Assessment of Ghana's Agriculture Sector, Natural Resource Management and Environmental Threats and Opportunities for USAID/Ghana

I. BACKGROUND

A. Context:

USAID/Ghana is currently in the process of developing a new Country Strategic Plan (CSP) for the period FY2004-FY2010. The new strategy being designed will remain engaged generally in the same four strategic objectives (SO) areas that USAID/Ghana currently works in, namely: (a) Trade, Agriculture and Private Sector; (b) Primary Education; (c) Health, Population and Nutrition; and (d) Democracy and Good Governance. It is expected to build on successes and lessons learned from our current program. However, substantial re-prioritization or realignment of activities within the SOs will be done to address the Government's strategy of poverty reduction through private sector wealth creation.

The process of preparing the strategy will involve several analytical assessments to inform the Mission on investment options available and enable it to adopt approaches that ensure sustainable development. This assessment will contribute to this effort and is intended to highlight those sectors and interventions, which will enable USAID/Ghana to build on the progress achieved during the current CSP period (1997 - 2003) towards increased economic growth and poverty reduction through agriculture and natural resource management.

Ghana's economic performance over the past several years has been mixed. During last half of the 1990's GDP growth averaged about 4.3%, after poor performance in the earlier part of the decade. A similar trend was observed for per capita income -declined from a high of about $450 in 1991 to a low of $325 in 1994 and recovering to around $400 in 1996- 1999. In spite of these facts, poverty declined from 52% to 40% between 1992 - 1999. The generally poor performance has been is attributed to poor fiscal management and deteriorating terms of trade in recent years. The year 2000 witnessed a dramatic adverse change for Ghana's economy. While prices for Ghana's prime commodities--gold and cocoa--fell, the price of its primary import, petroleum tripled. The government attempted to cushion the shock of a severe deterioration in real wages by subsidizing oil imports and utility rates. Attempts to prop up the currency and blunt inflation resulted in spending down increasingly scare foreign exchange reserves. In its desire to succeed in the elections at the end of 2000, the Rawlings government had little incentive to heed donor advice on measures for stabilizing the economy. This left the newly elected government facing an economic and financial crisis upon assuming office in January 2001.

The new government was faced with the dual challenges of stabilizing the economy while addressing the weaknesses in the fiscal system. Considerable progress was made in 2001 in meeting the first challenge; stabilizing the economy. This is manifested in a sharp drop in inflation and the stabilization of the exchange rate. From a peak of 42% in March 2001, inflation declined to 21% by December 2001, a lower rate than the targeted 25% proposed in the budget. Likewise, the rate of Cedi depreciation was slowed considerably, with the Cedi stabilizing at

around 7500 to the US$ till April 2002. Gross international reserves increased from three week of import coverage to around five weeks, aided in part by a stabilization of the terms of trade.

Central to the achievements in 2001 was improved fiscal performance. Cash expenditures of the Government were kept within budget and the revenue agencies achieved 96.5% of the (modest) targets that they were assigned. The Government's decision to seek relief on its external debt obligations under the enhanced HIPC Initiative also played an important role in holding down expenditures. With the decision to apply for HIPC status, Ghana was able to reduce external debt payments in 2001. In addition to reduced external debt payments, the government reduced expenditures on goods and services and capital projects in 2001. Indeed there is the recognition that measures taken so far were successful in the urgent task of stabilizing the economy, they are not a long-term solution to the problems facing the economy. The Ghana economy needs to return to a path of accelerated growth, achieving a sustainable 6% or more per year, if poverty is to be reduced.

Thus, USAID/Ghana has made a strategic choice to focus on poverty reduction, in part through agriculture-related private sector growth. This is based on the evidence that in order to have a sustainable impact on social indicators of poverty, income growth must be a part of the strategy. USAID/Ghana's choice is bolstered by the commitment of the Government to a program of action and policy reforms that seeks to accelerate growth, led by agriculture, in a manner that is consistent with poverty reduction (Ghana Poverty Reduction Strategy). In addition, USAID's is increasing its attention to agriculture in an effort to cut hunger and poverty.

Ghana's agriculture sector dominates the economy. Agriculture contributes about 37% of GDP and employs nearly 70 percent of the economically active population. However, the growth of the sector has generally been slow--well below the Vision 2020 target of 6%--contributing to an increasing reliance on food imports and continued food insecurity. This slow growth is largely attributed to low productivity. Farms are small--85% of the farms are less than 2 hectares. Fertilizer usage is one of the lowest in sub-Saharan Africa, with only 20% of farmers using fertilizer. Slashing and burning exacerbate low soil productivity, removing residues, up-down slope cultivation, and overgrazing. Only one out of 10 Ghanaian farmers uses high yielding crop varieties. Yet, its comparative advantages are and will continue to be in this sector and it has important growth prospects.

USAID has historically been an important donor in the nation's agricultural sector. Over the years, USAID/Ghana's program has increasingly emphasized private sector-led, market-oriented growth. The Mission's Agricultural programs have evolved from a focus on increased food production and food security measures to one of market-driven growth with emphasis on non-traditional exports while at the same time working with some of the more vulnerable communities under our PL-480 program. The evolving changes in program emphasis have been in response to both changes in needs and changes in possibilities.

Experience across Africa, including Ghana, has demonstrated that food security requires more than increases in food production alone. Open markets, an enabling policy environment, and overall economic growth are the most important elements of a sustainable food security strategy. Trade, investment, access to information and technology change present Ghana with vast new

opportunities. Regional integration and further reforms will provide political leaders, entrepreneurs and rural families with new economic opportunities and choices.

B. Current CSP

Increased Private Sector Growth is one of the major strategic objectives under USAID/Ghana's current CSP. This objective supports national goals of alleviating poverty and achieving increased household income through accelerated broad-based growth. However, Ghana is still struggling to get past the uneven progress it made in the 1990s. Two of the thematic areas supporting this SO are:

1) **Policy Reform and Financial Intermediation:** Sigma One is one of our main contractors working in this area to analyze and work with the Government of Ghana to undertake macro-economic and sectoral policy reforms. These have included reforms that focus on fiscal and monetary stabilization and eliminating or revising regulations that adversely impact Ghana's international competitiveness, especially in the agriculture sector, which has the best expert earning potential. For example, a Financial Sector Consultative Committee was formed with USAID assistance to review the sector's constraints and identify issues that has been influential in highlighting changes needed to the new government.

2) **Increased Management Capacity of Production and Marketing Enterprises:** Amex, Int. and Technoserve have provided critical technical and training assistance to support small and medium size firms engaged in exports, such as agriculture products and handicrafts. In addition, USAID/Ghana is working in tourism sector, the third largest foreign exchange earner, by focusing on such activities as improving the quality of the tourism experience and helping the public and private sectors resolve regulatory issues.

In the Mission's economic growth activities integrates P.L. 480 (Food for Peace) Title II activities to develop sustainable rural enterprises and small and micro-credit programs that provide increased food security in the more impoverished rural areas, particularly in the northern part of Ghana. We are working through four U.S. PVOs, Technoserve, Opportunities Industrialization Centers, Adventist Development and Relief Agency and Catholic Relief Services. A newer activity that has been added focuses on improving energy supply through increased regional cooperation, better energy policies, and improved management of energy demand/distribution.

C. Environmental Requirements

The core environmental requirements of USAID operating unit strategic plans are spelled out in ADS 201.5.10g, and are derived from provisions of the Foreign Assistance Act (FAA).

- Environmental Sustainability. USAID/Ghana recognizes that protection of the environment and wise management of the natural resources base are absolute

requirements of any successful development program. Per Section 117 of the FAA *"Environment and Natural Resources,"* it is mandatory for operating units to implement their programs with an aim to maintain (and restore) natural resources upon which economic growth depends, and to consider the impact of their activities on the environment. The legal requirements of the FAA are reflected in USAID's *ADS Chapter 204 "Environmental Procedures,"* which provides essential procedures and policy on the application of *22 CFR Part 216.* This regulation codifies the Agency's procedures "to ensure that environmental factors and values are integrated into the A.I.D. decision making process." Thus, USAID conducts assessments that help to ensure that its environmental priorities are incorporated into program planning, implementation and monitoring. The best opportunity to ensure that such issues are considered is at the planning stage.

- Tropical Forestry and Biological Diversity. Sections 118 *"Tropical Forests"* and 119 *"Endangered Species"* of the FAA codify the more specific U.S. interests in forests and biological diversity. These two provisions require that all country plans include: 1) an analysis of the actions necessary in that country to conserve biological diversity and tropical forests; and 2) the extent to which current or proposed USAID actions meet those needs. Section 118/119 analyses are specific legal requirements of all USAID operating unit strategic plans. Further, 22 CFR 216.5 requires USAID operating units to conduct their assistance programs in ways that are sensitive to the protection of endangered or threatened species and their critical habitats.

Translating the intent of the above legal requirements into a practical strategic planning approach, the ADS provides a priority-setting framework for missions to use in determining environmental threats and opportunities (See 201.5.8; and Supplementary References, Joint Planning and Guidelines for Strategic Plans, and Technical Annex B Environment, dated February 1995). The priority-setting process is intended to guide the setting of environmental strategic objectives, as well as to inform strategic objectives in other sectors.

II. PURPOSE AND OBJECTIVES OF THE ASSESSMENTS:

The need to combine assessments in these three areas stem from the fact that they have important interrelated issues that impact on each other in ways that influence sustainable development. The team of experts will conduct a comprehensive assessment of the key opportunities and constraints influencing the agricultural sector's contribution to economic growth in Ghana.

The environmental assessment will ensure basic compliance with the environmental provisions of the FAA. In addition the tasks embodied in this SOW will advance USAID/Ghana's Country Strategic Plan (CSP) by providing and ensuring:

- an overall assessment of the status of and trends in key components - including management - of Ghana's natural resources with emphasis on biodiversity and tropical forest resources;

- an overall understanding of developmental threats (including existing and proposed policy initiatives as well as the legal and regulatory framework) to environment, biodiversity and tropical forests: and
- an understanding of actions that must be taken to maintain biodiversity, tropical forests and ensure sustainable environmental and natural resource management given the documentation and analysis of threats.

The objective of the overall assessment is to provide USAID/Ghana with the analytical basis and recommendations on strategic options for the design and structuring of interventions for the development and implementation of the new CSP. It is the responsibility of the contract team to develop the methods and procedures that will be used in the assessment and to prepare the final report. For the most part, the assessment will be based on the review of existing literature in Ghana and interviews with key public and private sector individuals. No structured surveys are anticipated.

III. APPLICABLE DOCUMENTS:

- Ghana Poverty Reduction Strategy: 2002-2004, Government of Ghana, February 20, 2002.
- An Action Plan for Developing Agricultural Input Markets in Ghana. International Fertilizer Development Center, October 2001.
- Mission Country Strategy Plan and annual reports or R4.
- Ghana International Competitiveness--Opportunities and Challenges Facing Non-Traditional Exports, World Bank, June 21, 2001.
- National Workshop Proceedings on Production Support and Financial Services Program. SAFGRAD of the Organization of African Unity, and Council for Scientific and Industrial Research, Ghana. April 2001.
- Ghana Quarterly Economic Bulletin, Ghana Statistical Services.
- Ghana Living Standards Survey, Ghana Statistical Services, October 2000.
- Post-harvest Losses Due to Pests in Dried Cassava Chips and Comparative Methods for its Assessment--a case study on small -scale farm households in Ghana, GTZ. 1998.
- Ghana's Non-traditional Export Sector: Expectations, Achievements and Policy Issues. Addo E.; Marshall R. *Geoforum,* August 2000, vol. 31, no. 3.
- Accelerated Agricultural Growth and Development Strategy, Ministry of Food and Agriculture, 1998.
- The Agricultural Services Sub-sector Investment Programme, Ministry of Food and Agriculture. Undated (1998 or later).

- Ghana: Biodiversity and Tropical Forest Assessment, Ayensu, E.S., Adu, A., and Barnes USAID/Ghana, January 1996.

- Ghana: Biodiversity Review, USAID/Ghana, May 1991.

IV. PERFORMANCE REQUIREMENTS AND STANDARDS

a. Requirement: The performance requirement for this task order is the completion of a comprehensive assessment and report of the agricultural sector's potential contribution to economic growth in Ghana; and also of the environmental and natural resource threats and opportunities.

The team is required to identify distinct areas of commonality that complement and support each other and recommend approaches that enhance the complementarities. The team as a whole must work together when addressing the following areas, noted below, that are distinctly of common interest:

- Analyses and description of challenges associated with Ghana's agriculture and natural resource base.
- Issues related to cultural practices and their relations to natural resources, including soil and water management practices.
- Opportunities for livelihood, including CBO use of natural resources.
- Description of soil fertility, erosion an land use and related biodiversity conservation and ecosystem stability and recovery.
- Environment and natural resource review – compliance to FAA – in relation to agricultural production (use of forest, land and water resources as well as chemicals, etc.)

b. Standards:

Agricultural Sector Assessment

At a minimum, the assessment and final report must address the following areas:

1) The overall development challenge facing the country, in particular challenges associated with the agriculture sector its natural resources base.

2) Government of Ghana's, commitment to policies, investments and services that relate to the development challenges.

3) The food security situation in Ghana and the mechanisms in place to respond to food sector issues and/or emergencies.

4) Ghana's efforts to diversify agriculture exports to non-traditional products and the impact of this effort on rural livelihoods.

5) The primary commodity sub-sectors that have the greatest potential for generating economic growth in Ghana and for which Ghana can be competitive. Included here should be an assessment of the backward and forward linkages of the sub-sectors and their potential for employment, poverty reduction, and income generation. The analysis should address the dependence of these primary commodities on price and availability as well as associated requirements for lowering costs and increasing productivity (i.e., the tangible aspects).

6) A differentiated product approach - one that focuses on a consumer ready product and not a primary commodity – with the end users in mind and focusing on intangible attributes such as safety, image, standards, services, welfare, etc.

7) Issues related to cultural practices and their relations to natural resources, including soil and water management practices.

8) The key factors that affect the competitiveness and ability of Ghana to produce and market products and assess the potential for increased trade (domestically, regionally and internationally) and its impact on poverty reduction.

9) The related production support and financial services – such as extension, technology transfer, input and output market facilities and services including storage and distribution services.

10) The capacity of the Ghanaian private sector (business associations, cooperatives, professional organizations, commodity groups, and individual entrepreneurs) to assume responsibility for and oversee the direction of the profitable sectors, and its responsiveness to economic policy reforms in terms of investment.

11) The activities of other donors and how they interface with those of USAID.

12) The evidence related to income distribution and poverty in Ghana, and the most vulnerable groups and areas.

13) Options for USAID assistance, with consideration of USAID's comparative strengths/weaknesses, prioritize these options. Overlay these options with the poverty analysis in No. 12 above and provide specific recommendations for increasing lower income groups' access to growth opportunities.

14) Based on Nos. 1-13 above, recommend potential areas for cross-strategic objective program complementarities and synergies in the health, education, and governance sectors. This should include an assessment of the impact of HIV/AIDS on Ghana's potential for income growth and recommend specific interventions to respond to the negative economic effects on growth and household incomes.

Environment and Natural Resource Management Assessment

The Environmental and Natural Resource Threats and Opportunities Assessment will include the following activities:

1) **Review and compile information on environmental threats and opportunities relevant to Ghana's situation.** Review existing documentation to identify issues or themes that are potentially relevant for the Mission's efforts. Document the state of key biodiversity components and natural resources by: a) quantifying trends in their management, biophysical condition, productivity, abundance and distribution and b) identifying and analyzing the threats (e.g., degradation, depletion, pollution) to which they are subjected. Discuss the effectiveness of relevant Government of Ghana management authorities that supervise and govern the utilization, development and/or monitoring of environmental resources in terms of how they achieve environmental sustainability and mitigate negative development impacts, prevent degradation and/or achieve restoration of tropical forests and biodiversity

   The report will address:

   - Major ecosystem types such as afro-alpine, forests, savanna, grassland, wetlands, rivers and lakes highlighting important, unique aspects of the country's biodiversity, including important endemic species;
   - Natural areas such as Protected Areas (national parks, wildlife reserves, forest reserves) of particular importance to biodiversity conservation, critical for species reproduction, feeding or migration;
   - Description of soil fertility, erosion and agricultural land use as related to biodiversity conservation and ecosystem stability and recovery;
   - Plant and animal species that are endangered or threatened with extinction. Endangered species of particular social, economic or environmental importance should be highlighted and described, as should their habitats;
   - Recent, current and potential future primary threats to biodiversity and tropical forests whether they are ecological (e.g., fire), related to human use (i.e. agriculture, contamination, energy exploitation/development for biomass and hydropower;), institutional (i.e. absent, inadequate or failed policy regulation or enforcement) or transboundary issues as appropriate; and
   - Conservation efforts including their scope and effectiveness. This should include recent, current and planned activities by donor organizations that support biodiversity conservation and identification of NGOs, universities and other local organizations involved in conservation.

2) **Conduct an environmental and natural resource review of proposed strategy components.** Review the proposed USAID/Ghana SOs from environmental compliance perspective. Catalog critical factors/linkages and areas of opportunity in both environmental and programmatic areas with the intent to identify environmental threats and opportunities relevant to the Mission's strategy and services.

3) **Identify proactive means for incorporating environmental programming opportunities.** Analyze the issues arising from the above review processes to identify actions that must be taken in the country as a whole to protect/improve tropical forests and biodiversity. This is intended to provide specific recommendations to Mission planners for enhancing the strategic plan by incorporating sound environmental programming to the extent that they address USAID environmental goals while capitalizing on development opportunities.

V. Specific Tasks and Responsibilities

A total of eight (8) consultants with expertise in the three fields will for a team to carry out the whole Assessment. Three (3) expatriates and two (2) Ghanaian specialists in Agriculture and related fields will conduct the agriculture sector assessment while the remaining three comprising of two expatriates and one Ghanaian will carry the environmental and NRM assessment.

An Agriculturist with a good background in NRM will be the team leader. He/she will coordinate the final report that sets distinct sections/chapters for each discipline. The agriculture sector team must have at least two prominent development thinkers, preferably one an economist and one biological scientist. The team will work under the direction of the Program Officer (who will be coordinating the overall strategic planning process) or his designate. For additional technical guidance, the team will work in close collaboration with the SO-1 team and in part with other SO teams. The team leader for SO-1 will provide general oversight while in country and he or his designate will organize entry and exit meetings of the consultants with the Mission Director or her representative.

VI. Level of Effort

The services of a team of eight consultants will be required for up to 45 working days, including travel. Each U.S based consultant will have up to 3 days for preparation beforehand, 2 days for travel, 30 days in country and 10 days at home to complete the draft and final documents. The local consultants will complement the work of the off-shore consultant while in country. A six-day workweek will be authorized overseas if necessary.

VII. ACCOUNTING AND APPROPRIATION DATA *(to be filled in at time of award)*

Budget Fiscal Year: Operating Unit:

Strategic Objective: Team/Division:

Benefiting Geo Area: Object Class: Ceiling Price:

Total Amount Obligated:

VIII. REPORTS AND OTHER DELIVERABLES

The contractor shall prepare and submit to USAID:

- One preliminary report.
- One to two-page summary or overview on the status of biodiversity and conservation efforts in Ghana and implications for USAID or other donor programming and environmental monitoring which shall define the actions necessary for conservation. The summary will be based on the larger assessment document. This overview may be included in the Natural Resouce Management section of the USAID/Ghana Strategy.
- The final report that addresses all the standards contained in section IV and sets distinct chapters to agriculture sector on one hand and environmental and NRM on the other hand. The contractor shall submit 10 copies of the final report in English as well as in Microsoft Word on 3.5-inch disk.

In addition there shall be an oral debriefing upon delivery of preliminary report.

IX. DELIVERY SCHEDULE *(note: will need to put dates in)*

- In-country consultancies: 09/16/2002 - 10/16/2002.
- USAID/Ghana debriefing: Prior to departing Ghana
- Draft Report finalized/submitted to USAID/Ghana for comments: 11/06/2002
- USAID/Ghana comments provided: 11/20/2002
- Final Assessment Report: 12/04/2002

Illustrative Budget

Item	Cost/Unit	Units	Total
Daily rates for 5 Expatriate Specialists	$400/day	45 days x 5	90,000
Daily rates for 3 Ghanaian Experts	$250/day	35 days x 3	25,250
Per Diem in Ghana	$165/day	30 days x 5	24,750
Travel to Ghana	$3500 each	5	17,500
Internal Travel	$700 each	8	5,600
Per Diem for Ghanaians For local travel	$165/day	30 days x 3	14,850
Copying/Printing/Secretarial Services			6,000
Overhead	@40%		73,580
Total			**$257,530**

ANNEX E

NATURAL RESOURCE AND ENVIRONMENT ANNEXES

- E.1: Environmental Threats and Opportunities
- E.2: Compliance Review of Potential Environmental Impacts
- E.3: Regulated Pesticides and Trends in Pesticide Imports
- E.4: Land Degradation
- E.5: An Introduction to Conservation Cocoa

ANNEX E.1
ENVIRONMENTAL THREATS AND OPPORTUNITIES[1]

A. Major Ecosystem Types Such as Afro-Alpine, Forests, Savanna, Grasslands, Wetlands, Rivers and Lakes Highlighting Important, Unique Aspects of the Country's Biodiversity, Including Endemic Species

The two major biomes represented in Ghana are the tropical high forests (comprised of various associations) and the savannas. The southern half of the country supports the closed forest whereas the northern half supports savanna and woodland vegetation. The northern savanna is mainly of the Guinea type but an area of Sudan savanna occupies the north-easternmost corner of the country (Appendix X). These major vegetation types are by no means uniform or homogeneous; many variants occur in each type. Thus, there are, for instance, swamp forests where the ground is waterlogged in the forest zone and gallery forests along the edges of rivers in the savanna zone.

High Forest Zone

The high forest zone is made up of different types of forest, ranging from the wet evergreen (WE) rain forest, which experiences the highest amount of rainfall throughout the year, to the dry semi-deciduous (DSD) type, which experiences lower amounts of rainfall distributed only at certain times of the year and a well-defined dry season.

The wet evergreen (WE) forest type is found in the south-western corner of the country. Annual rainfall here ranges between 1700 to 2030mm. Typical species include *Cynometra ananta, Tarietia utilis,* and *Tieghemelia heckelii.* In terms of precipitation, the upland evergreen (UE) forest is similar to the WE but the two differ markedly in their floristic composition and structure. The UE forests are found on hills and mountainous areas. They are therefore referred to as mount forests. They receive up to 1700mm of rainfall and are wet throughout the year, often forming forest clouds. The moist evergreen (ME) forests located experience a somewhat lower amount of rainfall, 1500 to 1700 per annum, but do not differ in structure from the WE forest although there are important differences in their floristic composition.

The moist semi-deciduous (MSD) forest receives lower amounts of rainfall, 1200 to 1500mm annually, as compared to the evergreen sub-types and there is also a more clearly defined dry season. This forest type may be conveniently divided into north-western (NW) and south-eastern (SE) sub-types (Fig.4). Together, these two sub-types contain most of the country's valuable timber species. The species composition in the MSD forest type, as a whole, differs from the evergreen sub-types. In the former, many of

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[1] All material excerpted from one of the following public sources:
- "Strategic Environmental Assessment of Agricultural Services Sector Investment Programme (AgSSIP)." Ghana: MOFA and Environmental Protection Agency, March 2000;
- "National Biodiversity Strategy for Ghana", Ghana: Ministry of Environment and Science, 2002.;
- "Ghana Biodiversity Review", USAID, May 1991.

the species in the upper and middle strata exhibit the deciduous habit during the dry season when the influence of the harmattan is pronounced.

A dry semi-deciduous (DSD) forest type bordering the Guinea savanna can be recognized by the nature of the vegetation, the low amount of rainfall, 1100mm to 1200mm annually, and the pronounced dry season with its associated high temperatures. This forest type is also known as the Transition zone. The DSD forest sub-type, which is sometimes described as 'forest containing clearings of savanna' or 'savanna with clumps of forest trees' may also be conveniently divided into an inner zone (IZ) sub-type and a fire zone (FZ) sub-type. One of the most important timber species, Odum (*Milicia excelsa),* reaches its maximum abundance in the DSD (IZ) sub-type although at present this species is endangered. The DSD (FZ) sub-type is characterized by the occurrence of periodic fires, especially during the dry season.
The South-east outliers (SO) represent the driest of forest types, with an annually rainfall of about 750-1275mm.It is also the least extensive, occupying an area of approximately 20km^2 in small scattered patches. South-east outliers are found on the Accra Plains, one notable example being at the Shai Hills Game Production Reserve. A low floral diversity and trees with low canopies characterize this forest type. Within this forest type there are several rare tree species such as the charcoal tree, *Talbotiella gentii*, and few commercial timber species.

The Savannas

About two-thirds of the country is covered by savanna vegetation. Two of the three major types of savanna are represented in Ghana – The Guinea or Tall Grass Savanna (TGS), and the Sudan or Short Grass Savanna (SGS). The Guinea savanna, which receives an annual rainfall of about 1000mm to 1100 mm, occupies an area of about 144,948 km^2, consists of mostly broad-leaved trees some of which are also found in the DSD (FZ) forest sub-type. The Guinea savanna is by no means uniform or homogeneous. Many local variations exist and this has resulted in a variety of nomenclatures. This distinction is basically based on floristic composition.

The Sudan or Short Grass Savanna (SGS) lies to the north of the Guinea savanna and covers a greater part of Burkina Faso and Mali. In Ghana, this zone is limited to the extreme northern part covering an area of about 10,540 km^2. The natural vegetation is characterized by short grasses interspersed with low-density woodland of drought and fire-resistant species. This vegetation type is also not homogeneous.

Table 1: Area of Land covered by the vegetation types of Ghana

Formation Group	Abbreviation	Area (sq.km)	Percentage Cover
Wet Evergreen	WE	6,570	2.75
Moist Evergreen	ME	17,770	7.45
Upland Evergreen	UE	292	0.12
Moist Semi-deciduous	MS	32,890	13.79
Dry Semi-deciduous	DS	21,440	8.99
Southern Marginal	SM	2,360	0.99
Southeast Outlier	SO	20	0.0083
Total Forest		**81,342**	**34.1**
Tall-grass Savanna	TGS	144,948	60.77
Short-grass Savanna	SGS	10,540	4.42
Total savanna		**155,488**	**65.19**
Mangrove forest*	MA	1,670	0.7
Total Ghana		**238,500**	**99.99**

*Includes open water areas; actual area of mangrove vegetation is unknown but is now very limited

Minor Vegetation Formations

In addition to the two major biomes, other minor vegetation types are found in the southern part of the country. These are:

- The *coastal savanna*, usually referred to as the Accra-Winneba Plains in the south-eastern part of the country;
- The *strand or coastline* vegetation along the seashore; and
- The *mangrove* vegetation of the lagoons and estuaries distributed all along the coasts of Ghana, from Cape Three Points in the south-western part of the country to Denu in the south-eastern corner of the country.

The percentage cover of land by various vegetation types are shown in Table 1 above.

Lake and River Ecosystems

Lake ecosystems are scarce in Ghana. The only natural lake system is the Lake Bosomtwi which covers an area approximately 50 square kilometers and has eleven (11) fish species belonging to nine (9) genera and five (5) families. The Volta Lake created in 1964 and inundating some 4,840 square kilometers of pristine natural forest and the two dams on the Volta river at Akosombo and Kpong have indisputably altered the biodiversity and ecology of the river and adjacent areas. The original Volta River was found to consist of at least 100 fish species (Petr, 1967). Recent studies in Yeji sector of the lake encountered 66 species representing 39 genera belonging to 19 families (Ofori-Danso, 1999). Fish species including *Brycinus nurse, B. macrolepidotus, Eleotris senegalensis,* the bivalve, the Volta clam (*Egeria radiate),* the shrimp, *Macrobrachium spp.,* the West African manatee, *Trichechus senegalensis,* etc. are under severe threat of extinction (Ofori-Danson & Agbogah, 1995).

Other freshwater ecosystems include the major rivers such as the White Volta, Black Volta, Lower Volta and Oti. Others are Pra, Tano, Ankobra, Bia and Todzie-Aka. Also included are other impoundments serving as drinking water sources and/or for irrigation.

It is estimated conservatively that about 124 fish species from 62 genera and 26 families inhabit the major rivers.

The coastline of Ghana is lined with about 90 lagoons, several estuaries and rocky shore habitats that exhibit distinct array of biological diversities. Information on faunal, microbial and floral diversity is sparse, except for the five (5) Ramsar sites namely the lagoons of Keta, Songor, Sakumo, Densu delta and Muni-Pomadze where an appreciable amount of knowledge is available. The sixth Ramsar site, the Owabi Wildlife Sanctuary, is the only aquatic protected ecosystem. The Site protects the source of drinking water for Kumasi and its environs.

Access to, use and exploitation of biodiversity is therefore free and uncontrolled. The consequence is over-exploitation, pollution, weed invasions, habitat destruction, and eventual loss of biodiversity and possible extinction.

B. Natural Areas Such as Protected Areas (National Parks, Wildlife Reserves, Forest Reserves) of Particular Importance to Biodiversity Conservation, Critical for Specials Reproduction, Feeding or Migration

Sixteen percent (16 percent) of Ghana's land surface area has been set aside to conserve representative samples of her natural ecosystems in the form of forest reserves, national parks and other wildlife reserves including various traditional forms of conservation.

Permanent Protected Forests (Forest Reserves)

To date there exist over 280 forest reserves spread over all ecological zones of the country. These make up about 11 percent of the total land surface area of Ghana. All identified vegetation types of the country are represented.

Reserves have been created in the forests of the wet evergreen, moist semi-deciduous and dry semi-deciduous, as well as in the northern and southern savannas, coastal and mangrove vegetation types. These reserves are designated mainly as productive and/or protective. Some 75 percent of forest reserves are exploited for timber and non-timber forest products including fuel-wood, herbal medicines, cane and rattan. Designated protective forest reserves provide protections for watersheds and catchment. Entry into forest reserves is entirely through a permitting system administered by the Ministry of Lands and Forestry or any of its departments.

Though there is legislation prohibiting using lands at both sides of rivers and streams, most of the banks of these water bodies have little vegetation and consequently of few or no wild animals. A mandatory distance of 50 m from banks of rivers must be kept not and to be encroached upon. Most of the forest reserves have been badly logged or cleared for crop production and mining, or degraded as a result of sweeping bush fires. The alien plant species, *Chromolaena odorata*, has colonized many degraded forests, displacing indigenous species. *Leucena leucocephala*, a fast growing and an easily dispersible plant species, out-competes with indigenous species in degraded savanna woodlands. Current level of knowledge about the status of the reserves in terms of size and composition is inaccurate, unreliable and obsolete.

Globally Significant Biodiversity Areas (GSBAs). The Forestry Division of the Forestry Commission has re-designated about 29 of the existing forest reserves, covering an area of about 117,322 ha, as Globally Significant Biodiversity Areas (GSBAs). The creation of the GSBAs was attributed to the fact that those reserves were found to harbor a high concentration of biological resources of global conservation importance. Logging and other commercial extractive activities are excluded, while new management plans are being developed to ensure community participation and effective conservation and sustainable management of the biological resources of these areas. The recognition of the need to manage some of the existing forest reserves with emphasis on biodiversity conservation, is an innovative step by the Forest Services Division in terms of appreciating the need to conserve the biological resources of the nation (NRMP, 2001).

Important Bird Areas (IBAs). The Important Bird Areas (IBAs) concept uses birds as indicators of habitat quality. The concept also provides a practical index of the diversity and condition of an ecosystem on a site-by-site basis. Therefore, it is believed that conserving and managing such sites will result in the wise use of some of the most sensitive, fragile and ecologically rich habitats in the world. The concept was developed in Europe to advocate the conservation of sites that are nationally and globally important, and considered to be of critical importance for naturally occurring bird population, as well as biodiversity in general. There are 36 of such areas of global significance made up of protected areas and forest reserves covering an area of about 11,494 km^2 (4.8 percent of the country's land surface area) identified by BirdLife International in Collaboration with the Ghana Wildlife Society. Of the total area covered by IBAs 42 percent is forest, 48 percent is savanna and the 9.2 is wetland. With the exception of the Mount Afadjato and the Amansuri wetland, all the other IBAs, fall within the protected areas, forest reserves or Ramsar sites. The Ghana Wildlife Society has initiated Community-based site conservation actions in and around the two unprotected IBAs to manage them as community nature reserves (Ntiamoa-Baidu *et al*, 2001)

Biological Corridors. In December, 1999, Conservation International, together with other collaborators, organized a biodiversity priority setting workshop, to establish priority areas for biodiversity conservation within the Upper Guinea Forest Ecosystem (CI, 2001). The outcome of this process was the identification of some which were designated as Biological Corridors. The south-western portion of Ghana and the south eastern portion of Cote d'Ivoire constitutes one such corridors. Conservation International is promoting the use of innovative biodiversity conservation tools, such as ecotourism and cocoa agro-forestry (forested farms), to support biodiversity conservation in the defined biodiversity corridor.

Wildlife Reserves

Ghana is home to a large variety of wild animals and plants including endemic, threatened and vulnerable species. Major threats to wildlife in Ghana include the conversion of forestlands into other land use forms such as crop farming, pastures, mining, infrastructural development and bush fires. Habitat destruction and over-exploitation of wildlife for subsistence or gain are two main causes of wildlife loss.

Currently, there are sixteen (16) legally constituted wildlife reserves covering about 5.3% of the total surface land area. These are categorized into:

In addition, there are six (6) wetlands which have been declared as Ramsar sites.

Box 5: Wildlife Reserves

- *Strict Nature Reserve (1);*
- *National Parks (6);*
- *Wildlife Sanctuaries (2);*
- *Resources Reserves (6) and*
- *Biosphere Reserves (1).*

The reserves spread from the coastal savanna through the forest and transition vegetation types to the northern savannas. Currently, there is a problem of under-representation of a number of habitats including inland wetlands, mangrove forests, peat swamps and freshwater swamps. While terrestrial wildlife reserves are relatively better managed, a number of coastal wetlands are severely polluted to the extent that biological life is highly threatened. The Chemu and Korle lagoons represent near lifeless water systems whose biological composition is currently questionable.

Community Resource Management Areas (CREMA). The Wildlife Division of the Forestry Commission, under the Protected Areas Development Programme (PADP), has piloted-tested a new concept of community participation in wildlife management. This concept dubbed the Community Resource Management Areas (CREMA) allow those communities fringing the protected areas, to manage and sustainably utilize the wildlife resources within a defined area. This concept is the first step of empowering the local communities to actively participate in the conservation of wildlife outside the forests and protected areas systems (WD, 1998).

C. Description of Soil Fertility, Erosion and Agricultural Land Use As Related to Biodiversity Conservation and Ecosystem Stability and Recovery

The major soils are classified in Ghana as Oxysols (USDA: Oxisols) developed under evergreen rainforest with annual rainfall about 1750mm; the Ochrosols (USDA: Ultisols) developed in both forest and savanna environments under rainfalls between 900mm and 1650mm; the Groundwater Laterites (USDA: Inceptisols) in savanna areas; the Tropical Black Earths (USDA: Vertisols). Otheres include the Tropical Grey Earths (USDA: Alfisols) and various alluvial soils. (USAID Ghana Biodiversity Review, 1991)

The impact of soil erosion is not dramatic but widespread in all areas of the country with the increasing rate of deforestation. Soil erosion is widespread in Ghana to the extent that areas that are not degraded at present are being threatened. Soil erosion was notice in Ghana nearly seven decades ago and over the past three decades, the phenomenon has become an important form of land degradation in Ghana. Soil erosion occurs in the form of sheet erosion through surface run-off and rill erosion in shifting micro-channels and gully erosion in permanent channels. About 70 percent of the country is subject to moderate to severe sheet or gully erosion and about 40 percent of this land is in the savanna areas.

Declining soil fertility is now a serious constraint to agricultural production. Ghanaian soils are developed on thoroughly weathered parent materials and have been leached for a long time. A larger part of the original nutrients from the parent rock have been lost. As a

result of population increase, pressure on the land has reduced the 8-15 years natural fallow period, that is required to regenerate soil fertility after 1-3 years cropping, to 2-3 years.

The most widespread system of agricultural land use is the traditional bush fallow system of cultivation which involves slashing and burning of forests and grassland and rotation of the cultivated plots over a number of years. The system is sustainable under conditions of low population density and abundant land. Associated with the increase in population the demand for subsistence agricultural cultivation has increased along with the demand for cash crops and urbanization and infrastructural development. This has resulted in intensification of the bush fallow system in terms of frequency of cultivation. (MOFA 2000) Bush fallow cultivation has many connections to biodiversity: The cutting of the forest, though indispensable for agriculture destroys canopy, subcanopy and floor habitants. Burning kills off micro-organisms and seeds.

Tree crops grown in the forests of Ghana include cocoa (Theobroma cacao), oil palm (Elaeis guineensis), coconuts (Cocos nucifera), citrus (Citrus spp.), kola nut (Cola spp.), Coffee (Coffea spp.), rubber (Hevea brasiliensis).

Tree cropping has considerable influence on biodiversity of the forest. In all cases of cultivation forest vegetation must be cut. However, abandoned cocoa farms may return to secondary forest with restored forest habitats. In the more unfavourable environmental conditions however, for example drier forest and sandy soils, cocoa die-back followed by fire and or food crop farming may lead to degradation of forest land to savanna.

Generally, tree crop cultivation is more suitable for the forest environment because the soil-plant relationship in terms of nutrient cycling is maintained and soils are protected from erosion when the crop is established. Problems of erosion and rapid organic matter loss are associated with those tree crops which require complete clearance of the forest eg. oil palm. The same problems may arise when the bearing life of the trees is finished and the trees die. Landuse planning is needed to establish a spatial balance between tree crops, forestry and annual crops.

Swamp cultivation in the closed forests of Ghana takes place in the broad valley sections which are subject to shallow inundation during the rainy season and where soil moisture levels remain high beyond the rainy season on account of the reduced evapotranspiration or heavier soil texture. Rice, sugar cane and arrowroot (Colocasia spp.) and vegetables are cultivated.

Swamp areas provide good sites for cultivation because there is little soil conservation hazard, there is no need for fallowing because the soils may be enriched from adjacent slopes and, in the forest, extended cultivation requires only minimal supplementary irrigation.

The forest swamps however constitute specific environments and habitats whose floral and faunal nature have not received detailed studies. The total extent of developable swamp land in the forests is not known. Extensive and intensive use is likely to affect valley-side slope erosion and the drainage systems due to settlement and associated infrastructural constructions. There will be consequent environment and biodiversity impairment not only on the swamps themselves but in the larger areas of developments. (USAID Ghana Biodiversity Review, 1991)

D. Plant and Animal Species that are Endangered or Threatened with Extinction. Endangered Species of Particular Social, Economic or Environmental Importance Should be Highlighted and Described, as Should Their Habitats

Despite the lack of information on the full coverage of the biological resources of the country in such areas as the marine and other aquatic ecosystems, so far, about 2,974 indigenous plant species, 728 birds, 225 mammals and 221 species of amphibians and reptiles have been recorded. Three species of frogs, 1 lizard, and 23 species of butterflies have been reported to be endemic.

The Flora of Terrestrial Systems

Both indigenous and introduced species have been considered in the assessments of the country's floral diversity. A total of some 3,600 species of the major regional centres of endemism (see White, 1965) represent the three major taxonomic groups. Floral diversity is more pronounced among the angiosperms represented with well over 2,974 indigenous and 253 introduced species (Appendix Y).

Among the various vegetation types of the tropical rain forest, it is the wet evergreen forest type in the south-western part of the country that exhibits the highest level of endemism and species richness. Information on species diversity and endemism in the savanna biomes is very sparse. Biological diversity of species in the savanna woodlands and gallery forests of the savannas may show greater species richness than the dry savannas. Appendix Z gives the list of forest species thought to be endemic to the country.

Within Ghana there are areas of high biological diversity, referred to as "biological hotspots" the so-called "hot spots". The most notable of such areas is the Ankasa and Nini-Suhien Conservation Area in the south-western portion of Ghana (CI, 2002a). The apparent climatic diversity and inherent stratification of this type of vegetation explains why biological diversity is greatest here. See Appendix Z.

In West African, the Upper Guinea Forest Ecosystems is also recognized as one of the 25 global biodiversity hotspots. This is attributable to the fact that even though there is a very high concentration of biological diversity, the entire area has lost about 80% of the original forest cover and the remnants continued to be threatened with destruction.

There is only one known gymnosperm, *Encephalartos barteri*, which is indigenous to Ghana. The few others growing in various ecological zones in the country are introduced species for purposes including aesthetics and economic. The third taxonomic group, pteridophytes, is well represented with 124 known species.

The Fauna of Terrestrial Systems

The fauna of Ghana is composed of the following elements:

- Species which are found throughout the entire Guinea-Congolian tropical forest such as the Forest Elephant (*Loxodonta Africana cyclotis*) and the Chimpanzee (*Pan troglodytes*);

- Species which are limited to the Upper Guinea block of forest, such as the Zebra Duiker, Jentinks Duiker; Red Colobus Monkey (*Procolobus badius waldronii*) and Diana Monkey (*Cercopithicus diana*) . Bird species here include Wattled Cuckoo-Shrike (*Campephaga lobata*) and White-breasted Guinea Fowl (*Agelates meliagrides*);

- Species which are found in the Guinea-Congolian Forest/Savanna Transitional zone; such as the Tawny Eagle (*Aquila rapax*); and

- Species which are found in only the Sudan savanna such as the Korrigum (*Damaliscus lunatus korrigum*).

Animals are generally restricted in their distribution to either the forest or savanna but a few have geographical ranges which overlap the two. Some forest species enter the savanna along gallery forests while some savanna species enter the forest when it is opened up by farm, roads and other human activities (Booth, 1959). Species with specialized habitat requirements, such as the forest elephant and many of the primates, have become threatened as a result of various human activities.

The fauna of the terrestrial ecosystem, though relatively impoverished, comprise a diverse array of species including several of conservation concern. Current records show that there could be as many as 221 species of amphibians and reptiles, 724 species of birds, 225 mammalian species (with 93 recorded to inhabit the savanna ecological zone). Threatened species recorded in the country include four species of marine turtles and three species of crocodiles. Bird species of conservation concern include seven threatened species, including four species endemic to the Upper Guinea forest block and seven near-threatened species. Keystone species such as hornbills, parrots and birds of prey are well represented in the country.

Of the728 birds species confirmed to be occurring, 408 are non-passerines and 320 passerines, of which 494 are known or thought to be resident and 176 are regular seasonal migrants, including 100 from the Palaearctic. Of the total number of species occurring, 180 restricted to the Guinea-Congo Forests Biome and 37 restricted to the Sudan-Guinea Savanna biome have been recorded (Ntiamoa-Baidu *et al*, 2001; Ntiamoa-Baidu *et al*, 2000 a & b). Furthermore, eleven of the 15 endemic bird species within the Upper Guinea Forest occur in Ghana (See Plate 5). Six of the total species are considered threatened and 12 near-threatened (BirdLife International, 2000). The country is also important for water-birds being on the boundary of the East Atlantic Flyway and the Mediterranean Flyway (Smit and Peirsma, 1989; Ntiamoa-Baidu *et al*, 2001).

Endemism among terrestrial fauna has been observed in three species of frogs, *Hyperolius baumanni, H. fusciventris* and *H. sylvaticus* and the lizard, *Agama sylvanus* found in the Bia Forest Reserve and the Atwema Range Forest Reserve.

There is high degree of butterfly endemism in Ghana where about 23 species are classified endemic or near-endemic. As with floral diversity, "hot spots" for faunal diversity may be located in the high forest areas (accounting for 83% of the total number of species recorded), where canopy stratification and micro-climatic differentiation have provided habitats and niches for specific faunal organisms.

Marine Systems

Work on diversity of organisms in marine and aquatic systems has concentrated mainly on those exploited for food (principally mammals, reptiles, fishes and large shelled invertebrates). In cases where certain animal species are found to be disease-causing, as in many water-borne vectors, some limited study on the organisms' biology and possible eradication have been done. Aquatic plants (mostly those considered weeds and noxious to man) have been better studied than marine ones and little or no work appears to have been done on micro-organisms that inhabit such ecosystems.

Indications of extremely high biodiversity of the benthos of the shallow waters of the continental shelf have been reported in recent studies by the Department of Oceanography & Fisheries of the University of Ghana. About 60 percent of the soft bottom benthic macro-fauna encountered are believed to be new and unrecorded. There is virtually no information on meio-fauna (dominated by worms, oligocheates and crustaceans) and micro-fauna (such as ciliates, amoebas and foraminiferans) organisms in benthic waters.

About 392 marine species of organisms comprising 347 fish species belonging to 82 families has been recorded. There is also evidence available that the coastal waters of the country are being invaded by marine algae, a typical example is *Enteromorpha flexuosa,* which is believed to have drifted eastward from areas west of Ghana.

Although the entire Ghanaian coast environment is devoid of any living coral reefs it has been established that the entire continental shelf is traversed by the belt of dead madreporarian coral at a depth of 75cm.

Fresh Water and Other Near Aquatic Systems

Ghana's freshwater fish fauna includes 28 families, 73 genera and 157 species. About 121 species have been recorded from the Volta system within Ghana, which drains more than a third of the entire country. About nine species viz. *Barbus subinensis (Cyprinidae), Irvinea voltae (Schilbeidae), Chrysichthys walkeri (Clarioteidae), Synodontis arnoulti, S. macrophthalmus, S. velifer (Mochokidae), Limbochromis robertsi, Steatocranus irvinea (Cichlidae)* and *Aethiomastacembelus praensis (Mastacembelidae)* are endemic to freshwater system of Ghana (Dankwa et al, 1999).

Economically, 81 species are of food importance. Species of cultural importance include *Heterotis niloticus (Osteoglossidae) Clarias gariepinus, Heterobranchus longifilis (Claridae) Chrysichthys nigrodigitatus (Clarioteidae), Oreochromis niloticus (Chichlidae)* and *Lates nilo\ticus (Centropomidae).* Some species need to be protected because of their restricted distribution or their habitat degradation or destruction.

E. Recent, Current and Potential Future Primary Threats To Biodiversity And Tropical Forests, Whether They Are Ecological (E.G. Fire), Related To Human Use (I.E. Agriculture, Contamination, Energy Exploitation/Development For Biomass And Hydropower,), Institutional (I.E. Absent, Inadequate Or Failed Policy Regulation Or Enforcement) Or Transboundary Issues As Appropriate

Recent, current and potential threats to biodiversity and tropical forests are:

Deforestation. Ghana was once renowned for its extensive forests and wooded savanna, but that has changed drastically. Tropical moist forests originally extended over 145,000 km^2 of Ghana. By the turn of the century it was estimated that 88,000 km^2 of forests remained, occupying 35 percent of total land area. Between 1938 and 1981, the area of closed forest in Ghana was reduced by 64 percent from 47,000 km^2 to 17200 km^2 and open woodland declined by 37 percent from 111,000 km^2 to 69,800km^2. By the mid-1970s, more than 90 percent of the country's high forests had been logged since the late 1940s. The current area of intact forest is now estimated at between 15,800 km^2 and 17,200 km^2 which represents between 10.9 and 11.8 percent of the original cover and 6.9 percent of the country's total area.

Current deforestation rates average 22,000 ha/annum or about 1.3 percent. Very little closed forest remains outside the forest reserve network. It is estimated that less than 1 percent of forest cover is found outside forest reserves much of it in small scattered patches in swamps and sacred groves such as Boabeng-Fiema and Pinkwae forest.

Deforestation is associated with population growth and economic development and is directly linked to clearance for subsistence farming/shifting cultivation (yams), settled agriculture (cocoa), fuelwood and settlement. Fire is commonly used to clear forests. Deforestation of savanna is particularly serious in the Upper East region.

Forest degradation through timber extraction simplifies the structure of forest habitats and removes ecological niches leading to the diminution of species diversity. However not all forest species are threatened by loss of primary forest habitats; species such as bushbuch, Maxwell's duiker and royal antelope can adapt to and thrive in degraded forest habitat and farm fallow.

The most serious forest and savanna degradation is occurring outside reserves and these complex systems are being replaced by simpler less diverse ones as a result of continuous destructive farming and fires.

Desertification. Desertification is largely brought about through deforestation resulting from farming practices and fuel wood collection and is a major concern in the semi-arid parts of Ghana. It is estimated that 35 percent of the land area is subject to desertification. Evidence of increasing aridity includes lowered water tables, siltation of river courses and increased flooding.

The areas of greatest risk are the Upper Eastern Region (where incidentally there are no wildlife protected areas established) and the eastern parts of the Northern Region.

Land degradation is also extensive in the coastal short grass savanna of the Accra plains largely due to the urban demand for fuel wood.

Serious soil erosion is evident in the heavily settled areas of the northern tall grass savanna and has reduced agricultural productivity, carrying capacity, groundwater recharge, regeneration of vegetation. Soil erosion leads to increased sediment loads reducing the useful life of dams and reservoirs. The Volta Lake with its shallow depth (average 19m) is particularly vulnerable to siltation leading to a lowered generating capacity for the Akosombo dam.

Mining and Quarrying. Mining for gold, diamonds, bauxite and iron ore are long standing and important commercial activities in Ghana. Mining represents a serious threat to forest in certain areas, several which are of high conservation interest such as Afao Hills, Atewa, Cape Three Points and Tano Ofin. Iron ore extraction around Awaso (Afao) led to forest destruction. Gold mining is expanding and together with its associated pollutants, particularly arsenic oxide, represents a serious threat to forest reserves in the genetically rich wet evergreen forest zone.

Bushfires. In 1982-83, following severe droughts, uncontrollable bushfires accompanied by strong harmattan winds, devastated large tracts of land in Ghana and caused widespread famine. It is estimated that approximately 50% of Ghana's vegetation cover and about 35% of standing crops and cereals were destroyed. Prior to 1982 the Bomfobiri Wildlife Sanctuary was covered by Dry semi-deciduous high forest; this was largely destroyed by fires and now consists of open savanna communities and isolated forest remnants. Faunal diversity has been significantly reduced.

Bushfires spread from local fires used to flush game, clear fields and induce a dry season growth of grass for stock. Legislation controlling bushfires is poorly enforced and regulations widely disregarded. The incidence of bushfires is on the increase in the high forest zone where many plant and animal species are not fire-resistant and are therefore highly susceptible to destruction when bushfires occur. The result is habitat degradation and serious loss of biodiversity. See Plate 7.

Wildlife Hunting. In Ghana, the meat from wild animals is a major source of protein and hunting is important for rural subsistence. Though all species of mammals are eaten cane rats (grasscutter), antelopes and primates are the favoured bushmeat. In 1991, the volume of annual bushmeat hunted was estimated at about 384,000 metric tonnes. In many areas over hunting has contributed to a steep decline in species numbers and diversity. Hunting both within and outside wildlife and forest reserves threatens several species, particularly primates, with local extinction (C.I-Ghana, 2002).

There are very few areas outside conservation areas where viable populations of larger mammals are now found. Though protected by law several marine species are locally threatened. Sea turtles, notably green, leatherbacks and hawksbill, are killed for food, either at sea or when they come to nest.

Hunting at night using lights, the tradition of group or communal hunting, the use of fire, chemicals and snares have contributed to a precipitous decline in wildlife in Ghana.

Sedimentation. The amount of suspended matter in flowing, due to natural and anthropogenic factors, clearly affect the velocity of the current in our rivers and streams..

This has many repercussions both for the morphology of the rivers and the biodiversity therein. The amount of suspended matter also affects the penetration of light into the water and likely affect productivity. High sedimentation occurs during run-off from rainfall an at points of discharge from drains/sewers and other waste pipes. Fauna most affected are filter feeders or those with life-stages employing respiratory/feeding. Their feeding organs get clogged. This action is detrimental to their survival. Other aquatic animals that rely on sight for feeding, migration or reproduction are also negatively affected.

Siltation. Increases in silt load resulting from changes in land use (eg. Agriculture and urbanisation) or water use, accelerate the natural evolutionary processes of river and stream ecosystems, but in doing so cause a number of problems. The deposition of fine particles of silt on substrates, suffocates bottom organisms and cut down availability of their food. Such choking of the substrate may also render it unsuitable for spawning by those species requiring swift, well-aerated flows and clear pebble or gravel bottoms. The silt provides anchorage for vegetation, blocking flow order of streams and even may divert them into new courses. Siltation of freshwater ecosystems leads to reduction in flow resulting in the progressive restriction of these water bodies to smaller bed within the original channel with a concomitant loss of habitats for fish and other aquatic organisms.

Flooding. Flooding originates from overspill, river channels, local rainfall and tides. It may either introduce nutrients into an ecosystem or wash away both nutrients as well as vulnerable fauna especially' juvenile stages. This may lead to complete loss of and entire generation of a species.

Soil Erosion. Soil erosion occurs when the rate of removal of soil by water and/or wind exceeds the rate of soil formation. It is important to differentiate between natural erosion and erosion which has been accelerated largely as a result of human activity .Land use is perhaps the most significant factor influencing soil erosion in the country. This is because many land-use practices and construction of infrastructure leave the soil devoid of a protective vegetation cover, or with only a partial cover, for significant periods of time. Also there is mechanical disturbance of the soil. Specific aspects of land use often associated with accelerated soil erosion include expansion and intensification of arable cultivation, overgrazing, deforestation, unhealthy forestry practices, increasing demand for fuel-wood, site clearance in preparation for urban and industrial construction. They lead to changes in the soil ecology and hence the diversity of species in soils.

Coastal erosion destroys life in the inter-tidal area as well as disturbs life in near-shore coastal waters. For instance, essential sandy habitats for sea turtles may be lost. Extensive coastal erosion is also not only detrimental to the activities of artisanal fishermen for fish landing sites but also may in the long term degrade vital fish spawning sites.

Eutrophication. This refers to nutrient enrichment of surface waters often resulting in the growth of algal blooms and reduced oxygen levels in water. This is a process that affects Ghana's lakes and other bodies of water. Studies undertaken in the Department of Oceanography and Fisheries, University of Ghana indicate harmful marine algae in Ghanaian waters, which have potential to bloom at high nutrient values. During eutrophication, the quality of the affected water deteriorates until ii becomes unfit for use by human beings. The lakes and rivers become foul smelling and can no longer support many fish and other aquatic species. Fish kills may result and biodiversity will decrease.

Many waters in Ghana may undergo eutrophication as they continue to be polluted by upsetting the nutrient balance. Much of the excess nutrient material that enters our bodies of water comes from sewage. In particular, the use of detergents that contain phosphate greatly increases the quantity of phosphates entering our rivers and lakes through sewage. Rain washes nitrate from fertilizers off farms and into ponds and streams. Nitrates from automobile exhaust enter the water in the rain, and industrial plants discharge nutrients in wastewater, livestock wastes and agricultural run-off. All these favor eutrophication and serve as threat to biodiversity in the country.

Drought. In areas commonly affected by drought, lack of irrigation and lack of rain cause vegetation to wither and die. Higher than normal temperatures usually accompany drought. These high temperatures beyond threshold levels that can normally be tolerated increase stresses on plants and animals and add to tremendous loss of biodiversity.

Over-Exploitation. The demand for natural resources (fishing, fuel-wood gathering, charcoal making, hunting for birds and mammals, grazing etc) due to increasing population has led to over-exploitation of many fisheries resources of Ghana. Overexploitation of wetland forests (mangroves) and fisheries can cause changes in biodiversity of wetland habitats. Clear cutting of swamp or mangrove forests exposes the wetlands to erosion, produces change in the soil fauna, and causes loss of protection and food for juvenile fish species.

Water Pollution. The threats to biodiversity due to water pollution arise from municipal, agricultural and industrial activities. These include solid waste refuse, siltation, sewage-faecal, mining, pesticides, fertilizers and salinisation of soils.

Urbanization. The biodiversity of Ghana is under enormous threat due to the quest for socio-economic development, especially urbanisation, industrialization and tourism (eg. provision of hotel facilities, influx of people on our beaches for recreation etc). There is an urgent need to exploit our natural resources in a manner that may not cause irresponsible loss of biodiversity. A critical look at the impact of these development-oriented activities on the fragile ecosystem is required.

Forest Conversion. Floral biodiversity "thinning" or loss as experienced in Ghana may be attributed to a number of factors including permanent conversion of natural forests into other land-use forms such as crop cultivation, grazing, mining, infrastructure and settlement development. Since these activities increase with rising population growth, the rate of biodiversity loss accelerates. Though plant domestication (for instance, agricultural and forest plantation monocrops) may bring tremendous benefits to communities and the nation as a whole, its impacts on the country's biodiversity may be disastrous as indigenous species are threatened, displaced and replaced with, most often, fast-growing and genetically and phenotypically inferior introduced species and improved varieties. It is documented that such species as the African yam bean, *Sphenostylis sternocarpa*, hungry rice, *Digitaria exilis*, Casting's groundnut, *Kerstingiella geocarpa* and the rice species, *Oryza glaberrina* are being pushed into extinction through the introduction of exotics which are mostly high-yielding. Similar observations have been made in relation to woody forest species where fast-growing exotics such as *Leucaena leucocephala*, the neem, *Azadirachta indica*, etc., have spread vigorously mainly in the savanna zones displacing virtually all indigenous plant species.

The same factors that account for the "thinning" or loss of plant biodiversity may result in decline and loss of animal biodiversity. Forest conversions into other land use forms such as for timber harvesting, fuelwood gathering, crop cultivation, tree plantation establishments, mineral ore extraction and wildfires set deliberately or inadvertently may alter significantly species numbers and diversities as habitats and food sources are removed and other tropic relation-ships are disrupted. See Plate 8. A number of species of wild animals have been identified as vulnerable or under threat in Ghana (see Table 4).

Gene dilution among wild animal populations is generally and expectedly low due to the insignificantly low numbers of introductions with exotic species (an exception has been the escape of the introduced European rabbit, *Oryctolagues cuniculus* into wild).

In the case of domesticated animals (e.g. cattle, sheep, goats, pigs, poultry, horses, donkeys, cats, dogs, etc.) indiscriminate crossbreeding with exotic species appears to be the main threat to the gene pool of indigenous domesticated animals as certain survival potentials against biotic and abiotic agents associated with the indigenes get lost. The importance of domesticated animals to most people in Ghana as protein source is not to be denied and, therefore, the need to ensure an implementation of an animal production programme that guarantees the lowest minimum of gene dilution cannot be overemphasized.

Weak Legislation and Institutional Structures. Environmental legislation in Ghana is fragmented, much of it has been initiated in an ad hoc manner due to the lack of coherence in environmental planning and policy process. This has resulted among other things in the poor co-ordination of management between wildlife and forestry departments and often contradictory policies and activities (CI-Ghana, 2002b).

Past forest management was focused on only the reserved forest which constitutes the 20 percent of Ghana's land surface area. The result has been the loss of the rest of the 80 percent unreserved forest to other forms of land use. Consequently, the reserved forest and protected areas are now highly fragmented (Fig.6).

F. Conservation Efforts Including Their Scope and Effectiveness. This Should Include Recent, Current and Planned Activities by Donor Organizations that Support Biodiversity Conservation and Identification of NGOs, Universities and Other Local Organizations Involved in Conservation

In spite of the existence of a number of institutions and departments, biodiversity management and conservation has been far from satisfactory. A major constraint has been the lack of coordination, collaboration and networking between and among policy developing institutions on one side and policy-implementing institutions on the other side. The consequences have been overlaps, duplications, conflicts, unhealthy competitions, disharmony, etc.

Furthermore, there are undeniable weaknesses in the capacities and capabilities of some institutions. Lack of baseline data and deficiencies in information management constrain resource management. However, emerging high technology information systems such as remote sensing and satellite imageries, geographic information systems, global

positioning systems are becoming accessible now in the country. These tools will assist in ensuring excellent monitoring of trends in the management and development of biodiversity in the country.

The role played by local community participation and traditional knowledge in resource use and biodiversity conservation, are recognized as a first step towards ensuring the implementation of policies and programmes. Another innovative step that has been taken by the Government of Ghana is the development of an environmental education strategy being implemented under the leadership of the Environmental Protection Agency.

Ghana recognizes the important role of international cooperation and linkages in biological diversity conservation. It is a member of a number of international organizations such as the United Nations and its Commissions and agencies, International Tropical Timber Organisation, African Timber Organisation, the World Conservation Union (IUCN), The African Union, ECOWAS, etc. Ghana works with the convention secretariats and the multilateral and bilateral development institutions such as the World Bank, International Monetary Fund and the African Development Bank in her various programmes aimed at the sustainable development of her natural resources.

The government will introduce a number of economic measures to support and promote activities for the conservation and sustain-able utilization of her biological resources. These measures will include tax incentives, grants and subsidies. The incentives will be continuously monitored to ensure that they are effective in promoting the conservation and sustainable utilization of the country's biological diversity. For example, in Ghana, ecotourism, development Kakum National Park, has been found to contribute enormously to socio-economic development.

However, where any measure is found to have an adverse impact on the country's biological diversity, then it will be necessary to review and initiate the appropriate steps to address the situation.

Social Incentive Measures

Various measures will be put in place to show recognition for activities undertaken by chiefs and other traditional authorities, individuals, corporate bodies and communities engaged in the sustainable use and management of the country's biological resources. These could include national awards and naming of specific are as after such individuals and bodies. Occasions such as a the World Environmental Day, World Biodiversity Day, Arbor Day, National Farmers Day and World Day to Combat Desertification and Drought will be used to honor such individuals and bodies.

Traditional laws and sanctions, which promote biodiversity conservation, should be accorded legal backing so as to ensure effective enforcement.

Sanctions

Appropriate legislation, both at the national and district levels, should be developed to provide sanctions against individuals, corporate bodies and communities which engage in activities deemed not to be promoting the sustainable use and management of the country's biological resources.

ANNEX E.2
ENVIRONMENT AND NATURAL RESOURCE REVIEW

ENVIRONMENTAL PROTECTION POLICY

Environmental protection policy has a long history in Ghana. Dating back to the mid-1970s, the GOG established the Environmental Protection Council (EPC) as a response to commitments made during the UN Conference on the Human Environment in Stockholm in 1972. While the EPC was charged with safeguarding the country's natural environment in relation to the planning and execution of development projects, it was not until the mid-1980s, and the development of the Ghana Investment Code, that legislation to protect the environment took effect. At that time, the Ghana Investment Centre, the agency charged with coordinating and encouraging all investments except mining and petroleum, was mandated to evaluate how and to what extent investments would affect negatively the natural environment, and to propose measures to prevent or control those effects.

An important GOG initiative to protect the environment was the development of the National Environmental Action Plan (NEAP). The plan, to be implemented over a ten year period (1991-2000) defined the key environmental issues and provided policy and institutional strengthening recommendations to make Ghana's economic development strategy environmentally sustainable. During the same period, the GOG published draft guidelines for Environmental Impact Assessments (EIAs). The draft guidelines were used extensively by the EPC to evaluate the potential effects of a large number of development projects, most of which were in the mining sector. But formal adoption of EIA guidelines did not occur until 1994 with the passage of the Environmental Protection Agency Act 490, legislation which established the Environmental Protection Agency (EPA) to replace the EPC.

ENVIRONMENTAL IMPACT ASSESSMENTS

Act 490 states that the EPA is "to ensure compliance with environmental impact assessment procedures in the planning and execution of development projects, including compliance in respect of existing projects." In addition, the EPA can lawfully require that "any person responsible for any undertaking which in the opinion of the Agency has or is likely to have adverse effect on the environment to submit to the Agency.....an environmental impact assessment.." The EPA can oblige developers to hire consultants to conduct an EIA and prepare an environmental impact statement. The impact statement identifies environmental impacts and possible measures the developer intends to implement to mitigate those impacts. After reviewing the EIA and EIS, the EPA makes a decision to permit or not the developer to proceed with the investment. If the development is allowed to proceed, a system of monitoring is established to ensure that the developer protects the environment from potential harmful effects.

With respect to agricultural and natural resources sector, EIAs are required by law for the following projects, all of which are classified as environmentally critical:

Agriculture:

- Land development exceeds 40 hectares;
- Land development necessitates resettlement of more than 20 families; and
- New pesticides or fertilizers are introduced.

Drainage and irrigation:

- Construction of dams and man-made lakes;
- Drainage of wetland; and
- Irrigation.

Forestry:

- Conversion of hill forest to other land use;
- Logging or conversion of forest land to other land use within the catchment area of reservoirs used for water supply, irrigation, hydropower generation or in areas adjacent to forest, wildlife reserves;
- Conversion of wetlands for industrial, housing or agricultural use; and
- Forest plantation not less than 40 hectares.

Resort and recreational development:

- Construction of coastal resort facilities or hotels with more than 40 rooms;
- Hill top resort or hotel development;
- Development of tourist or recreational facilities in national parks; and
- Development of tourist or recreational facilities on islands in surrounding waters.

The EPA recently established tailored guidelines for eight sectors, including agriculture, tourism and forestry. The agency, which handles about 500 applications for development projects annually, coordinates its efforts with the Ministry of Private Sector. About 25 percent of all applicants are required to do EIAs, develop EISs, and monitoring plans. Most EIAs are conducted in the mining and manufacturing areas. The EIA Committee meets every three weeks to review EIAs.

The EPA hopes to assist communities and districts to plan for appropriate utilization resources, especially land and forests. Resource planning on a district level should reduce the number of EIAs done and reduce the amount of time needed to issue permits to developers. Regional or district planning and monitoring should also improve the ability of the agency to enforce environmental regulations, especially those regarding deforestation.

COMMODITIES AND THE IMPACT ON THE NATURAL RESOURCE BASE

Cereals

Maize

In terms of hectarage and geographical spread, maize is the number one crop in Ghana. It is the most important cereal and is cultivated from the coast to the savanna. The highest production occurs in Brong Ahafo and Northern Regions, followed by Ashanti, Eastern, Central, and Western Regions. The majority of farmers use improved varieties developed by the Crops Research Institute.

Major Constraints

- Lack good quality seed
- Low yield potential of available varieties
- Lack of drought tolerant varieties and low nitrogen use efficiency varieties
- Pest and diseases e.g. stem borer, storage weevils and streak
- Lack of mechanical shellers
- Lack of organic and inorganic fertilizers

Impact on natural resource base

- Slash and burn method of land preparation leads to:
- Loss of organic matter
- Soil erosion
- Harmful effect on beneficial insects.
- Depletion of soil nutrients.

Sorghum and Millet

Sorghum and millet are cultivated as a mixed crop. Sorghum ranks as the third most important food in terms of area. Its production is concentrated largely in the interior savanna, especially in Northern and Upper East and Upper West Regions. The crop is a major and popular component of the diet in the northern savanna zone and the crop also has good potential for export. The distribution of millet is the similar to that of sorghum.

Major Constraints

- Need varietal improvement including germplasm collection
- Need development of hybrids, brewing types
- Lack pest and disease screening
- Striga resistance
- Lack market information

Impact on natural resource base

- Soil degradation as a result of continuous cropping.
- The perenniality of the crop depletes the soil of nutrients.
- Build-up of pests, diseases and weeds.

Rice

Rice is planted in 34 out of 43 agricultural districts in Ghana. It is an important cash crop in the valley bottoms in Northern, Upper East and Upper West Regions and is also grown in moist areas in other regions, notably Western Region and Volta Region. Rice is increasingly grown by modern irrigation methods.

Major Constraints

- Need breeding for adaptability
- Need documentation of general husbandry and farming systems including socio-economic studies
- Need water studies including usage and crop stress
- Lack fertilizers both organic and inorganic
- Stem borers and blast
- Need soil surveys and studies in valley bottoms
- Bird damage

Impact on Natural Resource Base

- Improper plowing (against the contours and varying plow depths) encourages soil erosion and some depletion of the already limiting soil nutrients.
- On irrigated sites, the removal of most of the top soil during bunding and leveling contributes significantly to nutrient depletion, toxicities of iron and build up of weeds.

ROOTS AND TUBERS

Cassava

In terms of production, the number of farmers involved and contribution to agricultural gross domestic product, cassava is Ghana's most important crop. Over 70% of farmers cultivate the crop in 37 out of the 43 agricultural districts. The highest concentrations occur in southern Ghana, especially Ashanti, Brong Ahafo, Western, Eastern and Volta Regions. It is estimated that in 90 percent of cassava farms, cassava is a mixed crop.

Major Constraints

- Need germplasm collection and selection
- Fertilizer use including effects on cyanide content
- Cassava mosaic virus disease
- Soft rot diseases
- Lack mechanical harvesting

- Need marketing strategies and economies

Impact on Natural Resource Base

- Cassava production may lead to soil deterioration if grown continuously on impoverished land without fertilizers.
- Because of cassava's slow rate of sprouting and leaf canopy development, large scale mechanical cultivation would predispose the soil to erosion and loss of nutrients, particularly as poorer soils are produced by improper husbandry methods.
- When growing well, cassava smothers weeds and keeps the soil weed free for as long as good canopy is maintained. In addition, at harvest, pulling of tubers turns the soil over, thus facilitating land preparation for crops to follow.
- When soil fertility declines as a result of reduced fallowing or continuous cropping without fertilization, weeds build up. Pests and disease may also increase under such conditions but most are not serious.

Cocoyam

Cocoyam is the second most important root crop in Ghana in terms of cultivated area and production. It is cultivated throughout the forest zone in mixed stands.

Major Constraints

- Need for germplasm studies
- Need for fertilizer studies
- Need for pest and disease survey

Impact on Natural Resource Base

- Cocoyam cultivation has little effect on the resource base (soil factors). The land is not completely cleared for cultivation. Cocoyams are grown together with other crops. As soon as a complete leaf canopy develops (1-2 months after planting) the soil is completely covered and protected from soil erosion.
- There is no major build up of pests and disease or weeds connected with the cultivation of cocoyams.

Yam

Yam ranks next to cocoyam as the most important tuber in Ghana in terms of cultivated area and production. It is grown in 34 out of 43 agricultural districts, with about two-thirds of the cultivation concentrated in Brong Ahafo and Northern Regions.

Major Constraints

- Need for varietal trials and selection
- Requires staking including life stakes
- Heavy fertiliser requirements
- Need for better storage and post-harvest handling, including surveys
- Need for development of flour and packaging

Impact on Natural Resource Base

- Yam is a heavy feeder, but farmers do not usually apply fertilizers or manures. As fallow periods become shorter yam cultivation is bound to reduce soil fertility considerably if fertilizers/manures are not applied.
- Yam cultivation requires total land clearing (by hand or machine) and the making of mounds. The soil is, therefore, completely exposed and distributed, rendering it more susceptible to erosion. Mound construction loosens the topsoil and exposes the subsoils in between the mounds causing accelerated soil erosion. The exposed subsoil is heated from the sunlight causing iron pan formation and surface crusting which enhance soil degradation. Land surface becomes rugged.
- Weed build up is serious on lands cultivated to yam since it is left to fallow after harvesting. If fallow periods are not long enough for weeds that follow the yam harvest to be smothered by the fallow vegetation, then weeds, such as Imperata, Cyperus and Rotboellia become established and persist until the following planting season. If not properly managed, there is depletion of soil nutrients, erosion of soil, build up of weeds but no major build up of pests and diseases.

Sweet Potato

Apart from the high rain forest, sweet potatoes can be grown in all agro-ecological zones. At the moment, it is of limited importance in Ghana. However, it is an important high yielding, early maturing (3-4 months) high calorie food crop.

Major Constraints

- Need for varietal trials and selection
- Lack adequate information on agronomic practices including fertilizer usage
- Lack pest and disease surveys
- Need information on harvesting techniques

Impact on natural resource base

- The cultivation of sweet potato has little effect on the resource base and there is no build up of serious pests, diseases or weeds.
- The crop can successfully suppress weeds as a sole crop or as an intercrop.

LEGUMES

Groundnut, Cowpeas and Soybeans

Cultivation of groundnut and cowpeas typically on a mixed basis, is concentrated in the savanna zone, Upper East, Upper West, and Northern Regions. Production of both crops falls short of demand and groundnut products, especially the oil are imported to fill the gap. Soybean is a new crop and the production has been increasing at a very high rate. With increased production of the crop, food security at the household level can be

achieved with adequate post harvest treatment (drying). Soybeans can be stored for a long time in jute bags provided they are well dried and protected from insect infestation.

Major Constraints

— *Groundnut*
- Need for *Striga* pest and disease control
- Need for research on storage pests
- Need for research on anti-nutritional factors

— Cowpeas
- Need for varietal trials including disease resistant types
- Lack of information on tillage practices
- Need for marketing studies
- Need for mechanical harvesting

— Soybean
- Need for breeding and selection
- Lack of information on tillage, agronomic practices including intercropping
- Need for pest, disease and weed control
- Need for research on oil extraction, flour, and recipes

Impact on natural resource base

- Like most leguminous plants that fix nitrogen, cowpea, groundnut and soybean can provide part of their nitrogen requirement by fixing atmospheric nitrogen.
- The haulm, when left on the field, adds organic matter to the soil.
- The practice of heaping harvested groundnut and soybean in specific areas for picking of pods and threshing respectively, without returning and spreading the haulm to the field reduces the amount of organic matter that these crops may contribute to the soil. In the case of groundnut the net effect on the soil may be negative.

Plantation and Tree Crops

Cocoa

Cocoa is the most important tree crop in Ghana. It is the country's main export crop and contributes 14 per cent of the agricultural gross domestic product. It is grown widely in the humid zone. Ashanti, Brong Ahafo, Eastern, Western and Central Regions are the leading areas of production.

Major Constraints

- Need for technological packages for early establishment, re-establishment of cocoa farms and the efficient management of young cocoa farms until they come into full bearing.
- Need for varietal improvement for early establishment, high and stable high yield potential and good bean quality suitable to cocoa farmers in different environments.
- Need for research on resistance to cocoa swollen shoot virus and blackpod diseases.

Impact on the Natural Resource Base

- As a result of the low producer price of cocoa many farmers grubbed their cocoa farms during the 1970s and cropped the land intensively to food crops such as cassava and maize. The situation was exacerbated by such natural disasters as drought and bushfire and the deliberate felling of trees which provided permanent shade to the cocoa. The soils in these areas were, therefore, exposed to the vagaries of the weather making them not suitable for cocoa cultivation.

- The present cultivation techniques are not damaging the resource base by soil erosion but may without necessary control encourage the build up of pests and diseases.

Oil Palm

Oil palm production has grown rapidly in recent years. Palm oil and kernels, produced by small-scale farmers from natural palm groves, in the oil palm belt near the coast, were the leading export from Ghana during the latter part of the 19th century and the early part of the 20th century. The industry declined, and by 1955, Ghana had become a net palm oil importer. Over the past 20 years, the area planted to the crop has increased from 18,000 to over 100,000 ha, a growth of about 24 per cent per annum. Production is concentrated in a new oil palm belt in the ecologically more favorable interior forest zone, especially in Eastern, Western, and Central Regions.

Major Constraints

- Progeny selection, genotype/environment interaction studies
- Fertilizer including magnesium studies
- Intercropping with cover crops
- Soil suitability surveys
- Water stress and climatology
- Seedling wilts especially Fusarium
- Leaf miner and other pests
- Post harvest fruit loss
- Studies on the control of snakes and rats
- Impact on the natural resource base

Rubber

Rubber was planted as an estate crop by the Ghana Rubber Estate Limited in the Western Region; the Ghana State Farms Corporation and University of Ghana, Agricultural Research Station in the Eastern Region and as a smallholding crop by Rubber Growers Co-operative Societies and individual farmers. Rubber cultivation is only important in the evergreen rainforest zone where the rainfall is high (1,700-2.200 mm per annum) and the soils are acidic and too poor for cocoa.

Major Constraints

- Need for germplasm collection and selection
- Need for information on crop husbandry
- Need for control of pests and diseases

Impact on natural resource base

- In the preparation of land for the planting of rubber, the vegetation is cleared by brushing the undergrowth and felling large trees by axe, machetes or chain saw. The debris is stacked and burned. Under the smallholders system, intercrops are planted. Leguminous cover crops are established both to minimize soil erosion and to increase soil fertility. Weeding after planting is done using machetes and occasionally weedicides in larger plantations.

Shea Nut

Shea nuts are picked generally by women from trees growing wild, in the savanna zone particularly, and in some parts of Volta, Eastern and Ashanti Regions. Attempts are being made to cultivate the crop in order to sustain the shea nut industry.

Major Constraints/Opportunities

- Need for germplasm collection and selection
- Need for propagation studies
- Need for farming systems studies
- Need for means to process and refine the shea butter

Impact on natural resource base

- The shea trees traditionally grow wild. They are informally and formally managed by the women of the communities in the savannah to ensure production of the nut. The Forestry Commission has plans to increase shea tree management and to plant the trees.

Kola

Most production is from single plants scattered on crop farms - kola plantations among peasant farmers are uncommon. Most kola plantations are owned by the Ghana State Farms Corporation and are scattered in the forest areas of the Eastern and Ashanti Regions. Most of the kola produced in this country is exported to neighbouring countries in West Africa, mainly Nigeria.

Major constraints

- Need for germplasm collection and selection;
- Need for propagation including determination of the sex of the seedlings; and
- Need for improved storage and processing techniques.

Coconut

The coconut palm is an important crop in Ghana. Production is solely by small holders farmers along the litoral and in some inland areas especially around villages and settlements. Few large commercial plantations exist. Coconut covers an estimated 43,000 hectares mainly in the Western, Central and Volta Regions. Total production is estimated at 224 million nuts a year.

Major Constraints/Opportunities

- Need for variety trials
- Need for control of Cape St Paul's Wilt
- Need for improved post-harvest handling
- Need for soil suitability survey

Impact on Natural Resource Base

- The present cultivation methods used in Ghana cause very little damage to the resource base and no major build up of pests and weeds. In fact, the coconut with its well developed root system prevents soil erosion. In some Coastal districts it is often the only tree crop that can do well.
- If coconut farms are set up with a cover crop put under it, the nutrient status of the soils will improve.

Sugar Cane

Sugarcane is a very important energy food in Ghana without any substitute in the country.

Major Constraints
- Need for variety selection and maintenance

Impact on Natural Resource Base

- Estate canes are burned before harvesting and no thrash is left. Under light textured soils at Komenda the continuous cane after cane cropping soon depletes soil of its nutrients. Soil structure also deteriorates very fast. Very little destruction occurs under green cane harvesting on outgrower's fields where the thrash is left on the soil.

HORTICULTURAL CROPS

Pineapple

Commercial production of pineapples is concentrated largely in the less humid forest margins in the Eastern and Central Regions. Pineapple is the most important horticultural crop produced for export in Ghana.

Major Constraints

- Need for research on agronomic practices and fertilizers and their effects on fruit quality
- Need research on flower induction
- Mealy bugs and weed control
- Need to enhance soil and water conservation

Impact on Natural Resource Base

- Continuous cropping of pineapples damages the resource base through loss of top soil on steep slopes on which the crop is cultivated; loss of soil nutrients especially nitrogen and potassium, and encourages the build up of diseases and pests especially mealybug, nematodes and weeds.
- The use of bulldozers in clearing new sites for pineapple cultivation has resulted in felling of trees causing environmental degradation.

Plantain/Banana

Plantain is an important food crop. Its cultivation is limited to 29 districts, all in the forest zone. Plantain is usually grown in mixed stands for local consumption. Banana is cultivated on a much smaller scale than plantain and is mainly for local consumption although the crop has potential for export.

Major Constraints

- Need for germplasm collection and characterization
- Need for information on alley cropping and wind breaks with reference to lodging
- Need for information on general agronomy including spacing, mulching, cover crops
- Need for fertilisers and organic manures
- Banana weevil, nematodes and Black Sigatoka diseases

Impact on Natural Resource Base

- There is depletion of soil nutrients and a build up of pests, diseases and weeds, e.g. nematodes and weevils with the continual planting of bananas and plantains
- Large scale production methods can degrade the environment, e.g. abuse of fertilizers, pesticides and plastics

Tomato

Tomato is a major food item in the diet of Ghanaians and production is in well drained forest-savanna areas in Eastern, Ashanti, Upper East Regions.

Major Constraints/Opportunities

- Need for variety selection
- Need for improved crop husbandry including fertilizer usage
- Need for control of pests and diseases

- Need for improved techniques for preservation and processing
- Need for studies on production and marketing economics

Impact on natural resource base

- Tomato plots are generally continuously and intensively cropped, therefore, there is a serious build up of pests and diseases in almost all the major growing areas. For example, there is a build up of the Meloidogyne root knot nematode in the Tono and Vea irrigation sites in the Northern sector. The early and late blight final diseases also build up in the Akumadan and Ada areas. These occurrences are posing a serious threat to tomato production.
- The present cultivation techniques cause some depletion of soil nutrients and serious build up of pests, diseases and weeds.

Garden Egg

Garden egg is a major vegetable food item grown mainly in the forest transitional zone, where it is grown as a cash crop in a mixed crop system. Other production areas include Akpo and Kade in the Eastern Region, Kpando, Tokor and Vakpo in the Volta Region, Mankessim and Swedru in the Central Region and Weija in the Greater Accra Region.

Major Constraints

- Need for variety selection
- Need for socio-economic survey on use, economics and marketing

Impact on Natural Resource Base

- As the crop is not normally cultivated continuously on the same piece of land, very little damage is caused to the resource base and no major build up of pests, diseases and weeds take place.

Pepper

Pepper grows in all the ecological zones of Ghana, rainfed or irrigated, mixed or as a sole crop, with few cultivation problems. Commercial production is intensive and women are more heavily involved in the production and processing activities than are men.

Major Constraints

- Need for pest and disease control
- Lack of fertilizer studies

Impact on Natural Resource Base

- Present cultivation techniques (intensively cultivated sole garden crop) lead to some build up of pests and disease problems. Continuous cultivation of the crop has some effect (though little if well taken care of) on the natural resource base particularly with regard to soil factors.

Shallot

Shallot production is concentrated in the Anloga area in the Volta Region, Kwahu South of the Eastern Region, Mid-Volta Region and Saltpong area. Onions are produced mainly around Bawku East and West Districts of Upper East Region. Production is either intercrop or sole-crop and is continuous except for the fallow period of the dry season. These crops are produced annually with heavy fertilizers and manures.

Major Constraints/Opportunities

- Need for improved flowering and seed production including seed viability
- Heavy fertilizer requirements

Impact on Natural Resource Base

- The heavy use of organic manure has particularly helped in improving the fertility status of the soils of Bawku area where onions are cultivated. In the Anloga area it has converted an otherwise agriculturally unsuitable sand into a very productive soil, supporting a lucrative agricultural industry (Shallot farming). On the other hand, the continuous cropping of the soils of Kwahu South area over the years with little or no fertilization and manuring, coupled with lack of insect and disease control measures, has led to the depletion of soil nutrients and the buildup of insects and diseases.

Okro

Okro is an important vegetable and is grown and eaten in all regions of the Ghana. It is mainly grown in mixed-crop systems with cassava, millet/sorghum, and groundnut, and is both a rainfed and irrigated crop. Most of the production is locally consumed and it can be preserved by drying whole or as sliced fruit. It is sometimes made into a powder form for export to other West African countries. The stalk is used as fuel or for fiber production.

Constraints/Opportunities

- Need variety selection
- Need information on pests and diseases control
- Problem with weeds

Impact on Natural Resource Base

- Continuous cultivation on the same piece of land can lead to a build up of pests, leaf-eating insects (caterpillars, cotton leaf rollers etc.) and diseases if no proper rotation techniques are employed.

ANIMAL PRODUCTION

Cattle

Cattle production is based mainly on extensive pastoral or free range systems among small-scale farmers and ranching on state owned institutions. The northern savanna zone accounts for the bulk of the production. With the control of tsetse flies, livestock production in the forest zone is becoming increasingly common and integrated with plantation crops like oil palm. The West African Shorthorn is the predominant breed and accounts for over 80 percent of the population.

Cattle are housed in open kraals in most parts of the country but in a few areas they are kept in the compound houses. Cattle are generally herded out to graze on the open range during the day and return to the kraals at night. Cattle meat formed over 43% of the 46,000 tons of all meat production in the country in 1990. Ghana currently imports 50% of its domestic beef requirements; and this is likely to increase in the near future with population growth. In the savanna areas, cattle serve mainly as a source of ready income to support other activities. Production of milk, cheese and other diary products are important among the Fulani herding community and on the plains around Accra. The skin is eaten or tanned for leather works; bullocks provide energy for traction in limited areas; and the dung provides organic fertilizer for crops and fuel in scarce periods.

Major Constraints

- Grazing management systems practically non-existent in the traditional systems
- Mating uncontrolled, castration uncommon and breeding is all year round.
- Dry season limitations on feeding and watering .
- Disease control confined largely to free Government vaccinations against scheduled diseases (Rinderpest, Contagious Bovine Pleuropneumonia, Anthrax, and Blackleg).
- Prophylactic and curative treatments against endo- and ecto-parasites limited.

Impact on Natural Resource Base

- Overgrazing coupled with bush fires often lead to destruction of vegetation and damage to the soil.

Sheep and Goats

Sheep and goat meat formed about 37 percent of the 46,000 tons of the livestock meat production in Ghana in 1990. For small-scale farmers they provide a readily available source of income for other activities. In the main system of production, these two animals are produced together in a small scale backyard system either with or without housing. Other systems are free range where animals fend for themselves, backyard zero grazing with housing, tethered systems, and semi-intensive systems in which animals are confined and herded for grazing. Larger flocks are found within plantations, on institutional farms, on poultry and pig farms, and in combination with cattle.

Sheep breeds are mainly West African Forest or Djallonke. Within the peri-urban flocks the Sahelian types and crossbreeds (Djallonke x Sahelian) are found; crossbreeds account for 15% of the population. Goat breeds are of the West African Dwarf or Forest types.
Major Constraints

- Traditional management systems: shelter provisions are inadequate, overcrowded and do not protect from the weather. Rams and bucks run with females throughout the year. In-breeding is rampant. Young females are mated prematurely and castration is irregular.
- "Pests des Petits Ruminants" (PPR) estimated to account for up to 50% of small ruminant mortalities; No large scale vaccination campaign against this disease.
- Parasitic gastroenteritis and ectoparasitisms, caused by ticks and mange mites, result in poor productivity.
- Use of prophylactic and curative treatments are low.
- Pneumonia cases, arising out of poor housing, are frequent in the rainy season.

Impact on Natural Resource Base

- Feeding is extensive which can degrade soils and vegetation but supplementation with crop residues and agro-industrial by-products is becoming popular.
- Under plantation crops goats and sheep help control weeds and supply manure for soil.
- In the savanna regions overgrazing leads to soil deterioration. Production is limited during the dry season in the savanna areas by inadequate availability of water and herbage.
- The spread of the weed Chromolaena in the forest and transitional regions is becoming an important limitation to availability of natural pasture.
- Overgrazing especially in the Northern part of the country .leads to soil erosion This damage often exacerbated by bush fires.

Poultry

Poultry is the most developed among the domestic animal industries in Ghana. Almost every family keeps poultry. Production is mainly backyard and free range especially in the rural areas. The birds fend for themselves with or without feed supplementation. Some kind of housing is always provided. Chick mortality can be as high as 100 percent as veterinary care is virtually nil. These systems, using unimproved native breeds of chicken, guinea fowl, ducks and turkeys, result in about 80% of the national poultry production. Backyard production is also important in big towns and cities.

In all big town and cities there are intensive commercial production units dominated by small scale operators with holding capacities of 100 to 1000 birds. They use imported exotic breeds, good housing, balanced feeds, and all possible veterinary care. These farms mainly produce eggs although some broilers are produced; spent layers are also sold for meat. The major problems are the supply of chicks and feed. It is a Government policy to encourage poultry production by providing v

Fisheries

Fish constitutes about 70 percent of the daily animal protein intake of the average Ghanaian. Much of the marine fish catch is exported for foreign exchange but the bulk of the freshwater fish production is sold in local markets.

The industry provides employment and income for the families along the coast, around the Volta lake, medium sized reservoirs and large lagoons, and it is an important supplementary source of income along major tributaries of the Volta and other major rivers, small irrigation reservoirs and lakes.

Major Constraints

- Lack of landing sites for boats,
- Poor accessibility linking producing centres and markets,
- Hazardous transportation on the Volta and other major lakes and rivers.
- Poor harvesting schedules,
- Crude processing,
- Inadequate/poor marketing facilities

Impact on Natural Resource Base

- Indiscriminate fishing and competition over marine resources leads to depletion of supplies
- Use of firewood for curing fish leads to severe deforestation in some areas
- Drilling for mineral oil and its associated pollution leads to destruction of marine fishing resources

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ANNEX E.3
REGULATED PESTICIDES AND TRENDS IN PESTICIDE IMPORTS

Table 1: Provisional list of Banned Pesticides in Ghana

Name	Active Ingredient	Reasons for Ban
Aldrex T.	Adrin and Parathion	Persistent, highly toxic
Aldrin	Aldrin	Persistent
Dieldrin	Dieldrin	Persistent
E-605 Combi	Parathion	Highly toxic
Heptachlor C10	Heptachlor	Not in Use
DDT	Dichloro-Diphenyl-Trichloro-Ethane	Suferalternative
EDIB	Ethylen Dibromide	Highly toxic
D-D	Dichloropropane	Banned internationally
Bidrin	Dicrotophos	Banned internationally

Sources: Environmental Protection Agency (EPA 1994) Draft Legal Instrument of Act 528 Accra. EPA (1997) National Profile to assess the chemical management infrastructure in Ghana, Accra p.37

Table 2: Provisional List of Severely Restricted Pesticides in Ghana

Name	Active Ingredient
Azodrin	Monocrotophos
Unden	Propoxur
Lindane	Gamma BHC
Elocron	Dioxacarb
Gramaxone	Paraquat
Furadan	Carbofuran
Thiodan	Endosulfan
Atrazine	Atrazine

Source: Environmental Protection Agency (EPA) Draft for Legal Instrument of Act 528, Accra

Table 3: Imports of Pesticides by Brand Name and Active Ingredient (in Kilogramme or Litres)

Class	Brand Name	Formulation	Manufacturer	Active Ingredient	1995	1996	1997	1998	1999	2000
Insecticides										
IA	Phostoxin	3g TABLETS	AIMCO PESTICIDES	Aluminium Phospide	5,698	0	11,467	2,500	0	0
IA	Temik	GRANULES	RHONE-POULENC	Aldicarb	3,000	0	0	2,0010	0	0
IB	Azodrin	E.C.	INDUSTAN INSECTICIDES	Monocrotophos	0	0	1,000	0	0	0
I	Callfan	60 E.C.	MILENIA AGRO GENCIAS S/A	Endosulfan	6,672	2,167	0	32,000	33,800	48,000
I	Degesch Plates	PLATE	DEGESCH AMERIKA	Magnesium Phosphide	720	0	0	0	0	0
I	Karate	2.5 E.C.	ZENECA	Lambda-cyhalotrin	14,754	23,992	29,400	47,028	33,000	13,000
I	Super Homai	70 WP	Nippon SODA CO.LTD	Thiophanate methyl +Thiran	0	0	0	5,000	0	0
I	Thiodan	360g GRANUI	HOECHST S. AGREVO LTD.	Endosulfan	11,304	12,925	32,800	11,000	14,000	0
II	Actellic	2.5 E.C	ZENECA	Pirimiphosmethyl	17,700	1,300	15,158	5,500	0	0
II	Carbamult		Hoechst Schering Agrevo	Promecarb	0	0	0	0	200,000	0
II	Cymbush	10gm E.C.	ZENECA	Cypermethrin	600	0	18,350	52,000	2,000	0
II	Cymethsate	E.C.	ZENECA	Cypermethrin + Diamethsate	5,000	5,000	0	3,750	5,000	0
II	Decis	E.C.	AGREVO S.A.	Deltamethrin	0	24	5,000	11,000	11,500	8,000
II	Evisect S	59 WP	NOVARTIS	Thiocyclam Hydrogen Oxala	4,200	0	3,020	0	0	0
II	Fertigofol		Vector Agro SA	Fertifenophos	0	0	0	0	12,000	6,000
II	Karate+Duraban	2.5+48 E.C.	ARAB PESTICIDES	Lambda-cyhalothrin	0	8,400	58,800	72,200	0	0
				Plus Chlorpyrifosmethyl						
II	Lentrek	E.C.	AIMCO PESTICIDES	Chlorpyrifos	0	1,000	0	0	0	0
II	Lindane	20gm E.C.	AGRO CHEMICALS INDUS.	Gamma BHC	0	300,000	655,600	0	0	0
II	Nurelle	48g E.C.	ZENECA	Cypermethrin+Chlorpyrifos	0	0	5,870	16,000	26,000	10,000
II	Perfekthion	40 E.C.	BASF	Dimethoate	1,925	0	5,000	10,380	0	0
II	Permethrin		AAKO B:V:		0	0	0	0	6	0
II	Polytrin	C 165 UL	AAKO B:V. Agrides SA:	Cypermethrin	0	0	0	0	34,000	20,000
II	Polytrin	SC	American Cyanamid	Cypermethrin	0	0	0	00	14,000	12,000
II	R-300	3.0% WS	WHITMIRE MICRON-GEN	Resmethrin	0	0	11,800	14,468	0	0
II	Sherdiphos	E.C.	MITSUI CHEMICALS	Cypermethrin+Triazophos	0	0	0	6,000	20,000	0
II	Sumicidin	30 E.C.	SUMITOMO	Fenvalerate	0	0	10,494	2,500	0	0
II	Sumithion	50 E.C.	SUMITOMO	Fenitrothion	5,000	9,975	16,000	6,500	4,000	0
II	Trebon	40 E.C.	MITSUI CHEMICALS	Ethofanprox	5,200	0	0	0	3,000	0
II	ULV 600 S			Pyrethroids	0	0	0	0	10,000	21,000
II	Unden	20gm E.C.	BAYER	Propoxur	100,000	300,000	602,000	0	0	0
II	Sodium Silicate		Jewnin-Foffe Industry Ltd.		0	0	0	0	95	0
III	Biobit	WP	ABBOT LAB. INCO.	Bacillus thuringiensis	700	250	0	0	0	0
III	Cypercal	P 336 EC	Cypercodal, Gilmore Inc		0	0	0	0	22,000	103,000
III	Diazinon	40 WP, E.C.	NOVARTIS	Diazinon	10,220	0	0	609	0	0
III	Dursban	480g E.C.	DOW AGROSCIENCES LLC	Chlorpyrifosmethyl 48gm	0	5,000	37,680	48,3000	4,000	6,000
III	Malathion	50 WP, E.C.	ZAGRO ASIA LTD.	Malathion	0	0	0	609	0	0
IV	Pybuthrin	E.C.	AGREVO	Piperonyl Butoxide	1,000	100	0	0	0	2,625
				SUB-TOTAL Insecticides	193,693	670,133	1,519,439	349,354	448,401	249,625

Class	Brand Name	Formulation	Manufacturer	Active Ingredient	1995	1996	1997	1998	1999	2000
Herbicides										
IB	Gramoxone	276g E.C.	ZENECA	Paraquat	2,000	18,560	25,640	2,500	12,000	0
II	Bravo		AAKO B.V.		0	0	0	0	0	10
II	Dual	500 E.C.	NOVARTIS	Metolachlor	14,000	0	0	0	0	0
II	Fusilade	125 E.C.	ZENECA	Fluazifob-butyl	1,440	3,696	4,000	3,000	2,000	0
II	Glyphosphate	360 SC	Sanonda Co. Ltd.	Glyphosate	0	0	0	0	3,000	7,000
II	Hyvar X	80 WP	DUPONT AGRIC. PRODUCTS	Bromacil	2,800	2,240	3,238	6,500	2,000	1,200
II	Rilof		NOVARTIS	Piperophos	2,300	0	0	95,002	4,500	0
II	Roundup	36% E.C., GR	MOSANTO CO.	Glyphosate	3,347	3,998	13,240	32,914	23,500	7,000
III	Atrazine	80 WP, E.C.	AAKO B.V.	Atrazine	24,500	22,960	28,700	5,000	2,000	0
III	Basagram	160+340	BASF.	Bentazon+Propanil	5,000	0	0	2,700	25,000	13,000
III	Basta	20gl	HOECHST S. AGREVO LTD.	Glufosinate-Ammanium	5,000	0	0	2,500	0	0
III	Diuron	80 WP	BAYER	Diuron	5,000	3,960	7,044	6,500	1,584	1,000
III	Herbit Plus	60+300 E.C.	HOKKO CHEMICAL INDUST.	Phenothiol	0	0	7,000	0	0	5,000
III	Lasso	480g E.C.	MOSANTO CO.	Alachlor	5,100	0	1,800	15,000	0	0
III	Propanil	40% E.C.	RICECO	Propanil	0	0	7,000	0	0	5,000
III	Ronstar	250 E.C.	RHONE-POULENC.	Oxadiazon	9,100	0	10,000	28,000	20,000	12,820
III	Saturnil	40% E.C.	KUMIAI CHEMICAL CO.	Thiobencarto	6,000	0	9,400	2,500	0	0
III	Stomp	500g	AMERICAN CYANAMID CO	Pendimethalin	2,000	0	0	2,500	0	0
IV	Garlon	240 E.C.	DOW AGROSCIENCES LLC	Triclopyr	1,000	0	6,160	5,000	2,000	0
IV	Londax	600g GRANUI	DUPONT AGRIC. PRODUCTS	Bensulfuron-methyl	0	0	70	0	0	0
				Thiobencarb+Propanil	0	0	0	0	0	5,000
				Sub-Total Herbicides	**88,587**	**55,414**	**132,292**	**224,816**	**97,584**	**52,030**
Fungicides										
I	Sodium Pentaborate		Chapman Chemical		0	0	0	0	0	1,500
IA	Bavistin	200g GRANUI	BASF.	Carbendazim	200	0	0	0	0	0
II				Manro Antistani	0	0	0	7,200	0	0
III	Aliette	80 WP	RHONE-POULENC.	Fosetyl-aluminium	720	14,720	0	5,000	0	0
III	Ridomil	25 E.C. WP	NOVARTIS	Metalaxyl	112,000	116,000	48,000	100,000	0	0
III	Spartak Sierra		Agrevo UK Ltd		0	0	0	0	54	60
III	Thianosan		Biesterfeld Group	Thiram	0	0	0	0	20	0
III	Tilt	250 E.C. WP	NOVARTIS	Propicoazole	2,000	0	0	0	0	0
IV	Benlate	50 WP	DUPONT AGRIC. PRODUCTS	Benomyl	630	840	6,000	500	0	0
IV	Dithane M45	WP	ROHM AND HAAS CO.	Mancozeb	18,000	4,200	31,500	31,500	5,000	0
IV	Mancozeb		Agrides SA, Agsin Ptc Ltd.	Mancozeb	0	0	0	0	5,000	0
IV	Maneb		Besterfield dGroup	Maneb	0	0	0	0	0	12,500
IV	TopsinM	700g WP	ELF ATOCHEM NORTH AMERC	Thiophanate-methyl	0	0	8,150	10,000	0	0
IV	Trimangol	WP	ELF ATOCHEM NORTH AMERC	Maneb	0	55,800	36,000	28,500	12,000	0
	Folicur		Bayer	Tebuconazole	0	0	0	0	0	5
	Folicure	EW 250	Agsin Pte Ltd.		0	0	0	0	0	5
				Sub-Total Fungicides	**133,550**	**191,560**	**129,650**	**182,700**	**22,074**	**14,070**
Nematicides										
IA	Marshall	80 GRANULE	FMC CORP	Carbosulfan	0	0	1,000	1,000	0	1,000
IA	Mocap	20g E.C.	RHONE-POULENC	Ethoprophos	0	2,167	0	2,500	0	0
IB	Furadan	3g GRADULE	VIETNAM PESTICIDE CO.	Carbofuran	20,625	20,000	45,000	1,500	20,000	0
IB	Rugby	10g GRANULE	FMC CORP.	Cadusofos	0	0	4,995	0	0	4,000
	Growth Regulators			**Sub-Total – Nematicides**	**20,625**	**22,167**	**50,995**	**5,000**	**20,000**	**5,000**
IB	Ethephon			Ethephon	0	0	2,000	0	3,500	64
				Total Imports	**436,455**	**939,274**	**1,834,376**	**761,870**	**591,559**	**320,789**

Source: CEPS (Undated): Declared Chemical Imports to Ghana. Unpublished Working Documents, Accra

ANNEX E.4
LAND DEGRADATION

Land degradation comprises all the processes that lead to the deterioration in the quality and productive capacity of land. The quality of land is a complex attribute which acts in distinct ways to influence the suitability of land for specific uses (FAO, 1984). Simple land qualities include, depth of soil, organic matter content of soil, atmospheric or soil temperature, vegetative cover, flood regimes and amount of rainfall. Composite land qualities include crop yield, scenic beauty and biological productivity.

Land can be broadly categorized into: a) agricultural and related land i.e. farmlands, forests, grasslands and rangelands; b) non-agricultural land i.e. urban and other built-up land; c) mining and construction land; d) the coast. Surface water, underground water and the atmosphere are important components of the land resource space. In addition to being degraded themselves they are the means whereby soil, vegetation and wildlife may be degraded.

AGRICULTURAL LAND DEGRADATION

Agricultural land degradation takes the form of deforestation, rangeland deterioration, wildlife depletion, soil erosion, declining soil fertility and salinization. Deforestation is used in a broad sense as the removal of forest and grassland vegetation. This is the most common form of land degradation in Ghana. It occurs as the result of:

- Land clearing for agriculture
- Exploitation of vegetation resources
- Grazing of animals
- Bush burning

All these, to varying degrees, are necessary for the exploitation of the resources of the land. The question, therefore, is not whether or not vegetation must be cleared. It is the extent to which clearing and its effects are controlled and monitored.

Agriculture: All cultivation involves some cutting of vegetation. In Ghana the traditional bush fallow system of cultivation involves the slashing and burning of forest and grassland. In this system, long fallow periods allow for sufficient vegetative cover to develop before the land is cultivated again. Long fallow periods are, however, only possible if population growth and pressure on the land are low. The increasing population in Ghana over the past half century has meant that pressure on the land is considerable. Demand for subsistence agricultural cultivation has been compounded by demand for cash cropping such as cocoa, coffee, oil palm, and tobacco. These developments have resulted in the intensification of the bush fallow system in terms of the frequency of recultivation while the tree cash crops provide temporary cover for the land while they stand and bear.

The extent of deforestation in Ghana is not specifically known, either with respect to specific location and acreage or the structure and composition. It is estimated that about 70% of deforestation is attributed to shifting cultivation (bush fallow system). This coupled with other factors like the exploitation of fuelwood and timber reduced the total forest area in 10 years (1977-1987) from about 74, 400km^2 to about 18,500 km^2 with the forest reserves occupying about, 15,790 sq. km^2. It is suggested that a wide area of savanna fringing the outer limits of the closed forest zone in Ghana has been "derived" from the forest as a result of continuous farming activities. The extreme north east of the country which is almost treeless has been degraded from guinea savanna. On a wider scale both the interior and coastal savannas in their present state are thought to be degraded forms of woody formations.

Bush Fires: Bush fires constitute the most important cause of vegetation destruction in Ghana. Bush fires occur annually in the dry season from November to May. The causes of bush fires are both intentional and unintentional. Intentional fires are set by livestock owners who burn off dry vegetation to induce fresh growth, hunters who use fire to flush out game and farmers who fail to control farm fires. Bush fires are usually intense because they occur in the dry season when combustible material is plentiful. These fires are more widespread in the savanna areas than the forest areas.

Exploitation of Forest Produce: Forest products range from the subsistence extraction of construction materials and food resources to commercial cutting of timber and wood for fuel. These are all selective demands on the forest and grassland. With increasing population there is increased extraction for energy which may lead to degradation over extensive areas. It is estimated that current domestic consumption is 5,547,200m^3 of fuel wood and 1,992,400m^3 of charcoal per annum (Kesse G.O.)

Rangeland Deterioration: The natural grasslands in Ghana constitute the rangelands in the country. They are communally utilized and are not managed. In the northern savannah region more than 80 per cent of the inhabitants of the rangelands are farmers who grow food crops and rear ruminant livestock. Areas with high population densities are intensively farmed and grazed. For instance, in the Upper East Region, where the population density is more than three times that of the Northern Region, compound farming is practiced and most of the land is under permanent cultivation. Almost all trees have been cut down with the exception of only a few economic species thus leaving the land with very little cover to protect it from the elements. Crop residues are fed to livestock or used as fuel for cooking purposes leaving the land bare during the dry season and early part of the wet season. The net result is that of accelerated soil erosion and consequent reduction in plant growth.

The Upper East, Upper West and Northern Regions between them carry most of the cattle population of Ghana. Traditional cattle rearing in Ghana is based on an extensive system of production and is entirely dependent on the natural grass land vegetation. The utilization of grazing resources is controlled by traditional practices which under existing conditions are well suited to the socio-economic conditions of the people. The animals are taken to graze in the morning and herded back during the day and milked. Vegetation is managed by a system of burning which allows for fresh growth of green plants and clears unpalatable harsh

stubble. These practices provide a uniform utilization of the natural grassland resources and reduce the incidence of bush and woody species. Continual burning, however, results in the degradation of vegetation, exposure of soils and the erosion of soils.

In addition to possible degradation of vegetation through over grazing, soil erosion may occur as a result of (a) the animal trampling and the destruction of soil structure along trekking lines, (b) trampling around watering holes and dams (c) trampling of the soil in the shade of plants where cattle may rest during the heat of the day, (d) trampling at the corralling locations. These bare areas are clearly seen from the air and, on large scale to medium scale aerial photographs.

Soil Erosion

Soil erosion is the removal of soil material through the action of moving water and wind. As a natural process, soil erosion occurs at such a slow rate that replacement of lost material is possible through the process of weathering. Accelerated erosion occurs at rates that make it impossible to replace lost material. It is the result of the disturbance of the soil and its vegetal cover that exposes the soil to direct rain impact or wind action. Accelerated soil erosion is therefore primarily, but not necessarily, the result of deforestation or vegetation. Soil erosion occurs in the form of:

- Sheet erosion through unconcentrated surface run-off.
- Rill erosion in impermanent and shifting micro-channels
- Gully erosion in permanent channels outside stream channels

Under the traditional bush fallow system of cultivation, land tillage is reduced to a barest minimum with two simple tools, the cutlass and the hoe. The introduction of capital intensive large scale farming has meant the use of machinery which removes vegetation, especially roots which tend to bind the soil, and exposes the soil to erosion. This is particularly true in the case of rice growing areas of northern Ghana where large areas have been abandoned as a result of decline in soil fertility and land degradation.

Drought has the effect of reducing vegetation and exposing the soils. Droughts of varying duration have affected Ghana in the past. Frequent and extensive droughts lead to reduction of vegetal cover and when the rains begin again depending on their nature, erosion occurs.

In Ghana, rainfall in both savanna and forest areas are torrential. Soil erosion from rain occurs because in many agricultural areas vegetative cover has been removed, or the soil has been compacted by people and machines. When this happens, infiltration becomes difficult and most water that falls runs off causing erosion over wide areas.

Soil erosion as a form of land degradation in Ghana was noticed nearly five decades ago by agricultural officers-in the northern savanna zones. At that time erosion was restricted in occurrence and was not considered as a general problem (Department of Agriculture, 1937). Soil erosion was at the time not important in the forest zone except around settlements and on

over-farmed steep hill slopes around such towns as Obuasi. Over time, however, soil erosion has become the most important land degradation factor in Ghana. Erosion is widespread not only on farmland but also along the coast.

There is very little data and information on the incidence of erosion on agricultural lands. Halm and Asiama (1984) mapped erosion in the northeastern corner of Ghana, but that was nearly 20 years ago. Elsewhere our knowledge is much limited to generalizations.

Soil Fertility

Most Ghanaian soils are old except those in the valleys and have been leached for a long time. As a result, they have lost a larger part of the original nutrients from the parent rock. The soils have low exchange capacity as most of the clay minerals in the soil are kaolin due to rock weathering under the humid and tropical conditions. Ghanaian soils, especially savanna soils, have low organic matter content. Forest soils generally have fair inherent fertility particularly under tree crops. Reasonable yields can be obtained if the soil is not depleted of nutrients too rapidly by frequent cultivation of the land without adding fertilizer or organic matter.

In the past, soil fertility was maintained through periods of fallow under the traditional bush fallow system. However, in the face of increased population the period of fallow has been reduced from about 15 years to 2 or 3 years which is not enough to restore soil fertility. Fertilizer application is also low due to limited quantities imported and the fact that many small scale farmers find the price prohibitive. The consequence of the shortening of the fallow period

Desertification

Desertification may be considered as the ultimate form of land degradation in which the biological productive capacity of the land is more or less completely destroyed. It is usually the result of the combined effects of number of the land degradation forms. While there are no completely desertified areas in Ghana, total area at risk is approximately 83,489 square kilometres i.e. 35 per cent of the total land area of Ghana. This includes parts of the Accra Plains and the Upper West Region and the eastern part of the Northern Region. The most critical area is the Upper East Region. Desertification is a composite process involving the processes of overcultivation of the land through intensification and the reduction of the fallow period, bush burning, deforestation for fuel and construction material and overgrazing. These processes often occur simultaneously.

ANNEX E.5
AN INTRODUCTTION TO CONSERVATION COCOA

PUBLIC AND PRIVATE SECTOR PARTNERSHIPS

Conservation International is implementing this program in conjunction with existing organizations so that the achievements are more cost effective and sustainable. Major partners in the program are Kuapa Kokoo (an established cocoa cooperative that is the only source of "fair trade cocoa" on the United Kingdom market), the Cocoa Research Institute of Ghana (CRIG) and the Ministry of Food and Agricultures's (MOFA) Integrated Crop Pest Management Unit. For example, building on its existing relationship with Kuapa Kokoo, Conservation International has formed a partnership with CRIG and MOFA's Integrated Crop Pest Management Unit to develop Kuapa's extension service. Other partners include the University of Ghana's People Land Management and Environmental Change (PLEC), an EU-funded project, which has contributed expertise on sustainable farm systems and land-use.

The Project

The pilot project is comprised of three main areas:

Outreach: The development of a cost-effective farmer extension model promoting conservation-friendly approaches that improve farmers' profits and benefit the environment.

The Farmer Field School methodology is used as a cost effective approach to developing an extension network with Kuapa. The goal is to foster farmer learning by experimentation with known practices to identify those that work best under local circumstances. In effect, this methodology uses farmers to learn and develop the curriculum and, at the same time, turns farmers into the primary forum for advancing the message.

Capacity building: Capacity building within Kuapa Kokoo to strengthen its organization and reach markets.

This component is primarily to improve Kuapa Kokoo's efficiency and effectiveness as a service provider and to prepare for the eventual liberalization of the market in Ghana. Materials have been developed and training given to Kuapa Kokoo societies on group formation, dynamics, election procedures, officers' roles and responsibilities, meeting organization and reporting and on social dimensions of the community, for example, health, nutrition and sanitation. Materials are also developed describing fair trade principles in English and local languages. While fair trade cocoa now only accounts for about 1,000 of 400,000 mt of Ghanaian cocoa exports, it has substantial growth potential.

Research, monitoring and evaluation: To improve understanding of the agroforestry systems, livelihoods and community-Park relations

Research, monitoring and evaluation is to help identify the "ideal" mix of native plants and cocoa plants, balancing productivity issues with greater biological connectivity. The project has also begun the mapping of farms and their relation to remaining forests and protected areas and gathering data about flora and faunal species and their location related to the farms. Socio-economic studies provide information directly from the farmers as to the changes and impacts they see from the program and how that has changed the way they produce their cocoa.

A complement to the program is the Elephant Biology Monitoring (EBM) project. Elephants often trample or destroy crops like maize and cassava planted near the park's borders, creating additional hardships for farmers and increasing human/wildlife conflicts. The EBM team is working to understand the forest elephant population dynamics and feeding patterns to identify why crop raiding is increasing.

Ultimately, cocoa is one of Ghana's principle land uses and is a main cause of forest conversion to agricultural lands. Therefore, it is imperative to engage stakeholders so that the production systems incorporate best cocoa growing practices while maintaining biodiversity.