources according to their needs. For example, Mengang (1998, 239) notes that "when a hunting party returned to a village, all the animals killed were brought to the chief whose duty was to distribute the meat to all villagers." Therefore, it was illegal for any villager to venture into the village forests without the chief's permission. Also, with no established monetary unit at this time, resources were well protected by the village leaders to maintain the "barter" system upon which their economy depended. With the arrival of European traders in the late 1700s, villagers began undermining native laws governing the use of resources. Lulled by ostentatious goods from Europe, like salt, mirrors, matches, and machetes, villagers began obtaining forest resources without permission from the chiefs, in order to exchange them for these goods. Thus, with expansion in trade-by-barter and the introduction of a monetary system, the regal ethics system that had guided the use of resources in primitive Cameroon society for thousands of years began to collapse.

3.1.2 Colonial period

3.1.2.1 Early colonial period

Even though European ventures in Cameroon pre-date the nation itself, the earliest account of European settlement and interaction with the indigenous people was in the late 1700s and early 1800s by Spanish, English, French, and German explorers, traders, and

missionaries. The English dominated trade during this period and developed close relations with the local chiefs in the costal regions of Douala and Bimbia (or Victoria as the English called it (Limbe)). The English domination was not without rivalry from the German and French traders with vested interest in the business. The English government in 1842 made an agreement with two native kings to encourage lawful trade in ivory, kola, palm oil and palm kernels (Rudin 1938). This was an effort to stop the slave trade that was being discouraged by many European governments. Although the English government encouraged trade between English traders and the natives, it had no interest in annexing the territory even at the request of traders, missionaries, and the native kings (Rudin 1938). The English government's refusal to annex the territory meant no official trade, exploitation, and development policies guided transactions between the English traders and the natives. Although the traders relied on the "court of equity" to resolve disputes in the territory, unguided trade and exploitation continued in the territory until German annexation in 1884 (Rudin 1938).

3.1.2.2 German colonial policies

By the time of German annexation in July 14th 1884, trade in tropical produce had intensified and formed an important pull factor in the annexation agenda. With their government firmly in control of the territory, German planters began establishing plantations in the coastal region of the territory. These plantations were established by firms and individual planters, who engaged in extensive clearing of forest along the coast to create space for their plantations (Rudin 1938). According to Rudin, the number of

German planters increased from 7 in 1891 to 182 in 1913. Two trading firms existed at that time: the Woermann and Jantzen firm, and the Thormählen firm. With increasing demand for wood in Europe, principally for shipbuilding and canal piling, these trading firms began exploiting the forest for commercial purpose (Adeyoju 1976). Deforestation, therefore, was not only to create open fields for the development of plantations but also to export the logs to Germany. At first, German exploiters concentrated mainly on ebony logs but later on extended their exploitation to other African wood species like Iroko (African Oak), Mahogany, and Sapele (Adeyoju 1976). The increase in number of planters coupled with increase in demand for wood meant an increase in deforested areas. Roads and railways were constructed through the forest to support plantation and logging activities. For example the construction of a 168 Km (104 miles) of rail track linking Bonaberi and Nkongsamba from1906 to 1911, and the 280 Km (174 miles) of road linking Kribi and Yaounde in 1913 took place within the rain forest. By 1913, the Germans had constructed a total of 360 Km (224 miles) of rail tracks, 500 Km (311 miles) of roads in the forest region of Cameroon, and established 100,000 hectares (386 miles^2) of plantations in Limbe (Rudin 1938, 240).

The activities of these firms and individual planters flourished such that it created an economic base and attracted the intervention of the German government. Though the German government's intervention was mainly for taxation purposes, it did to a lesser extent regulate the firms' activities for the purpose of conservation. For example, the German colonial administration established a forest service and introduced specific provisions to guide timber harvesting. These provisions include enforcement of logging

and extraction techniques, minimum cutting diameters, and silvicultural operations (Hedin 1930). Even though German traders initially welcomed the annexation of the territory by their Government, they never welcomed its intervention in their business affairs. The German business community argued that "the government could not regulate their activities without their consent because they had charters to acquire licenses and concessions in the forest predating the political administration (Adeyoju 1976, 3)." With increasing competition and rivalry among exploitation companies, obtaining timber concessions from land owners became so complicated that the exploiters expressed the need for intervention and arbitration from the German government. Also, with the dwindling number of valuable species, it was apparent to timber traders that the trade was at risk of collapsing if nothing was done to control exploitation. To this effect, German exploiters and planters eventually accepted and supported their government's development policies for the resources in the new colony. As pointed out by Adeyoju (1976, 5), the German forest law in Cameroon consisted of nine main provisions:

1. Reservation of forest Areas;
2. Classification of forest offences and procedure for the arrest and prosecution of offenders;
3. Issuance and control of timber licenses;
4. Issuance of special licenses for the local use of wood and secondary forest produce;
5. Compounding of forest offenses by duly appointed forest officers;
6. Establishment of the procedures and functions of the forest service;

7. Prescription of circumstances in which bona fide land owners and certain forest operators could take specified forest produce free of charge;
8. Rule governing the payment of fees and royalties for forest produce harvested; and
9. Responsibilities for licenses for the establishment and maintenance of succeeding forest crops.

This legislation enabled the German government to quickly establish forest reserves and control logging by German exploiters and the shifting cultivation practice by the natives. The German government also established a forest service to ensure the implementation of these policies. The forest service was mostly staffed by Germans who received special training in tropical forest management in Berlin or in the Colonial Institute in Hamburg (Rudin 1938). A Botanical Garden was also established in Bimbia (still in existence today) to deal with scientific aspects of forest exploitation. A special agricultural school was also established in Bimbia (Limbe) to train natives in forest and agricultural management. According to Adeyoju (1976), the training received by the natives was very basic and did not prepare them for dealing with real professional issues. This was a strategy to keep the natives from detecting the colonizer's alternative policies and to render them powerless when it came to political negotiations.

The architect of these policies was the Colonial Society and its Economic Committee that was established by Bismark under the German colonial constitution. Article 1 of this constitution concentrated power in the hands of the Kaiser. This was to reduce

contestations over colonial legislative issues in the Reichstag (parliament) and to expedite exploitation of the colony (Rudin 1938). This centralized control through the Kaizer pleased the colonialists as they were able to run their affairs with less interference from the Reichstag.

3.1.2.3 English colonial policies

Following Germany's defeat in World War I, Cameroon was mandated to Britain and France by the League of Nations. The League of Nations accorded the western part of the country to Britain and the eastern part to France. The western part of Cameroon was administered as Nigerian territory until 1961 when the southern part of the territory became part of east Cameroon, while the northern part remained with Nigeria (see figure 2.2). Hence, English forest policies in Nigeria were enforced in the English-speaking part of Cameroon. The British established seven forest ordinances to guide forest management in British-Cameroon. Under these ordinances, a reservation program was created to protect forest areas that were already showing signs of over exploitation by timber exploiters and poor farming practices by the natives (Adeyoju 1976). Prominent provisions of the ordinances include:

1. The obligation of a timber operator to plant seven saplings for each felled tree;
2. Acquisition of land in which the destruction of forest affected continuous supply of forest produce;
3. The establishment of itinerant courts to speed up the reserve program;

4. The establishment of the Native Authority (NA) to control all unoccupied land and forest resources; and
5. The requirement that not less than 25 per cent of the land be set aside as forest reserves.

The British forest administration in Cameroon was faced with the problem of a shortage of staff to implement these policies. Natives had to be trained in forest management techniques in Government or Native Authority schools. Local chiefs were also trained and "Anglicized" as the British had to rely on the concept of indirect rule (Chilver 1963), by which local chiefs were charged with implementing and enforcing these policies.

Although the British administration experienced a shortage of trained foresters, it nevertheless continued the scientific forest management program that was started by the German government. The British government maintained the Botanical Garden in Victoria (Limbe), establishing branches in the 1930s and introducing botanical names for species in local languages (Adeyoju 1976). The British also maintained and expanded plantations created by the Germans. They vested all private plantations in the state and placed them under a parastatal: the Cameroon Development Corporation. Although Britain, like any other colonialist was out to maximize economic exploitation of its colonies, it did so in a more conservative manner, especially with regards to the management of forest resources.

3.1.2.4 French colonial policies

Unlike the British who adopted a more conservative approach to forest management, the French colonial administration encouraged the expansion of forest activities in many parts of the colony. Adeyoju (1976, 4) notes that construction of the Douala – Yaounde railway by the French was to facilitated the transportation of logs from the interior of the country to the port of export in Douala. Also, according to a 1939 publication titled *The Work of France in the Cameroons*, between 1922 and 1937, the French constructed 6,000 Km (3728 miles) of permanent and seasonal roads and 165 Km (103 miles) of railway in the colony. Most of these roads and railways traversed the dense rain forest that covers the southern part of the colony. This development venture by the French colonial administration led to a two fold increase in log exports in comparison to the pre-war level (Centre D'informations Documantaires 1939). This correlation between development and export of a forest resource supports a post independence accusation by Cameroonians that French development in the colony was mainly "drainage development" (Mengang 1998). That is, the French colonial administration embarked mainly on development projects that facilitated the exploitation of the colony and cared less about the welfare of the people and their environment. However, in 1946, the French introduced basic forest legislation in the territory through a general decree (ordinances) on forestry and land use. Prominent provisions of the French colonial forestry policies in Cameroon include:

1. The reorganization of a 1920 forestry service to cater for log exploiting services;
2. The creation of botanical and vegetation institutions to promote studies on the potential value of forest resources; and

3. Reinforcement of state ownership of all forest lands in the colony.

The 1946 forestry legislation was in use until 1973 when a national forest law was enacted. The 1973 law was prompted by reunification of the English and French speaking Cameroons whose forest legislations had evolved along different lines.

From this historical review, it can be concluded that colonial forest management in Cameroon was mainly for the economic benefit of the colonizers with little or no concern for the welfare of the Cameroonian people and their environment. While policies of the French colonial administration focused more on resource exploitation and alienation of communities from forest lands, the English administration's policies encouraged conservative use of resources and the involvement of natives in the affairs of the colony more than the French. Like the French, the Germans also encouraged resource exploitation but to a lesser extent than the French.

3.1.3 Post-Independence

With a majority (8 of 10 provinces) of Cameroon having a French background, the post-colonial government continued with the exploitative policies of its French colonial power, largely neglecting the more conservative policies of the English. Cameroon's post-independence resource exploitation policy is, in a way, inspired by the 1972 constitution. The constitution stipulates in its preamble that Cameroon was determined to "exploit its natural wealth in order to ensure the well-being of every citizen by raising living standards." The constitution does not limit resource exploitation nor specify how

the resources should be extracted to avoid depletion and environmental degradation. Although some modifications were made to the original French colonial forestry law after independence (1962, 1968, and 1973), it was not until the 1980s that Cameroon became really conscious of environmental protection (Nasong'o and Gabsa 1998). Important forest related laws since the 1980s include:

1. Law No 81/13 of 27 November 1981 stipulating the judicial regime of forestry, wildlife, and fisheries;
2. Law No 83/169 of April 12, 1983 on forestry regulations; and
3. Law No 83/170 of April 12, 1983 on wildlife regulations.

These forest related reforms of the 1980s gave birth to a new Ministry in 1992; the Ministry of Environment and Forest (MINEF). Although the creation of this new Ministry was a significant development, the crown event for the forest sector was the enactment of a new forestry law in 1994; law No 94/01 of January 20 1994 on forestry regulations. The forest sector has since been operating under this law.

3.1.3.1 Land use studies since the 1980s

The forestry reforms of the 1980s and early 1990s prompted academic research, especially in the area of social sciences in forestry. Most of this research was/is funded by international environmental groups and non-governmental organizations with stakes in the global forest and land use cover change. Research in the 1980s focused mostly on forestry education and policies. For example, Fultang (1988) examined how the government of Cameroon was educating its people on forestry issues. Carman (1989)

also did a study on how the government enforced the 1981 and 1983 laws governing the harvesting of its rain forests. Also, in efforts to understand forest distribution in Cameroon, and how its forest sector operates, a two part study titled *Cameroon and its forests* was carried out by Faure (1989 and 1990). In the first part (1989), Faure did a comprehensive study of Cameroon's natural landscape while the second part (1990), focused on analysis of Cameroon's forest sector. Similar studies on Cameroon's forestry sector activities include Aube (1993), Besong (1992), Fultang (1992), and Eba'ayti (1998). These authors examined the structure of Cameroon's forestry sector, its development, and its role in the country's economy. Studies in the late 1990s and early 2000 focused mostly on communal and agro forestry. For example, Thomas *et al* (2001) did a study on decentralization of forest management through community forestry management in the Kilum-Ijim forest in the Northwest province of Cameroon. In a similar study Acworth *et al* (2001) showed how the Mount Cameroon Project (MCP) has empowered the local people of the Onge-Mokoko forest area in the Southwest province in managing their forest resource. Djeumo (2001) traced the origins and development of community forestry in Cameroon. Still in another study, Fomété and Vermaat (2001) examined potential impacts of community forestry on rural poverty in Cameroon.

The increase in land use studies in Cameroon has certainly drawn the world's attention to the problem of forest loss that the country is currently facing. But research alone is meaningless if action is not taken by the government to address issues pointed out by these studies.

3.2 Previous Studies of Regional and National Land Use Changes

Most models of deforestation are designed to support less complex multidimensional processes. This is because deforestation is a social problem and, like all social models, deforestation models focus only on a few of the many variables involved in the cause and effect relationship in land use (Kiamowitz and Angels 1998). Lambin (1997) noted that the multidimensional nature of deforestation processes has led to different research approaches in deforestation studies. This is reflected in the plethora of literature on deforestation models, most of which were developed in the 1990s. Deforestation studies take into consideration the issue of scale. The size of the unit of analysis under study is an important aspect of any deforestation studies (Kiamowitz and Angels 1998). Kiamowitz and Angels assert that "factors affecting deforestation, the interactions between them and the magnitude of their effects vary significantly from one location to the other" (Kiamowitz and Angels 1998, 4). These authors are right in their assertion because even though two localities may suffer from the same land use problem, the contributing data and processes that led to the problem may be fundamentally different. Lambin (1994) argues that "at broad scale, the high level of aggregation of data obscures the variability of situations and relationships and produces meaningless averages" (Lambin 1994, 15). However, we can not deny that some local scale problems may only be understood when studied at a broader scale, since a local scale problem may only be part of a larger problem when put together. Therefore, studies in deforestation vary in scale from individual households/firm, small land areas, regions, countries and the world.

Apart from the use of scale, researchers in this field apply a variety of methods in their studies including analytical, simulation, and regression methods. Therefore, a review of existing literature on deforestation should focus on two criteria: *Scale* and *methodology*.

3.2.1 Household and firm level studies

The household is the smallest unit on the scale of deforestation studies and is always the starting point of most studies. Studies done at the household and firm level have mostly used conventional models in which it is assumed that actions of agents of deforestation are influenced externally by prices, technology, institutions and infrastructure (Kiamowitz and Angels 1998). Though agents' behavior is exogenously influenced, the free movement of labor between farm and off farm sectors makes population endogenous (Kiamowitz and Angels 1998). In these studies the agents' decision to maintain or cut down a piece of forest land is contingent upon the agents' socioeconomic status such as income level, size of household, and land holdings (Parks *et al* 1998). For example, Barbier and Burgress (2001) did a study on land expansion in which they employed a number of approaches, including a farm level approach. The results of this study showed that agricultural expansion is the main factor determining land expansion and forest loss in most areas of the tropical world. From a policy view point, governments must consider carefully their role in influencing local patterns of deforestation and forest degradation. States that support frontier expansion (e.g. Brazil) and those that sponsor logging activities (e.g. Philippines) (Kummer 1991) must revise their policies. Verburg *et al* (2004) developed a dynamic model that combines spatial and household data to

analyze and determine accessibility and land use pattern. The attractiveness of this model is based on its ability to measure and explain the spatial pattern of different land-use types. For example, results of this analysis indicate that the relation between land use and accessibility is dependent on the specific characteristics of the different land-use types. In a similar study Walker (1999) employs an agent based model of shifting cultivation that integrates household production theory and the concept of optimal forest rotation to explain patterns of land use and forest structure beyond the extensive margin of agriculture. A policy application of Walkers' study can be related to rural violence stemming from land scarcity. Governments need to develop policies that will reduce overall dependence of rural dwellers on land. Using a similar approach, Poole (2004) used poverty alleviation strategies for people whose livelihoods depend significantly on tree and forest resources to demonstrate how tree and forest-dependent peoples can be integrated into the wider economy. The result of Poole's study indicates that there is the necessity for governments to develop policies that enhance utilization of indigenous tree species within the household as well as integrating it into the wider economy.

In another household level study, Binam *et al* (2003) used a Data Envelopment Analysis (DEA) model to compute farm-level technical efficiency (TE) for a sample of 81 peasant farmers in the low-income region of Côte d'Ivoire. The results of their study suggest that substantial gains in output and/or decreases in cost can be attained given existing technology. In the same study, the authors used two-limit Tobit regression techniques to examine the relation between technical efficiency and various farm/farmer characteristics. This second approach showed the role variables such as family size,

membership to a farmer's club or association, and the origin of farmers play in agents' actions. Governments should therefore develop policies that enable farmers to create and participate in club activities. The authors also suggest that policy makers should consider policies that will facilitate public sector involvement in the provision of information on labor force management to peasant farmers. This will improve efficiency levels, and thus household incomes.

Other studies that employ analytical open economy models with exogenous variables include: Angelsen (1994) and Deininger and Minten (1996). Angelsen's (1994) land fallow and property rights study showed that lower discount rates may improve land management in already cleared areas but increase deforestation. Deininger and Minten (1996) used Chayanovian model to determine the effect of allocation of time by household and hired labor on farm activities. They found that agricultural productivity improvements that affect only already cleared land reduce additional deforestation by inducing farmers to devote more time to land already under cultivation.

3.2.2 Regional level studies

Next on the scale of deforestation studies is the regional level. Both spatial and non-spatial models have been used to analyze deforestation and other land use changes at the regional level. Not until the early 1990s, when Geographic Information Systems (GIS) technologies became a facilitating tool for the study of spatial phenomenon, few economic models dealt with issues of spatial dimension like deforestation (Kaimowitz

and Angelsen 1998). Since the introduction of GIS as a tool for analyzing spatial phenomenon, a number of GIS-driven economic models have been developed. Kaimowitz and Angelsen (1998) note that despite growth in economic models that analyze land use in a spatial context, very few of these models combine household and regional level analysis. These authors acknowledge the Dynamic Ecological – Land Tenure Analysis (DELTA) model as one of such few models. The DELTA model has been used by several land use land cover change researchers including Southworth *et al.* (1991a,b) and Dale *et al.* (1993a,b, 1994).

Designed to determine how attractive a parcel of land is to potential users, the DELTA model uses spatial data such as soil quality, natural vegetation, distance to roads and markets, etc, to rank and determine how many land users colonize a parcel of land at any given time period. Results of DELTA model analysis showed that when a parcel of land is located closer to infrastructures like roads or to facilities like markets, and/or when the land is of high soil quality, the probability that that parcel of land will be deforested increases. This particular conclusion has been criticized by Kaimowitz and Angelsen (1998) on grounds that the model makers "assume, rather than prove" their point. From a policy view point, the DELTA model could be useful in proving that policy makers need to always strive for a balance between the quality and quantity of policies they make with regards to land use.

Other studies based on spatial simulation models include Verburg *et al.* (2004), Monroe *et al*. (2004), and William *et al.* (2002). Verburg *et al.* (2004) used different measures of

accessibility such as distance, transportation cost and population size to test accessibility for a rural area at the forest fringe in the northeastern Philippines. Based on the capacity of different measures to explain the spatial patterns of different land use types, these authors found that, due to the presence of relatively dense and better road network in the northwestern part of the study area, it takes only 2 hours and 2 hours 15 minutes to get to San Jose and Del Pilar from San Mariano respectively. On the other hand, due to poor road network and the difficult topography, it takes between 5 and 9 hours to get to the eastern fringes of the study area. The authors conclude that logging accessibility follows a similar pattern as road accessibility. Policy makers must therefore consider accessibility as a limiting factor to forest conservation and make necessary policy adjustments when drafting policies on road development projects.

In the study by Monroe et al. (2004), an empirical spatial model of land use based on production factors of land, labor, and capital is used to analyze land cover change in western Honduras. The model employs two econometric approaches; the Multinomial Logit approach and the Binary Logit approach to detect changes in land cover from 1987 to 1996 as a function of agricultural suitability and transportation costs. Combining ground-truth satellite image analysis with analysis of the econometric model, the study showed that while significant reforestation had taken place between 1987 and 1996, a new area was deforested. The model attributed these changes to market accessibility (measured by cost of access) and topography. The model's strength is in its ability to capture changes between classes, in this case, deforestation and reforestation. The study by William et al. (2002) uses GIS spatial data to assess the effects of biophysical (annual

rainfall, dry season severity, soil fertility, soil water logging, soil depth, linear distances to the nearest paved highway, unpaved road and navigable river) and anthropocentric (rural-population density, urban-population size) predictors on deforestation in Brazilian Amazonia. Dividing the area into 1900 quadrates of 50 x 50 km, the model was programmed to randomly select and rank 120 quadrates on the bases of deforestation intensity. The researchers then carried out an ordination analysis to identify orthogonal gradients among the predictor variables. Finally, a multiple regression analysis was carried out to determine correlation of the variables with deforestation. The results indicated that highway density and rural-population size were highly correlated to deforestation.

In general, results of these regional level studies are not different from those of the analytical household studies reviewed earlier. In both groups of studies, it is concluded that forest areas closer to roads, village settlements, and markets are prone to deforestation than those farther from these infrastructures. Also, forest areas with better biophysical factors such as higher quality soils and drier climates are more likely to be cleared.

3.2.3 National and macro-level studies

National and macro-level unit is the largest on the scale of deforestation studies. Although most national and macro-level models support cross country analysis, the models reviewed here are those designed mainly to analyze deforestation and other land

use activities at the country level. These models are similar to the ones reviewed under household and firm level studies, except that in this case endogenous variables are added and computable general equilibrium (CGE) analysis is involved. As pointed out by Kiamowitz and Angelsen (1998 53), adding CGE model analysis to household and firm level analysis determines decision parameters which are an important link to macroeconomic variables and policy instruments. For instance, Martens *et al.* (2002) and Agnes and Ian (2005), studied subsistence agriculture and commercially oriented farming systems in upland and forest margin areas of Southeast Asia to determine their influence on forest exploitation. In a study that involves activities of the agricultural and forestry sectors, Pearce (2001) examined the economic value of forest ecosystems, while Owusu (1998) examined log export and structural adjustment programs as activities of the forestry and manufacturing sectors.

In the study by Martens *et al*. (2002), the authors tried to improve our understanding of deforestation by crossing spatial analysis and livestock economic studies. The authors employed non-linear models to determine how landscape dynamics are related to infrastructure development, ecological conditions, zoning policies and to the evolution and organization of production, consumption and marketing chains of livestock products in the Brazilian State of Pará. The study indicates that road construction investments in electrical energy, financial credit for cattle ranching and soybean, and poorly conceived land reform policies are the main drivers of deforestation in Brazil.

The study by Agnes and Ian (2005) examines traditional and commercial agricultural land use systems in Southeast Asia to demonstrate that the former is linked to "patterns of order and balance between a people's needs and the sustainability of their resources" while the later is linked to "disorder and destruction of resources." The authors argue that a shift from traditional land and resource use institutions to a centralized market driven system of land and resource used is to blame for forest exploitation. They point to the fact that state assertion of forest land and lack of secured property rights over land leads to encroachment on forest land by landless farmers. From a policy view point, the authors argue that policies and institutions should be structured such as to absorb the pressures of economic development on forest lands and other resources. This can be achieved through decentralization that involves transparency in the use of resources, responsible governance, and accountability.

In Awusu (1998), simple analytical approaches are used to study Ghana's forest sector which, since adopting the International Monetary Fund's structural adjustment program, has experienced an increase in wood exports. Awusu's analysis showed a direct link between adjustment and deforestation. He points to government's need to service external debts and local currency devaluations as an underlying cause of deforestation arguing that governments of forested nations have sacrificed their forests in order to adjust their economies and meet their political interests.

In Pearce's (2001) study, he used three well known economic valuation methods; contingent valuation (willingness to pay), travel cost method, and hedonic pricing (land

value) to demonstrate that all ecological functions of forests have economic values. The results of his analysis favored forest conservation and sustainable use over conversion to other uses. For this reason he argues that decisions whether to conserve forests or convert them to other uses should be based on comparative analysis of the use of forest land for other purposes and the economic values accorded to its non-market benefits. He asserts that this type of forest economic valuation helps policy makers "design markets that capture the value ideally for the benefit of the many vulnerable communities that rely on the forests for their well-being."

A number of studies carried out in the 1990s show a correlation between policies and forest loss. For example, Pearce and Warford (1993) carried out a study in Mexico, Indonesia, Costa Rica, and Malaysia to determine the effect of market policy on forest exploitation. In that study, they looked at different market and non-market values of timber such as carbon storage, pharmaceutical, ecotourism/recreation, watershed protection, existence value, and option value. Analyses of these variables in all four countries indicate that markets do not take into account non-priced benefits and costs. They argue that market policies that favor high discount rates in these countries have encouraged deforestation. Another study by Reppeto (1993) showed that mistaken policy intervention by governments can lead to deforestation. For example, he examined road construction in the Brazilian state of Para and found that deforestation, following road construction, increased from 0.6% to 17.3% of the state's area between 1972 and 1985. A Similar study by Kaimowitz (1997) on mines and estates development in forest lands in Bolivia also exemplifies policy failures that led to forest decline.

Studies have also been carried out which show that government subsidy policies contribute to forest loss. For example, a study of government subsidy in the Philippines by Kummer (1991), suggested that the granting of subsidies to farmers and ranchers led to a decline of about 25% of the nation's forest cover in the early 1990s. Also, studies by Gray (1997), Wilkinson (1998), and Kartodiharjo and Supriona (2000) indicate that Guyana, Indonesia, and Ghana, respectively, have large portions of their forest lands under concessions, resulting from government subsidy policies.

Poorly designed policies that plunged most developing nations into the infamous "debt crisis" have also been linked to forest loss in these countries. Examining the debt and deforestation link, Khan and McDonald (1995) analyzed data from 68 countries over a four year period (1981 to 1985) and found that debt service has a negative influence on forest management. These studies suggest a correlation between resource policy and forest loss.

Policies can be a powerful driving force in the management of the natural environment. When well conceived, policies can lead to the sustainable use of resources, creating a situation by which the society strives to match its needs with its natural resources by influencing people's perception of their needs and wants. Policies influence decision-making at every level of the society including the three components of sustainable development; namely economic efficiency, environmental integrity and social well-being. Policies therefore play an indispensable role in the sustainable management of the

environment and its resources and should be developed with care, taking into consideration results of the studies reviewed above.

CHAPTER IV

METHODOLOGY

This section describes the methods used to attain the objectives of this study. First, a brief description of the study areas and reasons for their selection is made. This is followed by a description of the methods employed. That is, what tests, what purpose, and what objective(s) the methods are aimed to address. This study made use of both quantitative and qualitative research methods. The quantitative approach is based on analysis of changes in forest cover using remote sensing techniques and empirical statistical and spatial models. The qualitative approach involves analyzing socio-economic, agricultural, and population data.

The literature reviewed in chapter 3 indicates that deforestation is a complex topic to study. Due to this complexity it is important to define the scope and limit the area(s) involved in any deforestation study. It is also important to simplify the analysis of any deforestation study to better understand the cause and effect relationship (Angelsen 1994; Kiamowitz and Angels 1998). Also, Masser (1984) cautions that any research that

is of a comparative nature should not be too ambitious and that its scope should be narrowed down. Therefore this study is limited to two study areas: the Buea/Limbe region and the Bertoua region in the Southwest and East Provinces of Cameroon respectively. Selection of the Buea/Limbe study area is for the following reasons: first, the region covers a significant portion (248,726 hectares) of Cameroon's forest land. Second, politically, Buea has been the seed of both colonial (German and British) and domestic administrations. Third, the Buea/Limbe population (English speaking) interacts closely with the Douala population (French speaking) hence, an ideal region for a national (bi-cultural) study. Fourth and lastly, the region is host to major national forest conservation projects like the Mount Cameroon Project and the Limbe Botanical Garden. The Bertoua region was chosen for the following reasons: First, the East province has the largest area of rainforest in Cameroon. Second, Bertoua is the heart of timber production in the country. Third, the region is largely rural with a majority of its population living a subsistence life which makes it suitable for comparison with the Buea/Limbe region which is made of predominantly urban dwellers. Fourth and lastly, the region is a prototype for the French colonial and post colonial forest management policies in Cameroon. Table 4.1 is a summary of attributes comparing the two study areas.

Table 4.1: Reasons for extrapolating the study areas

Buea/Limbe Study Area	Bertoua Study Area
Covers a significant forest area (248,726 ha)	Has the largest area of rainforest in the country
Seed of German and British administrations	Prototype for French forest management policies
Has a bicultural background with higher degree of urban lifestyle	Shows a higher degree of rural lifestyle
Host to major conservation projects	Timber production center in the country

4.1 Scope of Study and Study Areas

This study consists of two test sites (Figure 4.1). The first test site is located around the towns of Buea and Limbe in the Southwest province of Cameroon. This area constitutes part of the tropical rain forest of the central African region. This area has a total of about 248,726 hectares of forest land. It is host to one of the world's richest conservation sites, Mount Cameroon. According to Mount Cameroon Biodiversity Conservation Centre (MCBCC) this area has 49 strictly endemic plant species and approximately 50 endemic animal species. The population of the area is estimated at about 300,000 inhabitants. More than 50% of the population lives in the urban settlements of Buea and Limbe. Four historical clans settled in this area: Bakweri, Bamboko, Balundo, and Bimbia clans. Throughout history, these people have depended directly or indirectly on the forest for their livelihood. The arrival of the Germans in the 1800s and the establishment of cash crop plantations changed the state of the tropical rain forest of the area. An influx of laborers from different parts of the country, especially from the savanna and grassland areas and from neighboring Nigeria has reduced the amount of land available to the indigenous clans. This immigration over the years has led to illegal exploitation of the

forest and encroachment for agricultural activities. The establishment of the Limbe Botanical and Zoological Gardens (LBZG) and the Mt. Cameroon Project (MCP) in this area are aimed at controlling deforestation and other illegal activities in the Buea/Limbe region.

The second test site is located in the Bertoua region of the East province of Cameroon. This region forms part of Cameroon's southern plateau. This region is dominated by evergreen and semi-deciduous forest cover. The eastern part of this region, adjacent to the Central Africa Republic, is generally covered with savanna woodland and forms a dense network of gallery forest. A mosaic of cultivation and tree and shrub savanna occupy the area in and around the town of Bertoua. Although Bertoua is the most populated area in the east province of Cameroon, the province remains the least populated in the country. This region is inhabited mostly by rural dwellers who depend largely on subsistence agriculture (slash-and-burn) and forest resources for their livelihood. The construction of roads, railway lines and the opening of forest companies have led to increased migration into the region. Most of the migrants come from adjacent communities in the Central African Republic.

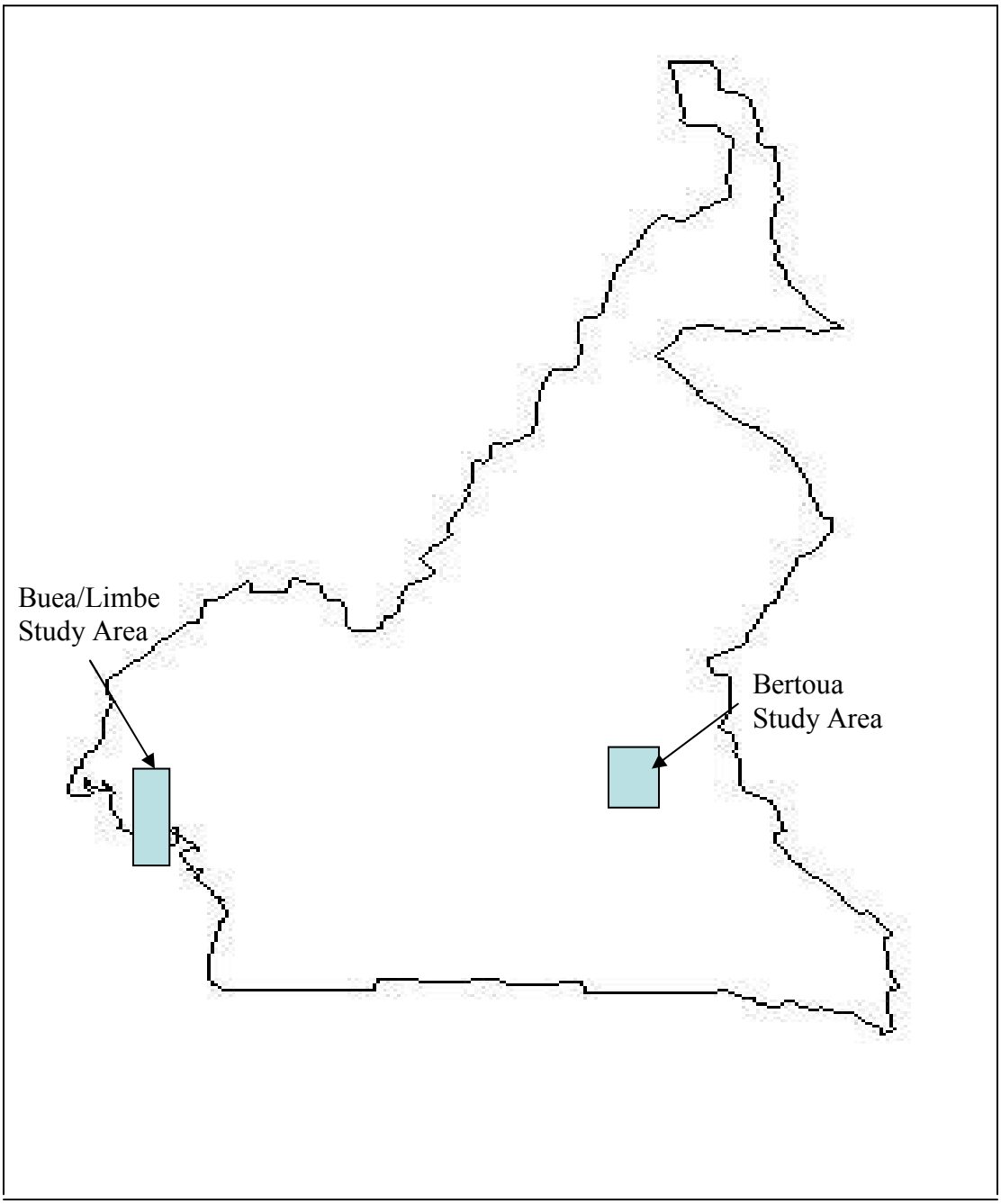


Figure 4.1: An outline map of Cameroon indicating location of the study areas

Due to an increase in industrial, commercial and agricultural developments, as well as population growth, the land cover in these regions has undergone changes. It is important to study these changes, understand their rate of occurrence and their effects on the most abundant resource of the region, the rain forest. Understanding land use cover changes and their effects on forest resources in these regions will lay the ground work for developing a forest policy and management prototype for Cameroon.

4.1.1 Why 1984 to 2000 time period?

The time period from 1984 to 2000 was chosen to carry out a land use and cover change detection using multi-temporal remotely sensed data (Landsat TM 1984, 1986 and ETM+ 2000) with provincial and zone-level socio-economic data. This time period was chosen for three reasons. First, it covers at least six years following the dates of enactment of two major forest and land use policy eras in Cameroon (i.e. the 1976 Land Use Ordinances and the 1994 Forest Policy). This is a reasonable time span to observe any meaningful change in land cover. Second, the two dates are the best available in terms of cloud free image scenes for the two study areas. Southern Cameroon falls within latitude 2º and 5º north of the equator, a tropical zone that is almost always covered by thick clouds. Third, there was the availability of image scenes for each study area within this time period that were close enough (second week of December) to be considered "anniversary dates." As Jensen (1996, 256) points out, "using anniversary date imageries removes seasonal sun angle and plant phonological differences that can destroy a change detection project."

4.2 The Frame for Analysis

The frame for analysis involves selecting and designing an empirical regression model to test the effects of ancillary activities on the physical and socio-economic environment. The frame for analysis in this study is three fold. It begins with acquisition and interpretation of remotely sensed data. Landsat imageries (TM and ETM+) of Cameroon are geo-referenced to the two study areas and land use changes for the time period 1984 to 2000 are identified. This is a pixel-based interpretation. This is followed by qualitative modeling and setting out important frames of the problem. First, the problem is modeled using factors that drive deforestation in Cameroon and second, the role of stake holders is examined. Third, sources of the problem are analyzed and framed into a series of concept maps. The concept maps are based on the results of a closed survey that was conducted in the two study areas. Two survey methods were used in the survey: simple random sampling and stratified sampling. In the simple random sampling method, a sample size of 40 people were randomly selected from a phone directory containing phone numbers of individuals living in the two study areas. The numbers were written on pieces of papers and placed in a hat and picked out randomly. The individuals were then contacted. In the stratified sampling method, phone numbers of people working in forest related sectors were collected from different ministries (Agriculture, forestry, etc.). These phone numbers were grouped into strata. Sample numbers were then drawn from within these strata and the individuals contacted. This method was used so as to ensure that the sample was representative. Based on outcomes of the different analysis (image analysis, socio-economic analysis, and analysis of important frames), goals, constraints

and objectives are laid out in a matrix to compare potential policy alternatives. Finally, policy alternatives are evaluated using different methods and criteria.

CHAPTER V

MEASUREMENT AND ESTABLISHMENT OF CHANGES IN FOREST COVER

This chapter presents a remote sensing model used to measure the rate and degree of forest loss in Cameroon over a sixteen year period. The remote sensing model is combined with an economic model (multivariate regression model) to estimate the driving forces behind forest loss in Cameroon.

5.1 Space-based Change Detection

Different change detection algorithms can be used in studies of this nature. These may include: write function memory insertion in which individual bands of remotely sensed data are inserted into a specific memory bank to visually identify change in the imagery (Price *et al*. 1992); band rationing or image differencing in which imagery of one date is subtracted from that of another (Green *et al*. 1994); and post-classification comparison which involves extracting the difference between two classified images of two different

dates (Jensen 1996). The post-classification comparison method was used in this study. The following procedure was applied:

- The Landsat data (TM1984, 1986 and ETM+ 2000) were acquired from Global Land Cover Facility (GLCF) (http://glcf.umiacs.umd.edu). The image data were acquired in an Orthorectified format geocoded in the spheroid and datum WGS84, with map projections UTM33 and UTM32 for Bertoua and Buea/Limbe study areas respectively.
- Band selection and combination was performed. Each image scene consisted of 6 band layers: 1 (blue), 2 (Green) 3 (Red) 4 (Near Infrared) 5 (Mid infrared), and 7 (Infrared). Band 6 (thermal band) was omitted as it was not required for this study.
- To merge the land cover information into one image scene, the band layers were stacked together using the tool "*Interpreter-layer stack*" in ERDAS IMAGINE 9.0.
- To further reduce processing time and create more disk space the "actual" areas being studied (area of interest – AOI) were clipped as a subset of the images. Also, clipping and extracting subsets of the images avoids cloud-covered areas from interfering and distorting the analysis. The image scenes from the Buea/Limbe study area were particularly problematic in this regard. Therefore clipping subsets of the images was indispensable for the analysis.
- A threshold analysis was performed at a confidence level of 0.05 with chi-square 7.820. This was carried out in order to determine the general change condition in the study areas. The threshold change was depicted in three classes: negative change (vegetation loss/degradation), no change, and positive change (vegetation increase).

5.1.1 Land-cover land-use classification

- Four separate supervised classifications were carried out using the maximum likelihood classifier. The supervised classifications were carried out on land-cover images for 1984 and 2000, representing date 1 and date 2 for the Bertoua study area, and for 1986 and 2000, representing date 1 and date 2 for the Buea/Limbe study area.
- Training data for the classification was derived from; 1) field observations carried out in December of 2005; 2) by interpreting the ecological map of the vegetation cover of South Cameroon (National Centre for Forestry Development 1979); and 3) the interactive forestry map of Cameroon (Global Forest Watch 2001).
- Using a remote sensed false color composite (FCC) raster 4, 5, 3 (near infrared, mid infrared and red respectively) and guided by training data, pixels from seven land-cover classes were selected. These classes include: Agricultural Field_1, Agricultural Field_2, Forest_1, Forest_2, Water, Deep Water, and Urban/Rural Built.
- The Agricultural Field_1 class corresponds to large expanses of cultivation land (plantations) characterized by shrub savanna, tree crops, palms, and broad-leaf plants. The Agricultural Field_2 class corresponds to grassland savanna and subsistence farming areas characterized by fragmented and partially covered plots with crops of <5m tall. The Forest_1 class corresponds to dense and moist evergreen forest. The Forest_2 class corresponds to degraded and less dense evergreen forest. The Water class corresponds to all inland water bodies both natural and man-made. The Deep Water class corresponds to sea water. Deep Water was classified only in the Buea/Limbe study area, as Bertoua is in the interior. This was to prevent the software from including pixels of the open sea with those of the water class which only

includes inland water bodies. The Urban/Rural Built class corresponds to build environment such as roads, towns and villages. Bare soil is also included in the urban/rural built class.

- Due to the fact that the focus of this study is on land cover change as a whole and not on specific aspects of land use, Agricultural Field_1 and Agricultural Field_2 were merged to form a single class: Agricultural Field. Likewise, Forest_1 and Forest_2 were merged into a single class: Forest Land. Since Deep Water (Atlantic Ocean) was classified only in one study area (Buea/Limbe), it was not considered in the final analysis.
- An accuracy assessment was performed on the classified land-cover maps. Maps of the Bertoua study area indicated an accuracy of 90% each for the 1984 and 2000 images while maps of the Buea/Limbe study area indicated an accuracy of 90% and 85% for the 1986 and 2000 images respectively.
- The classified maps were divided in to six zones (Figure 5.1 and 5.2). The Bertoua study area was divided into four zones (Zone 1 - NW Bertoua, Zone 2 - NE Bertoua, Zone 3 - SW Bertoua, and Zone 4 - SE Bertoua) while the Buea/Limbe study area was divided into two zones (Zone 5 - Buea/Limbe – North and Zone 6 – Buea/Limbe – South). It was not possible to follow political boundaries or specific surface area patterns to divide the classified maps into zones hence, the ULX-LRX and ULY-LRY map coordinate system for ERDAS IMAGINE 9.0 was used in the division process to prevent pixel data of other zones from overlapping. The reason for dividing the classified maps into zones was to increase the number of observations necessary for multivariate regression modeling.

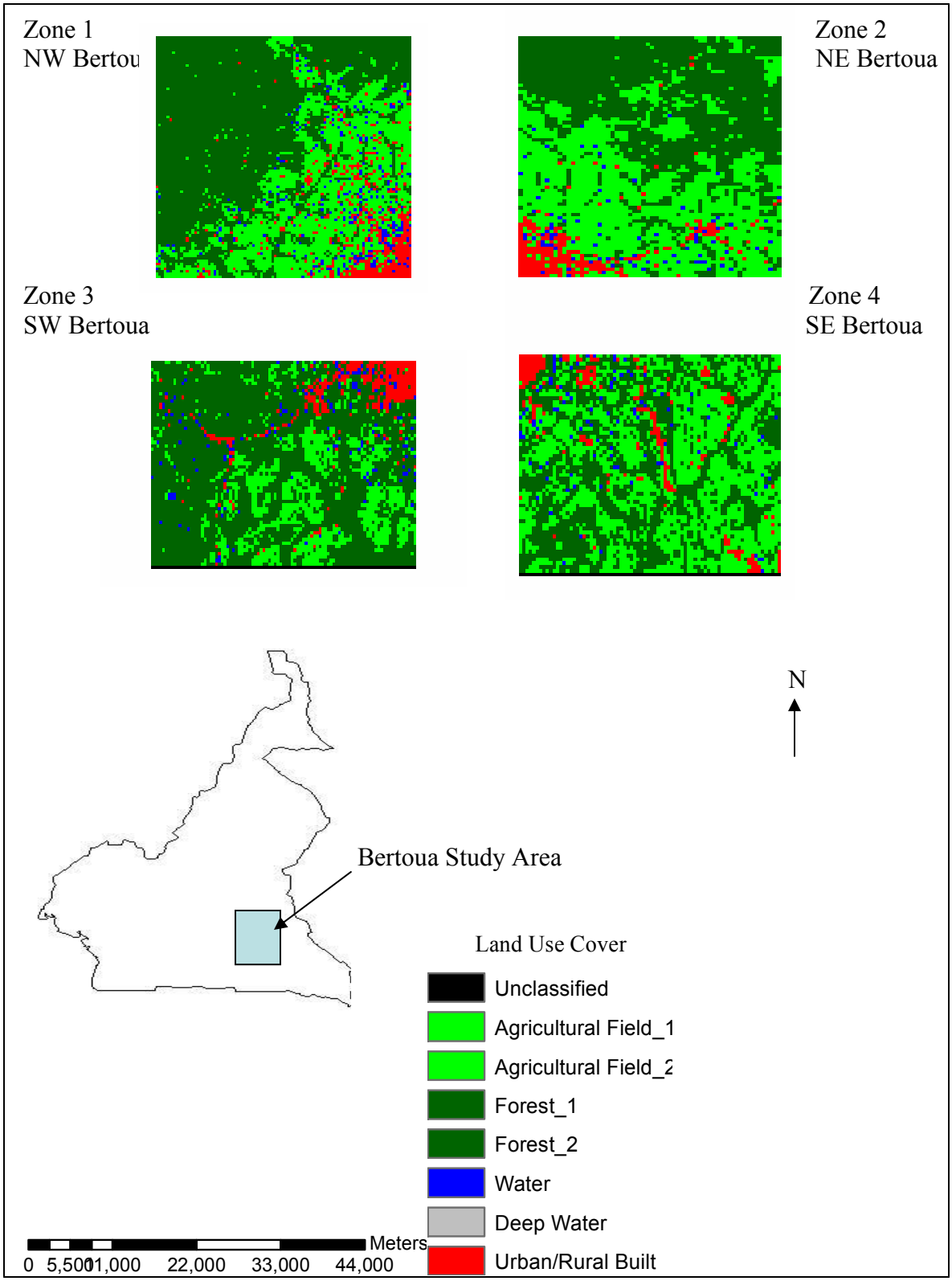


Figure 5.1: Land use cover of the Bertoua study area (zones 1-4): date 1 (1984)

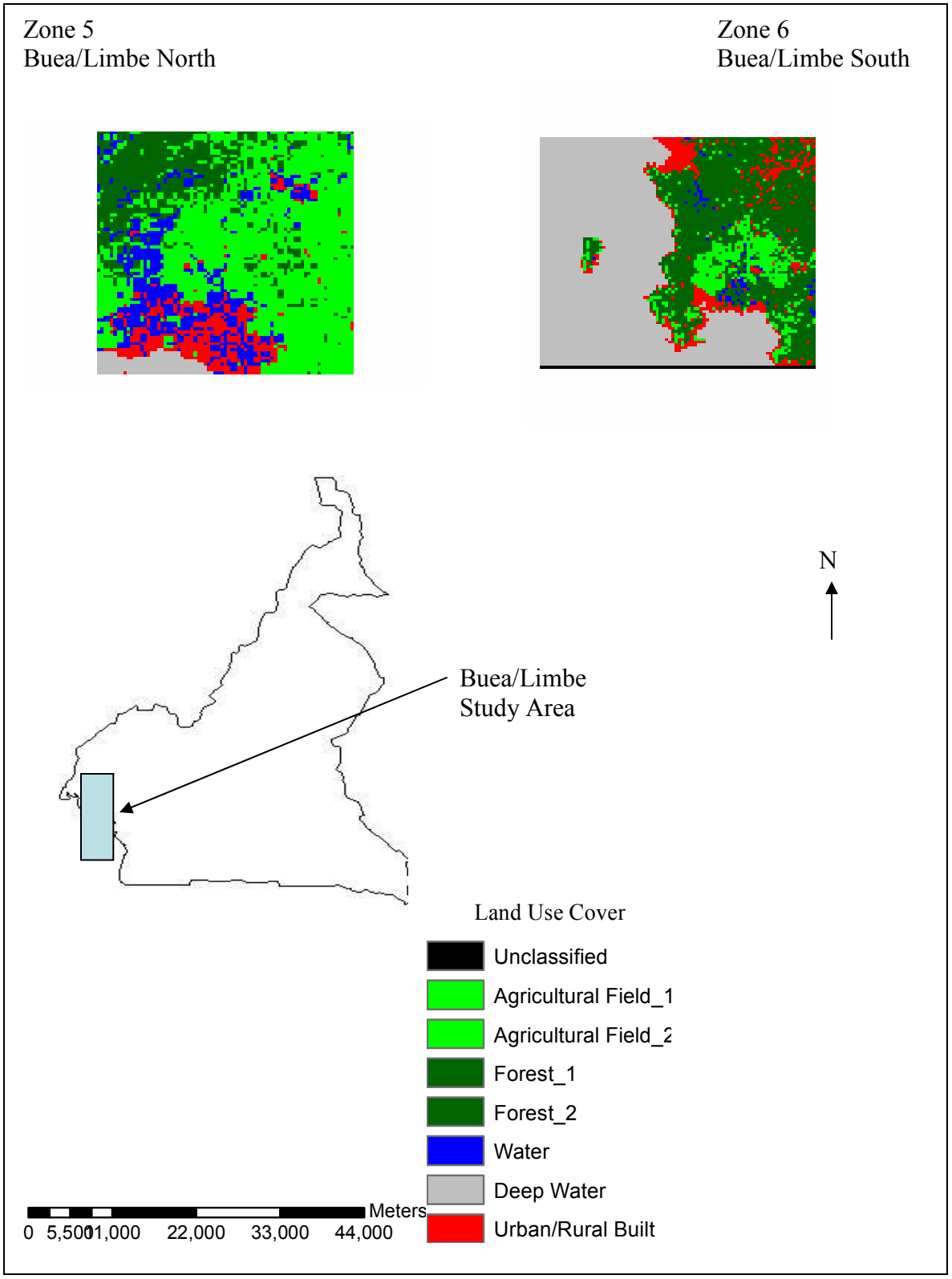


Figure 5.2: Land use cover of the Buea/Limbe study area (zones 5 and 6): date 1 (1986)

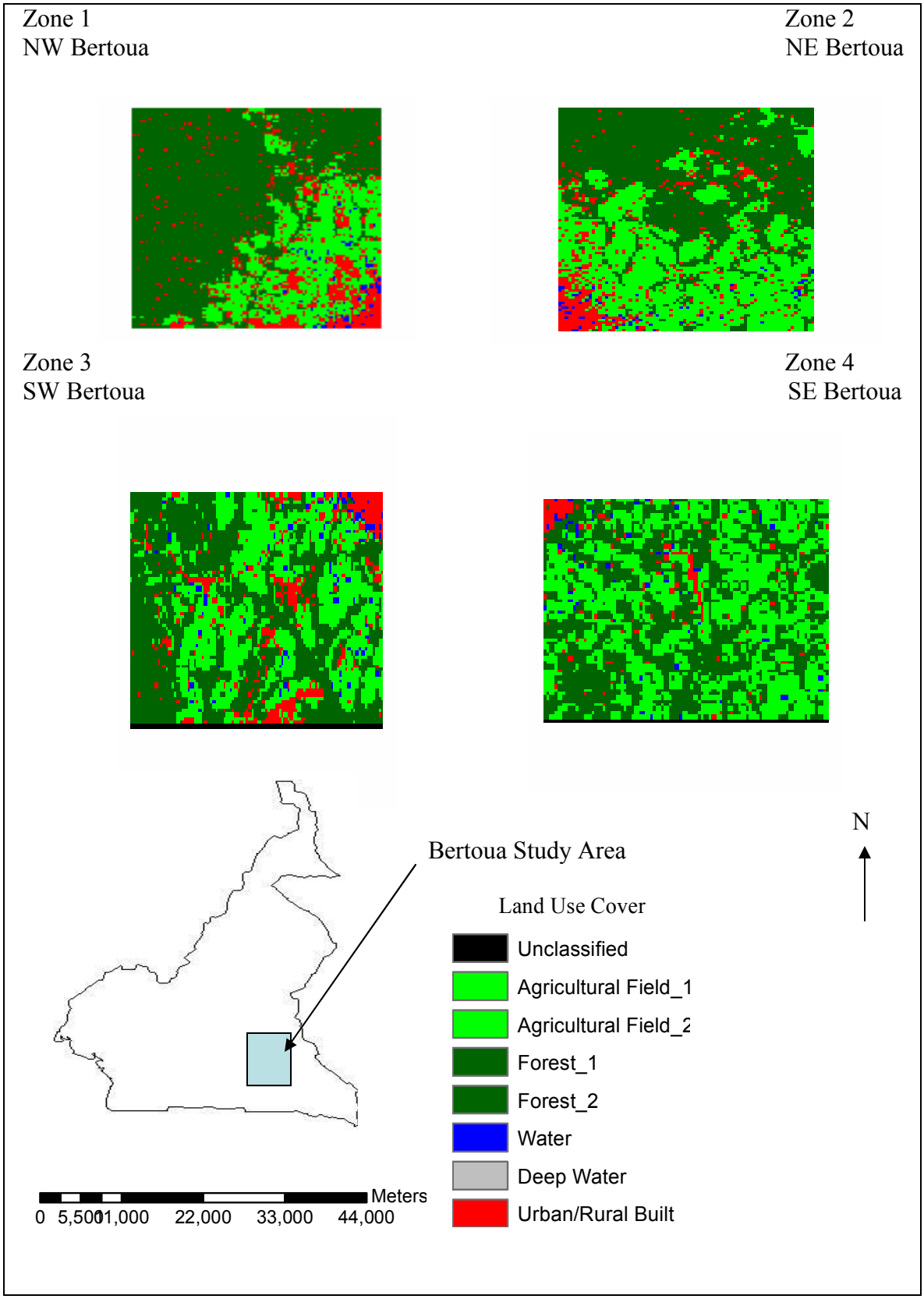


Figure 5.3: Land use cover of the Bertoua study area (zones 1-4): date 2 (2000)

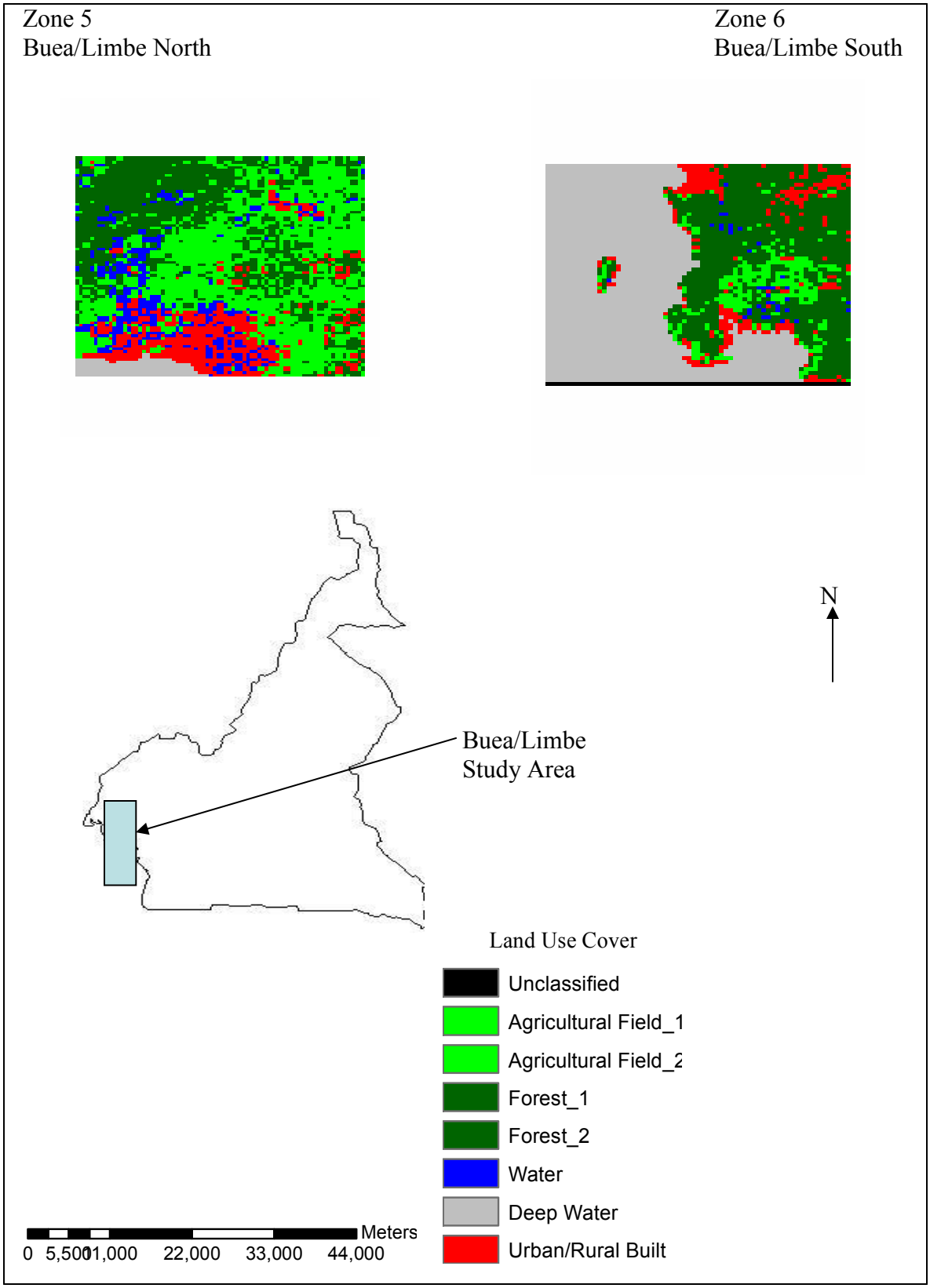


Figure 5.4: Land use cover of the Buea/Limbe study area (zones 5 and 6): date 2 (2000)

5.2 Change Detection Results

The above processing procedures led to a pool of change data (Appendix I) that was processed to determine changes that occurred in each of the six zones. Below (table 5.1) is a summary of the change data for the six zones. The positive and negative signs accompanying numbers in the table indicate increase and decrease change respectively for the different land uses.

Table 5.1: Zone-level land use and cover change data from 1984 to 2000

Zones		ZoneArea (Km²)	Agricultural Field (Km²)	Forest Land(Km²)	Water Body (Km²)	Urban/Rural Built (Km²)
Zone 1 (NW Bertoua)		121.87	+9.60	-6.17	+3.12	+6.56
Zone 2 (NE Bertoua)		104.17	+4.29	-1.14	+0.99	-4.17
Zone 3 (SW Bertoua)		74.89	-12.29	+14.49	+0.52	-2.71
Zone 4 (SE Bertoua)		63.40	+1.26	-2.44	+0.44	+0.73
Zone 5 (Buea/Limbe North)		55.77	+5.86	-6.48	+3.13	-2.50
Zone 6 (Buea/Limbe South)		24.67	+0.12	-0.82	-0.87	+1.28
Bertoua & Buea/Limbe Regions		444.77	+/-33.42 (+21.13)	+/-31.54 (-17.05)	+/-9.07 (+8.2)	+/-17.92 (+1.63)
Proportion in the total territory (%)			7.51	7.09	2.04	4.03
Annual change rate	Km²/yr		2.09	1.97	0.57	1.12
	%		1.29	0.87	4.78	2.52

5.3 Discussions

Analysis of the change data indicates that 20.67% of the total territory had changed in 16 years (1984 to 2000). Noticeable are changes (increase and decrease) in Agricultural Field and Forest Land (33.42 and 31.54 Km² or 7.51% and 7.09% in area respectively). Within this time period, Agricultural Field changed at a rate of 2.09 Km²/yr or 1.29% while Forest Land changed at a rate of 1.97 Km²/yr or 0.87%. All zones registered an increase in Agricultural Field except for zone 3 – SW Bertoua. Unlike the Agricultural Field class, the Forest Land class decreased in all zones but for zones 3 – SW Bertoua that showed an increase. Overall, the Agricultural Field class increased by 21.13 Km² whiles the Forest Land class decreased by 17.05 Km². Due to the fact that increase in Agricultural Field and decrease in Forest Land occurred in the same zone (SW Bertoua), and given that the change is almost of the same proportion (12.29 and 14.49 Km² respectively), it is logical to conclude that forest loss is driven primarily by the quest for farm land.

The analysis also showed changes in the Urban/Rural Built class. Urban and rural built environments are generally expected to increase over time with an increase in the population of a given locality. In this study, within a period of 16 years, 17.92 Km² of the Urban/Rural Built class changed (increase and decrease) at a rate of 1.12 Km²/yr or 2.52%. Three of the six zones (NW Bertoua, SE Bertoua and Buea/Limbe - South) showed an increase in their Urban/Rural Built class while the other three zones (NE Bertoua, SW Bertoua and Buea/Limbe - North) showed a decrease (see Appendix I).

Though it is a 50/50 change in terms of the number of zones (i.e. three zones experienced an increase and three zones experienced a decrease), an increase in urban/rural built environment in NW – Bertoua, SE – Bertoua and Buea/Limbe - South, led to an overall increase of 1.63 Km².

The Water Body class indicated that 9.07 Km² changed (increase and decrease) in 16 years at a rate of 0.57 Km²/yr or 4.74%. There was an increase of water in all but one zone (Limbe/Buea South), leading to an overall increase change of 8.2 Km². The availability of surface water is often influenced by the availability of trees. Given that there is an overall decrease in forest (17.05 Km²); the overall increase in water bodies can only be attributed to man-made lakes, ponds, swimming pools or flood water. But, it is unlikely that the increase was as a result of flooding because the landsat images were taken in the month of December, which is the dry season.

5.4 Panel Analysis: A Multivariate Regression Modeling

It is important to determine changes that occur in our environment but it is even more important to understand the forces behind these changes. Socio-economic activities have been identified as the main forces behind global environmental change (IGBP 1999). Therefore, socio-economic data of the Bertoua and Limbe/Buea study areas are linked with the results of changes observed from the imagery, to determine how they influence land use in these areas. This can be done by employing a multidimensional statistical

regression model (Panel analysis) to determine the relationship between dependent and independent variables. That is, to determine if there is a statistically significant correlation between the independent and dependent variables in the analysis, and how much of the variation is explained by these variables. Based on the regression equations, a proportion of estimates of future impacts of social and economic conditions on land use in the study areas are made. The panel analysis for this study is modeled after Kleinbaum *et al* (1998), Lambin (1994), and Wu *et al*. (2001). The model is mathematically expressed as follows:

$$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + ? + \beta_n X_n + E \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where :

Y = is the dependent variable. That is, change(s) that occurred in the study areas from 1984 to 2000. The four land use categories examined in the change detection phase were used as the dependent variables. These include:

- Agricultural Field;
- Forest Land;
- Water Body; and
- Urban/Rural Built.

X_n = are the independent variables. That is, potential causes or human forces that might have brought about changes in the land cover. Five independent variables are examined:

- Total population;
- Urban population;
- Rural population;
- Agricultural output and;
- Income per capita;

Due to the limited number of observations (six), all five independent variables could not be examined at once as that would limit the degree of freedom vis-à-vis the dependent and independent variables. Hence, the model was run four times (multiple regression), each time with a different independent variable.

β_0 = is a constant or intercept;

β_n = are regression coefficients; and

E = is the error component.

Table 5.2: Zone-level socio-economic data from 1984 to 2000

	Total population growth rate (%)	Urban population growth rate (%)	Rural population growth rate (%)	Agricultural output (% change)	Income per capita (USD)
ZONE 1	4.7	2.9	1.8	81	570
ZONE 2	2.9	1.8	1.1	76	565
ZONE 3	7.2	1.0	6.2	35	524
ZONE 4	2.1	0.3	1.8	73	562
ZONE 5	5.8	3.6	2.2	77	566
ZONE 6	4.1	2.5	1.5	72	561

The independent variable data was drawn from different sources including Food and Agricultural Organization (FAO) database at http://foastat.foa.org; the World Bank's

World Development Indicators database at http://devdata.worldbank.org; Country Statistics database at http://www.statoids.com/ycm.html; and from Cameroon's Annual Report of Provincial Statistical Service. Since the zones within the study areas do not correspond with political boundaries, calculations for the variables were made based on data at the divisional, provincial and national levels. Multivariate software, SAS, was used for the analysis (see Appendix II). Results of the analysis are summarized in table 5.3 below.

Table 5.3: Land Use and Cover Change Driving Forces in the Buea/Limbe and Bertoua Regions

Dependent Variable	Independent Variable	Constant	Parameter Estimate	Standard Error	DF	F	Pr>F	R^2
Increase in Agricultural Field	Increase in Rural population	1.65	+5.61323	0.26787	1	4.53	0.1241	0.7512
	Increase in Agricultural output		+0.44088	2.41493	1			
Decrease in Forest Land	Increase in Rural Population	5.53	+5.45751	0.06089	1	136.90	0.0011	0.9892
	Low Income Per Capita		+0.33662	0.54896	1			
Increase in Urban/Rural Built	Increase in Total Population	0.92	+0.44933	0.48815	1	0.85	0.4094	0.1748

5.5 Discussions

With the available change detection data and panel analysis results it is possible to make projections on the different land use activities and determine how each activity affects the environment. With these results the future of land use change mechanisms examined in this study can be projected as follows:

- An increase in agricultural field is the most significant change in the landscape of the study areas. This increase in agricultural field is also reflected by the increase in agricultural output. According to the regression modeling, an increase in agricultural field has a significant difference on the agricultural output increase ($R^2 = 0.7512$). This correlation is not surprising given the high rate of immigration in these areas, especially in the Bertoua area which has one of the highest (31.9%) in the country (Pokam and Sunderlin 1999). Most people move into these areas, looking for jobs in the logging sector. But because most of the immigrants are unskilled, they can not earn enough income to support their families hence, they have to engage in slash-and-burn agriculture which, in effect, increases cultivated land and pushes up agricultural output. The relationship between an increase in rural population, increase in agricultural output and increase in agricultural field can be expressed as follow:

  [Increase in Agricultural Field] = 1.65 + 0.44088 [Increase in Rural Population] + 5.61323 [Increase in Agricultural Output] ……... (2)

If agricultural field continues to change at the rate of 2.09 Km²/yr or 1.29% (1.32 Km²/yr increase), it will mean that an additional 18.48 Km² of land will be converted to agricultural land by the year 2020. Given that slash-and-burn is the main farming method in these areas, it is likely that the 18.48 Km² will be gained from forest land.

- A decrease in forest land is the second most significant change on these landscapes. Modeling this change, panel analysis shows that a decrease in forest land is associated with an increase in rural population and low income per capita ($R^2 = 0.9892$). This association is expressed as:

  [Decrease in Forest Land] = 5.53 + 0.33662 [Increase in Rural Population] + 5.45751 [Low Income Per Capita]…… (3)

With very little rural investment in these areas, the high rate of rural population, especially in the Bertoua area (70.1%), has led to competition for resources. Left only with an option of subsistent farming, hunting and small scale fishing, and the average income per person in these areas is so low (USD 5.70) that they have to encroach on the forest to augment their living standard. Industrial and illegal logging activities in these areas have led to a decrease in forest land of about 17.05 Km² or 1.06 Km²/yr. At this reduction rate, an additional 14.84 Km² of forest land will be lost by the year 2020.

- The urban/rural built environment has also brought changes in the Buea/Limbe and Bertoua regions. Compared to changes in agricultural field and forest land, changes brought about by urban/rural built were not very significant. A total of 17.92 Km² urban/rural lands had changed (increase and decrease) in 16 years. But urban/rural

built had only increased by 1.63 Km² in 16 years (0.10 Km²/yr). From a socio-economic stand point, a regression model ties this increase to an increase in total population ($R^2 = 0.4094$) of the two study areas. Their link can be expressed as:

[Increase in Urban/Rural Built] = 0.92 + 0.44933 [Increase in Total Population]……. (4)

Growing at a rate of 0.10 Km²/yr may appear insignificant, but a projection through the year 2020 indicates that an additional 1.42 Km² of forest land will be converted to urban/rural land.

5.6 Concluding Remarks

Mathematically, by the year 2020 a total of 34.74 Km² of forest land in the two study areas will be lost to agricultural and urban/rural expansion or simply left as "open fields" prone to different forms of degradation. This means that the 224.31 Km² (2000 estimate) of forest land in the Buea/Limbe and Bertoua regions will be reduced to 134.46 Km² by the year 2050. If such a loss occurs in the entire forest region of Cameroon, it is possible for the nation to lose more than half of its 22 million hectares of rain forest by 2050 if the problems causing this loss are not checked.

CHAPTER VI

CORRELATION OF CHANGES IN FOREST COVER WITH NATURAL RESOURCE POLICIES

In the last chapter a remote sensing model was used to measure the rate and degree of forest loss in Cameroon over a sixteen years period. The remote sensing model was combined with an economic model to determine the driving forces behind forest loss in Cameroon. Haven determined the degree, rate, and forces driving forest loss in Cameroon, this chapter will now correlate this loss to failed and inadequate policies. The chapter discusses how policy issues since independence (1961), particularly between 1984 and 2000, has directly or indirectly brought about changes in Cameroon's forest cover. The chapter shows how intricacies of the global market place and the complexities of the political, economic, and social conditions in Cameroon and the world have contributed to the country's forest loss. The chapter also explores the heterogeneous nature of stake holders and the role they play in the socio-economic and political setup of Cameroon's forest sector. The chapter begins with a very significant issue that is peculiar to most tropical timber exporting nations; the problem of market

failure. This is followed by a discussion of controversies in the forestry taxation system. The chapter continues with discussions on issues of policy failures and weaknesses, institutional weaknesses, foreign debt, population growth, and influences of forest loss. This chapter concludes with a discussion of the role of different stakeholders in Cameroon's forest sector.

6.1 Market Failures

Many services (mostly environmental services) provided by the forest are not traded in markets and, as a result we have not established markets based on prices and therefore do not enter into the decisions of private and public sector actors (Pearce and Warford (1993). For example, the government of Cameroon is the country's land owner who has the responsibility of maintaining lands under forest cover, but because the government does not get the full value of social benefits provided by forest, there is little or no incentive to protect the forest and the underlying lands. The market has failed to stimulate the government and the private sector in the direction of socially based objectives. This causes the government to misplace its priorities, hence, ushering in inefficiencies that lead to forest decline and, consequently, forest loss.

6.1.1 Lack of information on the Value of Non-market Benefits

Lack of information regarding the value of non-market benefits of forest is the reason for market failure (Pearce and Warford 1993; Pearce 2001). For example, non-market goods

such as biodiversity, watershed protection, recreation, and carbon sequestration appear to be of low importance to the government and to the local population as well (Fomété 2001). It is clear that the failure of markets to capture the value of non-priced services of the forest is an indirect but meaningful cause of forest loss that shapes the non conservation attitude of forest exploiters in Cameroon.

6.1.2 Low Concession Charges

Charges paid by timber concessionaires are relatively low compared to the market value of the resource (Fomété 2001). These low charges have encouraged foreign timber companies (especially French companies) to aggressively seek concessions in Cameroon's forests. There is also the lack of incentive for long term management due to logging competition among the many concessionaires. High profits due to low charges are also potential drivers of corruption that has handicapped strict enforcement of concession terms. Some of these market pricing systems already exist (Fomété 2001) but are poorly implemented or enforced due to lack of inventory equipment to calculate the fees. So, the acquisition of the necessary tool to do the accounting is vital for proper market pricing. Market mechanisms should also be used to give out concessions with strong ingredients such as supervision management and tenure of concession. Proper pricing can generate revenue that can be further used to better manage and protect the forest.

6.1.3 Lack of Well Defined Forest Property Rights

Although the government of Cameroon appropriates forest lands and all its resources, the local population regards it as theirs (Vabi and Sikod 2000). This is a problem because this means that forest property rights are not well defined (Amin 1999). In the absence of well defined property rights (complete specification of rights, exclusive ownership, transferability, and enforceability) the forest becomes a "common property" (Hardin 2000). According to Hardin, the use of common property leads to externalities ("tragedy of the common") as no one is liable for the cost of the externalities. Hardin argues that the solution to such a problem depends upon "mutually agreed upon coercion." In this situation therefore, it is important that property rights in Cameroon are properly defined (i.e. giving land ownership to individuals and communities) and enforced so as to better manage the forest. Simply declaring all forest as belonging to the state is not a wise approach as this has instead accelerated the exploitation and degradation of the forest. Coercion must be entered in a way that all parties with stakes must be willing to accept the rules and regulation that limit their access and yet protects the forest and the services that it provides.

6.2 Forestry Taxation Controversies

Poor or mistaken tax policies have created obstacles to the sustainable management of forests in Cameroon (Sikod *et al*. 1996). In an effort to resolve the issue of market failure, the government under the 1994 forest policy embarked on reforming the forestry

taxation system, output targets, regulation, private incentives and macroeconomic management. These policy interventions have instead created more controversies which have contributed to deforestation. This section focuses on two controversial issues - the forestry taxation system, and the involvement of local communities in managing and sharing the benefits from the exploitation of forest resources. These two controversies emanate from one of three objectives of the current forest policy – "the creation and equitable distribution of the revenue generated."

6.2.1 Forestry Taxation Modalities

The forestry taxation system under the 1994 Forestry Law recognizes two forest statuses; the Permanent Forest Estate and the Non-Permanent Forest Estate. Forest areas under the Permanent Forest Estate status belong to the state. All permanent forest areas are managed by local councils under the supervision of the Ministry of Environment and Forest (MINEF). Concessions under this status are divided into Forest Management Units (FMUs). The Non-Permanent Forest Estate, on the other hand, belongs to private individuals and communities. Concessions under this status are allocated for areas up to 2,500 ha, known as Sales of Standing Volume (SSV).

The main tax regulations contained in the 1994 Forestry Law are as follows:

- The Royalty for the Forest Area (RFA). Royalties are "rents" not "taxes," but are placed under tax regulations to ensure that concessionaires pay for the right to access the resource. RFA rates are determined on the basis of a base rate, valid for a

temporal period of 3 years. If all conditions are met during this time, a 15 year license, which is renewable once, is granted. The current RFA rate is FCFA 1,500/ha/year (approximately US$ 3.00) (Fomété 2001);

- The Felling Tax (FT). This regulation aims to eliminate wastage at the point of felling and to check the actual level of logging in the forest (Fomété 2001);
- Exit (export) duty on logs;
- Factory Taxes (exit duty on sawn products and entry taxes on logs taken into factories).

6.2.2 Decentralization of Forestry Taxation System

A major renovation of the new policy is decentralization of forestry taxation. Unlike in the old law where all forest revenues were controlled by the central government, the 1994 law introduced two instruments that empower local governments to manage revenues from their forest resources. These two instruments are the share of the RFA, and the 'FCFA 1000 tax'. The share of the RFA instrument divides total forest revenues in a ratio of 50:40:10. That is, 50% for the state, 40% for the local council, and 10% for communities neighboring the forest area. The 'FCFA 1000 tax' is a charge levied on holders of the SSV permit for every 1 cubic meter of timber logged. The revenue is earmarked for social projects like roads, schools, and hospital in the affected communities. This form of decentralized taxation could be a vital "wind-fall" for the councils as their regular annual grants never meet up with the local needs. For the forest

communities, it is more than just a "wind-fall" as they were virtually left out of the picture under the old law.

Although beneficial, decentralized taxation does not favor non forest communities. Geographically, the south, central, and eastern provinces of the country are getting more than 70% of the tax revenue, while the reminding seven provinces get less than 30% (Formété 2001). Apart from the geographic inequality, the decentralized taxation system does not lay out concrete modalities for the handling of tax revenues. Like its predecessor, the policy remains vulnerable to fraud, evasion, and misappropriation. For example, in his evaluation of the current management of forestry revenue, Fomété (2001) points to the fact that the 'FCFA 1000 tax' is rarely distributed as stated in the loggers' condition of contract. Logging companies have taken advantage of the weak modalities to benefit from the system by making only partial payments to the council and direct contributions in kind to the villagers. In some cases, powerful elites have made deals with loggers that benefit only them and not the community. In such cases, the council and the local population do not get the social benefits (roads, schools, hospital etc) as stipulated in the conditions of contract. From all indication, the 'FCFA 1000 tax' policy has turned out to be an official "bribe" for the local populations.

Due to the fact that the 'FCFA 1000 tax' instrument is applicable only to the SSV in the non-permanent forest estate, boundary problems are eminent. This is because the larger the non-permanent forest estate, the more benefit the local population gets from it. Boundary problems are particularly challenging to authorities due to lack of consensus

between all stakeholders. Developed without any proper consultations with the local populations, the community forest management provision of the new law has compounded the boundary problem. Some provisions are vague and lack legislative clarity. These problems delayed kick-off of the community forest management program, with not even a single community forest being allocated as of April 1998 (Lescuyer *et al* 1999). Local populations only began to comprehend the management program when the "*manual of the procedures for the attribution, and norms for the management of community forests*" was published in April of 1998. As for the boundary problem, a technical solution is being sought. Thanks to the help of the Tropenbos Cameroon Program (partnership between the Tropenbos Foundation/University of Wageningen in the Netherlands, and MINEF and MINREST in Cameroon); the problem is being resolved by the use of GIS tools. Based on the Cameroon national zoning plan, the Tropenbos Cameroon Programme (TCP) proposed the demarcation and management of permanent forest around the country (Lescuyer *et al* 1999).

Another problem with the decentralized taxation system is lack of transparency. There is little or no flow of information between the different stakeholders. Most forest inhabitants in Cameroon are illiterate. The few who can barely read and write find it difficult to interpret policy documents. This is a huge limitation which, coupled with the lack of adequate information to estimate their expected revenue, causes inhabitants to fall prey to the greedy loggers. Forest communities and other stakeholders should be educated on the provisions and procedure of the new law. This will help all players to work collectively towards attaining the goals of the new law. The decentralized taxation

system is a "bitter-sweet" pill as it does not benefit some local communities in the country. The geographic inequality that puts some council at the disadvantage can be neutralized by creating a special grant fund for non-forest councils in the country. This fund should come from the 50% state share of the RFA tax.

Although a decentralized forestry taxation system is now in effect in Cameroon, the government still places strong emphasis on centralized decision-making, ownership and control of forest resources. This has caused the local population not to cooperate with the government in managing the forest. These centralized decision-making policies have been partly responsible for failures to protect forests and for its extensive loss.

6.3 Policy Failures and Weakness

The government has failed to take into consideration the side effects of some of its policies. For example, road construction has been undertaken by the government mainly for development and security reasons. Much of the county's laws with regards to forest and land use and management decisions are strongly influenced by these broader development objectives. For example, road networks provide access to the forest hence, construction of a new road, whether it is by a logging company or as part of a national development plan, is an integral part of deforestation that leads to forest loss (Reppeto 1993). For example, The PERFED II road program initiated and funded by the European Union has 20% of the road network passing through the country's rain forest (ADB 1995). The government failed to realize that the construction of roads near or through the

forest leads to deforestation. It could as well be that the reason for constructing the road in the first place is undermined by the desire for logging by small business individuals, backed by some politically powerful groups that are able to influence government policies and not the other way around. The best policy in this situation would be to undertake reforms on road construction policies that would curb the negative incentives for unsustainable practices.

6.3.1 Subsidy Policy

Another failure is in subsidy policy. Studies by Kummer (1991), Gray (1997), Wilkinson (1998) and Kartodiharjo and Supriona (2000) indicate that large portions of tropical forests are under concessions due to government subsidy policies. The government of Cameroon gives subsidies either directly to private companies in the forest sector or indirectly to entrepreneurs in other sectors related to the forest sector. For example, subsidies granted to farmers have unintentionally led to the decline and loss of the nation's forest. With increased financial resources not directly generated from their existing lands, farmers would want to expand their land. Most often, expansion occurs in forested lands. Similarly, plantation agriculture has led to the clearing of large forest lands. For example, since 1991, the Cameroon Development Corporation has had plantation expansion of up to 10,000 hectares (Acworth *et al* 2001). This is mainly due to subsidized farm machineries and inputs that facilitate large scale production. This also forces smaller farmers, who do not have the means to acquire machinery, to invade forested areas and practice slash-and-burn farming. A remedy to this particular problem

is for subsidies to be codified with policies that require beneficiaries to carry out agricultural intensification rather than agricultural extensification that leads to forest loss.

6.3.2 Oil and Natural Gas Exploitation Policy

Policy decisions to exploit oil and natural gas in the sensitive Limbe coastal forest area is another cause to the loss of the country's forest. Since this policy was adopted about three decades ago, the coastal rainforest of Cameroon has suffered extensive loss due to the construction of an oil refinery in the Limbe neighborhood. The loss is also compounded by the fact that the oil field is located in the coastal division of Ndian which is about 50Km (31 mile) from the refinery site in Limbe. This meant that a road had to be constructed through the dense forest of Ndian division to facilitate the transportation of crude oil and natural gas to the refinery site in Limbe. The government's decision to allow the landlocked nation of Chad to export its oil through the port of Kribi has also led to the loss of Cameroon's forest. The laying of oil pipe lines from the oil field in Doba in southern Chad to the port of Kribi in the south of Cameroon (over 1,070 km i.e. 665 mile) is responsible for the loss of over 15 km² of rainforest (CED 2004). Another potential loss of forest under Cameroon's oil exploitation policy could come from the disputed oil rich Bakassi peninsula, which officially belongs to Cameroon following the ruling of the International Court of Justice (ICJ) (IRIN Africa 2006). The Bakassi peninsula is an extension of the Buea/ Limbe forest region between Cameroon and Nigeria.

6.4 Institutional Weaknesses

The forest sector of Cameroon is managed by many government ministries and agencies. Policy officials of the forest sector come from a number of ministries. In addition to representatives from the legislative and executive branches of the government, a total of nine governmental institutions are involved in policy making and implementation in the forest sector. These include the Presidency of the Republic, Office of the Prime Minister, the National Assembly (parliament), the Ministry of Environment and Forest, the Ministry of Agriculture, the Ministry of Tourism, the Ministry of Public Investment and Regional Planning, the Ministry of Industrial and Commercial Development, and the Office of Forest Development (ONADEF). With each policy official's role not clearly defined, too often there is conflict of interest among these officials. This often leads to bureaucracy which stifles effective decision-making leaving forest officials in the field with no concrete rules to enforce (Ekoko 1999).

In addition to this bureaucratic debacle is the absence of a strong and independent legal system to support the collection of revenues from the forest sector. The Ministry of Environment and Forest that is supposed to be the principal Ministry responsible for implementing forest policies is being incapacitated by influences from the Presidency and the Prime Minister's Office. Key personnel in these Ministries and agencies have little or no technical knowledge in sustainable forest management as their appointments are mainly political and not based on professional qualifications (Ekoko 1999). The "man-know-man" game (network connection), where by family, ethnic, and political ties are

used as a tool for recruiting personnel is endemic in the forest sector. The problem of incompetent personnel has led to poor governance and corruption in the sector. For example, a policy under the 1974 Forest Ordinances and Laws required the demonstration of use of public land to affirm legal property right over those lands led to land tenure. To demonstrate land use, the local population has engaged in deforesting public lands (Vabi and Sikod 2000). Officials are also being bribed to award private property rights on public lands. Also, in an effort to compensate small farmers displaced by large agribusiness entrepreneurs, the government decided to fragment and distribute publicly owned land (mostly forest land) to landless farmers (Vabi and Sikod 2000). The result of this institutional/policy weakness is overnight growth of "squatters" in public forest lands.

These entanglements between politics, personal interest and governance issues have led to a care free attitude amongst officials of the forest sector as there is lack of effective coordination of the many institutions involved in the sector. To resolve these institutional problems, the Ministry of the Environment and Forest must be independent from the Presidency and the Prime minister's Office when it comes to areas of technicality and policy design. Motivation of government employees through salary increase could also reduce if not eliminate corruption. Capacity building by structuring the different institutions involved in forest management could help to eliminate some of these weaknesses.

6.5 The Issue of Foreign Debt

As indicated in a study of 68 countries over a four year period (1981 to 1985) Khan and McDonald (1995) argue that debt service has a negative influence on forest management. External pressure from the International Monetary Fund (IMF) and World Bank (WB) to recover debts owed them by the government of Cameroon has left the nation's forest vulnerable. Forest policies in Cameroon are being influenced by the World Bank and the International Monetary Fund, mainly through the Structural Adjustment Plans (SAP) that favor longer durations of concessions to logging companies, and encourage large forest areas for concessions (Ekoko 1997). Other elements of the Structural Adjustment Plan policies implemented in Cameroon include: correction of fiscal imbalances mainly through reduction in public expenditure, reduction of the role of the state in managing the economy, promotion of privatization, removal of obstacles to international capital flows and to the formation and expansion of national capital markets, liberalization of exchange policies, removal of restrictive trade policies, and deregulation of labor markets (Kamanda 1995). The International Monetary Fund's Structural Adjustment Plan program required the Cameroon government to cut back on public spending. This caused the government to reduce employment by 5,500 between 1995 and 1997 (Ekoko 1997). This move left the unemployed with no option but to turn to illegal logging and slash-and-burn farming to support their families. The implementation of Structural Adjustment Programs, coupled with the economic crises of the 1980s and 1990s, led to a severe shortage of financial and human resources to manage and protect the country's forest. Most structural adjustment policies prescribed by the International Monetary Fund are

meant to liberalize the economies of countries adopting them and open up their markets to global economy. Instead, it has presented mixed fortunes for developing countries. Since its inception only a few countries like China, Brazil and Indonesia have been able to get meaningful benefits from the program. The rest of the developing countries have instead witnessed economic downturns (Brown and Quiblier 1994). In Cameroon, reduction in public spending has instead led to unemployment forcing people to rely on subsistence farming at the detriment of the forest. The International Monetary Fund's call for economic liberalization has not yielded much for Cameroon as the nation's foreign direct investments (FDI) remains low (31.4 million US dollar 2000 rate) and its economy remains low. Cameroon's foreign direct investments are mostly in the natural resource sector, notably in forestry, oil and cash crops. These are investments that are aimed at developed country markets and do very little to improve the lives of Cameroonians, but hurt their environment severely.

Cameroon's high external debt value and low per capita income has also been a drawback for the country's forest sector. According to the World Bank (2006), Cameroon's total external debt in 2000 was estimated at US$ 6.3 billion while its per capita income was US$ 570.0. High external dept and low per capita income has ushered in unfavorable terms of trade mostly on agricultural products (cash crops) and natural resources like wood.

These policies have indirectly led to forest loss because they have induced unemployment and poverty that force people to ravage the forest in efforts to support their families.

These policies have also stimulated agricultural export at the expense of forested land. Structural Adjustment Plan programs can lead to positive outcomes if well implemented. A policy that enables integrated implementation of the program and cooperates with national and international economies would break the chain of activities that leads to forest loss. Also, instead of simply canceling Cameroon's hard-currency debt as proposed by leaders of the G-8 nations, ecologist Thomas Lovejoy's "debt-for-nature swap" financing strategy could be adopted. In the debt-for-nature strategy, part of a nation's debt is cancelled in exchange for the nation investing the remainder into conservation. This strategy, which has been very successful in Latin America, can as well succeed in Cameroon which faces similar socio-economic and environmental conditions.

6.6 Population Growth

Like many other natural resources, forest loss in Cameroon has been linked to population pressure. As supported by results of the change detection and socioeconomic analysis in chapter 5, an increase in population has increased the demand for land to cultivate and fuel wood for energy. Also, an increase in population has given rise to cheap labor and generated high profits for agribusiness owners, making them more viable and having the desire for more land to expand their business. In the same light, an increase in population means more mouths to feed hence, expansion in agribusiness to meet the food demands of the population. An increase in population also leads to poverty as too many people turn to depend on few individuals for support. Increased poverty has caused many

families to depend totally on the forest for survival, through logging and slash-and-burn farming. The problem of population pressure is not only within the country. The pressure is also coming from outside the country. Economic growth and excessive foreign consumption of tropical produce like banana, cocoa, rubber, and palm nuts adds to the pressure. Cameroon has responded to this increase in demand by adopting policies that support agricultural extensification hence, expanding its area of cultivation at the expense of the forest. For example, since 1991, the Cameroon Development Corporation has expanded about 1,340 hectares of its plantations into the Onge-Mokoko forests in the Sourhwest province of Cameroon (Acworth *et al* 2001).

In all, a combination of political pressures to accelerate harvesting, corruption, the weakness of government forest administration, inappropriate concession license allocation and timber taxation systems, and the negative impacts of macro economic trade, population pressure, and Structural Adjustment Program polices have led to decades of unsustainable forest management in Cameroon.

6.7 A Conceptual Frame of Influences of Forest Loss

The aforementioned direct and indirect causes link up in chain reactions that result in forest loss as the end link or node. Figure 6.1 below is a conceptual framework (influence diagram) of these direct and indirect causes of forest loss in Cameroon.

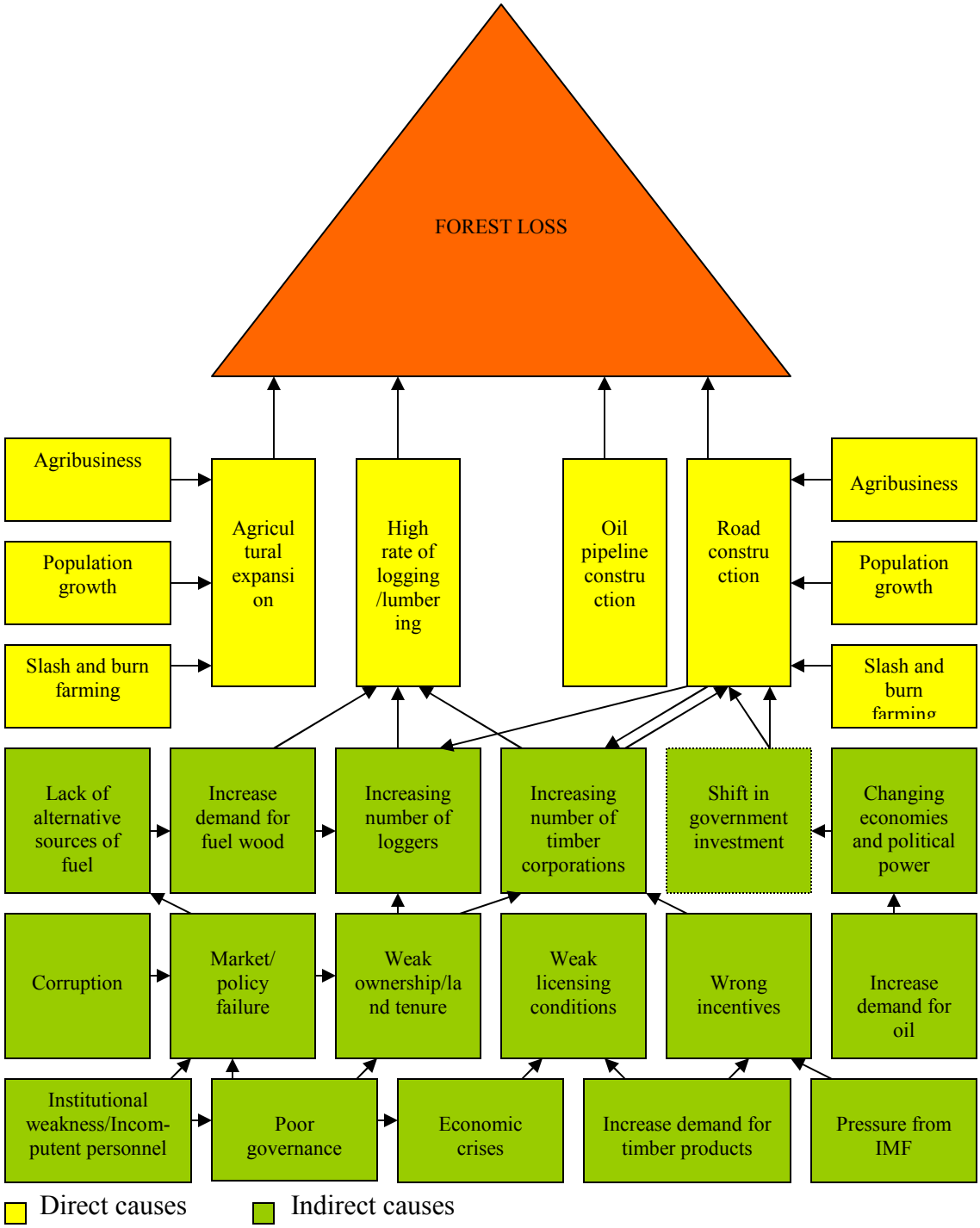


Figure 6.1: Influence diagram of direct and indirect causes of forest loss

6.7.1 Explanation of the Influence Scenario

Although the influence diagram appears to show some agents as directly linked to deforestation, there is actually no clear cut separation of direct and indirect causes of deforestation. In reality, forest loss is the result of long chains of causation that are not linear, but have feedback loops at some points or stages in the causation chains (Angelsen and Culas 1996). The links between agents and the extent of their influences among each other can be explained by the following scenario: Forest loss occurs in Cameroon because of deforestation. Deforestation happens because local people are continuously expanding and/or acquiring new plots. A family expands' or gets a new plot because the current plot is no longer fertile hence they have to keep on shifting every few years. This is because when they shift, they "slash-and-burn" because they believe it make the soil more fertile. Shifting cultivators, "slash-and-burn" (deforest) because they need to provide a means of survival for their families. This is because they are poor. They are poor because the present power structure discriminates against a majority of the people who have little or no means of survival. They are also poor because their families are too large, making it difficult to support. Agribusiness is a side chain of agricultural expansion undertaken by large multinational corporations (MNCs) involved in plantation agriculture. Agribusiness is due to excessive foreign consumption.

In another chain of causation, a high rate of logging occurs because there are too many (about 600) timber corporations in Cameroon. This is because of the weak conditions for obtaining forest exploitation licenses. This is due to wrong incentives that act as a pull

factor for timber investors. This is because of International Monetary Fund conditions that put pressure on the government to encourage investors in the forest sector of the economy. A side chain or "off loop" of wrong incentives is market and policy failures. This is because of corruption, institutional weakness and incompetent personnel, and poor governance. Also, at the rudimentary level, logging occurs because of the need for wood as fuel. This is because of lack of other sources of fuel, which is as a result of energy policy failure. The laying of oil pipelines is another chain node of causation. Two major oil pipelines traverse the Cameroon rain forest. These were influenced by a shift in government investment from the agricultural sector to the oil sector in the early 1980s when oil was discovered in the gulf region (Limbe) of the country. This shift was due to changes in economic and political powers in the country. This is because of increased demand for oil, mostly by western nations.

The last chain of causation is road construction. This chain has some feedback loops. Road construction is influenced by security needs, the need for forest exploitation by timber corporations, and by land occupation for agribusiness by multinational corporations (MNCs). Land occupation leads to building of more roads and further occupation of forested land in a circular self-reinforcing loop of cause and effect relationship.

6.8 The Role of Stakeholders

In recent years the forest sector of Cameroon has witnessed a swelling in the number of groups with stakes in the country's forest. The newest of these groups are Non-Governmental Organizations (NGOs), whose involvements have steadily increased in the last decade. International Non-Governmental Organizations (INGOs) are also a significant group whose number and activities is also in the rise as the country continues to open up to the rest of the world. Similar to International Non-Governmental Organizations are multilateral and bilateral partners. These partners, together with the government of Cameroon, play different roles in shaping Cameroon's forest policies, either by direct involvement with the forest sector or indirect involvement with sectors linked to the forest sector. Local population and logging companies also play an influential role.

6.8.1 Multilateral Partners' Stakes

The most prominent of the multilateral partners is the World Bank (WB) and the International Monetary Fund (IMF). World Bank's involvement in the forest sector of Cameroon can be traced back to the 1970s when it first granted loans to the government of Cameroon to boost forest projects and improve on the transportation of log for export (Ekoko 1999). This involvement continued to grow throughout the 1970s and 80s, not only financially, but technically as well. The most notable involvement is in the drafting of a proposed forest reform aimed at modifying the tax structure in the forest sector

(Ferrer 1996). According to Ferrer, under the 1994 World Bank proposed forest reform, the value of the log which is the base for taxation should be index-linked to the FOB price of the log rather than set administratively. This proposal by the World Bank is also in line with its sister institution, the International Monetary Fund's structural adjustment program condition, to encourage the government to reduce export taxes on forest products in an effort to diversify the economy and stimulate export production on the non oil sector (Ferrer 1996).

While the World Bank and the International Monetary Fund see their role in the forest sector of Cameroon as an advisory one, the government of Cameroon, local members of the public and some academicians see it differently. They argue that the intention of these two multilateral partners is nothing but a plot to hijack the county's forest and secure higher revenue for the government that will enable the payment of its debts (Tchoungui *et al*. 1995). On the other hand, some law makers (members of parliament MPs) and officials of the Ministry of Environment and Forest think the World Bank and the IMF are simply trying to impose on the government (Ekoko 1997). Whether the intension of these two bodies is to advise the government of Cameroon on how to manage its forest resources for the benefit of its people, or to secure higher revenue to ensure the repayment of loans, one thing is clear; these two bodies are major actors in the forest sector of Cameroon and will continue to influence fundamental principles guiding natural resource management as long as Cameroon remains a signatory to this bodies.

Apart from the World Bank and the International Monetary Fund, three prominent multilateral partners are involved in the forest sector of Cameroon. They are: the United Nation Development Program (UNDP), the Food and Agricultural Organization (FAO), and the European Union (EU). The UNDP and the FAO have been involved in forest projects in the country since the mid 1960s following the country's independence from France in 1961. The European Union on the other hand has been involved in the country's forest sector since the mid-1970s. Among its numerous projects is funding of the ECOFAC project in the Dja reserve which lies south of the Bertoua study area. The Dja reservation is also a Biosphere Reserve under UNESCO's *Man and the Biosphere Program* and is a World Heritage Site. According to the Ministry of the Environment and Forest, the stakes of these three partners are in the promotion of a Tropical Forest Action Plan (TFAP) that was initiated in the early 1980s.

6.8.2 Bilateral Partners' Stakes

As mention earlier, Cameroon is a bilingual country. This bicultural background has opened its doors for a wide rang of bilateral relationships with other nations and groups around the world. Many of these bilateral partners are donors who are also involved in the forest sector. These include the Caisse Française de Développement (CFD), the German Technical Cooperation (GTZ), the Canadian International Development Agency (CIDA), the United States Agency for International Development/Central African Regional Program for the Environment (USAID-CARPE), and the British Department For International Development (DFID). The stakes of these bilateral partners vary

depending on the degree of involvement of each of them. With the French as the former colonial masters, and with the high number of French logging companies in the country together with its political influence, the French cooperation is a major influential partner. This French domination of the forest sector is not unconnected to the "secret agreements" (DeLancey and Mokeba 1990, 179) signed between the government of Cameroon and France on the eve of independence.

6.8.3 Civil Societies' Stakes

The civil society is represented by National Non-Governmental Organizations and International Non-Governmental Organizations. Prominent International Non-Governmental Organizations with activities at all levels of the civil society are the World Wide Fund for Nature (WWF), the Global Forest Watch (GFW), and the International Union for the Conservation of Nature (IUCN). These organizations work mostly in collaboration with multilateral partners like the Food and Agricultural Organization (FAO), International Tropical Timber Organization (ITTO), and United Nations Environment Program (UNEP) hence, limiting their stakes with the forest sector. Even though the involvement of International Non-Governmental Organizations is not direct, their contribution (through the "boomerang effect" – the use of middleman to achieve an objective) to the development of forest policies that sees into the needs of the civil society is indispensable. For example, International Non-Governmental Organizations have worked with the government of Cameroon to initiate and sponsor key projects to

investigate causes and consequences of forest loss and land cover change, and to propose policy changes to try and remedy the situation. Some prominent projects include:

- The Campo-Ma'an Forest Project aimed at conserving biodiversity and promoting rational and sustainable use of natural resources and economic development of the Campo-Ma'an zone in the extreme southwest of Cameroon;
- Tropenbos Cameroon Programme (TCP) which focuses on the possibility of involving local communities in the process of agreeing on boundaries and uses of forest land; and
- Mount Cameroon Project (MCP) aimed at improving livelihoods, good governance, increase local capacity for forest and land management, and biodiversity conservation.

On the other hand, National Non-Governmental Organizations have been "mushrooming" around the country ever since the 1992 Rio Conference on Sustainable development. A majority of these National Non-Governmental Organizations do not have the capacity and force capable of influencing major forest policies in the country. But, that not withstanding, their close collaboration with local groups and International Non-Governmental Organizations creates a "boomerang effect" for the local forest users that has resulted in some limited stakes.

Last but not the least in this category of civil societies' stakes is the local population. A majority of people living in the southern region of the country derive their livelihood directly from the forest. Their main stake is in the non timber forest products (e.g. bush

meat) and the conversion of land for agriculture. The local population is also sensitive to the Pettit cash income derived from forest activities like the selling of charcoal and firewood to urban dwellers.

6.8.4 Logging Companies' Stakes

The stakes of logging companies in Cameroon can not be over emphasized. It entails securing their access to the country's forests with little or no regulation and at the least cost possible. Logging companies will, therefore, do everything to down play any policy options that stand in their way.

6.9 Concluding Remarks

Due to a series of motivations and driving forces that are interlinked, it is not easy to give a concise reason as to why there is forest loss in Cameroon. Even though analysis of the Buea/Limbe and Bertoua case studies reveals that agriculturalists, loggers, and urban/rural developers are among the direct agents of deforestation, a proper understanding of the deforestation processes requires a deeper explanation of interlinked driving forces behind these agents. Environmental economic literature indicates that those who are engaged in deforestation are not properly informed of the environmental value of forest. They either lack incentives to keep them from engaging in illegal and unsustainable logging or receive incentives from other sectors of the economy which

indirectly promotes illegal and unsustainable logging (Pearce and Warford 1993). Lack of, or over incentives, is a direct outcome of economic failures.

The success of any economy depends on how well the local markets operate and on the policies guiding its economic operations (Panayotou 1990). A failure in the workings of the economic system of a country can therefore be attributed (but not limited) to market and policy failures. When a market economy does not function properly, prices of goods and services generated by such an economy do not reflect the true social cost and benefits from resources used. This is misleading, especially to the layman who has little or no understanding of long term benefit/cost analysis and tend to be myopic in the use of resources. Policy failures are often due to attempts by governments to correct market failures (Panayotou 1990). For example, a common reaction to market failures by most governments is to improve their macro economic management portfolios, especially output targets. This strategy does not always turn out well for the forest sector whose interconnected ecological functions operate in a micro setting and accounts for more than 50 per cent of most forest products (Panayotou 1990). Macro economic management policies often disregard traditional land rights. When traditional land rights are taken away from the people, they are forced to use resources illegally, treating them as "common property," with no long term sustainable plan in mind (Hardin 2000). Any attempts, therefore, prevent forest loss and macro benefits such as preservation of biodiversity, genetic pool and reduction of global warming can not be met because the

local population has no incentive to protect a property whose rights have been taken away from them.

The correlation of change detection and natural resource policy has shown that the government of Cameroon and its policy makers still do not understand how well to incorporate environment and development needs in their plans and programs. The government of Cameroon cannot solve the problem of forest loss by simply going after direct agents. Existing literature indicates that the fundamental causes of deforestation are indirect agents that influence the actions of those who actually engage in deforestation, making them direct agents of deforestation (Deacon 1992; Amsberg 1998). Indirect agents are the results of national economic development goals and/or export oriented economies driven by international economic conditions. The Government of Cameroon and its policy makers must fully understand the intricacies of forest loss and land cover change to national and global environmental change to be able to make meaningful changes to Cameroon's natural resource policies.

CHAPTER VII

A PRACTICAL MODEL OF THE PROBLEM OF FOREST LOSS IN CAMEROON

So far this study has determined the degree, rate and forces driving forest loss in Cameroon. The study has also demonstrated how past and present policies contributed to the problem. Having identified failed and inadequate policies that led to forest loss in Cameroon this study will now proceed in developing/proposing policies to conserve Cameroon's forest. Before engaging in the policy development process proper, it is important to model the problem in a practical way; that is, contacting stakeholders and learning about their concerns. As noted by Smith (2003), one of the fundamental principles guiding decision-making in the public setting is the aggregation of individuals' perception on public issues into a collective or unified option. Therefore, this chapter employs ground truthing methodologies for determining individuals' concerns for forest loss and its environmental impacts. The aim of this practical modeling exercise is to derive information from people experiencing actual conditions of forest loss on the ground. This information will be used to form concept maps representing people's concerns about the problem of forest loss in Cameroon. An aggregate map of different

concerned groups will be developed to facilitate the identification of goals, constraints and objectives for the development of policies to conserve the forest.

7.1 Selection of Participants

A survey was conducted with participants representing the local population, the logging companies, and the government of Cameroon. The selection of participants was based on their geographic location in the country (southwest and eastern provinces) and on their knowledge and involvement in forest and agricultural activities.

The snowballing technique (used to access hidden population i.e. information from one participant reveals a potential participant) was applied so as to interview participants with different perspectives on the problem. It was not possible to gain direct contact with representatives of multilateral and bilateral partners, as well as those of Non-Governmental Organizations; but a thorough search of archival and internet resources provided substantial information on the concerns of these partners and the role they play in Cameroon's forest sector. The survey (Appendix III) was based on the following list of important framework components of the problem:

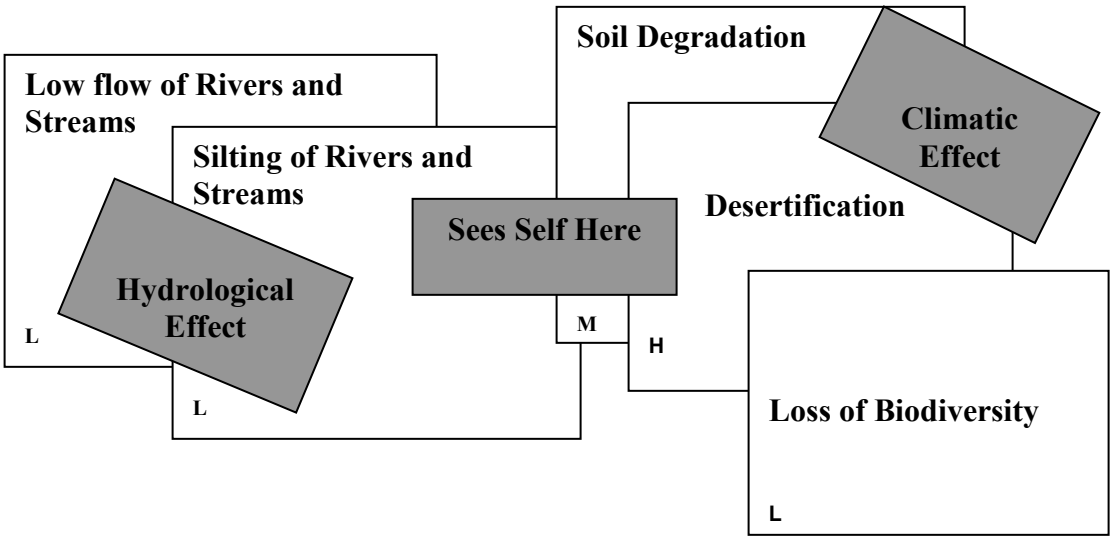
- Agricultural expansion
- Logging
- Road construction
- Oil extraction
- Desertification
- Soil degradation
- Low flow of rivers and streams
- Silting of streams and rivers
- Slash and burn farming

- Agribusiness
- Loss of biodiversity
- Loss of cultural identity
- Un-priced forest goods and services
- Wrong incentives
- Logging Concessions
- Concentration of landownership
- Weak or non-existing ownership and land tenure arrangement
- Illegal activities and corruption
- Population growth and pressure
- Excessive (foreign) consumption

7.2 Concept Mapping

What follows on the next couple of pages is a series of concept maps that emerged out of the list of important framework components of the problem. Each concept map is accompanied by a text box explaining the survey instrument above. These maps have been developed by grouping the thoughts of the participants according to their perception on the totality of the environment, agricultural expansion, access to the forest, and government policies and practices. From personal judgment, this researcher has also indicated on each concept map where his concerns fit. This is because the researcher is a Cameroonian and therefore has a stake in the country's forest problems. Participants' level of concern with each issue is indicated with the letters H = High, M = Medium, and L = Low. The final map (figure 7.5) is an aggregate of the concept maps.

Cameroon's forests have numerous environmental functions that are vital for the support system on which Cameroonians depend. Participants of this group show a degree of concern over the role of forest in regulating local climates, enabling the continuous flow of streams and rivers, soil stabilization, supply of nutrients, and a reservoir for biological diversity.

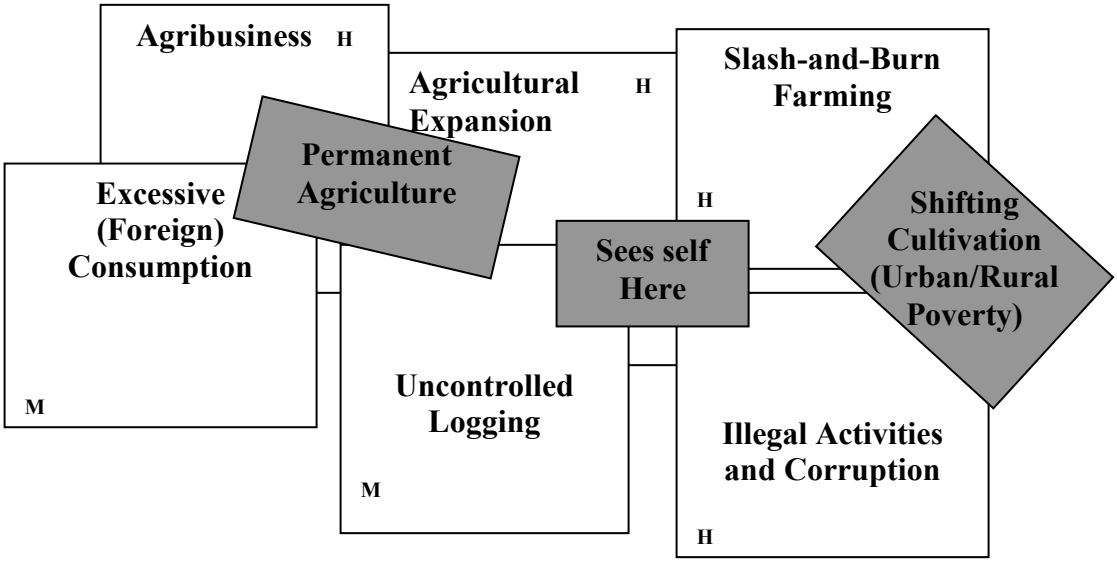


H = High level of concern M = Medium level of concern L = Low level of concern

The box "Sees Self Here" indicates were researcher's concern fits. This is because the researcher is a Cameroonian and therefore has a stake in the country's forest problems.

Figure 7.1: Concept map showing one group's focus on environmental concerns

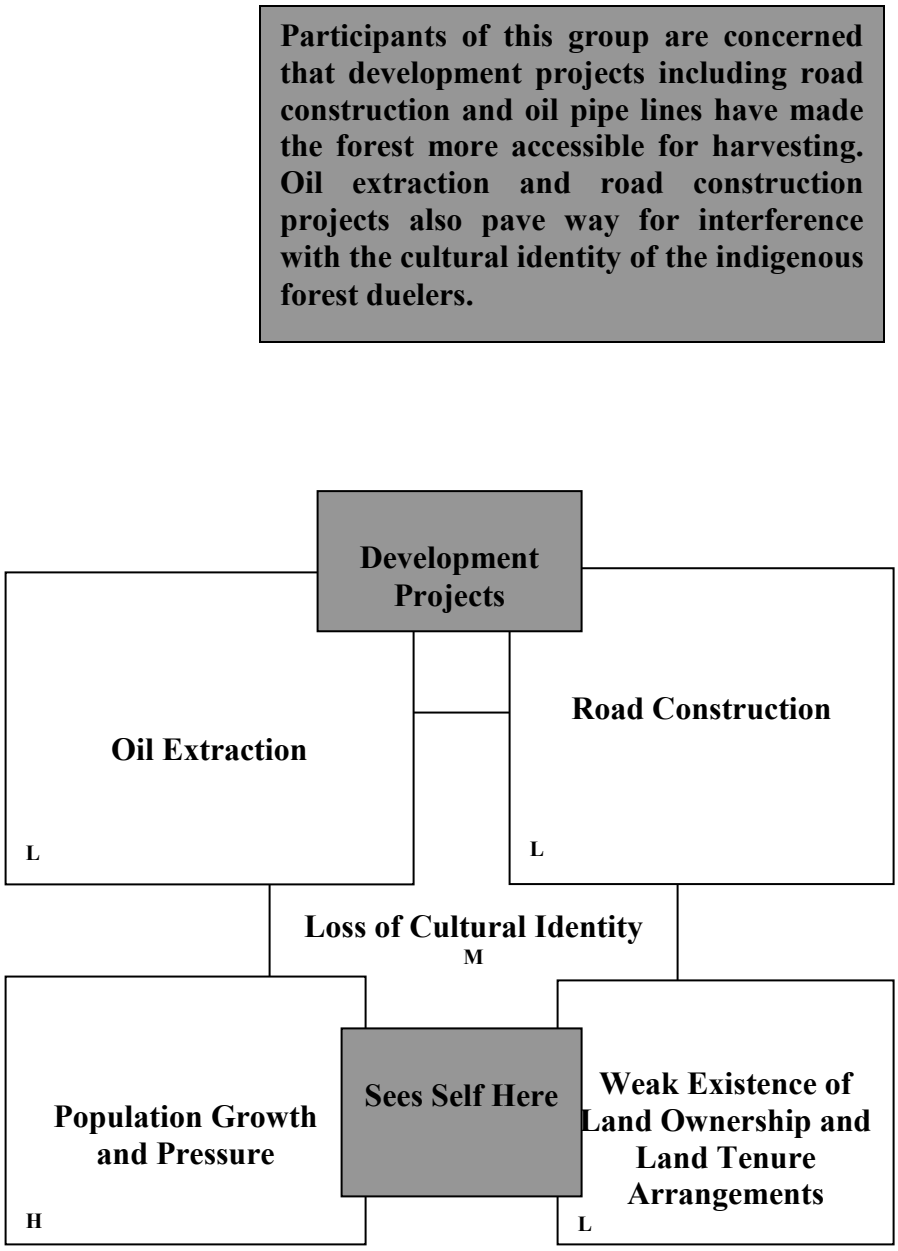
In this group, concerns are being expressed over the rate of logging and agricultural expansion. Notably is indiscriminate logging activities, agric expansion on forest land, as well as the shifting cultivating habits of the local population.



H = High level of concern M = Medium level of concern L = Low level of concern

The box "Sees Self Here" indicates were researcher's concern fits. This is because the researcher is a Cameroonian and therefore has a stake in the country's forest problems.

Figure 7.2: Concept map of a group concerned with logging and agricultural expansion

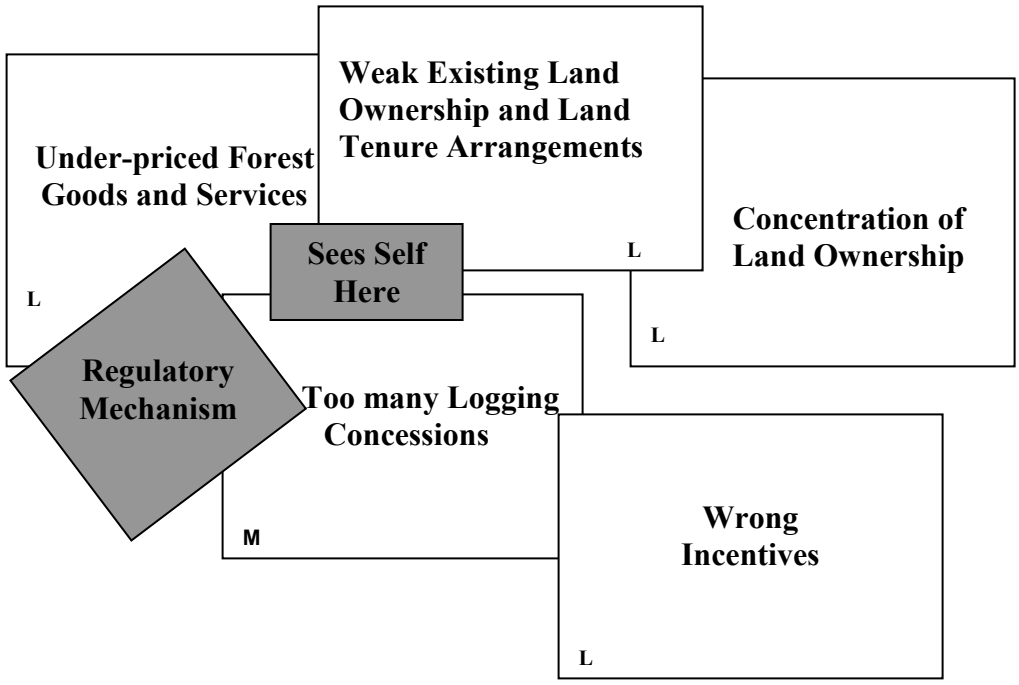


H = High level of concern M = Medium level of concern L = Low level of concern

The box "Sees Self Here" indicates were researcher's concern fits. This is because the researcher is a Cameroonian and therefore has a stake in the country's forest problems.

Figure 7.3: Concept map of a group concerned with access to the forest

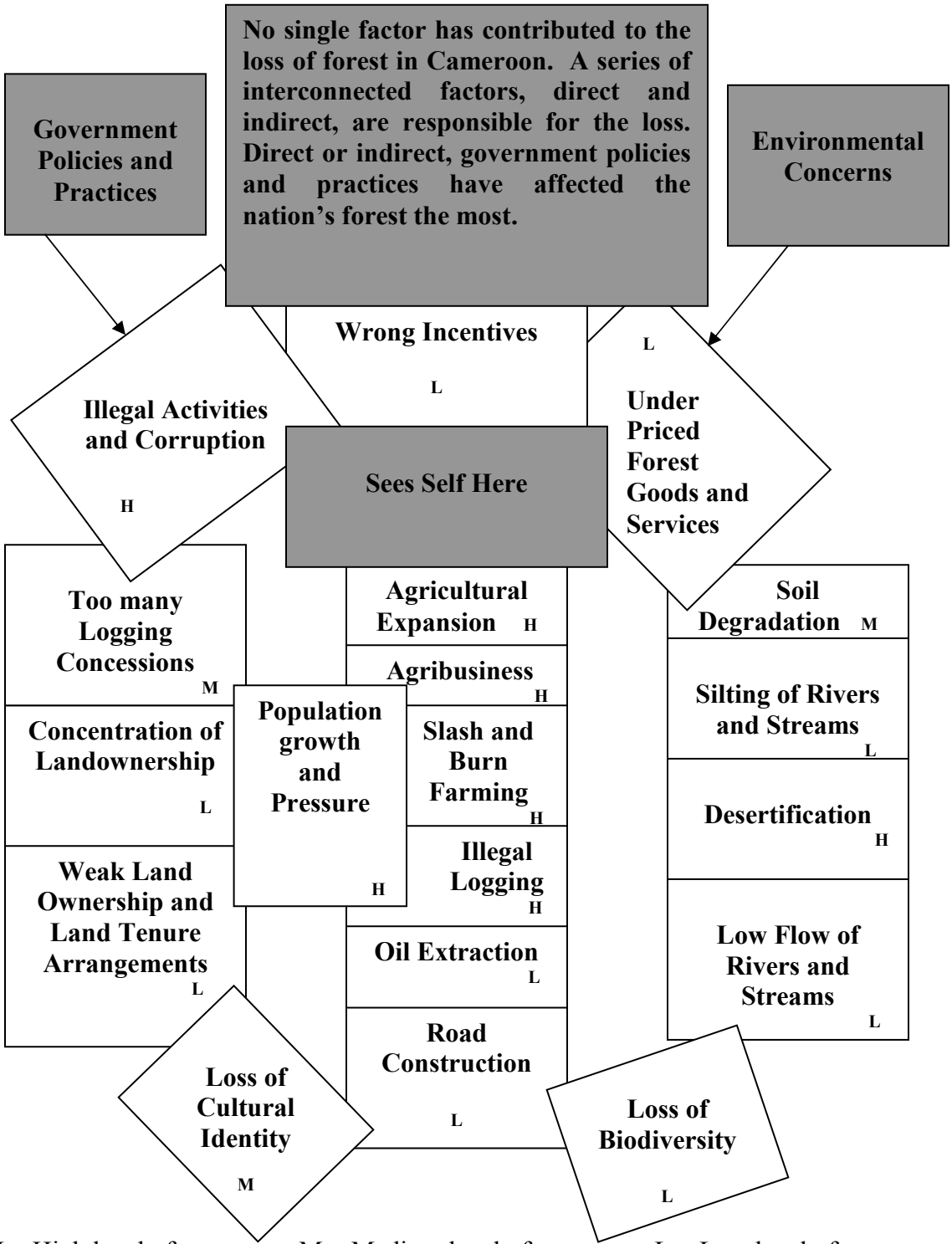
Participants of this group expressed concerns over external influences and government weaknesses including wrong incentives, too many logging concessions, and under-priced goods and service. Weak existing land ownership and land tenure arrangements have left the local population with the perception that the forest is a common property. This has led to "tragedy of the common" as logging becomes indiscriminate and uncontrolled.



H = High level of concern M = Medium level of concern L = Low level of concern

The box "Sees Self Here" indicates were researcher's concern fits. This is because the researcher is a Cameroonian and therefore has a stake in the country's forest problems.

Figure 7.4: Concept map of a group concerned with government policies and practices



H = High level of concern M = Medium level of concern L = Low level of concern

The box "Sees Self Here" indicates were researcher's concern fits. This is because the researcher is a Cameroonian and therefore has a stake in the country's forest problems.

Figure 7.5: Aggregate map derived from the integration of individual concept maps

7.3 Survey Results

Of the 40 individuals contacted, 32 participated in the survey. The results of the survey indicate that the problem is largely embedded in the complexities of the political, economic, and social set up in the country. As expected, agricultural expansion, population growth and pressure, illegal activities and corruption were among issues over which participants expressed the most concern. Analysis of questionnaire responses showed that 97% of respondents think there is agricultural expansion in the forest region of Cameroon. This supports the results of the change detection analysis which also identified an increase in agricultural field as the most significant change on the landscape. Eighty four per cent (84%) of respondents acknowledged that population growth and pressure is causing encroachment on forest lands. This is also in line with the outcome of the multivariate regression analysis which showed that a decrease in forest land is associated with an increase in rural population ($R^2 = 0.9892$).

Although correlation between forest loss and illegal activities and corruption was not tested in the regression analysis, 94% of participants in the survey acknowledged that illegal activities on the part of the local population, as well as corruption in the government of Cameroon and among forest officials in particular, is costing the nation its forest resource. Surprising results in the survey came from the question on land ownership and the issue of under-priced forest goods and services. Only 47% of participants think Cameroon's forest goods and services are under-priced. The reason for this could be lack of public information on the sales of timber and other forest products. Again, it is difficult for ordinary Cameroonians to think that forest products, and timber

in particular, are under-priced because when they see the high rate at which the forest is exploited (daily movement of trucks carrying timber) they conclude that it must be of high market value; otherwise exploiters would have stopped exploitation. Also, only 51% of participants acknowledged that weak land ownership in Cameroon has led to forest loss. The reason could be that local people do not acknowledge the government of Cameroon as custodian of the land since many people have fraudulently obtained a land certificate on public lands and now claim it as theirs (Fomété 2001). A complete result of the survey is shown on table 7.1 below:

Table 7.1: Concerns for forest related issues in Cameroon

Forest Issue	Number of Responses		Positive Response (%)	Weight/Level of Response
	Yes	No		
ENVIRONMETAL CONCERNS				
Desertification	26	6	81%	High
Soil degradation	21	11	66%	Medium
Low flow of rivers	17	15	53%	Low
Silting of streams*	17	13	57%	Low
Loss of Biodiversity	18	14	56%	Low
TOTAL	99	59	63%	Medium
CONCERNS FOR LOGGING AND AGRICULTURAL EXPANSION				
Agricultural expansion	31	1	97%	High
Uncontrolled logging**	21	9	70%	Medium
Slash and burn farming**	27	3	90%	High
Agribusiness*	25	6	83%	High
Illegal activities and corruption*	29	2	94%	High
Excessive consumption*	23	8	74%	Medium
TOTAL	156	56	74%	Medium
CONCERNS FOR ACCESS TO THE FOREST				
Road construction	17	15	53%	Low
Oil extraction	19	13	59%	Low
Loss of cultural identity*	20	11	65%	Medium
Weak land ownership and land tenure arrangements***	15	14	52%	Low
Population growth and pressure*	26	5	84%	High
TOTAL	97	58	63%	Medium
CONCERNS FOR GOVERNMENT POLICIES AND PRACTICES				
Under priced forest goods and services**	14	16	47%	Low
Wrong incentives***	17	12	59%	Low
Too many logging**** concessions	19	9	68%	Medium
Concentration of land ownership**	15	15	50%	Low
Weak land ownership and land tenure arrangements***	15	14	52%	Low
TOTAL	80	66	55%	Low

* = Number of null responses (i.e. number of participants that gave no response to the question).

7.4 Concluding Remarks

This chapter has given a practical view of people's perceptions to the problems of forest loss in Cameroon. Four categories of concerns were examined. Of these four categories, three (logging and agricultural expansion, access to the forest, and environmental concerns) showed a medium level of concern to the problem of forest loss in the country while one category (government policies and practices) indicated a low level of concern. From these results, one can conclude that, though Cameroonians are aware of the problems of forest loss in the country, it remains a non salient issue as none of these categories is of high level concern to the people. Cameroonians care about their environment but have greater concern for their immediate survival than to the survival of the environment. This attitude of the Cameroonian people towards the environment may sounds logical, but it ignores the rationale that their very survival depends on a healthy forest which is critical for ensuring long-term food security. The people's low concern for government policies and practices can be attributed to lack of trust and credibility of the government. This is because the Cameroonian people are not given enough opportunity to participate in policy making processes. Although the problem of forest loss is generally not salient among the Cameroonian people, the practical analysis performed in this chapter could generate greater concern as the results complement the outcome of the space-base and socio economic analysis in chapter 5. Analyses in the last three chapters will guide policy development in the chapter that follows.

CHAPTER VIII

DEVELOPMENT OF POLICIES TO CONSERVE THE FOREST

This chapter draws from the analysis of the last three chapters to develop policies that will help conserve Cameroon's forest. The task of this chapter is to identify policy goals, constraints, and objectives, and to select method(s) for identifying policy options. Policy options were developed by employing the following activities:

1. Predicting the possible outcomes of each policy option if it were to be implemented. Possible outcomes of each policy option were predicted by analyzing the influence diagram (figure 6.1) and carrying out simple qualitative and quantitative analysis to justify the predicted outcomes. For example, a partial equilibrium analysis was carried out to make assumptions on marginal valuations such as marginal social cost (MSC), marginal social benefit (MSB) and marginal private cost (MPC) in timber exploitation.
2. Each predicted outcome was related to at least one of seven evaluation criteria in table 8.1.
3. A policy options and objectives valuation matrix (table 8.2) was used to display objectives, evaluation criteria, and policy options.

4. The predicted outcomes were rated against the objectives. This task was performed to assess how well each policy's anticipated performance meets the objectives, as measured by evaluation criteria.
5. The predicted overall performance of each policy option was compared against each other.

8.1 Identification of Goals, Constraints, and Objectives

This study has identified shortcomings linked to deforestation and forest loss in Cameroon. Not all the shortcomings are unwanted. Some shortcomings may be necessary to redress other issues that may be of better socio-economic standing for the Cameroonian people. For example, the benefits of improving the wellbeing of the poor may be considered against some environmental effects of deforestation. This leads to value conflict. In defining policy goals therefore, it is important to consider all possible conflicting values and to make tradeoffs among alternatives. The following are suggested policy goals to help solve the problem of forest loss in Cameroon:

Stimulate government and private sectors in the direction of socially based objectives by reducing externalities

Inefficient management of Cameroon's forest resources is partly due to inefficient markets. Too often, the price (P) attached to Cameroon's forest products are less than the market price (marginal cost of production (MC) (Amin 1999)). When P < MSC it means P is not equal to marginal social cost (MSC). But when P = MSC it means MSC = MC +

MEC (marginal external cost). This means that in order to cover the cost of externalities, the marginal cost must reflect the cost of any additional unit of resource consumed. The government of Cameroon does not get the full value of social benefits provided by the forest mainly because markets do not consider environmental (externalities) cost; hence, offer little or no incentive to protect the forest and the underlying lands. Externalities arise because property rights are not well defined. Due to the fact that property rights are not well defined in Cameroon's forest, there are "competing claims and conflict" over forest lands. This has led to a scramble for forest resources; hence, mismanagement and lack of conservation and proper investment. If Cameroon's markets are to function efficiently there must be "the existence of well-defined, exclusive, transferable, and enforceable property rights over all resources, goods and services" (Panayotou 1993, 35). This goal addresses the economic efficiency legitimacy criterion because by reducing externalities (through price mechanism and police power), net social welfare can increase as policies designed to meet this goal stand a better chance to achieve greater benefits than costs. When benefits in the forest sector are greater than cost, the government of Cameroon will stop generating financial subsidy for the sector. This policy goal therefore has the potential of increasing government revenue and putting an end to the problem of fiscal deficits. This goal also requires a utilitarian approach to policy analysis; hence, forest resource use becomes more economically efficient. But this policy goal of efficient market operation is not without constraints. It could be limited by lack of well defined property rights, lack of information regarding the value of non-market benefit of forest, and lack of available technology. The objective is to improve market functioning and allocation of resources among alternate uses. Based on research

responses and literature from Cameroon, this would be a high level objective due to its economic efficiency importance.

- *Consider side effects of development and subsidy policies by undertaking reforms that would curb the negative incentives of unsustainable practices*

The Government of Cameroon in the past has unintentionally implemented policies that have had negative impacts on the nation's forest resource. For example, government policies have allowed road projects to take place in forestlands without considering the side effects of such projects. The government thinks only of the security needs of the country, without proper assessment of the environmental impacts of these development projects. Also, the government has been giving subsidies to commercial farmers and to entrepreneurs in other sectors of the economy who are not directly linked to the forest sector. Such subsidies enable farmers to convert more forestlands to agricultural lands. These subsidies also empower timber companies as it lengthens their concession period. The government has been very myopic in its approach to these policies. The government needs to adopt an approach that considers the long term effects of its policies. This policy goal of considering side effects of development and subsidy policies addresses three substantive policy legitimacy criteria: technical practicability, administrative implementability, and political feasibility. Constraints to this policy goal include pressure from powerful elites and political groups to serve their own interest, complying with the International Monetary Fund's structural adjustment program conditions, and limited administrative resources. The objectives are to restrict development projects from forestland and to reduce subsidies granted to forest sector operators and entrepreneurs in

other sectors related to the forest to within a limit that would not encourage more forest conversion. Based on research responses and literature from Cameroon, these would be medium level objectives because they do not directly address economic efficiency.

- *Eliminate forest tax evasion and enforce proper and regular payment of rents*

Tchoungui *et al*. (1995, 103) point to the fact that, despite intensive exploitation of Cameroon's forest and despite the forestry tax reforms of the 1994 forestry law, "the average annual revenue from forest exploitation in the south is only 800 million franc CFA (US$ 1.66million)." The tax evaluation system in the forest sector is inefficient. The current tax code was not properly designed. This has given the opportunity for operators in the sector to evade taxes and rents. The tax code also contains "loopholes" that enable officials to siphon revenues to private accounts. This goal is oriented towards market efficiency and accountability. Thus, it addresses economic efficiency and administrative implementability policy legitimacy criteria. This policy goal could be constrained by expensive and burdensome instruments of control, lack of trained forest personnel, and lack of proper feedback of government action. The objective is to strengthen forest tax regulations to cover any "loopholes" and to impose and enforce regulations. Based on research responses and literature from Cameroon, this would be a medium level objective as administrative weakness is the main issue here.

- *Encourage efficient management of the forest sector by limiting the number of institutions involved in the sector and increasing coordination amongst them*

The management of the forest sector in Cameroon is the responsibility of a number of government ministries and agencies. Although the Ministry of the Environment and Forest is the main ministry responsible for designing and implementing forest policies, its activities are often directed and coordinated from the Prime Ministers Office and the Presidency of the Republic. With many institutions involved, coordination of activities becomes very difficult as bureaucracy, politics, personal interest, and governance issues become inherent in the entire forest sector. This goal aims at improving coordination among institutions responsible for managing the forest sector. Thus, it addresses economic efficiency, administrative implementability, and stakeholder acceptability policy legitimacy criteria. This goal of management efficiency could be limited by too many institutions involved in this sector, and by entanglements between politics, personal interest and governance. The objective is to reduce high level bureaucracy to within levels necessary for the efficient functioning of the sector. Based on research responses and literature from Cameroon, this would be a high level objective.

- *Make efficient the Implementation of the Structural Adjustment Plan (SAP) program by adopting an integrated management approach*

Structural Adjustment Plan programs are not designed by the government. These are International Monetary Fund and World Bank programs imposed on indebted nations and nations that want to continue borrowing from these multilateral institutions. Structural Adjustment Plan programs in Cameroon have led to job losses and high dependence on

forest revenues to repay International Monetary Fund and World Bank debts. Although Structural Adjustment Plan programs prove to have negative socio-economic and environmental effects in Cameroon, these programs could also have tremendous positive effects if implemented in an integrated manner with maximum coordination with other sectors of the national and international economies. This goal addresses economic efficiency, administrative implementability, and stakeholder acceptability policy legitimacy criteria. Dependence on timber export for repayment of International Monetary Funds and World Bank loans could constrain this policy goal. The objective is to stimulate the economy, create employment, and sustain income growth so as to reduce over dependence on the country's forests. Based on research responses and literature from Cameroon, this would be a medium level objective.

- *Efficient income distribution and prices*

Forest depletion has been linked to population growth as an increase population has increased the demand for land to cultivate and fuel wood for energy. Also, the increase in population has led to cheap labor and generated high profits for agribusiness owners, making them more viable and having the desire for more land to expand their business. An increase in population also implies more mouths to feed; hence, expansion in agribusiness to meet the food demands of the population. Population increase also leads to poverty as too may people turn to depend on few individuals. Increased poverty has caused many families to depend totally on the forest for survival, through logging and slash-and-burn farming. Although forest loss is associated with population increase, the underlying cause here is income inequality. This goal of achieving efficient income

distribution and prices could close the income gap between the different classes; hence, reducing poverty and dependence on the forest by the poor and unemployed. This goal addresses economic efficiency policy legitimacy criteria. Lack of proper information on population and employment structure might limit the performance of this policy goal. The objective is to reduce poverty to a level that families can sustain themselves without, by necessity, turning to the forest for livelihood. Based on research responses and literature from Cameroon, this would be a high level objective.

8.2 Selection of Evaluation Methods

The *raison d'être* of conducting analysis in a *priori* public policy analysis is to assess the potential influence of different policy options (Focht 2005). This is usually done by predicting potential obstacles or constraints that may reduce the performance of a policy goal or hinder it from performing altogether. The analysis also considers a set of objectives that policy goals work towards attainment. This analysis will rank policy options according to how likely they are to meet the policy objectives. Three analytic methods can be used to evaluate policy options: Benefit/Cost Analysis, Cost Effectiveness Analysis, and Multi-Goal Analysis (Focht 2005). The use of any of these methods is influenced by its ability to consider policy legitimacies.

Benefit/cost analysis compares the positive economic values and the negative social values that might be generated as a result of a policy alternative. Therefore, maximizing efficiency legitimacy is the essence of performing benefit/cost analysis. The problem of

forest loss in Cameroon is not limited to inefficiency alone hence this method is not the best for this analysis. Cost effectiveness analysis is based on maximizing efficiency together with either a practicability or implementability legitimacy criterion. This is a more dynamic method than the benefit/cost analysis method because it maximizes a combination of efficiency and one other policy legitimacy criterion. Although it is a better method, it is still not the best for this analysis. The multi-goal analysis method maximizes the combination of all policy legitimacy criteria. This approach supports "positive and post-positive" analyses. Due to the fact that most public analysis is dominated by consideration of economic efficiency, this method favors policy options that are likely to produce the greatest net economic benefit (Focht 2005). A combination of all legitimacies (technical practicability, administrative implementability, political feasibility, economic efficiency, and stakeholder acceptability) is likely to produce the greatest net economic benefits. The multi-goal analysis method was employed in this analysis because it considers all seven policy goals identified earlier and involves all five policy legitimacy criteria hence, the greatest potential of producing net economic benefits in the forest sector of Cameroon.

8.3 Definition of Evaluation Criteria

This section identifies and explains different evaluation criteria used in comparing policy options. The policy criteria suggested are based on a general assessment of each criterion with respect to the problem of forest loss in Cameroon. The following policy criteria are suggested for further discussion and benefit cost analysis:

- *Market prices must reflect the true social cost and resource use*

This criterion is derived from the goal constraint of lack of information regarding the value of non-market benefit of forest. The criterion raises awareness of the value of the forest and the important role it plays in the wellbeing of the people. This evaluation criterion addresses all five legitimacy criteria - economic efficiency, technical practicability, administrative implementability, political feasibility, and stakeholder acceptability. This evaluation criterion is anticipated to meet the following objectives:

1. Improve market functioning and allocation of resources among alternate uses.

2. Restrict development projects from forestlands.

3. Strengthen forest tax regulations to cover any "loopholes" and to impose and enforce regulations.

4. Reduce subsidies granted to forest sector operators and entrepreneurs in other sectors related to forest to within a limit that would not encourage more forest conversion.

5. Reduce poverty to a level that families can sustain themselves without necessary turning to the forest for livelihood.

- *Reduce timber export to a sustainable limit within the shortest possible time frame*

This criterion is derived from dependence on timber export for repayment of International Monetary Fund loans. This criterion indicates that the current rate of timber export is not sustainable. This criterion will force the government to adopt better sustainable forest

policy alternatives and to exploit other sectors of the economy. This evaluation criterion addresses economic efficiency, administrative implementation, and stakeholder acceptability legitimacy criteria. This evaluation criterion is anticipated to meet the following objectives:

1. Stimulate the economy, create employment, and sustain income growth.
2. Reduce subsidies granted to forest sector operators and entrepreneurs in other sectors related to forest to within a limit that would not encourage more forest conversion.

- *The government must set a limit to the number of new roads occupying forest lands*

This criterion is derived from constraint that elites and political heavy weights might push for road projects in their constituencies for personal motives such as trying to guarantee their reelection into office. This criterion will force developers to consider alternative routes and design options that will minimize deforestation. This criterion addresses technical practicability, administrative implementability, and political feasibility legitimacy criteria. This criterion will meet one objective:

Restrict development projects from forestlands.

- *Reduce current forest concessions to within a sustainable limit*

This criterion will resolves the policy constraint of dependence on timber export for repayment of foreign debts. This criterion addresses technical practicability,

administrative implementability, and political feasibility legitimacy criteria. This criterion will meet the following objectives:

1. Reduce subsidies granted to forest sector operators and entrepreneurs in other sectors related to forest to within a limit that would not encourage more forest conversion.

2. Strengthen forest tax regulations to cover any "loopholes" and to impose and enforce regulations.

- *The activities of timber companies must be monitored and evaluated by the government and not by the companies themselves*

This is a qualitative criterion that is based on policy goal constraints of burdensome and expensive instruments of control and lack of proper feedback of government actions. It addresses economic efficiency and administrative implementability legitimacy criteria. This criterion will meet the following objectives:

1. Strengthen forest tax regulations to cover any "loopholes" and to impose and enforce regulations.

2. Improve market functioning and allocation of resources among alternate uses.

- *Management decisions must rely more on expert opinion not political opinion*

This is also a qualitative criterion with no specific target. This criterion is base on policy goal constraints of too many institutions involved in managing the forest sector and entanglements between politics, personal interest and governance. This criterion addresses economic efficiency, administrative implementability, and stakeholder acceptability policy legitimacy criteria. This criterion will meet one objective:

> Reduce high level bureaucracy to within levels necessary for the efficient functioning of the sector.

- *The income gap between high and low income earners must reduce annually at a reasonable rate*

This criterion is derived from the policy goal constraint of lack of proper information on population and employment structure. The criterion addresses economic efficiency policy legitimacy criterion. The criterion will meet one objective:

> Reduce poverty to a level that families can sustain themselves without having to turn to the forest for livelihood.

Table 8.1 below is a summary of goals, constraints, objectives, and performance targets while table 8.2 is a valuation matrix for policy options and objectives. The matrix shows how well each selected policy option meets policy objectives.

TABLE 8.1: GOALS, CONSTRAINTS, OBJECTIVES, AND PERFORMANCE TARGETS

POLICY GOALS	CONSTRAINTS	POLICY OBJECTIVES	PERFORMANCE TARGETS	LEGITIMACY CRITERIA
PG #1: Stimulate government and private sectors in the direction of socially based objectives by reducing externalities through effective price mechanism.	**GC #1:** Efficient market operation is limited by lack of well defined property rights. **GC #2:** Market efficiency is limited by lack of information regarding the value of non-market benefit of forest **GC #3:** Market efficiency is limited by lack of available technology	**OBJ #1** Improve market functioning and allocation of resources among alternate uses	**Threshold Criterion #1:** Market prices must reflect the true social cost and resource use	Technical Practicability, Administrative Implementability, Political Feasibility, Economic Efficiency, and Stakeholder Acceptability.

TABLE 8.1 Cont.

POLICY GOALS	CONSTRAINTS	POLICY OBJECTIVES	PERFORMANCE TARGETS	LEGITIMACY CRITERIA
PG #2: Consider side effects of development and subsidy policies by undertaking reforms that would curb the negative incentives for unsustainable practices	**GC #1:** Pressure from powerful elites and political groups to serve their own interest **GC #2:** Complying with IMF's SAP conditions **GC #3:** Limited administrative resources	**OBJ #2:** Restrict development projects from forestland **OBJ #3:** Reduce subsidies granted to forest sector operators and entrepreneurs in other sectors related to forest to within a limit that would not encourage more forest conversion	**Threshold Criterion #2:** Reduce timber export to a sustainable limit within the shortest possible time frame **Threshold Criterion #3:** The government must set a limit to the number of new roads occupying forest lands	Technical Practicability, Administrative Implementability, and Political Feasibility,
PG #3: Eliminate forest tax evasion and enforce regular and proper payment of rents	**GC #1:** Instruments of control are expensive and burdensome **GC #2:** Lack of proper feedback of government action	**OBJ #4:** Strengthen forest tax regulations to cover any "loopholes" and to impose and enforce regulations	**Threshold Criterion #4:** The activities of timber companies must be monitored and evaluated by the government and not by the companies themselves Internalize cost so as to determine an appropriate price system	Economic Efficiency, and Administrative Implementability

TABLE 8.1 Cont.

POLICY GOALS	CONSTRAINTS	POLICY OBJECTIVES	PERFORMANCE TARGETS	LEGITIMACY CRITERIA
PG #4: Encourage efficient management of the forest sector by limiting the number of institutions involved in the sector and increasing coordination amongst them	**GC #1:** Management efficiency is limited by too many institutions **GC #2:** Entanglements between politics, personal interest and governance	**OBJ #5:** Reduce high level bureaucracy to within levels necessary for the efficient functioning of the sector	**Threshold Criterion #5:** Management decisions must rely more on expert opinion not political opinion	Technical Practicability, Administrative Implementability, and Political Feasibility,
PG #5: Make efficient the Implementation of the SAP program by adopting an integrated management approach	**GC #1:** Dependence on timber export for repayment of IMF and WB loans	**OBJ #6:** Stimulate the economy, create employment, and sustain income growth	**Threshold Criterion #6:** Reduce timber export to a sustainable limit within the shortest possible time frame	Administrative Implementability, and Economic Efficiency.
PG #6: Efficient income distribution and prices	**GC #1:** Lack of proper information on population and employment structure	**OBJ #7:** Reduce poverty to a level that families can sustain themselves without necessary turning to the forest for livelihood	**Threshold Criterion # 7:** The income gap between high and low income earners must reduce annually at a reasonable rate	Economic Efficiency.

TABLE 8.2: POLICY OPTIONS AND OBJECTIVES VALUATION MATRIX

OBJECTIVE	EVALUATION CRITERION	EC WEIGHT	Outcome Valuations		
			POLICY OPTION "A" ("NO ACTION")	POLICY OPTION "B" ("REDUCING EXTERNALITIES")	POLICY OPTION "C" ("INTEGRATED IMPLEMENTATION OF SAP" PROGRAM")
OBJ #1 Improve market functioning and allocation of resources among alternate uses	**Threshold Criterion #1:** Market prices must reflect the true social cost and resource use	High	Low market functioning	High improvement in market functioning	Moderate improvement in market functioning
OBJ #2: Restrict development projects from forestland	**Threshold Criterion #2:** The government must set a limit to the number of new roads occupying forest lands	Medium	Continuous development projects in forestland	High reduction of development projects in forestland	Low reduction of development projects in forestland

TABLE 8.2 Cont.

OBJECTIVE	EVALUATION CRITERION	EC WEIGHT	Outcome Valuations		
			POLICY OPTION "A" ("NO ACTION")	POLICY OPTION "B" ("REDUCING EXTERNALITIES")	POLICY OPTION "C" ("INTEGRATED IMPLEMENTATION OF SAP" PROGRAM)
OBJ #3: Reduce subsidies granted to forest sector operators and entrepreneurs in other sectors related to forest to within a limit that would not encourage more forest conversion	**Threshold Criterion #3:** Reduce current forest concessions to within a sustainable limit	Medium	Continuous granting of subsidies	Moderate reduction in subsidy grants	Moderate reduction in subsidy grants
OBJ #4: Strengthen forest tax regulations to cover any "loopholes" and to impose and enforce regulations	**Threshold Criterion #4:** The activities of timber companies must be monitored and evaluated by the government and not by the companies themselves	High	Continuous tax evasion	No effect	No effect

TABLE 8.2 Cont.

OBJECTIVE	EVALUATION CRITERION	EC WEIGHT	Outcome Valuations		
			POLICY OPTION "A" ("NO ACTION")	POLICY OPTION "B" ("REDUCE EXTERNALITIES")	POLICY OPTION "C" ("INTEGRATED IMPLEMENTATION OF SAP" PROGRAM)
OBJ #5: Reduce high level bureaucracy to within levels necessary for efficient functioning of the sector	**Threshold Criterion #5:** Management decisions must rely more on expert opinion not political opinion	Medium	Low functioning of the sector	High improvement in the implementation of rules and regulations	Moderate improvement in implementing rules and regulations
OBJ #6: Reduce IMF influence on forest policies	**Threshold Criterion #6:** Reduce timber export to a sustainable limit within the shortest possible time frame	High	Continuous influence	High reduction of influence	Moderate reduction of influence
OBJ #7: Reduce poverty to a level that families can sustain themselves without necessary turning to the forest for livelihood	**Threshold Criterion # 7:** The income gap between high and low income earners must reduce annually at a reasonable rate	Low	Continuous dependence on forest	High reduction in forest dependence	Low reduction in forest activities
Overall Rating or Ranking			**3**	**1**	**2**

8.4 Concluding Remarks

Based on analysis and evaluation of policy options as demonstrated by the above matrix (Table 8.2), the policy option of "reducing externalities" exhibits the best performance (rank # 1). This policy option meets all five legitimacy criteria: economic efficiency, technical practicability, administrative implementability, political feasibility, and stakeholder acceptability. The policy also addresses most (six) of the policy objectives. By reducing externalities through price mechanism and police power, markets can function well and can lead to efficient allocation of resources among alternative uses over time. This can also enable the economy to attain its optimum potential of human welfare. The fact that the other five policy options were not included in the final performance evaluation matrix does not mean that they are not to be considered when making policy changes. It simply means that they have constraints that are more difficult to deal with than the other two options. All seven policy options have to be considered but the five that did not go through the goal-constraint evaluation will have to undergo intense deliberations during the policy adoption stage. That may require some tradeoffs. The "no action alternative" is included in the final performance evaluation because it is a fundamental policy option in any policy analysis process (Focht 2005).

CHAPTER IX

CONCLUSION

This study has shown how colonial and domestic policy failures have led to the loss of Cameroon's forest cover. As indicated by analysis in this study, market failure, policy failure, institutional weakness, debt crises, and population growth are issues that intricately work together to produce the negative outcome that is being witnessed in the forest sector of Cameroon. In other words, the problem is a result of a complex combination of socio-economic and political failures on the part of the government as well as the general public. These failures are mainly due to disagreements or discrepancies between the different actors in the forest sector. Some major stakeholders in the forest sector tend to disagree with or down play certain regulations. For example, underlying causative factors (indirect factors) that are mostly related to poverty are being overlooked by the government and instead concentrate on factors (direct factors) that only exist because of the underlying factors. The government must recognize that dealing with a single source cannot entirely do away with the problem of forest loss in Cameroon. Both direct and indirect causes must be dealt with equally since they are intricately connected. As identified by this study, one way of dealing with both direct

and indirect causes is to stimulate government and private sectors in the direction of socially based objectives. This will reduce the income inequality gap that has forced the poor to ravage the forest in order to survive.

The tri-factor methodology used in this study identified the need to "reduce externalities" as the best policy option of dealing with the problem of forest loss in Cameroon. The only ways of implementing this policy is through "price mechanism" and "police power." This is because externalities have been identified with market inefficiencies and lack of well-defined property rights over forest resources. But these instruments are likely to be constrained by external influences. For example, due to the political influence of the French in Cameroon, their timber companies (have the largest share of concessions) often benefit from their government's influence by suppressing policies that threaten their interest. The government and people of Cameroon must understand that France has not changed its colonial exploitative policies towards Cameroon, and will do every thing to monopolize rights to access the country's forest and other natural resources. The government of Cameroon must not allow companies from any single country to dominate the forest sector as this weakens the government's ability to set or negotiate prices. This could be a difficult stance against the French as their monopolistic behavior is not unrelated to a set of "entangling agreements" between their government and government of Cameroon (secret agreements) prior to the latter's independence in 1961. These "secret agreements" provided France with "an absolute advantage in the conduct of the affaires of the new republic of Cameroun" (DeLancey and Mokeba 1990, 179). However, this is not to say that the policy option of "reducing externalities" together with

other policy options proposed by this study is not attainable. As a sovereign nation, the government and people of Cameroon can use democratic avenues to exercise their sovereignty and annul these so called "secret agreements" and other unscrupulous agreements with other nations, companies, and individuals' that have turned Cameroon into their "milking cow."

The political atmosphere in Cameroon is another major constraint to efficient forest conservation policies. Cameroon has been undergoing socio-political changes in the past sixteen years, changing from a one party to a multi-party system. This has created much discrepancy between personnel from opposition parties and those from the ruling party. These personnel end up fighting for their personal interest and that of their political lineage rather than for national and environmental interest. In such an atmosphere, it is important that procedural policy legitimacy take its full course as "the people's power" has the ability to create a common ground (win-win outcome) on which the different actors can work, not only for their partisan and personal interest, but for the interest of all Cameroonians and their environment. Such common ground lies in understanding the socio-political and economic changes that occur in the country and in the world at large, and matching the changes with policies that meet the needs of the people without necessarily having a negative impact on the forest in particular and the environment in general.

A lasting solution to the problem of forest loss in Cameroon depends on involvement of every stakeholder in the development and implementation of policies to conserve the

forest, commitment from all stakeholders, efficient institutional capacity, and willingness of stakeholders to accept opportunity cost. For these conditions to be met, Cameroon's fundamental problem of poverty must be addressed first. This is because as this study indicates, poverty and forest loss are mutually related. As noted by Forestry Outlook for Africa (FOSA 2003, 80), "addressing poverty is critical to environmental protection, and protecting the environment is crucial for addressing poverty through sustainable production of goods and services." Addressing the problem of poverty in Cameroon is indispensable for reversing the current trend of forest loss since a majority of the poor depend on forest resources for their livelihoods. This will require more research on informal sector activities such as collection and trade of fuel wood, encroachment on forest lands, and illegal trade of timber and other forest products. A better understanding of these activities will lead to investments that can improve and integrate "illegal" activities into the formal economy.

By analyzing landsat imageries, detecting forest cover changes, correlating the changes with socio-economic activities and natural resource policies, and using ground truthing information to develop new policies, this research makes an original contribution to body of knowledge. This dissertation is only one of many forest research issues in Cameroon. Other forest related areas that require more research include forest plantations. At the moment, forest plantations account for less than 1 percent of the total forest area in Cameroon. More research needs to be carried out in order to determine the possibility of expanding forest plantations which could be a vital compensation for the loss of natural forests. Another important area requiring scholarly attention is researching the

possibilities for non-wood forest products becoming an important source of income and employment. Also, greater attention must be given to the declining capacity of the public sector institutions and the increasing role civil society organizations are playing in the forest sector of Cameroon.

References

Acworth, J., Ekwoge, H., Mbani, J., and Ntube, G. 2001. "Towards Participatory Biodiversity Conservation in the Onge-Mokoko Forests of Cameroon." Overseas Development Institute, London. *Rural Development Forestry Network, Network* Paper No. 25d.

Adeyoju, S. Kolade. 1976. *A Study of Forest Administration Problems in Six African Countries: Cameroon, Ghana, Kenya, Liberia, Nigeria and Tanzania*. Food and Agricultural Organization of the United Nations.

African Development Bank (ADB), 2003. "*Cameroon - Forest and Environment Policy Development Credit."* Environmental Assessment Summary. Abidjan.

African Development Bank (ADB), 1995. "*Country Environmental Profile – Cameroon.*" Working Paper No. 16. Abidjan.

Agnes, R.C. and Ian, C. 2005. Economic Development and Environmental Management in the Uplands of Southeastern Asia: Challenges for Policy and Institutional Development. *Agricultural Economics* 32(s1):243-256.

Amin, A.A. 1999. *Public Policy Failures in Timber Trade and Environment in Developing Economies*. Unpublished Paper, University of Yaounde II, Cameroon.

Angelsen, A. 1994. *Shifting Cultivation Expansion and the Intensity of Production: The Open Economy Case*. Working Paper No. 3. Michelsen Institute, Bergen.

Angelsen, A. and R. Culas. 1996. "Debt and Deforestation: A Tenuous Link." *WP10*, Chr. Michelsen Institute.

Angelsen, A. Shitindi, E.F.K. and Aarrestad, J. 1999. "Why do farmers expand the Land into Forests? Theories and Evidence from Tanzania,"*Environment and Development Economics*, 4(03):313-31.

Amsberg, von J 1998. "Economic Parameters of Deforestation," NBARD-India, *National Bank News Review* 14(2):26-39.

Aube, J. 1993. *Cameroon Forestry Sector Overview*. Agricultural and Rural Development Office, USAID, Cameroon. Pp. 78.

Barbier, E. B. and Burgess, J. C. 2001. The Economics of Tropical Deforestation. *Journal of Economic Surveys* 15 (3): 413-433.

Besong, J.B. 1992. "New Directions in National Forestry Policies: Cameroon," In Cleaver, K., *et al*., eds. *Conservation of West and Central African Rain Forests*. Washington, D.C., World Bank, World Bank Environment Paper No. 1. Pp.36-39.

Bhagwati, J., 1995. "The Case of Free Trade," In *Green Planet Blues: Environmental Politics from Stockholm to Rio.* Westview Press, Oxford.

Binam, J.N., Sylla, K., Diarra, I., and Nyambi, G. 2003. Factors Affecting Technical Efficiency among Coffee farmers in Cote d'Ivoire : Evidence from the Centre West Region. *African Development Review* 15(1):66-76.

Brown, N.J. and Quiblier, P. 1994. *Ethics and Agenda 21: Morals and implications of a global Consensus*. United Nations Publications, New York.

Cameroon Republic, 1992. "*Environment and Sustainable Development for Cameroon.*" Report on Multi-Disciplinary Mission. Yaoundé, Cameroon

Carman, C. 1989. Saving the Rain Forest: The Cameroon Plan. *Wood and Wood Products* 94(12):62-66.

Centre d'Informations Documantaires. 1939. *The Work of France in the Cameroons*. CID No. 36, Paris.

Center for Environment and Development (CED) 2004. *Inauguration: Pipeline*. CED Press Release, June 12, 2004.

Chilver, E.M. 1963. "Native Administration in the West-Central Cameroons 1902-1954," In Kenneth Robinson, and A. Frederick Madden (eds.) *Essays in Imperial Government.* Presented to Margery Perham. Pp. 89-139. Basil Blackwell, Oxford.

Clark, B.D., 1990. *"Environmental Impact Assessment (EIA): Origins, Evolution, Scope and Objectives."* Paper presented at the 11th International Seminar on EIA and Management, July 1990, Aberdeen, Scotland.

Country Statistics Database. 2006. Cameroon. http://www.statoids.com/ycm.html

Dale, V.H., O'Neill, R.V., Pedlowski, M., and Southworth, F. 1993a. Causes and Effects of Land Use Change in Central Rondonia, Brazil. *Photogrametric Engineering and Remote Sensing,* 59: 997-1005.

Dale, V.H., Southworth, F., O'Neill, R.V., Rosen, A. and Frohn, R.C. 1993b. Simulating Spatial Patterns of Land Use Change in Rondonia, Brazil, *Lectures on Mathematics in the Life Sciences*, 32: 29-55.

Dale, V.H., O'Neill, R.V., Southworth, F., and Pedlowski, M. 1994. Modeling Effects of Land Management in the Brazilian Amazonian Settlement of Rondonia. *Conservation Biology*, 8: 196-206.

Deacon, R. 1992. "Controlling Tropical Deforestation: An Analysis of Alternative policies." *Policy Research WP1029*, World Bank.

Deininger, K. and Minten, B. 1996. *Poverty, Policies, and Deforestation: The Case of Mexico*. Research Project on Social and Environmental Consequences of Growth-oriented Policies. Working Paper No. 5. Policy Research Department, World Bank, Washington, DC.

DeLancey, M.W. and Mokeba, H.M. 1990. *Historical Dictionary of the Republic of Cameroon*. Second edition. The Scarecrow Press, Inc. Metuchen, N.J., & London.

Djeumo, A. 2001 The Development of Community Forests in Cameroon: Origins, Current Situation and Constrains. Overseas Development Institute, London. *Rural Development Forestry Network*, Network Paper No. 25b. Pp. 1-16.

Eba'ayti, R. 1998. Cameroon's Logging Industry: Structure, Economic Importance and Effects of Devaluation. *Center for International Forestry*, Jakarta, Occasional Paper No. 14.

Ekoko, F. 1997. "The Political Economy of the 1994 Forestry Law". CIFOR, Yaounde-Cameroon.

Ekoko, F. 1999. *Environmental Adjustment in Cameroon: Challenges and Opportunities for Policy Reform in the Foresrty Sector.* Workshop on "Environmental Adjustment: Opportunities for Progressive Policy Reform in the Forest Sector"? World Resources Institute April 6, 1999.

Faure, J.J. 1989. Cameroon and its Forests. Part 1: The Natural Landscape. *Revue Forestiere Francaise* 41(6): 533-544.

Faure, JJ. 1990. Cameroon and its Forests. Part 2: The Forestry sector. *Revue Forestiere Francaise* 42(3): 553-369.

Ferrer, V. 1996. "Contribution to an Electronic Seminar of Ekoko: Poverty and Deforestation in the Congo Basin Rainforest". Tokyo, United Nations University.

Food and Agricultural Organization (FAO) Database. 2006. http://foastat.foa.org

Focht, W. 2005. Gaining Stakeholder Acceptance of Technological and Environmental Decision-making. *Industrialization and Environment*, 1: 165-200.

Forestry Outlook Study for Africa (FOSA), 2003. *African Forests: A View To 2020*. FAO, Rome.

Fomété, T. 2001. "The Forestry Taxation system and the Involvement of Local Communities in Forest Management in Cameroon". Overseas development Institute, London. *Rural Development Forestry Network*. Network Paper No. 25b (ii). Pp. 17-27.

Fomété, T. and Vermaat, J. 2001. "Community Forestry and Poverty Alleviation in Cameroon." Overseas development Institute London, *Rural Development Forestry Network*. Network Paper No. 25h. Pp. 1-8.

Fultang, B.A. 1988. "Trends in Forestry Education in Cameroon and Francophone Africa," In Nwoboshi, L.C. et al., eds. *Forestry Education in Africa: The Ibadan Experiment after 25 years (1963-1988)*. University of Ibadan, Department of Forest Resources Management; Department of Wildlife and Fisheries Management. Pp. 117-130.

Fultang, B.A. 1992. "The Efficiency of the Forestry Taxation System in Cameroon," In Cleaver, K., et al., eds. *Conservation of West and Central African Rain Forests*. Washington, D.C., World Bank, World Bank Environment Paper No. 1. Pp.293-296.

Global Forest Watch (GFW), *2000. Threats to Cameroon's Growing Timber Industry. Yaoundé, Cameroon.*

Global Forest Watch (GFW), 2001. *Interactive Forestry Atlas of Cameroon.*

Global Land Cover Facility. 2006. Landsat in Web Interface. http://glcf.umiacs.umd.edu

Gray, J.A. 1997. *Forest Concession Policies and Sustainable Management of Tropical Forest*. Paper Presented at the FDBS-FINEP-IBAMAUNDP Workshop on Forest Policies and Sustainable Development in Amazon, 14-16 July, Rio de Janeiro, Brazil.

Green, K., Kempka, D., and Lackey, L. 1994. "Using Remote Sensing to Detect and Monitor Land-cover and Land-use Change." *Photogrammetric Engineering and Remote Sensing*, 60(3):331-337.

Hardin, G. 2000. "Tragedy of the Commons." In *Economics of the Environment*, Ed., R. Stavins. Addison-Wesley Longman.

Hedin, L. 1930. *Etude sur la Forêt et les Bois du Cameroun*. Paris.

IDS, 1999. *Transforming Environmental Policy and Practic*e. Institute of Development Studies, IDS 2000 Initiative – Program 3.

IGBP, 1999. *Implementation Strategy for Land Use and Cover Change*. Revised Draft, April.

IGBP and IHDP, 1995. *Land Use Land Cover Change Science/Research Plan.* IGBP and IHDP, Stockholm and Geneva.

IRIN Africa, 2006. Cameroon-Nigeria: Cameroon Flag Hoisted over Bakassi as Nigerian Troops Pull out. http://www.irinnews.org

Jensen, J.R. 1996. *Introductory Digital Image Processing: A Remote Sensing Perspective*. Prentice-Hall, New Jersey.

Jua, N.B. 1999. *Indirect Rule in Colonial and Post Colonial Cameroon*. http://lucy.ukc.ac.uk/Chilver/paideuma-Indirect2.html.

Kaimowitz, D. 1997. *Factors Determining Low Deforestation: The Bolivian Amazon*. Ambio 626:537-40.

Kaimowitz, D. and Angelsen, A. 1998. *Economic Models of Tropical Deforestation: A Review*. Center for International Forestry Research.

Kamanda, C.B. 1995. Cameroon: *The Retrenched Workers of the Civil Service and Parastatals, Assessing the Need for the Reforms*. http://apad.revues.org/document453.html.

Kartodiharjo, H. and Supriona, A. 2000. *The Impact of Sectoral Development on Natural Forest Conversion and Degradation: The Case of Timber and Tree Crop Plantation in Indonesia.* CIFOR Occasional Paper, No. 26, Bogor, Indonesia.

Khan, J.R. and McDonald, J.A. 1995. *Third World Debt and Tropical Deforestation*. Ecological Economics, 12:107-124.

Kleibaum, D.G., Kupper, L.L., Muller, K.E. and Nizam, A. 1998. *Applied Regression Analysis and other Multivariate Methods*, p.111-119, Duxbury Press.

Kummer, D.M. 1991. *Deforestation in the Post War Philippines*. Chicago, University of Chicago Press.

Lambin, E.F. 1994. *Modeling deforestation Processes: A Review*. Trees, Tropical Ecosystem Environment Observation by Satellite, Report No. 1, European Commission Joint Research Center/European Space Agency, Brussels.

Lambin, E.F. 1997. "Modeling and Monitoring Land-cover Change Processes in tropical Regions". *Progress in Physical Geography*, 21:375-93.

Lescuyer, G., Fouda-Muoulende, T, and Fines, J.P. 1999. *Enquêtes Socio-économiques dans la Zone du Programme Tropenbos Cameroun*. Tropenbos Cameroon Programme, Econ2 Project, Kribi (Cameroon) Wageningen University (The Netherlands).

Lowry, W.R. 2003. "A New Era in Natural Resource Policies?" In Vig, N.J. and Kraft M.E. (ED.), *Environmental Policy: New Directions for the Twenty-First Century*. CQ Press, Washington D.C.

Martens, B., Poccard-Chapuis, R., Piketty, M.G., Lacques, A.E. and Venturieri, A. 2002. "Crossing Spatial Analyses and Livestock Economics to Understand Deforestation Processes in the Brazilian Amazon: The Case of São Félix do Xingú in South Pará." *Agricultural Economics,* 27 (3), 269-294.

Masser, I. 1984. "Cross-national Conparitive Planning Studies: A Review." *Town Planning Review* 55 (2), 137-149.

Mengang, J.M. 1998. "Evolution of Natural Resource Policy in Cameroon." In Resource Use in the Tri-National Sangha River Region of Equatorial Africa: Histories, Knowledge Forms, and Institutions, eds. Heather E. Eves, Hardin Rebecca, Stephanie Rupp, *Yale Forest and Environmental Studies Bulletin*, bulletin 102, Pp239-248.

Middleton, J., 1997. *Encyclopedia of Africa South of the Sahara,* Charles Scriner's Sons, USA, Vol. 1.

Mol, A.P.J., 2001. *Globalization and Environmental Reform: The Ecological Modernization of the Global Economy*. MIT Press, USA.

Monroe, D.K., Southworth, J. and Tucker, C.M. 2004. "Modeling Spatially and Temporally Complex Land-Cover Change: The Case of Western Honduras." *The Professional Geographer,* 56 (4), 544-559.

Mount Cameroon Biodiversity Conservation Centre (MCBCC). 2002. *Conserving Biodiversity and Improving Livelihoods: A Business Plan.* Limbe Botanical and Zoological Gardens.

Munn, R.E., (ed.) 1979. *Environmental Impact Assessment*. Scope Report 5, 2nd. Ed. John Wiley, Chichester, England.

National Centre for Forestry Development (Cameroon). 1979. Ecological Map of the Vegetation Cover of South Cameroon. *Pilot Project on Tropical Forest Cover Monitoring*, United Republic of Cameroon, United Nation Environment Program (UNEP) & Food and Agricultural Organization (FAO).

Nasong'o, S.W., and Gabsa, W.N. 1998. *Environmental Policy and the Politics of Ecologism in Cameroon and Kenya*. http://www.jsd-africa.com

Owusu, J.H. 1998. "Current Convenience, Desperate Deforestation: Ghana & Structural Adjustment Program and the Forestry Sector." *The Professional Geographer* 50 (4):418-436.

Panayotou, T. 1990. *The Economics of Environmental Degradation: Problems, Causes and Responses.* HIID Development Discussion papers 335, Harvard University.

Panayotou, T. 1993. Green Markets: *The Economics of Sustainable Development*. ICEG/HIID, ICS press, San Francisco – California.

Parks, P.J; Barbier, E.B; and Burgress, J.C. 1998. The Economics of Forest Land Use in Temperate and Tropical Areas. *Environmental and Resources Economics*, 11(3-7):473-487.

Pearce, D.W. and Warford, J. 1993. *World without End: Economics, Environment and Sustainable Development*. Oxford University Press, New York.

Pearce, D.W. 2001. The Economic Value of Forest Ecosystems. *Ecosystem Health* 7 (4) 284-296.

Pokam, J. and Sunderlin, W.D. 1999. *L'impact de la Crise Economique sur les Populations, les Migrations, et le Couvert Forestier du sud-Cameroun.* CIFOR Occasional Paper 25. Center for International Forestry Research. Bogor, Indonesia.

Poole, N.D. 2004. Perennialism and Poverty Reduction. *Development Policy Review* 22 (1), 49-74.

Powell, F.M. 1998. *Law and the Environment*. West Educational Publishing Company, USA.

Price, K.P., Pyke, D.A., and Mendes, L. 1992. "Shrub Dieback in a Semiarid Ecosystem: The Integration if Remote Sensing and GIS for Detecting Vegetation Change." *Photogrammetric Engineering and Remote Sensing,* 58(4):455-463.

Repetto, R. 1993. "Government Policies, Economics and the Forest Sector." In Ramakrishna, K. and Woodwell, G. (eds.) *World Forest for the Future*. Yale University Press, New Haven, Connecticut.

Rudin, H.R. 1938. *Germans in the Cameroons 1884-1914: A Case Study in Modern Imperialism*. New Haven, Yale University Press.

Sikod, F.A., Amin, A. and Nyamnjo, F. 1996. "Interlinkages between Trade and the Environment: A Case Study of Cameroon." *UNTAD/UNDP Project Report.*

Smith, G. 2003. *Deliberative Democracy and the Environment*. New York, Routledge.

Southworth, F., Dale, V.H., Frohn, R.C. O'Neill, R.V. and Dearstone, K.C. 1991a. *A Dynamic Land Tenure Analysis Model Emphasizing the Ecological Impacts of Deforestation.* Mimeo.

Southworth, F., Dale, V.H. and O'Neill, R.V. 1991b. "Contrasting Patterns of Land Use in Rondonia, Brazil: Simulating the Effects on Carbon Release." *International Social Sciences Journal,* 130: 681- 698.

Tchoungui, R., Gartlan, S., Simo, JA. Sikod, F., Youmbi, A., Ndjasana, M., and Winpenny, J. 1995. *Structural Adjustment and Sustainable Development in Cameroon*. A WWF study, ODI Working Paper No. 83, London.

Thomas, D., Gardner, A., and DeMarco, J. 2001. "Devaluation of Decision-making: Lessons from Community Forest Management at Kilum-Ijim Forest Project Cameroon," In Jeffrey, R. and Vira, B., eds. *Conflict and Cooperation in Participatory Natural Resource Management.* New York, Palgrave. Pp. 189-203.

UNECA, 1996. *The Convention on Biological Diversity*, October.

Vabi, M.b. and Sikod, F. 2000. *Challenges of Reconciling Informal and Formal Resource Access Tenure: Evidence from WWF-supported Conservation Sites in Cameroon*. Second Pan-African Sumposium on the Sustainable Use of Natural Resources in Africa: Ouagadougou, Burkina Faso.

Verburg, P.H., Overmars, K.P. and Witte, N. 2004. "Accessibility and Land-use Patterns at the Forest Fringe in the Northeastern part of the Philippines." *The Geographical Journal* 170 (3), 238-255.

Walker, Robert. 1999. "The Structure of Uncultivated Wilderness: Land Use Beyond the Extensive Margin." *Journal of Regional Science* 39(2):387-410.

Wilkinson, B. 1998. *Guyana – Environment: Government on the Defensive on Forest Concessions*. Inter Press Service, www.oneworld.org/ips2/apr/guyana.html.

William, F.L., Ana, K.M.A., Götz., S., Philip, M.F., Scott ,B., Eduardo, M.V. and Carlos, D. 2002. "Predictors of Deforestation in the Brazilian Amazon." *Journal of Biogeography* , 29 (5-6):737-748.

World Bank's World Development Indicators database. 2006. http://devdata.worldbank.org

Wu, W., Lambin, E.F. and Courel, M.F. 2001. *Land Use and Cover Change Modeling for North Ningxia, China.* Sino-Belgian Cooperation Project on Northwest China. University of Louvain, B1348, Belgium.

APPENDIX I

CHANGE DETECTION DATA FROM POST CLASSIFICATION ANALYSIS

Table A.1.1. Pixel analysis of land use cover change in the Limbe/Buea and Bertous Regions

	BER84_Z1	BER84_Z2	BER84_Z3	BER84_Z4	BER00_Z1	BER00_Z2	BER00_Z3	BER00_Z4		BUE86_Z5	BUE86_Z6	BUE00_Z5	BUE00_Z6	
AGRIG_1	16203	27345	12417	12921	26431	26329	2507	6256		15297	1356	6127	2442	
AGRIC_2	17453	20312	19573	21034	17900	26096	15818	29105		12338	3219	28023	2274	
FOREST_1	27683	26252	11221	23437	29226	24183	35857	16252		9869	7617	11847	2295	
FOREST_2	56312	29702	29786	8985	47910	30501	21251	13450		10164	11078	981	15486	
WATER	1497	1322	1931	1196	4972	2424	2509	1690		5651	1593	9133	626	
URB/RUR	16267	10819	8292	2879	8976	6219	5278	3699		8655	2559	5870	3983	
						BERTOUA	**REGION**							
		ZONE 1	135415	**121.8735**			ZONE 2	115752	**104**			ZONE 3	83220	**74.898**
	Agric =	33656	44331			Agric =	47657	52425			Agric =	31990	18325	
	Increase in Agric =		10675	**9.6075**		Increase in Agric =		4768	**4.29**		Decrease in Agric =		13665	**12.2985**
	Forest =	83995	77136			Forest =	55954	54684			Forest =	41007	57108	
	Decrease in Forest =		6859	**6.1731**		Decrease in Forest =		1270	**1.14**		Increase in Forest =		16101	**14.4909**
	Water =	1497	4972			Water =	1322	2424			Water =	1931	2509	
	Increase in Water =		3475	**3.1275**		Increase in Water =		1102	**0.99**		Increase in Water =		578	**0.5202**
	Urb/Rur =	16267	8976			Urb/Rur =	10819	6219			Urb/Rur =	8292	5278	
	Increase in Urb/Rur =		7291	**6.5619**		Decrease in Urb/Rur =		4600	**4.14**		Decrease in Urb/Rur =		3014	**2.7126**
										BUEA	**REGION**			
		ZONE 4	70452	**63.4068**			ZONE 5	61974	**55.8**			ZONE 6	27422	**24.6798**
	Agric =	33955	35361			Agric =	27635	34150			Agric =	4575	4716	
	Increase in Agric =		1406	**1.2654**		Increase in Agric =		6515	**5.86**		Increase in Agric =		141	**0.1269**
	Forest =	32422	29702			Forest =	20033	12828			Forest =	18695	17781	
	Decrease in Forest =		2720	**2.448**		Decrease in Forest =		7205	**6.48**		Decrease in Forest =		914	**0.8226**
	Water =	1196	1690			Water =	5651	9133			Water =	1593	626	
	Increase in Water =		494	**0.4446**		Increase in Water =		3482	**3.13**		Decrease in Water =		967	**0.8703**
	Urb/Rur =	2879	3699			Urb/Rur =	8655	5870			Urb/Rur =	2559	3983	
	Increase in Urb/Rur =		820	**0.738**		Decrease in Urb/Rur =		2785	**2.51**		Increase in Urb/Rur =		1424	**1.2816**

Table A.1.1 shows the six zones of the two study areas with their different land-use cover classes. The pixels are entered under their respective zones and dates of acquisations. For example, BER84_Z1 stands for; Bertoua 1984 image scene zone 1 while AGRIC_1 represents the class; Agricultural Field_1…etc.

The spatial resolution for LANDSAT TM and ETM+ sensors used in the change detection mission is 30m x 30m. This resolution was converted Km² Before determining the actual area covered by each class of pixels. The area in Km² was then used in the cover change analysis and discussion

APPENDIX II

MULTIVARIATE REGRESSION ANALYSIS

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: AGRI AGRI

Number of Observations Read	6
Number of Observations Used	6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	83.68253	41.84127	4.53	0.1241
Error	3	27.71787	9.23929		
Corrected Total	5	111.40040			

Root MSE	3.03962	R-Square	0.7512
Dependent Mean	5.57000	Adj R-Sq	0.5853
Coeff Var	54.57127		

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: AGRI AGRI

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-38.50945	24.18634	-1.59	0.2096
RURPOP	RURPOP	1	5.61323	2.41493	2.32	0.1027
AGOUTPUT	AGOUTPUT	1	0.44088	0.26787	1.65	0.1983

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: FOR FOR

Number of Observations Read	6
Number of Observations Used	6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	130.71744	65.35872	136.90	0.0011
Error	3	1.43229	0.47743		
Corrected Total	5	132.14973			

Root MSE	0.69096	R-Square	0.9892
Dependent Mean	5.25667	Adj R-Sq	0.9819
Coeff Var	13.14452		

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: FOR FOR

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-195.85451	35.25623	-5.56	0.0115
RURPOP	RURPOP	1	5.45751	0.54896	9.94	0.0022
INCPER	INCPER	1	0.33662	0.06089	5.53	0.0117

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: WATER WATER

Number of Observations Read 6
Number of Observations Used 6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	2.18860	2.18860	1.50	0.2877
Error	4	5.83288	1.45822		
Corrected Total	5	8.02148			

Root MSE	1.20757	R-Square	0.2728
Dependent Mean	1.51167	Adj R-Sq	0.0911
Coeff Var	79.88321		

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: WATER WATER

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-20.25732	17.77597	-1.14	0.3181
INCPER	INCPER	1	0.03901	0.03184	1.23	0.2877

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: URBRUR URBRUR

Number of Observations Read 6
Number of Observations Used 6

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3.91842	3.91842	0.85	0.4094
Error	4	18.49911	4.62478		
Corrected Total	5	22.41753			

Root MSE	2.15053	R-Square	0.1748
Dependent Mean	2.98667	Adj R-Sq	-0.0315
Coeff Var	72.00434		

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: URBRUR URBRUR

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	1.51138	1.82746	0.83	0.4547
POP	POP	1	0.44933	0.48815	0.92	

APPENDIX III

A Closed Survey on Important Frames of Forest Problems in Cameroon

Please say/tick Yes or No to the following list of important frames of forest problems in Cameroon.

- Do you think there is agricultural expansion in southern Cameroon? YES___ NO___
- Do you agree that there is uncontrolled logging of Cameroon's forest? YES___ NO___
- Is road construction contributing to loss of Cameroon's forest? YES___ NO___
- Have oil extraction and the pipeline project diminished Cameroon's forest? YES___ NO___
- Is Cameroon suffering from desertification? YES___ NO___
- Are there serious soil degradation problems in Cameroon? YES___ NO___
- Is low flow of rivers and streams a problem in Cameroon? YES___ NO___
- Do you silting of streams and rivers in Cameroon due to forest loss? YES___NO___
- Is slash and burn farming a common practice in Cameroon? YES___NO___
- Is the expansion of agribusiness contributing to forest loss in Cameroon? YES___NO___
- Is Cameroon losing its biological diversity because of uncontrolled logging? YES___NO___
- Are people in the forest region losing their cultural identity due to forest loss? YES___NO___
- Are Cameroon's forest goods and services well priced? YES___NO___
- Are wrong incentives in the forestry and in other sectors to blame for forest loss? YES___NO
- Are there too many logging Concessions in Cameroon? YES___NO___
- Has concentration of landownership led to forest loss? YES___NO___
- Has weak or non-existing ownership and land tenure led to forest loss? YES___NO___
- Have illegal activities and corruption led to forest loss? YES___NO___
- Is population growth and pressure causing encroachment on forest lands? YES___NO___
- Is excessive foreign consumption causing agricultural land expansion? YES___NO___

APPENDIX IV

INSTITUTIONAL REVIEW BOARD APPROVAL

Oklahoma State University Institutional Review Board

Date:	Tuesday, April 11, 2006
IRB Application No	GU0612
Proposal Title:	Forest Policy: Forest Loss and Land Use Cover Change in Cameroon
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 4/10/2007

Principal Investigator(s

Richard Mbatu
22 N. University Place #12
Stillwater, OK 74075

David Lewis
022 Ag Hall
Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

X The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 415 Whitehurst (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,

Sue C. Jacobs, Chair
Institutional Review Board

Phone Script

Although no concern form is needed for this study, this script will be read out to participants before the survey is taken.

Call:

Hello, my name is Richard Mbatu

I am taking a survey on forest problems in Cameroon.

This survey is in partial fulfillment of my Ph.D. requirement at Oklahoma State University.

This survey is titled: Important Frames of Forest Problems in Cameroon.

The purpose of this survey is to collect information that will be used for grouping participant's thoughts according to their perception on the totality of the environment, agricultural expansion, access to the forest, and government policies and practices.

The different groups of thoughts will then be used to develop CONCEPT and AGGREGATE maps for policy formulation.

This survey will take approximately 5-10 minutes.

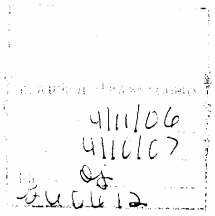
This is an anonymous survey, as this call is NOT recorded and NO name will be attached to responses.

Your participation in this survey is voluntary.

Do you wish to take part in this survey?

No; the call is terminated.

YES; the survey begins.



VITA

Richard Sungkekang Mbatu

Candidate for the Degree of

Doctor of Philosophy

Thesis: FOREST POLICY: FOREST LOSS AND LAND USE COVER CHANGE IN CAMEROON

Major Field: Environmental Science

Biographical**:**

Education: Bachelor of Science in Geography and Environmental Management, University of Dschang-Cameroon, August 1998. Bachelor of Science (Honors) in Geography and Environmental Management, University of Witwatersrand - South Africa, December 1999. Master of Science in Geography, Oklahoma State University, December 2003. Completed the Requirements for the Doctor of Philosophy degree at Oklahoma State University, December 2006.

Experience: Tutor, Phoenix Collage of Johannesburg - South Africa 1999-2001. Field technician, Environmental Impact Assessment on Power Line Transmission, Johannesburg - South Africa, 2000. Teaching Assistant at Oklahoma State University, 2002-2006. Coordinator of RAISE program – Rural Alliance for Improving Science Education at Oklahoma State University, 2006-2007.

Name Richard Sungkekang Mbatu Date of Degree: December, 2006.

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: FOREST POLICY: FOREST LOSS AND LAND USE COVER CHANGE IN CAMEROON

Pages in Study: 150 Candidate for the Degree of Doctor of Philosophy

Major Field: Environmental Science

Scope and Method of Study: The purpose of this study was to analyze Cameroon's colonial and domestic forest policies and show how these policies have led to forest loss in Cameroon, determine their consequences on the environment, society and the economy, and develop policies to conserve the forest. The study is divided in three main sections. In the first section, a remote sensing model is combined with an economic model to measure the rate and degree of forest loss in Cameroon over a sixteen years period (1984-2000), and to identify the forces behind this loss. In the second section, changes in land use and forest cover are correlated with colonial and domestic policies. In the final section, a public policy analysis method (Multi-Goal Analysis) is used to develop/propose policies to manage and conserve the forest.

Findings and Conclusions: The remote sensing model indicated that 20.67% of the total territory of the study areas had changed in 16 year (1984 to 2000). Noticeable are changes (increase and decrease respectively) in Agricultural Field and Forest Land (33.42 and 31.54 Km^2 or 7.51% and 7.09% in area respectively). Within this time period, Agricultural Field changed at a rate of 2.09 Km^2/yr or 1.29% while Forest Land changed at a rate of 1.97 Km^2/yr or 0.87%. The economic models showed decrease in forest lands as the second most significant change on the landscape with increase in agricultural fields showing the most significant change. Modeling this change, panel analysis showed that decrease in forest lands is associated with increase in rural population and low income per capita (R^2 = 0.9892). Mathematically, by the year 2020 a total of 34.74 Km^2 of forest land in the two study areas will be lost to agricultural and urban/rural expansion or simply left as "open fields" prone to different forms of degradation. If such a loss occurs in the entire forest region of Cameroon, it is possible for the nation to lose more than half of its 22 million hectares of rain forest by 2050. Of the seven policy options proposed to reverse this trend, the option of reducing externalities in the forest sector through price mechanism and police power is the most efficient based on policy legitimacy criteria.

ADVISOR'S APPROVAL: DAVID K. LEWIS