Environmental Impact Review of the Non-Traditional Agricultural Export Sector in Ghana

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LIST OF ACRONYMS

CEPS	Customs, Excise, and Preventive Services
CRI	Cocoa Research Institute
CSIR	Council for Scientific and Industrial Research
ECOWAS	Economic Community of West African States
EIA	Environmental Impact Assessment
EIR	Environmental Impact Review
EPC	Environmental Protection Council
FAO	Food and Agriculture Organization
FRI	Food Research Institute
GAEC	Ghana Atomic Energy Commission
GEAP	Ghana Environmental Action Plan
GERMP	Ghana Environmental Resources and Management Plan
GIC	Ghana Investment Centre
GIS	Geographic Information Systems
GOG	Government of Ghana
IAB	Institute of Aquatic Biology
IPM	Integrated Pest Management
MOA	Ministry of Agriculture
NEIS	National Environment Information System
NPK	Nitrogen-Phosphate-Potassium
NTA	Non-Traditional Exports
NTAE	Non-Traditional Agricultural Exports
TIMO	Trade and Investment Management Office
TIP	Trade and Investment Program
UG	University of Ghana
USAID	United States Agency for International Development
WRI	World Resources Institute
WRRI	Water Resources and Research Institute

1.0 INTRODUCTION

The production and export of non-traditional export (NTE) products have been promoted by the Government of Ghana (GOG) and international donor agencies with the aim of increasing foreign exchange earnings and diversifying the economy. The proposed Ghana Trade and Investment Program (TIP) is an US $80 million program to be supported by the United States Agency for International Development (USAID) aimed at increasing the capacity of NTEs. The NTE strategy focuses on increasing exports of a variety of high value products that are in demand in temperate countries (and also other African nations), and that are suitable and economical for production and manufacture in Ghana. Policies and institutional capacities have also been established by the GOG to support and facilitate the marketing and export of NTEs.

Non-traditional agricultural exports (NTAEs) are an important subsector of NTEs.[1] The main NTAEs produced in Ghana are pineapples, kola nuts, and yams. Other fruits, vegetables, and nuts are also emerging as potentially important export crops. The growth of NTAEs offers important opportunities for generating foreign exchange, and has strong future economic potential for both small and large-scale producers in Ghana. The realization of this potential requires that attention be given to the impacts of NTAE production on natural resources. NTAEs are not expected to have direct impacts on threatened or endangered species or critical habitats; however, the production of these crops inevitably involves changes in the use of natural resources and impacts of new technologies. In order to secure the success of NTAEs in Ghana, the challenge is to ensure that production is environmentally, economically, and socially sustainable.

This Environmental Impact Review (EIR) is being undertaken as a critical step to begin the assessment of actual and potential impacts of NTAE production on environmental conditions and natural resources. The EIR is required by USAID as part of the preparations for the TIP in Ghana. It summarizes: a) NTAE crops and their characteristics; b) the main environmental impacts and some of their socioeconomic implications; and c) recommended responses, which include policy, institutional, and legislative reforms, a variety of mitigation measures, development of monitoring capabilities, and research activities. The development of these actions and responses is essential to avoid and minimize adverse environmental impacts and to ensure the sustainable use of resources and long term productivity of NTAEs.

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[1] In this context, the concept of 'non-traditional' refers to: a) crops which are 'new' or exotic to Ghana (not produced traditionally in Ghana), or b) crops which have been traditionally produced for local consumption, but are now being exported in foreign markets or in unprecedented volumes.

2.0 BACKGROUND ON NON-TRADITIONAL EXPORT AGRICULTURE

2.1 Overview of Non-Traditional Export Crops in Ghana

Initial results of the government's efforts are encouraging. NTE earning expanded from US $1.9 million in 1984 to $62 million in 1990. The commercial agricultural export subsector, including horticultural products, fish/seafoods, game/wildlife, medicinal plants/seeds, and other agricultural products, is the fastest-growing NTE subsector. In 1991, the value of NTAEs reached $33.93 million (54.24 percent of total value of NTEs), an increase of 17.9 percent from 1990. From 1990-1991, the number of NTAE exporters increased by over 60 percent.

The horticultural products exports, the most vigorous product sector in agriculture in terms of numbers, contributed 24.72 percent of NTAE value in 1991 and continues to show an upward growth. Some of the highest value crops, pineapples, yams, peppers, and coconuts have experienced dynamic growth trends. In addition, kola nuts contributed 2.66 percent of NTAE earnings and other agricultural products accounted for 5.26 percent.

At the end of the TIP program in 1997, it is projected that NTEs will be at least $390 million annually and growing at a rate of 30 percent per annum. The 12 leading NTEs will constitute only 70 percent of the total value (down from the current 85 percent). And the total number of NTE exporters will double from the current 1800 to 3600 in 1996. More specifically, the GEPC projects that pineapple exports will expand from $3.82 million in 1990 to $12.54 million in 1995, and yams from $0.967 million in 1990 to $7.0 million by 1995 (up from $0.183 million in 1988).

The main market for NTAEs is Europe. In 1991, for example, the EEC market (principally the United Kingdom, Holland, and Spain) absorbed 44.53 percent of the total exports by value. But increasingly, Ghanaian products are also reaching markets in Africa, North America, and Asia. For example, in 1991, the ECOWAS markets (primarily Ivory Coast, Togo, and Burkina Faso) accounted for 20.83 percent of total NTAE exports.

Several NTAE products are well-known to Ghanaian producers, since they have been produced for local consumption for many centuries. However, such crops often have special requirements to meet specified quality standards for foreign markets. Many are also perishable, which demand new mechanisms and changes in marketing, packaging, transport, customs, and infrastructure. The timing and quantities of exports must be strategically planned in order to fulfil market demands at optimal times. These requirements place demands for production technologies and processes, including use of specified chemicals -- which create challenges to Ghana's agroexport producers. These kinds of sophisticated production and marketing strategies are necessary to

compete with other exporters in the international market.

The government is attempting to develop and implement policies to promote the growth of NTAEs. These policies include incentives for exporters, such as tax rebates, custom duty exemptions, and a retention scheme. In addition, other planned policies, some to be supported by the TIP, include simplification of export procedures, establishment of market infrastructure, legislation and credit packages for encouraging agroexports, and strengthening institutions such as the Ghana Export Promotion Council (GEPC) and Ghana Investment Centre (GIC).

Marketing bottlenecks, periodic market gluts, along with lack of efficient export and transport processes have been identified as central constraints in the NTAE sector. Therefore, to date, most NTAE projects have emphasized attempts to improve the efficiency and growth of export enterprises and marketing. Little attention has so far been given to natural resource issues which could pose increasing problems if the TIP projections for NTAEs are attained.

Ensuring the sustained success of NTAE production will require attention to natural resource issues and the environmental impacts of certain crops and production practices. If consideration is not given to conserve and rationally use the resource base upon which these crops depend, significant production constraints could emerge in the future.

2.2 Key Agricultural Products and Production Characteristics

2.2.1 Pineapples (Ananas comosus). The leading NTAE crop in Ghana is pineapples. The main variety is Smooth Cayenne. Importers usually prefer half-ripe to ripe fruit, but there is variation in the preferred color. There are no international grading standards for pineapples, but Ivory Coast standards are applied. Pineapples are normally packed by size, appropriately labelled, and transported by air or sea.

Pineapples have been produced for many decades in Ghana as a local crop, but have been commercialized for export in large volumes only in the past ten years. Rainfed pineapple production does well in areas of fair rainfall distribution of annual magnitudes of at least 1000 millimeters. In view of the need to reduce transportation costs and avoid losses, pineapple cultivation for the export market has been largely confined to an area within 50 kilometers of Accra. The favored areas are the hills of the middle Densu Basin, the Akwapim highlands, and other areas in the Greater Accra Region. An estimated 50-80 percent of pineapples exported are produced by smallholders; the remaining is on a few large plantations.

Pineapple production for export involves the clearing of all vegetation, sometimes with the use of a herbicide. The land is

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then ploughed, occasionally with the use of a bulldozer. Commonly, approximately 20,000 suckers are planted per acre.

Pineapple production for the export market is generally chemical-intensive. Usually a balanced fertilizer containing Nitrogen-Phosphate-Potassium (NPK) is applied just before planting or at 4-6 weeks after planting. Ammonium Sulphate or Urea and Potassium fertilizers are also applied at specified times after planting. Pineapples do not tolerate weeds; many farmers use herbicides such as Diuron, and/or with Bromacil. Because mealy bug wilt can spread rapidly, some farmers treat suckers before planting with a systemic insecticide such as Dimethoate, Rixion, Perfecthion, Dimeton methyl, or Phosphomidon. Phytophthora (heart/root) rot is controlled by using Hetalaxil or Aluminium ethyl phosphite. Base rot can be treated in similar fashion or with Captafol. Re-cropped land may be infested with nematodes, which are sometimes controlled with nematicides.

Calcium Carbide is applied to force fruiting. Many farmers add a small quantity of kerosine or Ethrel plus urea to get better results. The fruit is normally treated with ethylene prior to harvest to ensure ripening and good coloration. Fruit is harvested with the stalk trimmed and treated with a solution of Benomyl (Benlate), Thiabendazole, or fungsil Benlate mixture immediately before packing to control watery heart or black rot. Pineapple yields of 25 tons per acre are achieved, but it is estimated that on average only half of the yield is exportable.

A major constraint for increasing production is available capital to purchase suckers and agro-chemical inputs. Few small farmers have capital (or access to credit) to purchase all or sufficient chemical inputs; many pineapples are not of export quality and losses to pests and diseases can be high. Outgrowers rely on their buyers to force and artificially ripen the fruit.

Another problem in pineapple production is market gluts at certain times of the year, which reduces prices and saturates the exporting avenues. Market gluts are attributed to dependency on rainfed production, and constraints of storage, processing, marketing, and transportation. Soil erosion and the heavy use of agro-chemicals also pose serious environmental and health problems discussed later in this report.

2.2.2 Yams (Dioscorea spp.). Tropical root crops, such as yams, cocoyams, cassava, and sweet potatoes are important staples throughout the tropics and sub-tropics in Africa. The two most commonly cultivated yams in Ghana are the white (Guinea) yam (Dioscorea rotundata) and the water yam (D. alata).

The yam varieties grow well on fertile land that is well drained. They adapt well to a climate with a long dry season. The white yam varieties develop and mature for harvest in about 8

months. The "Puna" and "Laborkor" varieties of white yams are highly rated in terms of their tastes and palatability, and are the principal yam varieties exported.

Virtually all of the yam exported is produced by smallholder farmers in the transitional zone in central Ghana. Because of its importance in the local diet, yam production is well known to farmers. Yams for export are monocropped on land cleared of all trees and vegetation. Traditionally, yams are propagated by tuber sections/cuttings. The cuttings and whole tubers are susceptible to bacteria, fungi, insects, and rodents, but are rarely treated with a pesticide. The export markets require small yams weighting 500-1000 grams, which are seed yams produced with non-traditional methods. The main markets are Europe and North America.

Yams for export are cultivated on small mounds or on ridges; between 20,000-30,000 stem sector/cutting are planted per acre. Most yam farms are weeded by hand; herbicides are rarely used. Stalks from split bamboo or tree branches are used to support the yam plants. Yams for export are harvested after 5-6 months with the use of a sharp stick. Maximum care must be taken at harvest and while the tubers are being packed, loaded, transported, and stored; cuts or bruises increase the likelihood of attack by microorganisms, including nematodes, which can cause rot.

In some cases, the inadequacy of availability of yam for seed/section in the right quantities and quality hinders production. More important, the bulkiness of yams which does not lend them to easy handling, storage, and transport represents a significant constraint. In addition, larger markets need to be identified for the yam produced in Ghana.

2.2.3 Kola Nuts. The kola tree grows naturally in the closed-canopy forest. More recently, naturally occurring or planted kola trees have been used to shade cocoa and coffee trees. With the recent moves to increase and formalize export, some old cocoa farms are being uprooted and converted to the cultivation of kola trees, including the use of some hybrid varieties. Large plantations of kola trees have not yet been established. The major producing areas are found in the Ashanti, Brong Ahafo, Central and Eastern Regions.

Kola trees require 4-5 years to mature; they produce for 40-50 years. The kola tree pods are usually allowed to drop from the tree and harvested. The pods are manually opened and the nuts removed. To keep the nuts fresh, they are often sprinkled with ash and wrapped in large moist leaves for transport. Most farmers do not use any chemicals in the production or export processes.

Kola nuts have for many centuries constituted an agricultural export commodity from Ghana, and remain among the most valuable exports to the interior of West Africa. Kola nuts are consumed

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principally in the savannah area, primarily by the Muslim population in the Sahelian nations. The principal constraint to increasing export volume and value are formal markets. The trade has for the most part been informal, although the GOG is attempting to formalize the effort -- especially with Nigeria -- to generate much needed foreign exchange. Recently, quantities of dry nuts have also been exported by sea to Europe and North America to service the growing African and Caribbean communities.

2.2.4 --Palm Oil and Other Agricultural Products. Other agricultural crops have potential to contribute to export earnings, including an assortment of fruits, nuts, vegetables, and spices/herbs. Promising fruits and nuts -- mostly tree crops -- include oil palm, mango, papaya, coconut, banana/plantain, and cashew. The ecological conditions vary for each of these crops. These tree crops are important not only because of their production potential and export value, but also because their cultivation techniques are well known to smallholders. Some tree crops, such as cashew nuts and coconuts, are durable and have longer shelf-lives thereby not restricting production to the Greater Accra Region. Perennial tree crops also protect the soil and reduce the risks of wind and water erosion. These factors bode well for smallholder participation throughout Ghana in export production.

Palm oil and palm kernal oil became important export commodities in the early 1800s. The oil palm tree grows naturally in the closed-canopy forest zone. The export trade in oil palm products has been informal and has fluctuated during the past century. In recent years the cultivation and export of oil palm has increased mainly as a result of government encouragement, export opportunitiers, and the introduction of high and quick yielding varieties. Many smallholder farmers have cleared land and established small oil palm plantations; only a few large plantations exist in Ghana. Hybrid oil palms are usually monocropped; production often involves the use of agrochemicals.

Vegetables such as peppers/chilies, okra, egg plant, beans are in demand throughout the year, both locally and overseas. In particular, there is scarcity in Europe from October to March. In Ghana it is possible to produce many of the vegetables in demand the year round. Vegetable production usually involves the use of agrochemicals including fertilizers and pesticides. Most vegetables have a short shelf-life and must be carefully handled to avoid damage; farms need to be located close to ports to avoid losses in transport.

Finally, two spices with significant potential for export are black pepper and ginger. Black pepper are found growing wild in the closed-canopy forest zones. Both spices can be commercially grown in the Eastern and Western Regions and areas along the fringes of the closed-canopy forests of Kintampo, Wenchi, Sunyami, and Kete Krachi.

3.0 ENVIRONMENTAL IMPACTS OF NON-TRADITIONAL AGROEXPORT CROPS

3.1 Introduction

The production of non-traditional agroexport crops directly depends upon, affects, and is affected by the natural resource base. A full understanding of NTAE production and its potential in Ghana requires knowledge of the environmental impacts of these crops, including repercussions on vegetation, soils, water, human health, and the wider ecology and society. These impacts influence productivity, yields, profitability, and long term viability of NTAE crops.

The specific environmental impacts of non-traditional agroexports vary considerably and depend largely on the type of crop, production technologies, and agroecological conditions. As will be described in this section, some of the production practices degrade the natural resources, and the resulting negative impacts may constitute high costs to producers, which jeopardize the potential to meet the production goals set by the TIP. These problems therefore require mitigation measures. When the negative impacts result in off-farm degradation of resources (i.e., 'externalities'), they represent high costs to society more broadly. In contrast, some environmental impacts may be neutral or even positive, if, for example, the production practices facilitate soil conservation or enhance agroecological diversity; and these cases offer lessons for sustainable achievement of the TIP production goals.

3.2 Principal Types of Environmental Impacts in NTAE production

It is important to characterize and assess the diverse types of environmental impacts in the NTAE sector, analyzed below.

3.2.1. Deforestation and Land-Use changes

The cultivation of some NTAE crops often entails clearing of land that is under forest cover. With the expansion of NTAE production as projected in the TIP, deforestation is increasing, and is also expanding into hilly areas, even in steeply-sloped marginal land unsuited for cultivation. Deforestation in Ghana is occurring at a rate of 25,000 hectares per annum. This is contributing to land degradation and soil erosion which can undermine production. (See next section.) This kind of land clearing is thus inappropriate and counterproductive. It is not known what specific rates of deforestation are attributable to NTAE production alone; but it is clear that the process will intensify in the future, if measures are not taken to control the expansion of NTAE production into forested and sloped land.

The problems associated with deforestation are particularly evident for pineapples and yams. The common use of wood stakes in

yam production also entails expanded exploitation of forest resources. It has been estimated that approximately two acres are deforested for every one acre of yams produced. On the other hand, kola nuts are grown in trees and on agroforestry systems which are better suited to maintain vegetative cover and crop diversity, while simultaneously utilizing the soil productively.

In other areas, the growth of NTAE production does not entail clearing of forested land, but instead involves conversion of diverse subsistence crops or grains to the new crops in monoculture systems. These land use changes may reduce the diversity of crops and vegetation in a given area, and may reduce the availability of food crops for local consumption.

Detailed data is not available on the transformations of land use that have occurred for NTAE production, and more information is clearly needed to understand the extent of deforestation and the repercussions of crop substitution.

3.2.2 Soil Capability and Erosion

Ghana is naturally endowed with a variety of soil resources suitable for agriculture, but optimal production of NTAE crops requires utilization of particular soil types, nutrients, and climatic conditions. Analyses have been undertaken in Ghana to determine soil capability for specific NTAEs. For this purpose, the country has been divided into five main agroclimatic zones. Characteristics of soil texture, structure, depth, and fertility must be adapted to the type of crop. If producers do not cultivate NTAE crops in areas which have appropriate soils, production can suffer and soil degradation may occur as well.

For example, in pineapple production, the soils must have moderately structure, loam to sandy texture, high organic content, and responsiveness to fertilization. Pineapples therefore can be grown in the semi-deciduous rain forest zone and the grass savannah zone. Black pepper, on the other hand, require deep soils acid soils, which are well to moderately well drained, high annual rainfall, and preferably soils with high organic content. Mangoes require soils with sandy clay loam to clay loam topsoils, high organic content and nutrient contents, and do not tolerate high salinity. If these crops do <u>not</u> have these soils conditions, their yields and quality will decline. Therefore, ensuring an appropriate match between the crops and the agroecological and resource capacities is critical.

Most of the upland soils described as 'suitable' for non-traditional export crops are fragile and susceptible to soil erosion hazards, especially when large tracts are cleared for agriculture. Soil erosion is evident throughout much of Ghana; over half of the land under production is subject to erosion. This area is likely to expand with the increase of NTAE production as

projected in the TIP. Soil erosion is particularly severe in NTAE farms when producers cultivate in steep areas and do not use soil conservation practices. For example, in some areas of pineapple production, analysts have noted that farmers' failure to plant on the contour has provoked erosion. Soil erosion leads to degradation of soil structure and declining fertility over time, resulting in internalized costs to farmers. It also can provoke off-farm damages to other farmlands and resources. For example, soil runoff into the Densu river has increased with the expansion of NTAEs. Siltation of the river disrupts fisheries and causes water pollution.

In addition, when cultivation and other farm practices are mechanized for a long period (as in large-scale pineapple production), the subsoils tend to become compacted. When this happens, the exploitable volume is reduced as air and water and roots cannot penetrate through the compacted layer. This condition induces soil erosion and again, hinders production. Furthermore, the use of bulldozers to level the land in pineapple production can shift topsoil in harmful ways.

3.2.3 Pesticide Use and Repercussions

For several NTAE crops, producers use considerable volumes of pesticides, including insecticides, nematicides, fungicides, and herbicides, for controlling a variety of pests and diseases. Producers perceive a necessity to use chemicals in order to meet phytosanitary standards, quality standards, and yield goals for external markets. The use of pesticides is especially prevalent and high in perishable crops such as pineapples, vegetables, and mangoes, which are subject to stringent quality controls. Large-scale monocultural plantations tend to use the largest amounts of pesticides per hectare, partly because homogeneous conditions that tend to be more susceptible to pests, and because they have strong pressures for increasing yields. For example, as explained earlier, numerous pesticides are used in fresh pineapples for export. On the other hand, pineapples produced for juicing or canning (rather than for fresh export) do not require as high quality, and therefore usually entail lower use of pesticides. Moreover, pesticides are rarely used for kola nuts and for yams.

Preliminary investigations and observations of agrochemical use in pineapples and other export crops in Ghana suggest that pesticides are frequently applied inappropriately -- for example, mixing chemicals incorrectly, using faulty equipment, applying ineffective products, or applying wrong dosages or at inappropriate times. Moreover, pesticides are often applied unsafely. For example, users have been observed without protective equipment, mixing pesticides with their bare hands, spraying without shoes, and reusing pesticide containers.

Such problems of pesticide misuse are particularly evident among smallholders. The reasons for the problems are largely related to the users' lack of information about alternative non-chemical methods of pest control, their lack of experience and information for safe and effective agrochemical use, and their lack of capital for purchasing appropriate equipment and products. Although smallholders in Ghana may be familiar with NTAE crops such as yams, kola nuts, and even pineapples, the switch to commercial production often obliges them to use chemicals with which they are often unfamiliar. Furthermore, both small and large-scale farmers tend to use pesticides as a 'weapon,' sometimes believing the myth that 'more is better,' rather than using chemicals judiciously and selectively.

These chemicals are very expensive, signifying a large cost burden on producers. In addition, several negative effects emerge from the inappropriate use of pesticides in NTAEs:

a. Residues in products: If pesticides are applied in excessive dosages or too close to the harvest time, the residues accumulate in the fruit in levels that exceed the residue standards established by governments of importing countries. Consequently, when such a violation is detected in the import inspection process, the entire shipment of the product is rejected for import, resulting in serious financial losses to the producers. This form of rejection from pesticide contamination has happened rarely in Ghana, but has occurred in numerous other countries where NTAEs are being promoted, and the rejections have resulted in losses of millions of dollars. It will become an increasingly serious risk to Ghanaian producers, with the rapid expansion of NTAEs and the increase in pesticide use. The problem of residue accumulation in products is particularly serious for persistent pesticide products, such as organochlorines; and residues in excessive levels also pose health hazards to the consumers.

b. Contamination of Water, Soil, and Vegetation: Some kinds of pesticides also accumulate in the wider environment -- in the water, soil, and vegetation, and air; and when they are used irrationally, they may result in pollution/contamination problems. For example, it has been reported that some small pineapple farmers have harmed their own crops and vegetation in their farms when they have used herbicides that are unsuited for the particular weed, or used with improper dosages. Pesticide contamination of the Densu River is suspected from the runoff of pineapple plantations. Soils in pineapple plantations also may be harmed with the accumulation of toxic nematicides which disrupt the useful functions of natural soil microorganisms over time. The extent of kinds of problems require further examination, and measures are needed to avoid such hazards.

c. Harm to Users' Health: Pesticides can also harm the health of those who apply the products and other people who are exposed. The

types of health impacts from pesticide exposure are categorized into acute and chronic damages. Acute effects are primarily poisonings, associated with symptoms such as vomiting, fever, vertigo, diarrhea, delirium, muscular convulsions, neural damage, or even death; and they are provoked usually by direct exposure to toxic products. The number of pesticide poisonings in Ghana per year is not known, but the incidence of the problem is likely to increase as the use of pesticides increases in NTAEs. Chronic effects include longer term impacts that are caused from exposure to pesticides, and they include headaches, allergies, dizziness, dermatitis, blurred vision, or mutagenic or carcinogenic effects that emerge over the long term. These health damages from pesticides are borne mainly by agricultural workers and small farmers, i.e., the poorest and most vulnerable in rural areas. The causes of the problems are often due to unsafe use of the products, peoples' lack of knowledge of the dangers, and similarly, gaps in the provision of information by pesticide distributors. The risk and numbers of poisonings and chronic damages from chemicals will increase with the expected growth in NTAE production, if measures are not taken to ensure rational integrated pest management and safe chemical use.

d. Resistance - The 'Pesticide Treadmill': Finally, a significant long-term effect and risk of pesticide use is resistance of pests to products. It is well-known to scientists that pests develop resistance to chemicals, as a result of basic genetic selection processes, and therefore, the pesticides lose efficacy over time. Farmers' response is often to increase pesticide applications; yet, this tends to aggravate resistance. This phenomenon can trap farmers into 'addiction' to pesticides the are ineffective, leading to high economic losses. The incidence of resistance in pineapples and other NTAE crops in Ghana has not yet been documented, but this situation has occurred in other countries and inevitably will occur in Ghana as well, if chemical-intensive production methods are continued.

In sum, these actual and potential negative impacts from pesticides create high costs and risks which can offset economic returns. Avoiding these kinds of problems is possible (and is essential), through integrated pest management methods and only minimal safe application of pesticides. Furthermore, all of these negative effects can be avoided in crops such as Kola nuts and yams that rarely use pesticides. In this sense, Kola nuts and yams appear to be more ecologically compatible and less expensive than crops that are more chemical intensive.

3.2.4 Impacts of Fertilizers

Although the use of fertilizer may be useful and needed in some crops for contributing to increases in yields and quality of products, the improper use of fertilizers can have negative impacts on production as well as harmful off-farm effects. In particular,

when pineapple farmers use fertilizers excessively or with an inappropriate nutrient balance, the fruit of the pineapple may be harmed. Incorrectly balanced fertilizer applications will create a wrong level of sweetness and shortened shelf-life of pineapples that are required for export standards.

In addition, chemical fertilizers are easily washed off by rain into streams, rivers, and other areas, where they become sources of pollution. When deposited into rivers and streams, heavy loads of chemical fertilizers contribute to an increased growth of vegetation and weed, leading to eutrophication and reduced water volume. This disrupts fish and aquatic life, as well as reducing water available for human consumption. A recent chemical analysis of the Densu River outside of Accra revealed pollutants from chemical fertilizers, especially near the urban area. An expansion of NTAEs to the production goals projected in the TIP is likely to exacerbate this problem (meaning high costs to society), unless steps are taken to prevent this pollution.

3.2.5 Agroecological Diversity Impacts

Although the promotion of NTAE crops is intended partly to encourage 'diversification,' ironically, the conversion of local food production to NTAE production sometimes entails a switch from heterogenous production systems (with a diversity of crops and vegetative types), to monocultural (or less diverse) systems. Moreover, standardized varieties and uniform genetic stock are required by international markets in many cases. This reduction of diversity within agroecosystems may have some advantages for economies of scale and efficiency, but the reduction of crop diversity can increase vulnerability of the agroecosystem to pests and diseases, reduces the nutrients in the farming system, and simultaneously may increase economic risks of production to farmers who depend on a single species or crop. Conversion to new standardized seeds may also mean the loss of indigenous seed varieties. In the case of Kola nuts, however, production generally maintains a diversity of crop species, since they are commonly intercropped with cocoa trees; and this type of agroforestry system therefore has agroecological advantages.

In sum, the main environmental impacts outlined above need careful consideration in the overall TIP program. There are multiple causes underlying the problems identified in this sector. One significant cause is the tendency of farmers to focus on short-term yield maximization in NTAE production. Other causes include lack of information, training, and policies concerning sound use of resources and agrochemicals in NTAEs, and gaps in research and institutional capacities. Addressing these environmental impacts and their causes is critical to ensure that the TIP goals are achieved in a sustainable way.

3.3 Socioeconomic Implications

The development of NTAE production in Ghana involves unique socioeconomic impacts that are interrelated with the environmental factors in some situations. In particular, it is important to consider the distribution of benefits of NTAE production -- i.e., who are the main beneficiaries of NTAEs? how is it contributing to local economic and social development?

One of the unique characteristics of NTAE production in Ghana is that a large proportion of production is by small scale producers. Although specific survey data is not available on the land tenure situation in NTAEs, initial rough estimations suggest that 80-90 percent of the total value of NTAEs are from small scale farmers. In fact, some of the crops are 'traditional' to smallholders, for internal markets. For example, small farmers have been producing Kola nuts, yams, and sometimes pineapples for generations for their own consumption, so the switch to export production in these crops offers them special opportunities. In these cases, the small farmers are 'outgrowers' who sell their produce to the large buyers and exporters. Furthermore, the Ghana Export Promotion Council has formed 'Export Production Villages' in five areas, which help support NTAEs for small producers. In sum, early indicators suggest that the NTAE sector appears to benefit a broad spectrum of farmers throughout Ghana.

At the same time, however, Ghana has several very large-scale NTAE producers, particularly in pineapple plantations, who have a growing share of the total land in pineapple production. These large land holders/exporters have influential and prominent positions in the NTAE sector, tend to have high levels of efficiency and productivity, and also have access to capital, technology, marketing connections, and other infrastructure required for export production. It appears that these large scale producers have a competitive advantage to small farmers in some cases, in terms of their efficiency, market access, and economy of scale. Some analysts have suggested that a new land market is being created, and a land-consolidation process is occurring in parts of the pineapple-growing region. Apparently, some smallholder pineapple farmers are cultivating further into hilly areas, on increasingly marginal land. This process contributes to deforestation and land degradation, as mentioned earlier, and can hinder their productivity and access to markets.

Both small and large-scale farmers have to adapt their production practices to new standards and requirements for export markets, but small farmers face special constraints in this situation. Poor farmers often lack access to information and inputs for NTAE production, and therefore may be unable to meet the quality criteria. They also tend to lack resources and information for safe and rational use of agrochemicals (as noted earlier), so that they are particularly susceptible to problems from

agrochemicals. The small NTAE farmers have not been given attention and technical assistance that they need.

Furthermore, NTAE production has potential to generate off-farm employment and small rural industries in some situations. In other countries (especially in Central America), the growth of small processing industries, such as canning or juicing factories, has made a substantial impact to the NTAE sector. In Ghana, the expansion of such processing plants could increase socioeconomic benefits (if planned carefully) and could also avoid the risks of exporting perishable crops, as well as adding value to the product before it is exported.

In sum, addressing these socioeconomic issues as well as the environmental impacts, can help promote the sustainable and equitable development of NTAE production in Ghana.

4.0 RESPONSES TO ENVIRONMENTAL IMPACTS IN NTAE PRODUCTION: RECOMMENDED POLICY REFORMS, MITIGATION, MONITORING & RESEARCH

The above overview of actual and potential environmental impacts suggests that policy reforms, mitigative actions, and monitoring activities are needed - if the TIP production goals are to be achieved in a sustainable and productive way. It is also clear that more research is needed to acquire complete information on the environmental impacts. These necessary initiatives, summarized below, will require coordination and a leading responsibility by the Environmental Protection Council. They will also require actions and collaboration by several public institutions, farmers, and the private sector.

4.1 Policy, Institutional, and Legislative Reforms

The present encouraging performance of the NTE sector can only be sustained through a sound policy, legislative, and institutional framework. The existing policies in agriculture, trade, exchange rates, and the environment generally favor expansion in non-traditional agroexports. The NTE policies should coincide with the government's broader policies promoting decentralization and private sector expansion, and the National Environmental policy which seeks to reconcile economic development and resource conditions. However, these broad policies need to be harmonized to avoid and/or reduce undesirable land use conflicts and adverse environmental impacts.

4.1.2 EPC Involvement in Policy Dialogue on NTAEs

Institutions involved in the various aspects of the NTE process include GEPC, the Ghana Investment Centre (GIC), Customs Excise and Preventive Services (CEPS), and Ministries of Trade, Tourism, and Agriculture. In order to sustain and plan the

successful and sound expansion of NTAEs, policy dialogue and coordination is needed among these organizations. This kind of interaction may be assisted through the proposed 'Trade and Investment Management Office' (TIMO). The Environmental Protection Council (EPC) should be involved as an active member in the policy dialogue and decision-making of the TIMO. Non-government organizations or associations (e.g., the Horticultural Association) should also be involved in the NTE policy formulation. Any policy changes proposed in the policy dialogues must be analyzed in terms of their environmental impacts and their fit with the promotion of sustainable growth of NTEs.

4.1.2 Legislative and Policy Enforcement Reforms

Other policy reforms may be needed to help mitigate negative environmental impacts and to ensure the sustainability and equity of NTAE production. In particular, legislative or regulatory reforms may be needed in the following areas:

- land use policies to prevent deforestation and cultivation of marginal steeply-sloped lands and watersheds for NTE production;
- improved enforcement of pesticide policies and laws to avoid the negative impacts and ensure sound use of chemicals;
- policy incentives to encourage alternative non-chemical means of pest control, soil conservation, and agroforestry;
- improvement of infrastructure and marketing policies for NTAEs, especially to meet the needs of small farmers;
- review of land tenure policies, to ensure secure ownership and sustainability of production, especially for small producers;
- environmental standards that pertain to pollution levels in rivers and foods, and mechanisms to implement the standards, aimed to mitigate the off-farm impacts.
- establishment of guidelines for environmental impact reviews to examine new activities and investments that affect NTAEs.
- policy support for subsistence and local markets, to ensure food self-sufficiency and local nutrition needs -- to balance the support being directed to exports.

All of these policies aimed to improve the sustainability of NTAE production should be incorporated into the TIP planning and policy, in order to achieve the overall objectives of the program. If focus on yield maximization and financial targets is pursued at the expense of the natural resource base, NTE expansion may be jeopardized. Changes are needed to ensure a harmonious policy framework for sustained production.

4.1.3 Institutional Strengthening

Activities concerning mitigation of environmental impacts of NTAEs coincide with the interests and activities of the Environmental Protection Council (EPC). However, some changes and

improvements of capacities will be needed to strengthen the EPC to pursue policy-related work, mitigation measures, and monitoring for NTAEs. Moreover, efforts will be needed to build coordination among other institutions working on environmental issues, which are listed in the final section of this review.

4.2 Mitigation Measures

The negative environmental impacts of NTAE production may be minimized or prevented through the adoption of mitigation measures related to land use, soils, agrochemicals, agronomic practices, and training. It should be realized that some of these problems are found not only in the NTE sector; they require changes in the broader agricultural field. The following measures are therefore recommended to ensure success of NTAEs:

4.2.1 Training and Education on Sound NTAE production

The increasing production of NTAEs has necessitated the need to organize workshops and training for NTAE farmers, grower cooperatives, plantation owners/managers, workers, and extension agents. Educational opportunities for long-term courses and degrees, as well as short-term courses, will contribute to the overall productivity and sustainability of NTAE crops. The government, universities, donor agency, and private sector need to contribute support to training and educational programs. The main coordinating bodies should include the Ministry of Agriculture, the EPC, and the programs should last at least four years. The following specific areas should be trained and encouraged in NTAE courses:

a. Sound Land Use -- including land-use planning, sustainable use of NTAE land, good tillage methods, agroforestry practices, and use of beneficial tree crops such as kola nuts in agroforestry.

b. Soil Conservation and Fertility -- i.e, measures to avoid erosion and ensure soil conservation and soil fertility in NTAEs, including strip cropping, cover cropping, mulching, alley-cropping, intercropping, ploughing and ridging along the contour, rational and appropriate application of fertilizers, restricted use of agricultural machinery in areas with fragile soils or slopes, and soil capability analysis.

c. Management of Pests and Pesticides -- especially Integrated Pest Management (IPM) in NTAEs, safe and rational pesticide use to avoid the negative impacts of pesticide use, with an emphasis on non-chemical methods that are feasible and economical, and use of pest monitoring and threshold analyses. (Special attention needs to be given to workers who tend to lack information.)

d. Other agroecological practices -- including rational use of water, fertilizer, and organic manures, nutrient management methods, and selection of varieties.

4.2.2 Extension Services for NTAE Production and IPM

Also important is the need to develop reliable extension services for NTAE producers, especially to serve the needs of small farmers. Presently, producers have mentioned that lack of expert advice is a major constraint, and they have to seek expertise and information from other countries on specific agronomic issues in NTAEs. Often, such information is expensive and difficult to acquire. Extensionists need to give special attention to sustainable and environmentally sound practices which will contribute to productivity gains -- including sound land use, soil conservation, IPM and pesticide management, as summarized above. The main implementing institution for this should be Extension Services of the MOA, but more resources and people will be needed to strengthen their expertise. The private sector may have a collaborative role as well.

4.2.3 NTAE Processing and Transport Needs

Capital, technological capacities, and infrastructure are needed to develop processing -- i.e., canning and juice-making -- as well as maritime transport for NTAEs. These capacities are particularly crucial for pineapple, because fruit produced for canning and juicing have less strict requirements than <u>fresh</u> fruit exports, and in turn, this fruit would use lower inputs of chemicals in production. Also, shipping by boat rather than air enables exporters to export different quality of fruit that can be produced with less chemicals. At the present time, a great deal of fruit is rejected because it does not meet fresh fruit quality standards, but it <u>could</u> be exported if the fruit was canned or made into juice. There are very few processing companies in Ghana; and building this capacity could add value to crops, increase NTAE earnings, and avoid waste of NTAEs, as well as reducing expenses and potential problems from agrochemicals.

4.2.4 Activities of Decentralized Government in NTAE issues

The government of Ghana has long been concerned with the devolution of administrative responsibilities and political authority for local development and environmental management. NTAEs present new environmental opportunities and challenges that should be known to district authorities for appropriate planning and policy law formulation. A series of workshops can be organized at the district level to discuss the environmental and socio-economic impacts of increased NTAE production.

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4.5 Development of Monitoring Capacities

An important way to help achieve the TIP targets in NTAEs in a sustainable way and to avoid adverse impacts is to develop an effective monitoring system. There is a need for improved knowledge about the resource factors, capabilities, and interacting elements that affect and emerge from NTAE production.

A fair amount of environmental data and information already exists in Ghana. However, these are scattered, uncoordinated, and inadequate. A major shortcoming of the monitoring system is the lack of a common framework and collection center. In addition, data collected does not provide complete information on the social, cultural, and economic aspects of the human environment.

Monitoring of the impacted areas of agroexport crops should be carried out by a number of government ministries, departments, and research institutions in a coordinated way. These agencies have specific mandates which control their routine activities. Their mandates should be modified in order to include monitoring of indicators pertaining to the sustainability of NTAEs.

In order to ensure effective monitoring and evaluation of the agroexport sector, the establishment of a National Environment Information System (NEIS) within the EPC as proposed under the Ghana Environmental Action Plan (GEAP) is timely. The NEIS is administered by the EPC, but is a network of information centers and institutions that work in the environmental field. All institutions participating in the monitoring and those gathering other environmental data will be required to furnish the EPC with prescribed data periodically. The NEIS has already started performing in a limited way. Its main functions are:

a. to provide an information referral service on a wide range of environmental subjects;
b. to serve as a readily accessible archive of homogenous data sets on environmental quality;
c. to provide organized data on the state of the environment through publications and other means and to serve as information support for development planning;
d. to provide a means for early warning and evaluating the impact of development and environmental activities;
e. to provide inputs for environmental education programs.

The main services to be provided by the NEIS will include referral, data bank, data synthesis services, and publication and information support. The EPC with other agencies will prepare annual National Environmental Data Reports and other information. The reports will provide data on the quality of the environment and natural resources, and they should include specific sectors of the economy, including the production of agroexport crops.

Increased activities on NTAEs will imply additional responsibilities for institutions involved in monitoring, evaluation, and other activities. Special measures may be needed to ensure the incorporation of monitoring procedures that pertain to environmental impacts of NTAEs in the NEIS. The institutions that will collaborate with the EPC in the monitoring include:

- Ministry of Agriculture (Crop Services, Research and Extension and Plant Protection and Regulatory Services)
- Plant Protection and Regulatory Services
- Institute of Aquatic Biology, Council for Scientific and Industrial Research (CSIR)
- Water Resources Research Institute, CSIR
- Food Research Institute, CSIR
- Soils Research Institute, CSIR
- Department of Geography and Resource Development, UG
- Ghana Atomic Energy Commission
- Environmental Protection Council.

The Ministry of Agriculture has statutory responsibility for agricultural activities and the respective departments identified perform general roles which pertain to the production of NTE crops, eg. with respect to crop species and yields, extension services, and application of agrochemicals.

The research institutes of the CSIR have specific mandates governing their activities. Their participation in research and monitoring activities with respect to the NTE sector will exert extra pressure on their already limited resources. The Geography Department of the University of Ghana, the Ghana Atomic Energy Commission (GEAC) and the EPC have similar and important roles to play in promoting greater productivity within the non-traditional export commodity sector. However, the quality and reliability of their service delivery system falls short of what is required in a growing NTE sector. This is due mainly to the inadequate resources. The institutions need additional resources to enable them to render useful services. For example, the EPC could benefit from training in data management and analysis.

For effective monitoring of changes in the quality of land and other natural resources, baseline data and information will be systematically assessed and measured on several indicators. The indicators must be carefully selected to ensure they correspond to the environmental impacts of NTAEs. Following is a partial list of suggested indicators for monitoring.

a. Land-Use Trends
   - Deforestation (location and rates) in NTAE area
   - Changes in natural versus cultivated area
   - Changes in vegetation (maps, Geographic Information)
   - Cropping/fallow periods
   - Introduction of new land uses.

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b. Measures in Soils
   - Erosion indicators
   - Soil fertility measures
   - Soil capability (agricultural potential) analysis

c. Data on Agrochemicals and Pest Control
   - Volumes and types of agrochemicals used in NTAEs
   - Residue levels in products
   - Agrochemical levels in soils and water with special attention to pollution in the Densu River
   - Pesticide poisoning and other health impacts
   - Data on integrated pest management methods
   - Monitoring of pest resistance

d. Agroecological Data
   - Agricultural yields
   - Crop species
   - Crop diversity indices on cultivated land
   - Biodiversity indices on fallow fields
   - Appearance and frequency of indicator species

4.6 Research Gaps

The NTE strategy has been implemented for 10 years. The full range of environmental and socioeconomic impacts of NTAEs are not well understood or are unknown. As the TIP aims to increase the production of NTAEs, it is urgent to improve data and understanding in this area. Several research priorities can be identified. The priority issues, in order of importance are:

a. Local Environmental Impacts of NTAEs.
   (Research by: Environmental Protection Council, Accra, and the World Resources Institute, Washington DC)
b. Agrochemical Use and IPM in NTAEs
   (Research by EPC, GAEC, MOA, FRI, FAO, and WRI)
c. Impacts of Pineapple Production on the Akwapim Hills
   (Research by: EPC and Dept. of Geography, UG)
d. Environmental Impacts of Yam Production in Fragile Zones
e. Improved Production of Traditional Crops
f. Natural Resource Accounts
g. Private Sector Research activities

5.0 CONCLUSION

In sum, carrying out the responses identified in this section -- including policy and institutional reforms, mitigation measures, monitoring activities, and research activities -- is needed to avoid degrading resources in the NTAE sector. They are also necessary to work towards the export goals of $390 million by 1997 in the TIP. Giving serious attention to environmental considerations is critical to ensuring the sustainability and productivity of NTAEs and to benefit Ghana in general.

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7.0 ADDITION

7.1 Specifics on Research concerning Environmental Impacts

This section consists of summaries of the major research areas which should be developed regarding the environmental impacts of the NTAE sector in Ghana. They are listed in order of priority. The summaries also identify institutions that would be involved in such research endeavors, and estimated funds required. These figures should be seen as tentative estimations.

a. Local Environmental Impacts of NTAEs. More detailed analyses of the local-level environmental impacts of the increased production of non-traditional agroexport crops are needed. Included should be the effects of the environmental impacts on the local socioeconomic conditions. The results of such an investigation should be shared with both district and national policymakers as well as the development assistance community and can be sued to help identify specific measures to prevent adverse impacts. The EPC in collaboration with the World Resources Institute (WRI) has recently launched an effort that will address some of these issues.

Implementing Institutions: EPC with technical support of WRI

Duration: 3 years

Estimated Funding Levels: $20,000/per year x 3 = $60,000

b. Agrochemical Use and IPM in NTAEs. More information is needed on the use of herbicides, fertilizers, pesticides, fungicides, and nematicides in the production of non-traditional agroexports; chemical residues in NTE crops, particularly pineapples and pepper/chilies; and contamination of soil and water resources. The FAO in collaboration with MOA and EPC has established a facility at GAEC to determine pesticide levels in agricultural produce, but more resources are needed to strengthen capacities of this facility and its functions for NTAE analyses. Particular attention should be paid to the use of agrochemicals by small farmers involved in NTAEs. The study should build on the initial study on pesticides by the Friends of the Earth in Ghana, and it should be aimed to identify feasible alternative pest management (IPM) methods and measures to avoid problems.

Implementing Institutions: EPC, GAEC, MOA, Food Research Institute (FRI), with WRI

Duration: 3 years

Estimated Funding Levels: $40,000/per year x 3 = $120,000

c. Pineapple Production on the Akwapim Hills. A special study should be conducted on the changing land use patterns in Akwapim South District. The area is the site of significantly increasing cultivation of pineapples and hot pepper. Particular attention should be given to changes in land tenure, erosion levels, and changes of vegetation and crops. Some of the information can be obtained from GIS and other remotely-sensed data, although ground-truthing and more detailed information on NTAE production and local socio-economic activities will require fieldwork.

Implementing Institutions: EPC and Dept. of Geography, UG. The two institutions are involved in Ghana Environmental Resource Management Project (GERMP) which will establish the required framework for such study.

Duration: 4 years

Estimated Funding Level: $30,000/per year x 4 = $120,000

d. Yam Production in Transitional Zones. There is urgent need to assess the rate of deforestation emanating from yam production for export in the fragile transitional zones of Ghana. Research findings in this area can be used to determine the extent and repercussions of deforestation, as well as potential mitigation measures.

Implementing Institutions: EPC, MOA, Forestry Department

Duration: 2 years

Estimated Funding Levels: $20,000 per year x 2 years = $40,000

e. Improved Production of Traditional Crops. Many of the emerging NTAEs in Ghana are traditionally cultivated by smallholder farmers or naturally-occurring and simply harvested, including kola nuts, coconuts, yams. As the demand for these crops increases, there will be the need to developed improved production means. Research should be conducted to examine the future demand/supply of these crops and to ensure the improved production means and/or value-added efforts that are developed are ecologically sound and environmental safe.

Implementing Institutions: MOA, Cocoa Research Institute (CRI)

Duration: 2 years

Estimated Funding Levels: $20,000 per year x 2 years = $40,000

f. Natural Resource Accounts. The common indicators of economic growth throughout the world are flawed because they ignore the costs of natural resource use. It is important for the government of Ghana to recognize the impacts economic growth has on the

resource base. Research efforts should be made to undertake economic valuation of natural resource conditions and develop natural resource accounts for the principal natural resources affected by NTAE production, including soils, water, and forests.

Implementing Institutions: Department of Economics, UG

Duration: 3 years

Estimated Funding Levels: $25,000 per year x 3 years = $75,000

g. The Role of the Private Sector. On-going privatization efforts by the government of Ghana, including the promoting of NTAEs, means an increasing role for private enterprises to become aware of and participate in natural resource management and ecological restoration and environmental reclamation efforts. Research should be conducted to examine alternative means for private-sector participation in environment management. The efforts should include workshops and/or roundtable discussions with for-profit organizations.

Implementing Institutions: Ministry of Agriculture and private sector companies

Duration: 2 years

Estimated Funding Levels: $10,000/year x 2 years = $20,000

7.2 Tentative List of Priority Actions for Funding

Of the actions, measures, and research activities mentioned in this report, the following are identified as important priority actions on environmental impacts, which require funding. Preliminary estimates of funding levels are also noted:

1. Support of Policy and Institutional Measures ($60,000)
2. Training and Education on Sound NTAE production ($80,000)
3. Extension Services for NTAEs and IPM ($150,000)
4. Monitoring Capacities on Environmental Impacts ($60,000)
5. Research on Local Environmental Impacts ($60,000)
6. Research on Agrochemical Use in NTAEs ($120,000)
7. Research on Environmental Impacts of Pineapple Production in the Akwapin Hills ($120,000)
8. Research on Yam Production in Transitional Zones ($40,000)
9. Research on Improved Production of Traditional Crops ($40,000)
10. Development of Processing & Transport Capacities ($200,000)
11. Activities of Decentralized Government on NTAEs ($20,000)
12. Research on Natural Resource Accounting for NTAEs ($75,000)
13. Research on Private Sector activities ($20,000)