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**Desertification in Eritrea:
Causes, Status Report, Solutions
and Current Outlook**

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A paper presented by Kiflom Michael KAHSAY
State of Eritrea

Desertification in Eritrea

Introduction

Eritrea is located in the north-eastern part of Africa, covering a land area of 124,432 km². Its altitudes range from 60 meters below sea level to 3,180 m above sea level. A century ago, Eritrea was endowed with an abundant wildlife and vegetation, but due to mismanagement during the successive periods of colonial rule, the long armed struggle leading to independence and recurrent droughts, these natural resources have declined dramatically. Forest resources in particular, which are an integral part of the natural resource base of the country, have been devastated.

The vegetation which once covered some 30% of the total land area of the country has been drastically reduced in less than a century. By 1952, that figure had declined to 11%, and in 1960 the forest cover was estimated 5%.¹

Eritrea has wide range of ecological conditions due to its topography. This provides it with a multitude of environmental opportunity to have a diversity of vegetation. Some of its areas which are at higher altitudes are covered in mist for extended periods and this enables moisture-demanding species such as *Aweli*, *Kiliaw* and *Tahses* to grow there.

Temperatures are relatively low in the highlands whereas in the lowlands it is generally hot and arid. Along the coast, the climate is hot and the vegetation is influenced by the salinity of the soils and water. As traditions among the people of Eritrea vary significantly from one part of the country to another, land use practices also differ to a great extent, not

¹ Pagini, 1952. (Cited in) Bein and others. Useful Trees and Shrubs in Eritrea. “*Identification, Propagation and Management for Agricultural and Pastoral Communities*”, Technical Handbook No 12. Regional Soil Conservation Unit (Nairobi: 1996)

only because of different ecological conditions but also because of socio-cultural differences. Those and other factors have contributed to the depletion of the Eritrean vegetation and led to desertification.

As a consequence, this resource exhaustion has resulted in shortages of wood for fire, construction of houses, excessive soil erosion, vanishing wildlife and general environmental degradation and desertification. Some of these trees and shrubs which had been potentially and economically valuable to the society were extinct and some are in the verge of extinction.

To combat this alarming situation, the Ministry of Agriculture of the State of Eritrea is carrying out intensive afforestation activities in cooperation with Ministry of Education, Eritrean Youth and Student Association, local Administrative and people's participation and along with non-governmental organizations and line ministries. The success of these efforts, however, depends on appropriate policy options, strategies and technical inputs such as species selection for different sites, production of healthy and good-quality seedlings and post-planting management. In order to do this, appropriate sensitization within the society and coordination among all the stakeholders is required.

This paper will discuss some issues concerning to Eritrean vegetation distribution by zones, causes of their desertification, government policy and strategy taken to tackle them, suggested options for solving desertification and finally will recapitulate with conclusion.

Distribution of Vegetation

Eritrea is classified into six ecological zones based on altitude, vegetation, and other ecological and geographic factors. Based on different researches made by different scholars in Eritrean biodiversity such as Bein, the Eritrean vegetation could be viewed from an angle

of six zones.²

1. Central Highlands Zone

The Central and Northern Highlands cover an area of 2,672,000 ha.³ This area includes the plateau of the highlands and the higher parts of the eastern and western escarpments of the country. It receives an uneven rainfall throughout the year. In the highlands the wet season may extend from March to December, but July and August are the only months with relatively reliable rainfall. The eastern escarpment gets rainfall almost all year round. Temperature varies from one site to another depending on the geographic setting of the area. As a result, the highland is composed of mixed natural forest such as *Juniperus Procera*, *Olea Africana* and *Juniperus Procera*.

The temperature and rainfall distribution have an influence on the mode of life of the habitants of this area. A large number of them live by farming and this have affected the natural vegetation negatively. Widespread clearing for farming purposes has converted forests into cultivation fields.

2. Western Escarpment Zone

The western escarpment of the country is relatively dry and hot. Rainfall and temperature change drastically from the top of the mountains to the Western Lowlands. The western part of the country receives rainfall from the southwest monsoon from April to November. It enjoys the heaviest rains in July and August. The natural vegetation changes in composition and structure depending on the variety of moisture and

² Pagini, 1952. (Cited in) Bein and others. *Useful Trees and Shrubs in Eritrea. "Identification, Propagation and Management for Agricultural and Pastoral Communities"*, Technical Handbook No 12. Regional Soil Conservation Unit (Nairobi: 1996)

³ Araya E. Elias. *State of Forest Genetic Resources: "Prepared for The sub- regional workshop FAO/IPGRI/ICRAF on the conservation, management, sustainable utilization and enhancement of forest genetic resources in Sahelian and North-Sudanian Africa (Ouagadougou, Burkina Faso, 22-24 September 1998)"* (Eritrea: Asmara, Ministry of Agriculture, December, 2001).

temperature.

Vegetation is very poor, low and scattered in this area. It is largely the habitat of scattered shrub-like acacia species and closed canopy woodlands.

This area gets little rainfall and large part of the woods remains dry. The habitants of this area and settlers from the highlands come to this area to cut them for fire wood. They do not plant trees as substitutes. As a consequence, the mountains are left barren and eroded during rainy seasons.

3. The Green Belt Zone

This zone, on the Eastern Escarpment, is one of the few remaining areas of relatively undisturbed natural woody vegetation in Eritrea. The area is unique as it enjoys two rainy seasons providing more than 1,000 mm annually.⁴ This supports for the growth and regeneration of the vegetation of that area. The major rainy season is from June to August, with light rains from November to December.

The Eastern Escarpment forests cover an extensive area from the top plateau, running down to the east through several ranges of hills to the beginning of the Eastern Lowlands. Currently, the whole area is enclosed for tourism, regeneration of natural vegetation and wild life purposes. However, there are still families who maintain their cultivation and graze their animals in this forest area.

4. The Southwestern Lowland Zone

The South western Lowland Zone covers 20,000 km² in the Gash Barka Zone.⁵ These are vast fertile plains which are yet under utilized for agriculture. The area comprises

⁴ Araya E. Elias. State of Forest Genetic Resources: *“Prepared for The sub- regional workshop FAO/IPGRI/ICRAF on the conservation, management, sustainable utilization and enhancement of forest genetic resources in Sahelian and North-Sudanian Africa”* (Ouagadougou, Burkina Faso, 22-24 September 1998) (Eritrea: Asmara, Ministry of Agriculture, December, 2001).

⁵ Araya E. Elias. State of Forest Genetic Resources: *“Prepared for The sub- regional workshop FAO/IPGRI/ICRAF on the conservation, management, sustainable utilization and enhancement of forest genetic resources in Sahelian and North-Sudanian Africa”* (Ouagadougou, Burkina Faso, 22-24 September 1998) (Eritrea: Asmara, Ministry of Agriculture, December, 2001).

important water resources that flow almost throughout the year such as Setit which borders Ethiopia Gash-Bark which flow 3-4 months annually. This is the area of grassland with scattered Acacia and Doum palm trees. Since the area is less populated the species composition and density is not much changed.

However, people are coming down from the highlands for cultivation and fire wood. Add to this due to the rehabilitation and reintegration program of demobilized soldiers, refugee returns from Sudan and the displaced people from the border conflict of Ethiopia and Eritrea caused more destruction to the natural vegetation.

Moreover, the Eritrean army force has cut an enormous quantity of the Doum palm trees to build their trenches against Ethiopian forces and Acacia for fire wood. This had abandoned the land for erosion and environmental degradation.

5. The Northwestern Lowland Zone

The North Western Lowland covers 3,040,000 ha.⁶ It holds of an extensive sandy plain. There is little information about the vegetation of this zone. However, for the most part it consists of Cappairs, Decidua, and Balanites. This area is full of semi-arid species. It has very high temperature with little rainfall. The settlers are pastoralists. Therefore, the forests are not endangered. Fuel wood in this are is abundant.

Hence, this area could be utilized as a field of fuel wood. However, an appropriate research is required to be conducted ahead to know which seedlings to plant, considering their adaptability to the environment and their life span to grow and be ready to be used for fire.

6. The Coastal Plains Zone

⁶ Araya E. Elias. *State of Forest Genetic Resources: "Prepared for The sub- regional workshop FAO/IPGRI/ICRAF on the conservation, management, sustainable utilization and enhancement of forest genetic resources in Sahelian and North-Sudanian Africa"* (Ouagadougou, Burkina Faso, 22-24 September 1998) (Eritrea: Asmara, Ministry of Agriculture, December, 2001).

The total area of the Eastern Coastal Plain is 4,670,000 ha.⁷ The coastal plains consist almost entirely sand. Much of the vegetation is tolerant of a combination of drought, grazing pressure and salinity. However, as the population grows along the coastal line and new roads started to be built, the natural vegetation is been cleared for transportation, agriculture and heavily grazed by the animals. In some areas the people cut them for diverting floods towards their fields. As a consequence, the soil becomes carried by winds and washed by flood and loses its fertility.

Some Causes of Desertification

a. Land Tenure System

There are three types of land owning system in Eritrea. The exception one that has a negative contribution at soil conservation and water management had been the traditional land tenure system termed as “Dessa” System (village ownership). This system provides equitable access to all members of the villages and is conducive for subsistence agriculture. It allows for periodic redistribution of land every 5-8 years. As had been discussed by R. Srikanth, from land improvement point of view, this system has the following disadvantages.⁸

- A rotation period of 5-8 years is too short to make long term investments in improving land, such as tree planting, agro forestry, digging wells, and application of soil conservation techniques.
- There is no sense of ownership of land among the people and this serves as major disincentive for making any investment on land.

⁷ Araya E. Elias. State of Forest Genetic Resources: “Prepared for The sub- regional workshop FAO/IPGRI/ICRAF on the conservation, management, sustainable utilization and enhancement of forest genetic resources in Sahelian and North-Sudanian Africa (Ouagadougou, Burkina Faso, 22-24 September 1998)” (Eritrea: Asmara, Ministry of Agriculture, December, 2001).

⁸ Srikanth R. *Challenges of Environmental Management in Eritrea-A Case Study* (Eritrea: Asmara, Department of Environment, June 2003), AJEAM-RAGEE Volume 6, p62-70.

- Cropland is open to communal grazing in the post harvest season, which results in the removal of crop residues and exposes the land for wind erosion.

The new land law which was proclaimed in 1994 was designed to address the issue of land ownership among other things. However, the implementation of the land policy is not effective as far as it should be.

b. Plants of an adverse environmental effect

Eucalypts are very prominent among the tree species of the highlands. They had been introduced from Australia more than a century ago. These trees do not have any significant economic benefit except for firewood. In fact, they have an adverse effect on the underground water and deter the growth of natural vegetation on their area. The indigenous trees could grow at slower pace even with little water. Eucalypts have long roots that cover large area and consume large amount of underground water.

Similarly, cacti had been introduced from abroad by missionaries in the 1830s.⁹ They have a number of positive contributions to the economy, notably fruits which are used as food for the people and animals, their leaves are used as food for animals, their stems are also used as fuel for fire wood. On the top of this these plants could prevent the land from wind and flood erosion. However, they also draw large quantity of underground water and this has a negative contribution at the development of natural vegetation.

The worst plant is Tamer-Musa. This plant had a devastating impact on the Magreb countries. It had badly affected Tunisia, Egypt, Sudan and now has spread to Eritrea. It could not even be used for economic benefits or for food for animals. It absorbs almost all underground water and exterminates all plants around it.

Temer-musa appeared in Eritrea in the early nineties. Currently, it is covering a large

⁹ Bein and others. Useful Trees and Shrubs in Eritrea. “*Identification, Propagation and Management for Agricultural and Pastoral Communities*”, Technical Handbook No 12. Regional Soil Conservation Unit (Nairobi: 1996).

area in the South Western Lowland Zone. It has a tremendous character at growing and spreading its seeds. It covers large area within short period of time. People of the area speculate that the distribution of its seeds became easier with animals and transporting cars.

This plant has become now a priority issue by the country looking at its harmful effect on the vegetation. Ministry of Agriculture in coordination with the local administration has tried to solve the problem by burning down the Temer-Musa and allowing the people to cut them for fire wood. However, approach has proved insufficient to solve the problem yet.

c. Cutting trees for agriculture and other purposes

South Western Lowland Zone of the country is becoming the home of many refugee returnees from Sudan, demobilized and rehabilitated freedom fighters and the settlement of hundredth of thousands of people who were evacuated from the war zone of the border area between Ethiopia and Eritrea. Add to that a large number of people are coming to this area from the densely populated areas of the highlands for the cause of agriculture and trade. The policy of the government also encourages for this move.

Cutting trees for agriculture, for fire wood and for housing now become undesirable effect of the new settlers. Large areas are used for cultivation and are left desolate with no shelter from wind or flood erosion. No sensitization had been made on the society to keep the environment sustainable or plant trees as substitutes.

The cutting of the Doum palm by Eritrean armed forces for the use of trenches from the river banks of this zone will have the worst effect on the long run on fertility and vegetation cover of this area.

In addition, the consequence of wild fire which is done by cattle herders or outlaws, brick makers and people who practice spate irrigation from trees should not be overlooked

its impact on desertification.

As cited in the National Environmental Management Plan, the Ministry of Agriculture stated that the main causes for the reduction of the forests are:¹⁰

- Expansion of agriculture: e.g. 300,000 ha of forest land is said to have been cleared for agriculture upon the arrival of the Italian colonialists
- Consumption of fuel wood: an estimated 4.4 million cubic meters are consumed annually on a national scale
- Thirty years of liberation war
- Construction of traditional houses known as *hidmo*
- The attitude that trees are abundant and a gift of God to be utilized at will.

Government policy and Strategies

Concerning to forest resource and related to environmental issues a number of policies and strategies have been passed and implemented by the Eritrean government. Some of the land policies of the government highlighted by the National Environmental Management Plan are:¹¹

- National Environmental Management Plan (NEMP-E, 1995)
- National Action Programme to Combat Desertification and Mitigate the effects of drought (NAP, 2001) and
- National Biodiversity Strategy and Action Plan (2000).

In accordance with article 26 of the United Nations Convention to Combat Desertification (UNCCD), the Government of Eritrea has made substantial investment in the

¹⁰ Bein and others. Useful Trees and Shrubs in Eritrea. “*Identification, Propagation and Management for Agricultural and Pastoral Communities*”, Technical Handbook No 12. Regional Soil Conservation Unit (Nairobi: 1996).

¹¹ The State of Eritrea Ministry of Agriculture. *National Report on the implementation of the UNCCD* (Eritrea: Asmara, October, 2004).

energy sector, the largest of which is the Hirgigo Power Plant. Electric lines are being extended far into the rural communities to those who had been among the main instigators of deforestation.

The improved stove “*Mogogo*” renamed “Adhanet” meaning saver, used for baking injera (local staple bread) is one of the best achievements for its innovators which made use of the local knowledge. This stove helped the society to save energy and indirectly the forests. The Ministry of Energy and Mines is undertaking a huge task now at distributing those stoves to the rural areas.

On the other hand the Ministry of education is working hard to incorporate environmental education in school curriculum. It had an adult radio program which creates awareness to the people on forest and environment conservation. One of the targets of the program is to encourage communities to have their own wood lot, manage it themselves and be the prime beneficiaries.

In 2003, the Government of Eritrea launched an operation for economic growth named ‘Warsay-Yikalo Development Campaign’ with full participation of the local community. A new Ministry of National Development was established then to coordinate and monitor the implementation progress. The main mission of the campaign was to combat desertification.

Moreover, the Government of Eritrea has constantly been concerned about the severity of soil degradation and its effect on the economy at national and regional levels. As a member of Intergovernmental Authority for Drought and Development (IGAD), it has actively participated in the development of IGAD sub-region environmental education and training programs.

Remedial for Desertification

Deforestation is the cause of land degradation and loss of biodiversity of the country. The scale of the impact on the social and economic aspect of the society is enormous. A large section of the society depends on biomass fuel as a source of energy. To maintain a sustainable environment the following options could be pursued.

a. Afforestation:

Afforestation is taken as an important activity among many ministries of the country, such as Ministry of Education with its Students Summer Program, Ministry of Agriculture, Ministry of Land Water and Environment and the Zoba Local Administrations. According to the statistics provided by the Ministry of Land, Water and Environment, 56 million seedlings of different type have been planted covering 16,000 ha of land.¹² However, the survival rate of these plants is affected by lack of rainfall, follow ups and proper guarding from people and animals.

As a strategy, planting indigenous trees would be advisable considering the unfavorable effects of Eucalyptus and others from past experience of the area.

b. Soil and Water Conservation:

Cutting trees and burning of grassland exposes fertile soil to water and wind erosion. This leads to ecological degradation. Cognizant of this fact the Government is making considerable efforts to face this problem by mobilizing its scare resource. Since 1994, high school students have been regularly undertaking planting and terracing activities for soil

¹² The State of Eritrea Ministry of Land, Water and Environment. "Eritrea's initial National Communication under the United Nations Framework Convention on Climate Change (UNFCCC)" (Eritrea: Asmara, December 2001).

and water conservation during the summer time. It is considered that more than 75,772 km of terraces have been built since 1994 to 2003.¹³

c. Closure System:

Land closure system is a traditional way of conserving the natural vegetation and keeping the environment sustainable. Today, this tradition had been adopted by the administrative zobas and is working as rule for governing the people in their use of the land and the forest with their habitat.

Closure system could be divided into two. Those are temporary and permanent closures. Temporary closure system is the traditional one. This system is practiced in the highlands and is meant to preserve grass for the animals during the dry season. The government introduced a new way of preserving wild life and vegetation. This is the permanent closure system. This system delineates a particular land for closure and prohibits people from using that land for cultivation or animal feeding for a certain period of years with the agreement of the local people.

This approach has worked in many areas and became acceptable by the local people which are the main beneficiaries of that scheme. As a result the system helped for the restoration of the degraded ecosystem and the coming back of the wildlife which had been lost during war times of the armed struggle.

Referring to Ministry of Land, Water and Environment statistics, more than 200,000.00 ha of land are brought under the closure system till 2003.¹⁴

¹³ The State of Eritrea Ministry of Land, Water and Environment. *“Eritrea’s initial National Communication under the United Nations Framework Convention on Climate Change (UNFCCC)”* (Eritrea: Asmara, December 2001).

¹⁴ The State of Eritrea Ministry of Land, Water and Environment. *“Eritrea’s initial National Communication under the United Nations Framework Convention on Climate Change (UNFCCC)”* (Eritrea: Asmara, December 2001).

d. Protect Natural Forest:

Eritrea's remaining thick forest area is mainly located in the Eastern Escarpment Zone and South Western Zone. The Eastern Escarpment enjoys two raining seasons in a year. The government ruled out all kinds of intrusion in this area to preserve the wild life and vegetation for the cause of tourism.

As a result of this, the lost wild animals are returning and the indigenous vegetation is re-generating. Strong laws are passed to punish people who cut trees and hunt animals on this area.

However, there is still shortage in the management aspect. There needs to be a coordinated work between the Ministry of Agriculture, Local Governments and the society as a whole. Ministry of Agriculture should consult the society which indigenous vegetation it should plant that is adaptable to the area. The local people should take the responsibility of keeping the forest. The local government's responsibility is to ascertain that the local people are the main beneficiaries of the forest.

e. Solving Energy Problem

Majority of the Eritrean society use wood for energy with the exception of few cities that have had access to electricity from the time of the Italian presence. Even the larger cities which have electricity depend much on fire wood for cooking and baking their bread. As a consequence, large forest cover of the country is destroyed.

The remedy in the aspect of energy may be seen from two aspects. The first aspect is the short-term one. In the short-term strategy the country could improve the efficiency of its existing structure of energy utilization. For instance, the traditional stove "Mogogo" had been improved to save much energy. The improved stove "Adhanet" has around 21%

efficiency as demonstrated experimentally, while the traditional stove “Mogogo” is less than 10% efficient.¹⁵

In the long term, adequate power supply stations are required for the society to make use of instead of depending on wood for fuel. In connection with this, the Eritrean Electric Authority (EEA) has made considerable progress in its efforts to increase the electricity generation capacity. It has increased the capacity from 35 MW in 1991 to 84 MW by the end of 2001 by establishing new power supply plant.¹⁶

Moreover, the Authority is looking for alternative energies from the renewable resources. Currently, Wind and Solar energy fields were built in many areas and are giving service to the people.

Conclusion:

Centuries ago, Eritrea had been endowed with a plentiful eco-system marked an abundance of natural forests. However, the era of western colonization, followed by the armed struggle for liberation, resulted in the continuous cutting of trees for cultivation and for fuel, which in turn exposed the land for erosion.

After independence, the Eritrean government formulated applicable policies with regard to land, forest and environment issues. It drafted pertinent strategies and started implementing them by involving the community.

Today, it is very encouraging to witness natural vegetation re-generating and the wildlife coming back to its habitat. However, much remains to be done in the aspects of

¹⁵ The State of Eritrea Ministry of Land, Water and Environment, “*Eritrea’s initial National Communication under the United Nations Framework Convention on Climate Change (UNFCCC)*” (Eritrea: Asmara, December 2001).

¹⁶ The State of Eritrea Ministry of Land, Water and Environment, “*Eritrea’s initial National Communication under the United Nations Framework Convention on Climate Change (UNFCCC)*” (Eritrea: Asmara, December 2001).

farm tree nurseries, agro-forestry, energy-saving cooking practices, soil and water conservation, awareness creation, promotion of natural regeneration, environmental education and research on biodiversity conservation and Eritrea's ecology.

In addition, one needs to be aware that the global energy crisis has also affected Eritrea. Prices of all commodities are rising, including energy costs. At the same time, the economic capability of the people is far behind the demanded standard of living. People are starting to seek alternative energy sources as many are moving away from electric consumption to fuel wood. As people become more dependent on fuel wood, forests will be endangered.

In the meantime, the price of charcoal is rising. As community trees are non-excludable and non-rival, people are cutting them illegally to make profit. The entire afforestation program taken by the students during their summer time and largely the national campaign under the name “Warsay-Yikalo” is threatened by this phenomenon.

Hence, Eritrea is now left with few forested areas, and if those are destroyed today for fuel to solve the current problems, the impact on the coming generations will be devastating. Therefore, strong tree management must be in place and trees must be owned by individuals to keep them properly as they know that they are the beneficiaries.

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