DESERTIFICATION

Desertification refers to the reduction of the biological productivity of land to low levels especially as a result of human action in semi-arid areas. It can be also defined as;

A process whereby desert conditions are extended to marginal lands. These conditions include very low rainfall amounts, long dry seasons (drought), hot temperatures, low soil productivity and general limited surface water.

In Africa, in the Northern part, the process of desertification is commonly called sahelisation which means the extension of the Sahara desert into nearly marginal lands of the dry Sahel belt and semi- arid savannah lands. Within the Sahel region, the countries which are most affected by the danger of desertification are Mali, Niger, Burkina Faso, Senegal, Chad and Mauritania. Northern Nigeria, Sudan and Somalia have started experiencing desert like conditions. It has also extended to the wetter parts of the savannah lands and semi-arid savannah region.

Today, there are large areas showing Sahel like conditions in Northern Uganda in Kotido, Katakwi, Moroto; Central Uganda in Nakasongola and Hoima, Bushenyi in South West Uganda. Other areas are in some parts of Tanzania; Kenya, Ethiopia border lands and Southern Sudan. In Southern Africa in Botswana, Namibia and South Africa due to the Kalahari-Namib desert. Other areas at risk of desertification are Chile due to the Atacama desert, Australia due to the Simpson, Great Victoria and Great sandy deserts. In Asia due to the Arabian desert, in China the Gobi desert, in North America in California due to the Mojave desert.

In all these, the following are indicators of desertification;

1. Frequent occurrence of drought arising from limited sources of moisture in form of rainfall and vegetation. This leads to sharp rises in environmental temperatures creating more dry conditions.
2. The presence of low and unreliable rainfall due to a reduction in rainfall amounts followed by severe and prolonged droughts.
3. There is reduced water levels in rivers, lakes, streams and swamps due to hot temperatures that lead to high rates of evaporation, even boggy and other water logged places tend to dry up.
4. There is accelerated soil erosion caused by both wind and water as a result of the ground being left bare and exposed to agents of erosion.
5. In areas where irrigation is practiced, desertification is evident through increasing levels of salination due to excessive evaporation and loss of soil moisture because of hot temperatures.
6. A reduction in biodiversity for both plants in terms of extent and species and animals in terms of size due to dry conditions that cannot sustain life.

7. Desertification is also characterised by large quantities of sand and dust particles in the atmosphere. This is caused by wind blowing dry areas causing dust storms.
8. It is also evidenced there is reduced productivity of the soil caused by a reduction in soil organic matter (humus) and nutrient content increasing famine which may lead to death.
9. There are also large expanses of bare land left due to the loss of water retentiveness of the soil that leads to low levels of soil moisture affecting plant growth. This is common in areas under nomadic pastoralism.
10. It is further evidenced by flow of winds with high velocities with low moisture content since there is no vegetation to interrupt their course and hot temperatures reduce moisture content in the winds.

CAUSES OF DESERTIFICATION

Desertification is a result of both natural and man-made factors. The following are the natural factors that have led to desertification

1. In Eastern Africa, parts of Somalia, South Sudan, Northern Kenya and Northern Uganda are affected by desertification because they lie on the leeward sides of the Ethiopian highlands. They are crossed by the dry North East trade winds which lose their moisture on the wind ward side of the Ethiopian highlands where rainfall is received affecting plant growth on the leeward side due to hot temperatures causing higher rates of evaporation and transpiration in plants creating desert like conditions.
2. The Sahara and its Southward extension into the Sahel is caused by dry winds originating from Asia; the Harmattan (North East trade winds) since these winds blow across the hot and dry Arabian desert, they do not bring any rainfall to Northern Africa but instead pick the little moisture there is in the region. This creates much drier conditions over a wide territory of Northern Africa with much affected countries being Ethiopia, Egypt, Chad, Sudan, Somalia and Eritrea.
3. Cold ocean currents have also caused aridity in some parts of Africa. The Kalahari and its extension the Namib are due to the occurrence of the cold Benguela current that blows along the Western Coast of Southern Africa. When the South East trade winds blow over this cold current, they become cold and when they blow onshore, they get warmed by the hot land, become lighter and blow across Namibia, Angola and Botswana without causing any rainfall. Similarly in the North western part of Africa in Morocco, Algeria and Guinea, the cold canary current is responsible for dry conditions. Here the Westeries blow over the canary current having a similar effect as the South East trade winds.
4. The absence of large water bodies such as lakes and rivers in the Sahel in countries like Mali, Somalia, Niger and Northern Nigeria has contributed to desertification. This is because they act as sources of moisture through evaporation necessary for rainfall formation therefore their absence leaves these areas devoid of sources of rainfall.
5. The presence of poor sandy soils especially in the arid and semi-arid areas in the Sahel, Sahara, Kalahari – Namib in countries like Chad, Mali, Somalia, Northern Nigeria,

Botswana and Angola discourage the growth of thick vegetation accelerating soil erosion. This reduces rainfall formation due to limited sources of moisture leading to increased temperatures hence desertification.

6. The absence of thick vegetation cover especially in the Sahel region, Sahara, Kalahari has discouraged rainfall formation due to the presence of thorny bushes, scattered trees and oasis trees. As such, these areas experience very hot temperatures, accelerating soil erosion hence desertification.
7. Desertification in Africa is also due to the effect of continentality. Areas close to the coastline receive heavy rainfall as the moisture picked from the oceans is dropped near the coastline leaving distant areas dry. Coastal areas in West Africa such as; in Nigeria, Ghana receive more rainfall compared to Northern Nigeria, Mali, Chad and along the East African coast, more rainfall is received in Dar-es-Salaam and Mombasa leaving the interior of Kenya dry.
8. The presence of pests such as locusts and caterpillars as well as herbivorous animals like giraffes, antelopes, elephants and zebras destroy vegetation exposing soils to agents of soil erosion especially wind and water. It also leads to a reduction in the amount of rainfall due to reduced sources of moisture creating arid conditions. Locusts affect Somalia, Sudan and Mali while North East Uganda in Kidepo Valley National Park, Marsabit National Park and Masai-Mara game reserve, Serengeti plains in Kenya have large numbers of herbivorous animals.
9. Persistent drought conditions experienced have also contributed to desertification in Africa. This is due to increased rates of de-vegetation, pollution due to industries, swamp reclamation, road construction works resulting into global warming.
10. Natural hazards in form of floods, earthquakes, volcanicity lead to destruction of vegetation affecting soil fertility hence reducing the productivity of land.
11. The use of poor methods of farming such as monoculture and overstocking leading to overgrazing, bush burning by both shifting cultivators and nomads results into soil exhaustion, destruction of vegetation in the marginal lands creating bare grounds prone to severe soil erosion, dust clouds and prolonged droughts. This is so in countries like Mali, Somalia, Sudan, Northern Nigeria, Northern Kenya, North Eastern Uganda and Zambia.
12. Draining of wetlands like swamps, marshes and bogs especially in highly populated areas in order to create space for settlement, farming, industrialization and road construction has led to desertification in some areas. This results in a reduction in surface water resources (hydrology), reduction in atmospheric water vapour, loss of vegetation cover, lowering rainfall amounts and leading to an increase in temperatures hence desertification. This is especially the case in Senegal.
13. High rates of deforestation mainly in the savannah woodlands, wooded savannah grasslands and tropical forests for land for settlement, farming, industrialisation, construction works as well as for firewood, charcoal and timber has resulted in desertification. This is because it leads to a reduction in atmospheric moisture lowering

chances for rainfall formation resulting in high temperatures, loss of surface water and increased erosion especially by wind.

14. The extension of agricultural and uncontrolled settlements in marginal lands especially swamps and fringes of deserts and semi-deserts has further led to desertification. This is due to an increase in human population and the introduction of the cash crop economy that forced some communities to cultivate fragile lands extending the boundaries of deserts.

15. The high population growth rate in developing countries has led to population pressure on land resulting into overuse of cultivable land, soil deterioration making the soils lighter and prone to wind erosion. It has also led to land fragmentation, using poor methods of farming, deforestation, swamp reclamation and environmental pollution affecting rainfall formation processes while leading to an increase in temperatures and more dry conditions.

16. Excessive harvesting of existing water resources by man through having too many animals at water points in the Sahelian countries, irrigation, excessive drilling of boreholes has led to the lowering of the water tables affecting plant growth and rainfall formation leading to the emergence of desert conditions.

17. The sinking of boreholes and construction of dams especially in dry areas has contributed to desertification through lowering of the water table affecting the growth of luxuriant vegetation. This further affects rainfall formation, results into hot temperatures, limits surface water hence causing aridity. This is especially so in the Sahel region.

18. Environmental pollution especially of air and land resulting from industrialization where they emit toxic gases, burning of fossil fuels, bush burning led to the accumulation of Carbon dioxide and other carbon compounds in the air. These gases trap the sun's insolation within the lower atmosphere leading to global warming and sometimes lead to the formation if acidic rain. On the other hand, land pollution destroys the existing vegetation cover, reduces soil productivity exposing land to agents of soil erosion hence desertification.

19. Space exploration and use of helicopter gunships and land mines during civil wars discharge poisonous gases into the atmosphere damaging the ozone layer. This has gradually led to the ozonosphere losing its natural ability to absorb the ultra violet B radiation from the sun allowing more heat to reach the earth's surface rising atmospheric temperature hence global warming. Civil wars have been common in Somalia, Sudan, Mali and Congo.

20. Mining and quarrying has also contributed to desertification. Mining companies destroy vegetation cover while in the process of settling up mining fields and establishing infrastructure while with the use of open cast method, a lot of dust is released causing air pollution. Mining equipment also produce gases and smoke as well as processing plants. This interferes with rainfall formation creating drier conditions. This is evidenced in Congo, Gabon, Central Africa and in the Niger delta where oil spills are common.

21. There are poor environmental policies in most developing countries such as Kenya, Uganda, Mali, Chad, Ethiopia and Somalia. The countries do not protect water catchment areas such as forests and swamps, have limited protection of river banks, steep and unstable slopes from cultivation and clearance resulting in landslides and loss of agricultural lands. This has led to misuse of such areas resulting to reduced rainfall amounts, low productivity of land and increased temperatures hence aridity.
22. There is limited environmental awareness by the local communities in most developing countries such as in Somalia, Ethiopia, Eritrea and this has led to massive destruction of forests, wetlands and pollution, overgrazing and bush burning. It has affected the hydrological cycle leading to reduced rainfall, increased temperatures and has exposed the land to agents of erosion hence desertification.
23. Establishing irrigation projects in very dry lands has increased the rate of desertification. This is because when irrigation water is supplied in areas of high rates of evaporation, salinity of soil increases and these cannot support heavy vegetation leading the soils prone to agents of erosion. This is so in the Nile valley and on the old White Nile Scheme in Sudan.

EFFECTS OF DESERTIFICATION

1. It leads to scarcity of both surface and underground water making the affected lands unsuitable for man, livestock, wild animals, birds and other living organisms. This is experienced in Chad, Somalia, Eritrea, Sudan and may lead to deaths.
2. It leads to scarcity of food causing famine since the land becomes too dry due to low unreliable rainfall and hot temperatures to support cultivated crops and wide range of livestock. This is so in countries like Somalia, Niger, Mali, Chad, Ethiopia and South Sudan.
3. There is wide spread soil erosion by both wind especially during dry seasons, raising dust in the atmosphere causing air pollution and water during the rainy season due to erratic rains destroying crops and human settlements. It also destroys the landscape through creation of depressions and gullies as well as contributes to silting of water bodies in the Sahel region.
4. It leads to a great loss of soil productivity and fertility due to little rainfall received, over cultivation leading to poor yields. This results into famine and poverty. This is very common in Mali, Chad and Niger.
5. Desertification leads to loss of biodiversity, both plants and animals due to hot temperatures and limited amounts of rainfall in places such as in the Kalahari and Sahel regions. Only thorny drought resistant plants can survive while many animals may be forced to migrate to other wetter areas. This affects the development of the tourist industries.
6. Desertification leads to the formation of sand dunes due to wind erosion that pose as obstacles to the construction of transport and communication lines especially roads as well as also encroach on farm land and settlements as the case was in the coastal zone of

Somalia. Clouds of dust also become very common and contaminate air with dust particles. As such, these areas have remained under developed as movement is deterred.

7. It results in critical scarcity of fuel wood, charcoal and other wood products due to deforestation. This has affected many communities in the semi-arid regions especially in the Sahel where they cannot afford other energy sources such as biogas. The cattle herders have therefore resorted to using dry animal dung for cooking.
8. It limits human settlement to a few places where surface water can be found especially at banks of rivers like along the River Nile in Egypt and Oasis Misaha, Tarfaw, Farafra in Egypt, El Atrun, El Gir in Sudan, for domestic and irrigation purposes. This leads to pockets of population pressure and associated problems such as congestion, poor sanitation, easy spread of diseases and pollution further degrading the environment.
9. Desertification results into a decline in the water table due to over utilisation of underground water sources through drilling of boreholes for domestic and industrial use and prolonged drought. This increases aridity due to failure of plant cover as well as increased water shortages affecting man and animals.
10. It leads to poverty which results from loss of wildlife, livestock, fisheries soil productivity and limited sources of water for irrigation. This affects people's income as well as the social status of pastoral communities in Somalia, Mali and Chad.
11. Desertification leads to scarcity of pastures and water encouraging nomadism. This has made the Fulani of West Africa and Berbers and Tuaregs of Sahara, Galla of Somalia seasonally migrate in search for the same. In the process it has led to conflicts with farmers over water points for water for irrigation such as in the Sahel along River Nile, Niger and Lake Chad. This has further led to destruction of property and loss of lives.
12. It has contributed to the displacement of people (refugee problems) due to harsh climatic conditions, limited surface water, limited food supply and other basic necessities in Somalia, Mali and Chad. This sometimes results into loss of lives, animals, spread of diseases and loss of property especially for those crossing international boundaries.
13. It encourages air pollution when wind blows dust into the atmosphere. This affects visibility discouraging air transport hence limiting the number of tourists in the region which also affect sources of revenue. This is so in Sudan and Somalia.

MEASURES TO CONTROL DESERTIFICATION

1. Encouraging afforestation and re-afforestation programmes to enhance rainfall formation, moderate temperatures and provide fuel wood and charcoal for domestic use. Drought resistant tress are being planted in several countries such as Algeria, Chad, South Sudan, Niger and in Somalia; the forestry department is involved in growing acacia, casuarina pine, cactus, date palms and tamarisk. In Mongolia and China, emphasis is put on planting trees which are of value to man and livestock.

2. Governments in Africa are encouraging pastoralists to reduce livestock population to keep it in line with the carrying capacity of the range lands. In the Jos plateau in Nigeria, the Fulani are being encouraged to sell off their surplus herds of cattle through establishment of communication lines, meat butcheries and village livestock markets. This helps in avoiding over grazing which exposes lands to agents of erosion.
3. Planting shelter belts between deserts and productive land in order to stop the extension of deserts. In Algeria, a broad belt of trees was planted to keep the Sahara from advancing and in Nigeria, the fast growing neem tree was planted.
4. Encouraging the use of alternative sources of energy other than wood to prevent deforestation. Such sources include biogas, especially among herders, Hydro Electric Power, solar, thermal natural gas and wind energy.

NB: these may not be readily affordable in all vulnerable lands.

5. Launching mass education campaigns about the dangers of desertification and the need for environmental conservation in order to prevent misuse and unnecessary destruction of vegetation. This can be done through the use of mass media like radios, magazines, newspapers and televisions as well as seminars, workshops, plays and clubs.
6. In some countries like Northern Kenya, Somalia and Sudan, farmers in vulnerable lands are being encouraged to practice agro-forestry such that they grow leguminous trees which can restore soil fertility, bring underground water near the surface, provide shade for the animals, lower air temperatures and provide wood fuel.
7. Encouraging the use of modern methods of farming such as use of fertilizers to improve soil fertility, use of paddocking to avoid over grazing, growing of hybrid crops to increase production of both food and cash crops and in Sudan, crop rotation and soil conservation methods such as mulching is used. In addition, the government of Sudan prevents arable farming in areas prone to wind erosion.
8. Governments in Africa have put in place laws and regulations protecting forests, wetlands and water bodies. These are also aimed at reducing the rate of exploitation.
9. Establishing irrigation schemes in arid and semi-arid areas in order to improve soil productivity through supplying water necessary for plant growth. This can supplemented by the use of fertilizers. This was done in Sudan on the Gezira, Senegal the Richard's Toll; Ethiopia the Awash and plain of death, Aswan high dam in Egypt. In Libya, River Benghazi was created from underground water aquifers to provide irrigation waters.
10. Controlling population growth through birth control methods such as use of pills, inject plans, condoms through persuasive means by using media would reduce on the rate of deforestation and overuse of water resources and pollution of the environment. This has helped a lot in the Sahel region especially in Nigeria as well as in Mongolia.
11. Efforts are being made across the world to reduce activities that lead to global warming such as open air testing of nuclear and atomic weapons, emission of industrial fumes and burning of pastures by nomads. This would help to reduce the destruction of the ozone

layer and it's after effects. This has been achieved through organizing international conferences.

12. Spraying with pesticides in order to eradicate pests such as locusts, caterpillars, army worms, tsetse flies that destroy vegetation and affect livestock. This has helped to save the vegetation cover and animals.
13. Encourage treatment of industrial wastes and the reduction in the emission of gases in the atmosphere. This has been achieved through passing of laws that regulate the operations of manufacturing industries hence saving the ozone layer.
14. Controlling the advancing sand dunes on productive land can also help control desertification. In Iran, it has been done by spraying them with petroleum residue which when it dries forms a mulch that keeps the moisture allowing vegetation to grow. As such, much desert land has been reclaimed.

REVISION QUESTIONS

1a) Account for the extensive desertification in Africa.

b) Outline the steps being taken to control desertification in the Sahel.

2. Assess the impact of desertification on the physical and human geography of the Sahel region on Africa.

3. To what extent are natural factors responsible for the expansion of deserts in Africa.

4. Examine the causes and effects of desertification in Africa.

5. ''Man is the desert maker''. Discuss.